

July/August 2015

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Mural by Thomas Hart Benton



SPECIAL FEATURE: 15 Transformative Years

31 IN THE LEED

A worldwide lens on 15 LEED-certified projects built in the last 15 years reveals the rating's versatility, value, and staying power.

After 15 years at work in the field, U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) certification has found applications in settings as diverse as the systems it supports. From a supertall tower in Taiwan to permanent housing for the homeless on Hollywood's Santa Monica Boulevard to the 26-building university campus of KAUST in Saudi Arabia—LEED ratings of all levels have been achieved on many fronts, both foreign and domestic, and continue building the foundation for future generations.



MURAL BY THOMAS HART BENTON

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Inspiration and Motivation



BRENDAN OWENS
chief of engineering, USGBC

A few years ago I was chatting with a new USGBC employee who had just joined us in a senior leadership position. We had just wrapped up a meeting about something or other and this new leader was explaining how excited they were to be working at USGBC. I get to hear that a fair amount—people like to work here and we do inspiring, important work with really fun, smart people. But the next statement they made blindsided me. It was something to the effect of “and I’m so happy to be at this place in such early days—this organization has so much potential.”

I didn’t know what to say. Had they missed the memo that LEED had fundamentally changed the construction industry? In less than a decade! In 150 countries! And 10+ billion square feet!

Sometimes the prideful, automatic reaction is the exact wrong one. The hard truth of it is that we’ve got a long, long, long way to go. In the face of the causal role that the buildings industry plays in global calamities like climate change, resource scarcity, biodiversity loss, drought—the list goes on—it’s fundamentally irresponsible to look backward and think that our job is done. It was a humbling lesson that I’ve tried very hard to carry with me ever since.

This issue of USGBC+ is about past success to be sure, of which these examples are but a few of thousands we could have chosen. But more importantly it’s about how these buildings must be a catalyst for an even more rapid, effective, and inclusive revolution of the built environment.

I have a semi-tortured relationship with at least one of the projects we’ve chosen to highlight. Back when I joined USGBC as staff, we didn’t have very many options in terms of case studies

that we could present during trainings about LEED. As such, I have, if the rough calculations I just made are correct, spoken about aspects of the Phillip Merrill Environmental Center almost 350 times in the last 15 years. Needless to say, it got kind of stale. But seeing it here is like visiting with an old friend (a friend who, in hindsight, turns out to have been more of a professor and mentor than drinking buddy) and it brings me joy.

So enjoy these case studies of the transformative work that your colleagues in this movement are responsible for—but don’t enjoy them as memorials to great work. Enjoy them as gauntlet’s thrown directly in your face as a dare to create something better. Draw inspiration from them, but more importantly draw motivation from them and then go and do it better.

USGBC’s best days, in my opinion, are the days when we work to make ourselves obsolete. The idea that we’ll look back on these buildings as artifacts of a bygone era may seem preposterous, but that time will come. We’ll look at them as buildings that used more energy than they produced or polluted rather than cleaned water and that is thrilling to me, and existential for those who come after us. So while we want to—and should celebrate what we’ve achieved, let’s also use it as a place to demarcate where we jump-start what’s next and the future that we’re counting on you to deliver.

LEED ON,

HOLISTIC APPROACH

100 Resilient Cities program helps urban areas around the globe meet 21st-century challenges.

BY JEFF HARDER

Travel just about as far west as you can along Interstate 10 in Texas and you'll find El Paso, a city of 675,000 hugging the U.S.-Mexico border. Like other urban areas around the world, El Paso strives to provide its citizens with access to healthcare and social services among its most vulnerable residents, replace aging stormwater and electrical infrastructure, plan for drought and flood, create stable, high-quality jobs, and conserve water through alternative sources. Ensuring that El Paso can thrive in the future and bounce back from whatever misfortune comes its way means solving problems that resonate beyond its city limits. "It doesn't matter where we draw the line on the map," says Nicole Ferrini, chief resilience officer for the city of El Paso and a founding member of the U.S. Green Building Council (USGBC) Chihuahuan Desert Chapter. "We have to deal with these things as a regional community."

That sentiment is at the heart of 100 Resilient Cities, the Rockefeller Foundation's \$100 million effort launched to help El Paso and 99 other urban areas around the globe meet 21st-century challenges—from climate-change-induced disasters to deep-rooted economic and social problems. By making progress within this 100-metropolis nucleus, the rest of the world can share the benefits. "We may be called 100 Resilient Cities, but our work is not just about 100 cities," says Michael Berkowitz, the president who oversees the program.

"It's about building the tools and frameworks so that all the world's cities can use them. In other words, we're trying to build a global practice of resilience, one that can help cities do better for their citizens in both good times and bad."

The 102-year-old Rockefeller Foundation has spent generations addressing the needs of cities because urban settings are uniquely relevant to us all. They're hubs of culture, business, and technology. Today, more than half the world calls a city home. "By the middle of this century, two-thirds of the world's population will live in cities," Berkowitz adds, "and those urban areas will face greater threats than ever before from factors such as climate change and globalization."

The concept of resilience refers to how well a city's constituent parts—its businesses and institutions, the systems that keep it functioning, its residents—can survive, adapt to, and overcome adversity. That adversity generally comes in two forms: chronic stresses (entrenched problems like food and water shortages, drug addiction and violence, and economic deprivation) and acute shocks (distinct disasters like earthquakes, floods, and severe hurricanes). A city's resilience boils down to four overarching aspects—leadership and strategy, health and well-being, economy and society, and infrastructure and environment—and draws in disparate fields, from sustainability to disaster risk reduction to economic and social justice.



Nicole Ferrini is the chief resilience officer for the city of El Paso and founding member of the U.S. Green Building Council Chihuahuan Desert Chapter. Photo: Brian Kanof



Michael Berkowitz is the president of 100 Resilient Cities.

If the scope of resilience sounds far reaching, that's by design. "It's about recognizing the intersection of social, physical, and economic issues," says Max Young, vice president of global communications and marketing at 100 Resilient Cities. "You can't think about responding to a storm without thinking about poverty: By and large, the poor and vulnerable are the most impacted by storms, especially when you get weeks and months removed. Similarly, you can't think about earthquakes without thinking about small businesses, because half of small businesses don't reopen after a disaster."

At the same time, one resilience intervention often creates a cascade of positive outcomes. Young mentions Medellín, Colombia, a 100 Resilient Cities designee that was once at the center of the global drug trade. For the population living in poverty on the city's hillside, narcotics seemed to be the only viable career: They were cut off from Medellín's public transportation system and, as a result, were several hours removed from jobs in the city's economic center. But when the city built a system of gondolas into the hillside and linked it into the subway system, things changed. "People went from having a

commute of several hours to 20 minutes," Young says. "All of the sudden, they have access to these jobs in the valley floor." Community centers appeared at the base of the gondolas, new buildings on the hillsides drew more people to the city's outskirts, and drug-related crime and violence fell along the way. "By solving an economic problem, they actually solved physical and social problems," Young says.

In 2013, the Rockefeller Foundation announced 100 Resilient Cities, a program designed to improve the resilience prospects of cities around the world. Since 2013, the program has selected 67 locales, from Bangkok, Thailand, to Lisbon, Portugal, to New York City. (The remaining 33 will be selected next year.) Each selection was based on the cities' track records for building partnerships, their leaderships' propensity for innovation, and other criteria. Along with connecting these 100 cities to a network of more than 50 partners from the private, public, academic, and nongovernmental organization sectors to help implement resilience measures, the program funds two to three years' worth of salary for each city's chief resilience officer (CRO). These advisors report to mayors and chief executives, garner support for resilience-building projects by working across



Left: Joseph Riccillo is the chairman of the board for the Chihuahuan Desert Chapter. Right: Grounds of the Paisano Green Community, a LEED Platinum-certified part of the Housing Authority of the City of El Paso (HACEP). Photos: Brian Kanof

government departments and the broader community, and create strategies based on efficient, cost-effective solutions that have profound, positive impacts.

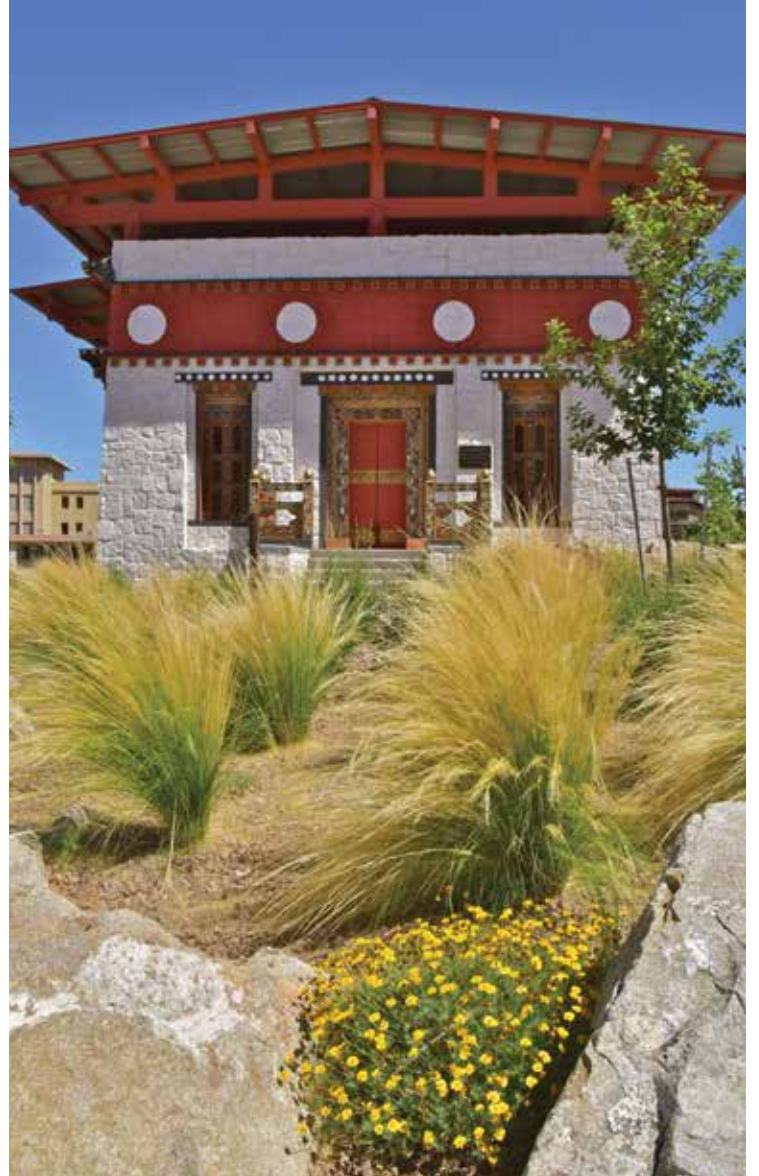
“The CRO organizes people, brings initiatives together, breaks down silos, and makes sure we’re all moving in the same direction and with the same vision toward the same goal,” Nicole Ferrini says.

El Paso—Ferrini’s lifelong home—was among the first cities selected by 100 Resilient Cities, and Ferrini took her post as CRO in December 2014. Ferrini holds degrees in architecture and interior design and a wealth of experience in urban planning. “But you know what really prepared me to do this?” says Ferrini. “All my time with USGBC.” In 2006, Ferrini helped found the USGBC Chihuahuan Desert Chapter, spending nearly a decade getting the region familiar with the concepts of green building and sustainability. Resilience and sustainability, as Ferrini sees it, are inextricably linked. “Resilience zooms out from the built environment, organic foods, all those places where sustainability tends to live, into this greater umbrella that includes economic development and social justice. But when I map it out in my mind, it always drills back down to that core foundation that sustainability

provides. Is resilience different? Yes. Can you separate the two? In my view, absolutely not.”

Joseph Riccillo, chairman of the board for the Chihuahuan Desert Chapter, who has high praise for Ferrini’s early efforts as El Paso’s CRO, agrees. “To be honest, I think sustainability started the conversation and made people more aware of the need for resilience. Resilience and sustainability go hand in hand.”

For the last six months, Ferrini has been working out of the city’s Office of Resilience and Sustainability, building on her years of experience with the USGBC Chihuahuan Desert Chapter to hash out El Paso’s resilience strategy. While the region has occasional, disastrous flooding—the last such incident occurred in 2006—it’s not as exposed to the same acute shocks as other 100 Resilient Cities locales. Instead, Ferrini expects El Paso’s resilience strategy to address those everyday stressors that affect the city’s long-term stability: economic diversity, access to quality affordable housing, access to water in an arid climate, and, in particular, health and wellness. “Health and wellness has been a huge driver in every single conversation we’ve had,” Ferrini says. “How can we leverage a physical environment



**Left: Texas Tech University Health Sciences Center (TTUHSC) El Paso Paul L. Foster School of Medicine.
Right: The University of Texas at El Paso (UTEP) Lhakhang. Photos: Brian Kanof**

within our city that supports wellness for the individual? How do we create an economic system that allows people to be comfortable enough to focus on their own health and wellness? How do we get past some of these preventable disease components? How do we reduce the strain on our local healthcare system?"

The answers to these questions and others transcend borders. Ciudad Juarez—another 100 Resilient Cities designee just over the Rio Grande in Chihuahua, Mexico—and Las Cruces, New Mexico, share many of the same resilience challenges as El Paso, as do other desert locales around the world. "The capacity to survive, adapt, and thrive in the face of 21st-century challenges is critical for any city," says Kurt Fenstermacher, assistant to the city manager for El Paso. "El Paso, however, is unique in that we are positioned to set the standard for safety, prosperity, diversity, and human health in the context of a growing international metroplex nestled in the arid climate of the desert southwest."

As part of formulating the city's resilience strategy, Ferrini has connected with more than 25,000 residents through social media and met face to face with hundreds of community stakeholders through a series of intimate roundtable discussions. And when her audience's opinions dissent from her own, she opens her ears. "Really, I want to hear what they think resilience means for their community and measure those perceptions against the activities we have going on," Ferrini says.

Recent strides in green building have helped further the resilience conversation in El Paso. The city is home to Paisano Green, a 73-unit complex that's the first LEED Platinum-certified senior public housing building in the country. (Within the next half decade, all of El Paso's public housing will be upgraded to LEED Silver standards or better.) Beyond providing a cost-effective place for its residents to live, Paisano Green has helped galvanize an impoverished elderly population, Ferrini says. And after volunteers helped plant a community garden on the property, it's become a



Left: The Kay Bailey Hutchison Desalination Plant is the largest inland desalination plant in the world. Also shown is the Carlos M. Ramirez TECH2O Center in El Paso, Texas. Right: The University of Texas at El Paso (UTEP) campus focuses on open spaces. Photos: Brian Kanof

gateway for a broader resilience conversation. “Now we’re talking about food, community, health, and buildings, and looking at it through a social justice lens,” Ferrini says.

Elsewhere, El Paso has begun moving away from an economy dominated by low-skilled, low-wage jobs into increased emphasis on the healthcare and biotechnology industries—a shift that could lead to healthier residents. An icon of this change is the Medical Center of the Americas, a 440-acre medical campus that’s had more than \$400 million worth of infrastructure investments over the last 15 years and is home to institutions like Texas Tech University Health Sciences Center El Paso and University Medical Center of El Paso. “It’s a great economic engine in this new high-tech industry that will bring higher jobs and wages,” says Emma Schwartz, president of the Medical Center of the Americas Foundation. “There’s also a side benefit: We’re a medically underserved area, and increasing our reputation in the medical and biomedical space makes it easier to recruit for positions. We’re producing our own physicians and nurses

who will hopefully stay here. And we’re researching topics that are important to Hispanic and border populations. This great industry could also have an impact on healthcare and health status in our region, which also has an impact on economic growth and stability.”

Under the auspices of 100 Resilient Cities, one city’s success can set an example for 99 others: Rome and Byblos, Lebanon, are collaborating on cultural heritage preservation, while San Francisco and Medellin are sharing best practices for responding to earthquakes. As El Paso advances toward a resilient future, the lessons it learns along the way can inform how other desert cities can flourish. For now, Ferrini is grinding away, breaking down walls and finding common ground to ensure her hometown can thrive through this century and beyond. She plans to present a final resilience strategy to the El Paso community later this year. “When I do that, I won’t be standing there saying, ‘This is the Nicole Ferrini plan for resilience,’” she says. “I’ll truly be able to say this plan comes from the mind, body, and soul of this city.” ●

Commitment to **QUALITY**

Mexico City's Instituto Thomas Jefferson looks for ways to make its sustainability efforts as impactful as possible.

BY KILEY JACQUES

For 37 years, the Instituto Thomas Jefferson (ITJ) has been a forerunner for social emotional learning, project-based education, and student-powered innovation. Today, its mission is campus-wide sustainability on all fronts—from LEED-certified buildings to Green Apple Day of Service (GADOS) projects to the environmentally focused K-12 curricula.

ITJ—a network of schools based in Mexico City, Guadalajara, and Queretaro—is committed to “whole school sustainability,” which is built on a framework that looks at organizational culture, physical place, and educational programming. “ITJ is not a common school,” notes Organizational Culture Leader Monica Bleiberg, whose role it is to connect the ITJ community through initiatives that build a sustainability culture. “We enrich our educational model with innovative projects all the time so our teachers and students are used to new challenges,” she explains. “When we decided to embrace the whole school sustainability framework, Green Apple Day of Service became the perfect way to motivate teachers and students to commit to sustainable initiatives.”

GADOS is a global initiative developed by the USGBC that encourages educators and students to rethink their schools—participants have multiple and varied opportunities to redesign and transform their surroundings to make them more sustainable. Past projects have included removing toxic

materials from school grounds, performing sustainability assessments, hosting open houses at green schools, and creating signage to encourage conscientious behavior. ITJ has set the goal of 1,000 GADOS projects this year. Bleiberg admits the figure is a challenging one, but believes it is achievable. “We still have some time...we already have 910 projects registered, so I think it is likely we will get to 1,000 projects.” Given GADOS is scheduled for September 25, 2015, they will likely reach that goal.

However, Physical Place Leader Mariana Aristizabal notes, “To have a high-quality, big-impact project is more important than the number of projects.” This idea is somewhat new—originally the focus was on the number of projects completed. Now they wish to emphasize quality over quantity. “It is more important to have a project that includes all of the community and all of the schools, teachers, and staff,” says Aristizabal.

Each ITJ campus has its own sustainability coordinator, who is responsible for organizing GADOS projects. Individual project ideas come from many sources including educators—one teacher looked into how to create wind power on site. The students, too, offer suggestions—like conserving water by putting a bucket in the shower to collect the water that flows while waiting for it to heat up, and using it for irrigation, cleaning, or some other purpose.



Georgina Cruz, teacher at the Instituto Thomas Jefferson's Zona Esmeralda campus helps a young student water a schoolyard garden.



Left: Jesse McElwain, Center for Green Schools, works with Diana Figueroa, ITJ Sustainability Coordinator, to engage students in Green Apple Day of Service planning.

In 2014, ITJ made the decision to invest in its future as a forward-thinking, cutting-edge institution. It has since worked tirelessly “to put all of its students and teachers in schools that have a responsible environmental footprint, support the health of occupants, and support education for sustainability.” The institute has partnered with U.S. Green Building Council’s (USGBC’s) Center for Green Schools, which works to “ensure every student has the opportunity to attend a green school within *this* generation.”

The Center works directly with staff, teachers, faculty, students, ambassadors, elected officials, and communities to turn schools into sustainable places to learn, work, and play. Through its work with the Green Schools Fellowship Program, the staff at the center have gained insights into system-wide sustainability for schools like ITJ. Hannah Debelius and Anisa Baldwin Metzger from the center recently used this knowledge to design and lead training with Bleiberg and Aristizabal to clarify the roles and responsibilities of ITJ’s sustainability coordinators.

Currently, ITJ’s Physical Place department is building a new high school for which they are seeking LEED Platinum

certification (it will be the first to achieve this designation in Mexico). They have set 27 goals that will aid in its function as a learning tool. They also seek certification for existing buildings. “We work on everything people can touch and see,” says Aristizabal, who oversees the reconstitution and renovation of the campuses. With support from the Center, ITJ plans to implement LEED Lab, a multidisciplinary immersion course that utilizes the built environment to educate and prepare students to become green building leaders and sustainability-minded citizens. Students at each campus will participate in the certification process.

“For ITJ, the emotional health, the values, and the skills of a child are even more important than his or her academic success,” says Bleiberg. “We care about the emotional side of learning, of buildings, of teaching because at ITJ we know, we have seen the amazing things a passionate 15-year-old student can do. So we work to engage and direct the students’ passion toward positive changes.”

ITJ’s K-12 curricula focus on energy efficiency, water conservation, transportation, air quality, food and nutrition, and waste management. Their collaboration with the Center



Left: Rachel Gutter, senior vice president of Knowledge at USGBC speaks with Ricardo Carvajal, co-founder of Instituto Thomas Jefferson.
Right: Student on the Instituto Thomas Jefferson's Santa Monica campus sorts trash to divert waste from a landfill.

for Green Schools has resulted in the idea of “sustainable intelligence,” which is based on the award-winning curricula and programming of EcoRise Youth Innovations in Austin, Texas. “This year, we encouraged sustainable projects through project-based learning,” explains Bleiberg, who sees this as a way to cover all academic areas. “Next year, we will pilot a sustainable intelligence curriculum from kindergarten through 12th grade.”

And what do the students think of all this? “They are happy,” says Aristizabal. “They understand we only have one planet so we need to start taking action right now. They are committed to these sustainable teachings. They know they are doing good things for the planet at this moment and they want to keep going. We have 22 students who want to be leaders on climate change.”

Commitment to whole school sustainability includes communicating with the greater community to share their activities and to keep people abreast of the schools’ progress. Establishing “conservation behavior” and institutionalizing “progressive efficiency” are also key components for success. It takes the whole academic body to reach such ambitious goals. Luckily, its educators, staff members, and students share the same vision and are excited to see it coming to fruition. Of ITJ’s students, Bleiberg says, “They are used to feeling empowered and capable of having a positive impact on the world, but it still requires consistent and great effort from them.” Clearly, they are making that effort. ●

Examples of **Green Apple Day of Service**

Projects by ITJ Students

- **Planting edible gardens**
- **Recycling in classrooms**
- **Eco-Day participation**
- **Composting**
- **Reforestation planting**
- **Making of organic cleaning products**
- **Blog writing about sustainability issues**
- **Water conservation initiative planning**

Reducing IMPACT

Kaiser Permanente turns to renewable energy
to create a healthier environment.

BY MARY GRAUERHOLZ

To witness the profound effects of climate change, look no further than California's Central Valley, where a record drought has left an eerily parched, dust-blown landscape. Scientists in California, the home state of healthcare provider Kaiser Permanente, are sounding dire warnings that unless greenhouse gases are vastly reduced, conditions are expected to worsen.

The effects of climate change, such as those found in the Central Valley, have the potential for great harm to human health, both directly and indirectly. Kaiser Permanente, headquartered in Oakland, California, has a long history of linking the environment to human health. Now the healthcare provider and not-for-profit health plan, already a leader in green energy, will take another major step forward and purchase enough renewable energy to meet half of its electricity consumption in California.

Between two separate deals with NextEra Energy Resources and NRG Energy, solar and wind power will replace much of Kaiser Permanente's need for fossil fuels, significantly reducing greenhouse gases, a known contributor to climate change. Kaiser Permanente facilities—including 38 hospitals and more than 600 outpatient medical offices countrywide—emit more than 800,000 metric tons of greenhouse gases a year. The facilities use almost 1.5 billion kilowatt hours of electricity a year.

"We see climate change as a health issue," says Ramé Hemstreet, Kaiser Permanente's chief energy officer. "We think this is a tangible example of improving the

health of the community we serve." Purchasing renewable energy is one outcome of the organization's bigger goal: a pledge in a 2012 Sustainable Energy Policy to reduce its greenhouse gas emissions by almost a third, by the year 2020 (from a 2008 baseline). "That's an absolute goal, despite the fact that we are adding members and building new facilities," Hemstreet says. "Buying renewable energy is a big step in reaching it." The wind and solar projects, in fact, will enable Kaiser Permanente to meet its goal three years earlier than expected.

By purchasing solar and wind power, Kaiser Permanente will do more than just reduce its reliance on carbon-based fuels; it also will reduce the water required to produce the electricity. "It's a win-win," Hemstreet says.

Climate change impacts human health directly and indirectly, Hemstreet says. Hotter days result in injuries and illnesses. Storms threaten public safety. Degrading air quality likely causes more respiratory disease, such as asthma. Warmer weather, as well, creates a change in pathogens, possibly changing the nature of disease—as Hemstreet says, creating "a larger range for certain diseases."

Construction on the wind farm and solar installations that will supply the alternative energy is underway, Hemstreet says. The Golden Hills Wind Project, in Alameda County in Northern California, will be supplying energy later this year, after existing turbines are replaced with more efficient and more avian-friendly turbines. Solar energy will be provided by the Blythe Solar Power Project in Southern California's Riverside County. It is expected to be operational by mid-2016.



Ramé Hemstreet, Kaiser Permanente's chief energy officer. Photo: Emily Hagopian



The Golden Hills Wind Project in Alameda County will supply energy this year after more avian-friendly turbines replace existing turbines.

NRG Renew, a subsidiary of NRG Energy, Inc., will install solar panels at as many as 170 Kaiser Permanente facilities, which includes medical offices, hospitals, and clinics. As much as 70 megawatts of on site solar will be produced through these solar photovoltaic arrays, primarily on carports and other parking structures that accommodate a combined 20,000 parking spaces.

Besides reducing the carbon footprint, Kaiser Permanente's move toward renewable energy will save water. Wind and solar energy require essentially no water to operate, thereby not polluting water resources or threatening other needs for water, according to the Union of Concerned Scientists. In comparison, fossil fuels require a great deal of water, and some forms, such as coal mining and natural gas drilling, can pollute sources of drinking water. Hydraulic fracturing (fracking) that extracts natural gas also requires large amounts of water.

Kaiser Permanente's renewable-energy project is another step toward a safer, healthier environment and a deeper expression of the organization's long-held understanding of a link between environmental health and human health.

As early as the 1960s, Kaiser Permanente staff questioned the role of the environment in human health. In 1961, staff members invited Rachel Carson, author of the groundbreaking environmentally themed book, *Silent Spring*, to speak to its staff physicians and scientists. More recently, Kaiser Permanente formed a partnership with Health Care Without Harm and the Business Renewables Center, begun by the Rocky Mountain Institute, to help the healthcare

industry and the rest of the country's business community develop more renewable energy resources.

Kaiser Permanente hopes to inspire other healthcare organizations to take a leadership role in reducing the potentially devastating consequences of climate change. In fact, it is the organization's responsibility to help lead the way, Hemstreet says. "We hope to set the example for others in the healthcare community," he says.

There are other healthcare organizations making an effort, Hemstreet adds, pointing to Gundersen Health Systems in La Crosse, Wisconsin, and its environmental program, Envision. "They've been a leader," Hemstreet says. But compared with Kaiser Permanente's enrollment of almost 10 million members, Gundersen is small. "I'm quite confident that the total amount of renewable energy that Kaiser Permanente is purchasing is larger than any other healthcare organization in the U.S.," says Hemstreet.

It's not too late to turn the ship around, Hemstreet and others agree. One study, by the U.S. Department of Energy's National Renewable Energy Laboratory, considered the feasibility and impact of generating 80 percent of the country's electricity from renewable sources by 2050. The conclusion: Global-warming emissions from electricity production could be reduced by approximately 80 percent.

Hemstreet sounds a note of optimism. "I certainly think we have to look now at how we're going to adapt to a changing climate," he says. "I think there's still time to avoid a cataclysmic effect." ●

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Rewriting **HISTORY**

How the ancient Egyptians built the pyramids matters to climate change.

BY ALEX WRIGHT

Spoiler alert: We may be wrong about how the ancient Egyptians built the Great Pyramids. Decades of schoolchildren are taught the prevailing theory: The pyramids were constructed from enormous blocks of solid stone, cut by hand from far away quarries, and hauled across the searing desert sands. We imagine—thanks in large part to Cecil B. DeMille—thousands of shirtless, sweating slaves harnessed to thick hemp ropes, dragging enormous square blocks of stone up steep ramps. The feat seems so incredible that some wonder whether the Egyptians had help from other planets. Always a rational voice in the room, Neil deGrasse Tyson counters, “Just because you can’t figure out how ancient civilizations built stuff, doesn’t mean they got help from aliens.”

Figuring out how the pyramids were built has interesting applications beyond Egyptology. Today’s building materials do not have an expected lifespan anywhere near 4,000 years. And many of our modern construction processes consume so much energy and emit so much CO₂ that we’re quickly destroying the very world we’re working to build. The Egyptians seemed to know something we don’t about using locally sourced materials to construct extraordinarily durable buildings without the huge environmental footprint so common today. Did the

Egyptians use their minds as much as their muscle, and if so, what can we learn from them?

The skepticism Tyson addresses comes from a logical place. Despite the common teachings of the building of the pyramids at Giza, the feat of construction seems almost implausible. The Great Pyramid of Khufu was the tallest man-made structure on earth for over 3,800 years—16 times as long as our country has existed—until the construction of the Lincoln Cathedral in England. When built, the pyramid was 756 feet long on each side, 481 feet high, and composed of 2.3 million stones weighing on average nearly three tons each. Many of the joints between the blocks are so accurate that a human hair cannot be passed between adjoining blocks.

According to what we’ve been taught, quarried stone blocks weighing several tons were hauled to the pyramids, before the invention of the wheel. They were quarried out of the hillside with tools made of copper. And a city’s worth of laborers were housed and worked in a cramped area for decades. It’s difficult to imagine and little evidence exists to support this idea—no copper tools have been found around the site, no evidence remains of housing laborers, and no clear hieroglyphs exist documenting the quarrying, transportation, or ramp-lifting of these blocks.



Above: The Great Pyramids of Giza - the pyramid of Menkaure 215 feet; the great pyramid of Khufu, 481 feet; the Pyramid of Khafre 448 feet. Below: A common image in many of our minds explaining the construction of the pyramids.



In the 1980s, a French materials scientist named Joseph Davidovits proposed a different theory—the Egyptians didn't haul the blocks to the pyramids but rather made the blocks one at a time in place on the pyramids. Davidovits suggested that the blocks were formed by pouring an ancient concrete—he called it geopolymer—into wooden molds. A fraction of the laborers would be needed to haul sacks of moist geopolymer concrete to wooden forms placed exactly where each block was needed. Joints between poured concrete blocks would always be perfectly accurate as a compacted moist mixture hardens against neighboring blocks. Davidovits suggested that the geopolymer concrete was made from crushed limestone, clay, water, and lime, a highly alkaline activator that caused the crushed limestone mixture to reconstitute into a man-made stone.

Davidovits's theory caused quite a stir among Egyptologists, historians, materials science researchers, and anyone who cared that a well-established explanation for the construction of something as iconic as an Egyptian pyramid was being turned on its head. Not only that, but if the Egyptians cast block in place from an early form of concrete, many established theories assigning the invention of mass-produced concrete to the Romans would be off by a few thousand years.

One would imagine that modern scientists with electron microscopes could prove in short order whether Davidovits was correct. Michel Barsoum, professor of materials science at Drexel University and a native of Egypt, never meant to

get into the study of the pyramids but was amazed to hear Davidovits's theory. Barsoum was more amazed to find that no one had proved—or disproved—the idea.

Barsoum, along with a graduate student named Adrish Ganguly, began studying samples from the inner and outer casings of the pyramids. What they thought would be a months-long study turned into a five-year odyssey. In the end, they disproved some of Davidovits's assumptions but proved his overall theory.

Barsoum believes that the Egyptians did cast a small but significant portion of the block in the pyramids. His electron microscope analysis indicates the Egyptians didn't use clay in the geopolymer mixture, as Davidovits proposed, but rather diatomaceous earth, a naturally occurring, commonly found soft sedimentary rock formed from the fossilized remains of algae.

And Barsoum importantly disagrees with Davidovits by suggesting that not all the blocks were cast-in-place geopolymer. Rather, Barsoum suggests that the Egyptians used both man-made cast block along with limestone block quarried and hauled to the site in the way our traditional explanation proposes. Barsoum believes that only the exterior casing blocks and the blocks at the higher levels of the pyramids were cast geopolymer blocks. This makes sense: The casing blocks were visible, so cast-in-place block with extremely accurate "joints" would be appropriate to exterior application. And the blocks at higher levels of the pyramids were harder to reach for quarried



Left: A gash in the side of one of the pyramids shows a combination of irregularly cut quarried limestone blocks surrounded by tight-jointed, cast-in-place geopolymer blocks. Right: Curved, perfectly aligned joints between these backing blocks are evidence of the blocks being cast in place rather than poured.



Left: A ground level block in front of the Great Pyramid of Khufu includes an irregular lip at the bottom. This lip indicates that the block was cast in place.

Images © Michel Barsoum, used with permission.

blocks hauled up ramps—replacing these with cast-in-place geopolymer blocks made the process easier.

Linn Hobbs, professor of materials science at the Massachusetts Institute of Technology, has also added to Davidovits's original theory and Barsoum's corroborating research. Hobbs's students have reverse engineered a geopolymer concrete made from crushed limestone, kaolinite, silica, and natron salts, a substance found in the evaporated remains of saline lake beds. The Egyptians used natron salts for mummification. When exposed to water, natron salts become alkaline, a perfect activator to make a geopolymer reaction.

As predicted, new theories that suggest that even a small portion of the stones in the pyramids at Giza were man-made blocks formed from an early form of concrete have erupted into a firestorm of resistance and vitriol, most notably from those with the most to lose when an established theory is pulled apart. As much as Barsoum assumed that solid materials analysis could indisputably prove how some of the pyramid's blocks were made, the debate still rages on.

Separating the debate from the historical discussion can shed important light on how we can improve today's construction materials by exploring what the Egyptians might have done. Just the idea of an ancient form of geopolymer

concrete masonry that has lasted 4,000 years can forever change the way we build today.

Concrete is the most voluminous material made by all humankind. It's used all around the world in roads, bridges, dams, and buildings. The key binding ingredient in today's concrete is Portland cement, which alone is responsible for 6 percent of the world's CO₂ output.

And concrete made with Portland cement isn't as durable as its environmental footprint might warrant. Concrete bridges are often taken out of service after only 50 years, due in part to harsh conditions like road salt, heavy truck traffic, and freeze-thaw cycles. While the relatively stable environment of the Giza pyramids avoids many of the harsh conditions of today's urban built environment, the 4,000-year durability of the structure indicates the expanded material lifespan possible with geopolymer concrete. When coupled with a much smaller carbon footprint—geopolymer concretes like those the Egyptians likely pioneered have a tenth the carbon footprint of Portland cement-based concretes—geopolymers offer a compelling alternative.

Geopolymer concrete is significantly different from Portland cement-based concrete. To simplify the science, Portland cement is akin to a strong glue whereas a geopolymer reaction is akin to a two-part epoxy. Portland



Cement factory in China. The production of cement alone is responsible for 6 percent of the world's CO₂ emissions.
Image ©Jonathan Kos-Read, used with permission of Creative Commons license.

cement binds together all kinds of aggregates to form relatively strong building materials. But that high reactivity comes at an environmental cost.

Geopolymer reactions, on the other hand, require two parts—a source of alumina silicates as well as an alkali activator. The former, the alumina silicates, is often found in volcanic ash. The latter, the alkali activator, is often found in lime. When the two are combined, a chemical reaction results in the creation of a strong concrete. Interestingly, while the process of creating the structural bonds in Portland cement is different from that of geopolymers, the final product can be near identical—something called calcium-silicate hydrate or CSH.

The Romans are often cited as inventing concrete, and they surely perfected its use. The Pantheon in Rome is to this day the largest unreinforced concrete dome, still standing 2,000 years later. The Romans couldn't have made a concrete of the type we make today—they didn't have kilns capable of super heating limestone to 2,000+ degrees Fahrenheit. Rather, the Romans pioneered a form of geopolymer concrete. They combined volcanic ash mined from sources like the island of Pozzollo with lime made from kilning limestone at relatively low temperature to make a strong concrete, much of which is still around.

Imagine how we could revolutionize today's concrete masonry industry by rediscovering the Egyptians' formula. Low-cost, sustainable, resilient, and highly durable masonry

could be produced nearly everywhere on the planet from materials sourced locally, all without ultra-high embodied energy binders.

Watershed Materials, with the help of the National Science Foundation, has been exploring just that. Two phases of SBIR grants have been applied toward creating durable concrete masonry from the geopolymerization of alumina silicates found naturally in common earthen materials. If we're successful, we may be able to revive part of the science that allowed the Egyptians to make man-made stones so durable that they've not only lasted for over 4,000 years but have also fooled modern historians by appearing identical to geologically formed, quarried rock.

Watershed Materials has developed the first prototype of a new masonry block machine that applies intense compressive force to allow the interparticle contact necessary for geopolymerization of common earthen materials of relatively low reactivity. Along with the design of a new machine for producing sustainable masonry, Watershed Materials is developing mix designs to create strong durable geopolymer masonry from common clays and earthen aggregates found nearly everywhere across the planet.

While we may have been wrong about how the ancient Egyptians built the pyramids, learning the right answer has implications for modern materials science and provides a new way forward toward developing far more durable and sustainable alternatives. ●



Above: The ceiling of the Pantheon in Rome—the largest unreinforced concrete dome in the world—still standing 2,000 years later. Below: Bahia Honda Bridge in the Florida Keys. The reinforced concrete deck was installed in 1938 and abandoned 34 years later.





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IN THE LEED

A worldwide lens on 15 LEED-certified projects built in the last 15 years reveals the rating's versatility, value, and staying power.

WRITTEN BY **KILEY JACQUES**

After 15 years at work in the field, U. S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) certification has found applications in settings as diverse as the systems it supports. From a super-tall tower in Taiwan to permanent housing for the homeless on Hollywood's Santa Monica Boulevard to the 26-building university campus of KAUST in Saudi Arabia—LEED ratings of all levels have been achieved on many fronts, both foreign and domestic, and continue building the foundation for future generations.

ILLUSTRATION BY TRISTAN CHACE



The opening illustration is a take on Charles Demuth's *I Saw the Figure 5 in Gold*. It evokes movement in an urban setting—much like the progress of LEED during the past 15 years.

The Philip Merrill Environmental Center

The Philip Merrill Environmental Center, headquarters to the Chesapeake Bay Foundation (CBF)—a 35-year-old non profit organization dedicated to resource restoration and protection and environmental advocacy and education—is the first building in the world to be LEED Platinum certified. In design, construction, and operation, the building reflects the organization's mission to protect and restore the bay.

It was with deep consideration that they decided to build on this extremely sensitive site—the aim always being to use the building and grounds as teaching tools.

Today, a steady stream of visiting school children goes out on the Bay in kayaks and other watercraft to learn about the ecosystem and the importance of protecting it through sustainable design. Beyond informing students, the center serves as an interactive model that educates the greater community by reducing pollution, mitigating environmental impact, and saving money.

"LEED provided a more holistic definition of sustainable design, helping our team to create a new benchmark that embraced a vision of sustainable design that aligned with a vision of how we can build in harmony within our watershed," says architect Greg Mella of SmithGroupJJR.



The Philip Merrill Center is the first building in world to be LEED Platinum-certified.

Opened in 2001, the 32,000-square-foot center—built atop the foundation of a defunct beach club—has received international acclaim as a model for energy efficiency, high performance, and water conservation. They have also since restored the 30-acre site to its original habitat of natural waterways, meadows, and shoreline.

At the time of its construction, small singular efforts at sustainability on the residential front were being made, but SmithGroupJJR looked at ways to scale those efforts up to serve in a commercial capacity. Imperative to its success, they viewed the project not only in terms of environmental design but also with respect to occupant wellness and health—part of a whole building-systems approach. “When SmithGroupJJR set out to fulfill the Chesapeake Bay Foundation’s goal to create the greenest building possible, there were not a lot of examples of buildings in the United States that approached sustainability holistically,” explains Mella, who, together with his team, became forerunners for the model.

Fifteen years ago, cutting-edge features included: natural air ventilation, galvanized siding made from recycled metal, passive solar power, composting toilets, and a rainwater catchment system, which treats water onsite to be used by employees for hand washing, doing laundry, and irrigating the grounds. “We hadn’t understood the complicated regulatory issues related to using rainwater for hand washing,” notes Mella. “The accomplishment was pioneering not only for its day, but also even today few buildings have stepped over this hurdle.” He adds, “The natural ventilation design of the Merrill Center has influenced many designs that followed, finally breaking the perception that energy-efficient buildings need to be sealed off and isolated from the natural world.” Then, as now, the headquarters uses 10 percent of the potable water and 30 percent of the energy of a conventional office building.

The building continues to serve as a founding example of how LEED works. “It’s not surprising that when CBF and SmithGroupJJR connected with the pilot version of LEED, we pursued and accomplished LEED Platinum—the first project in the world to achieve that target, paving the way for thousands that followed,” says Mella proudly.





Exterior of hotel, Heritance Kandalama, Sri Lanka. Photo by Samitha Godamanna; courtesy Aitken Spence.

Heritance Kandalama Hotel

The 152-room, five-star Heritance Kandalama Hotel located in Dambulla, Sri Lanka, is the first LEED-certified green building outside of the United States, as well as the first LEED-certified green hotel in the world. In 2000, it was awarded LEED certification as a LEED v1 pilot project. “The certification was certainly groundbreaking for LEED, as the USGBC’s first international project, and for green buildings in Sri Lanka, to earn an international green building recognition,” says LEED Fellow Mario Seneviratne.

Designed by the late architect Geoffrey Bawa, the 253,000-square-foot hotel is located in the historic cultural triangle’s heartland and is flanked by two World Heritage sites—making it an area of tremendous cultural and historical importance.

Erected on stilts to maintain the natural rainwater flow, Heritance Kandalama’s surrounding grounds were restored after construction, and 80 percent of the roofs are planted with native vegetation. “The building was planned around the backdrop of a rock formation to provide a degree of passive cooling, which reduced the overall cooling load,” explains Seneviratne. Additionally, the hotel’s total water and sewer needs are met from resources onsite; all water is recycled and

reused, and effluent passes through two treatment plants before irrigating the landscape.

“Green Technologies worked with the hotel owner, Aitken Spence Hotels, to transform this environmentally sound architectural design to a LEED v1-certified building,” explains Seneviratne. The team applied passive design principles, was at all times sensitive to the natural surroundings, and gave the utmost attention to conservation on all fronts—making Heritance Kandalama Hotel a very unique destination.

The University of Santa Barbara’s Bren Hall

University of Santa Barbara’s Bren Hall achieved LEED Platinum certification in 2002, making it the greenest laboratory building in the country and the first in the University of California system to be LEED certified. It houses the Bren School of Environmental Science & Management and the Environmental Sciences department, and is the nation’s first building to earn two LEED Platinum certifications—one for New Construction and one for Existing Buildings.

The \$26 million, 84,672-square-foot building designed by Zimmer Gunsul Frasca Architects stands as a physical manifestation of UC Santa Barbara’s efforts in scientific and academic innovation and leadership, and as a

**Below: Courtesy
of the Bren School
of Environmental
Science &
Management**

pioneer in low-impact facilities. "It has become a living laboratory for new technologies," says Development Engineer Sage Davis, who points to the incorporation of 20 percent coal fly ash, a waste product, into the concrete mixture used in the building's construction, as one example. "This was revolutionary at the time, and now it is practically commonplace." Another strategy was the new white-roof membrane used to reflect and reduce the heat absorbed into the building, which is now the standard on campus, when applicable.

To maximize energy efficiency in such an energy-intensive laboratory setting, the design team relied on natural ventilation provided by operable windows in ocean-facing offices, which intentionally lack air conditioning units. "A key feature in the office wing is the ample natural lighting, natural ventilation, and beautiful views, which make the offices a very pleasant place to work," says Davis. Additionally, the office wing has four breezeways and two decks that allow for

outdoor collaboration in meeting areas that capitalize on the temperate environment and natural lighting.

To further reduce energy waste, the windows are equipped with sensors that shut heaters off when the windows are opened. High-efficiency lighting fixtures with occupancy and daylight sensors help minimize electricity usage and a rooftop solar photovoltaic system generates approximately 10 percent of the building's power onsite.

Water conservation is achieved with waterless urinals, low-flow fixtures, and automatic sensors on all toilets and sinks, as well as the use of reclaimed water for irrigating the landscape, which is comprised primarily of drought-tolerant plants. The use of recycled and renewable construction materials, extensive resource use and air quality metering, and low-VOC paints and finishes are also among the ways Bren Hall earned both its credits and its reputation as "the highest standard for sustainable buildings of the future."



The Solaire

Located just a few blocks from Ground Zero in lower Manhattan's Battery Park City, the Solaire stands as the world's first-ever "green" high-rise apartment building, having earned LEED Gold for New Construction and Platinum for Existing Building.

At the time of its opening, the 27-story, 293-unit complex was the most environmentally responsible residential high-rise, worldwide. It uses 35 percent less energy than its conventional counterpart, and at least 40 percent of its materials—many of which are made of recycled content—were manufactured within 500 miles of the site. The building generates about 5 percent of its own electricity through photovoltaic solar panels, and natural gas is used for its air-conditioning and heating systems, which means a reduction in greenhouse emissions as well as utility costs.

As a building occupying waterfront property, water treatment is of special importance; it is cleaned and regenerated onsite, which means a decrease by one-third of potable water compared to similarly sized traditional structures. Each apartment uses separate water lines to flush toilets with treated wastewater piped up from a basement treatment plant, and rainwater collected in a 10,000-gallon cistern irrigates both a park and a rooftop garden.



Solaire is the first green high rise apartment building in the world.

Phipps Conservatory Center for Sustainable Landscapes

On what was once a paved public works yard, visitors to Phipps Conservatory Center for Sustainable Landscapes (CSL) are now greeted by 1.5 acres of lush green space and biodiverse plantings that provide food, shelter, and nesting areas for wildlife right in the heart of Pittsburgh. For the planners behind CSL, LEED Platinum certification provided a blueprint from which they built a model for sustainability across a broad array of metrics.

Having achieved the highest number of points awarded under version 2.2 of LEED Platinum, they pursued and achieved three additional certifications including the Living Building Challenge, which required the building to demonstrate net-zero energy and water usage over the course of a full operational year. Additionally, the site is the first and only SITES Four-Star Certified project for landscapes and illustrates how the natural landscape is inextricably linked to the building itself. The CSL also achieved the first and only WELL Building Platinum Pilot certification, making it the first and only project to attain all four certifications.

"Together, we see these four standards as diversified, complementary, and mutually reinforcing,



The Phipps Conservatory of Sustainable Landscapes introduces the public to the importance of human-environment interactions.

a holistic set of standards for green building,” says executive director Richard V. Piacentini. “Because the CSL is part of a public garden experience enjoyed by over 350,000 visitors annually, it is uniquely positioned to introduce the public to the... importance of human-environment interactions and the interconnections between people, plants, health, planet, and beauty.”

Key features include a 4,000-square-foot lagoon fed by roof runoff, an atrium, biophilia-inspired artwork, behind-the-scenes looks at the inner workings of solar panels, wind turbines, and digital building controls. Additionally, a green roof supports more than 150 native plant species from a range of local ecosystems.

The vast majority of the materials and products used in construction came from local sources, including wood from salvaged Pennsylvania barns that constitutes the skin of the building. “These factors are a remarkable testament to the determination, innovation, and spirit to be found locally,” says Piacentini. “It’s our hope that the recognition our region receives for its central role in the project elevates its leadership status in the movement and inspires more buildings like ours.”

Through talks and presentations, docent-led tours, and education programs, the CSL reinforces the

importance of human-environment interactions with emphasis on urban green space and gardening, healthy food initiatives, and sustainable building practices. “The creation of educational programs tailored to broad societal spectra enables Phipps to connect themes of sustainable living to choices visitors can incorporate into their lives,” notes Piacentini.

The Leopold Center

The Aldo Leopold Foundation’s headquarters, the Leopold Center, located in rural Fairfield, Wisconsin, is the first LEED Platinum-certified carbon-neutral building to exist. All of its energy needs are met onsite and its annual operations account for no net gain in carbon dioxide emissions. The building uses 70 percent less energy than a typical building of its size, and it produces 10 percent more energy than it consumes yearly.

The means by which that kind of energy savings is achieved include a geothermal radiant floor system—the primary system for heating and cooling the building. Additionally, by separating the fresh air ventilation systems from heating and cooling systems they are able to save two to five times the amount of energy used by a conventional building. Furthermore, a 198 panel roof-mounted solar array meets 110 percent



The Leopold Center's solar array meets 110 percent of its energy needs.



Dell Children's Hospital, located in central Texas.
Photo: Jody Horton Photography

of the building's energy needs on an annual basis, and insulated roof panels reduce gaps so less heat escapes.

Construction goals for the center included "maximizing the use of materials through innovative engineering," which led to the truss-formation of joined logs that, if used otherwise, would be considered unsound. Unique to this project is the fact that nearly all of the center's structural elements were built from pine trees planted by Aldo Leopold and his family between the years 1935 and 1948. Site-harvested wood was used for trusses and beams, as well as siding and finish work, while other locally harvested materials were used for exterior siding, flooring, furniture, and interior paneling. The Leopold Center is the very embodiment of its surroundings.

Dell Children's Hospital

Dell Children's Hospital, located in central Texas, is the first hospital in the world to be certified LEED Platinum under the LEED for Healthcare (LEED-HC) rating system. It serves as a valuable resource for medical professionals, architects, urban planners, environmentalists, and other officials interested in learning what it takes to turn a hospital into a 32-acre "living" campus.

And what it takes is smart design. Principal among the energy-saving strategies employed at Dell are: independent lighting and temperature controls in each patient room; reflective roof materials and light-colored sidewalks that reflect the hot Texas sun, thereby decreasing the urban "heat island" effect and the amount of energy required for air conditioning; high-efficiency fluorescent lights; air conditioning with automatic on/off switches; and a specialized ventilation system that recovers energy from building exhaust air.



The California Academy of Sciences is the only double LEED double Platinum museum in the world.

Other features include green roofs, a stormwater pond, and rapidly renewable construction materials. Additionally, 20 percent of the hospital's land has been devoted to open vegetated space planted with drought-tolerant native species and irrigated with recycled, nonpotable water, which means 1.4 million gallons of water are saved each year. Exterior lighting was designed to minimize light pollution; numerous recycling stations are found all through the campus; and low-VOC carpeting, adhesives, and paints were used for finishes. Furthermore, the hospital encourages the use of alternative transportation by providing bike racks and giving parking priority to hybrid and alternative-fuel vehicles, as well as to employees who carpool.

Visitors (and patients) can find out about this very special environment by reading the 21 signs describing its features located throughout the hospital. The Dell campus is at once a place for healing and learning.

The California Academy of Sciences

"As a public science museum and world-class research institution, the California Academy of Sciences is the only building in the world to combine an aquarium, planetarium, natural history museum, and a four-story rainforest under one living roof," says building systems manager Hershov Al-Barazi. It is also the world's first Double Platinum museum and the world's largest Double Platinum building.

Located in San Francisco's Golden Gate Park, the Renzo Piano-designed Academy received its first LEED Platinum rating under the New Construction category in 2008. In 2011, it was given a second LEED Platinum rating under the Existing Buildings: Operations & Maintenance category. Today, it stands as a prime



example of sustainable architecture whose function it is to host a wide variety of programs and exhibits about the history and the future of life on Earth.

"It represents the highest level of environmental performance, and sets an example as a leader in the San Francisco green building community," says Al-Barazi, who describes the iconic 2.5-acre living roof as being planted with over 1.7 million plants highlighting native plant species. "It creates an important ecological corridor for local species and represents the largest swath of native vegetation in San Francisco." The entire community makes use of the space, as it is used for public programs, citizen science projects, and research studies by high school and university students.

The Academy hosts over one million visitors each year. "By providing the public with tangible experiences centered around the natural world, we hope to help cultivate an appreciation for life on Earth and inspire environmental stewardship," says Al-Barazi.

Among the reasons for its Platinum certification is the fact that nearly 100 percent of the building's electricity comes from clean energy sources including the Hetch Hetchy hydroelectric plant and an onsite solar array. Additionally, water use is 32 percent below the LEED baseline due to the waterless urinals and low-flow faucets,

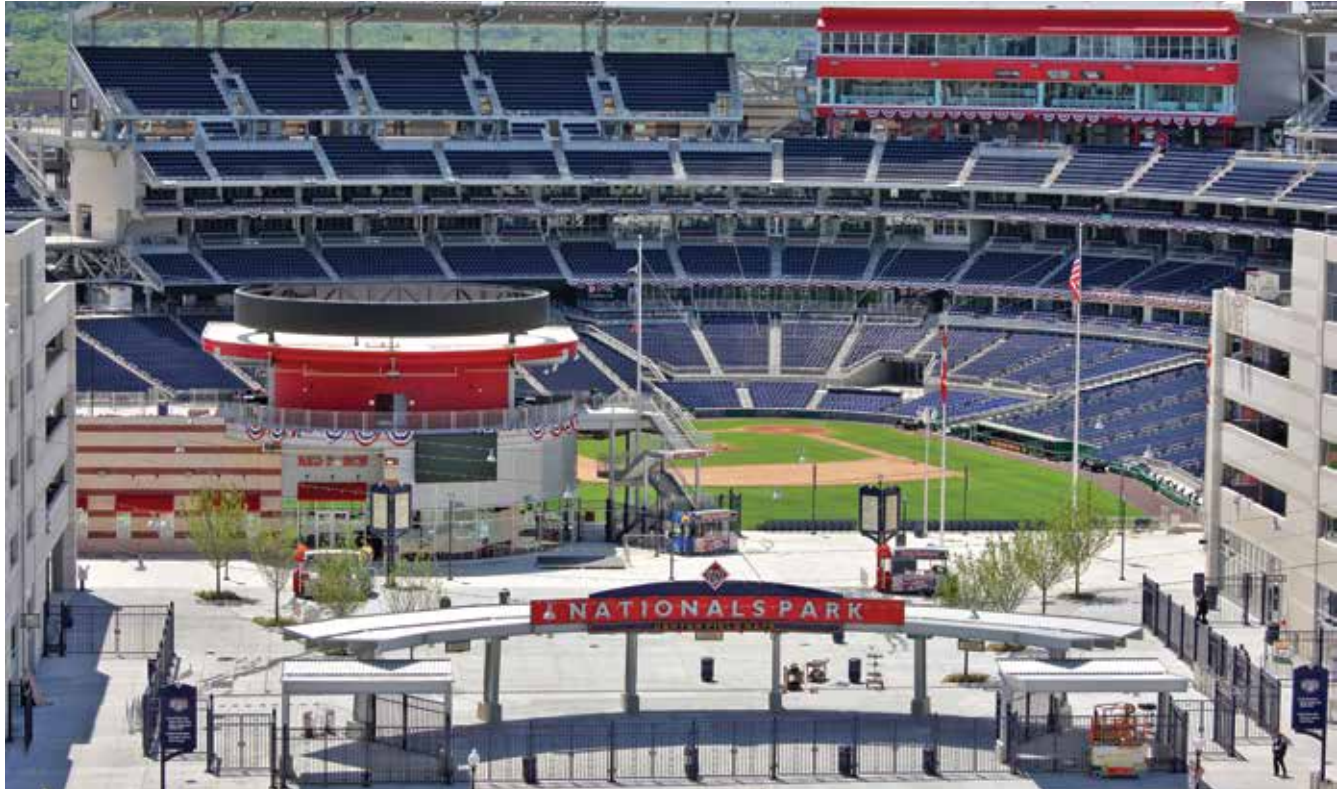
toilets, and showerheads. Between 60 and 65 percent of its waste is diverted from landfills into recycling or composting facilities, and 87 percent of the roof surface is covered in vegetation, which means a reduced "heat island" effect. Furthermore, 100 percent of excess stormwater from the roof drains into an underground chamber, where it percolates back into the water table, preventing runoff from entering the city's stormwater system.

All told, it is an exceptional example of large-scale sustainability at work in the public sector.

Nationals Park

The 1.1 million-square-foot Nationals Park in Washington, D.C., is the work of HOK and Devroux + Purnell Architects, who conceived the very first major league baseball stadium to earn LEED certification. Because the stadium is located on the bank of the Anacostia River, the team focused on improving the quality of stormwater leaving the site. "Prior to starting construction, the 25-acre ballpark plot was enrolled in a voluntary environmental remediation program, which dramatically transformed the former industrial site," explains Anica Landreneau of HOK.

Completed in 2008, key features of the stadium include: a 6,300-square-foot green roof; screens for capturing solid material from both rainwater and wash



Nationals Park is the first LEED-certified baseball stadium.



Step Up On Vine's rooftop farm in Los Angeles is the world's first LEED Platinum aeroponic rooftop farm. Photo: Shangri-La Construction, LP

water leaving the seating areas; large sand filters buried under the project for treating stormwater; a sanitary system for filtering wash water; low-flow faucets and dual-flush toilets; air- (versus water-) cooled chillers; and energy-efficient field lighting. Other LEED-aimed strategies include additional insulation, high-performance glazing, overhangs and external shading, and heat-recovery ventilation in the locker rooms. Furthermore, special attention was also given to the treatment of organic debris like peanut shells and hotdog buns, which are unique to this project.

"In all, the ballpark was expected to use 15 percent less energy, by cost, than a comparable conventional ballpark. The project team selected construction materials for their recycled content, regional availability, and low chemical emissions," notes Landreneau, whose team promises that "efforts to clean local groundwater using this smart system will continue throughout the life of the ballpark, ensuring that it does not pollute the Anacostia watershed or nearby Chesapeake Bay."

Throughout construction and today, Nationals Park has had a positive impact on the local community. The project has created nearly 1,000 jobs and has served as a catalyst for green development in the Southwest Waterfront community. "The facility proved that sustainable outcomes are possible, even on the most challenging of facilities," says Landreneau, "as long as you have a team willing to find a way to turn those challenges into opportunities."

It is especially important to note that since Nationals Park earned its LEED certification, numerous other sports facilities have followed suit.

Step Up on Vine

"Recovery is so difficult if you are homeless," says Tod Lipka, president and CEO of Step Up on Vine, a nonprofit based in Los Angeles that provides LEED Platinum-certified permanent housing for the chronically homeless. The 30-year-old organization's mission is to create opportunity for recovery for people with serious mental illness. Two years ago, it was decided the color of that opportunity should be green.

The project is the result of collaboration between Step Up on Vine and affordable housing developer Hollywood Community Housing Corporation. It is a 36-unit permanent housing development built for those who are most symptomatic with their mental illness and who are living on the streets of Hollywood. A \$15 million investment in the Hollywood community resulted in the acquisition and redevelopment of the building. Originally a 1925 hotel, Shangri-La Construction did a major rehabilitation; though they kept the foundation, they completely rebuilt the structure, which sits several blocks from the infamous corner of Hollywood and Vine. "From the beginning, we approached it as a LEED project because that's our commitment," says Lipka. "We think it is good practice in the community to think from a green perspective. We work with people with mental illness so we are very thoughtful about resources and utilizing resources from an organizational perspective."

Economically, it made sense. There is usually more funding given to housing, but not as much for the support services required for it to be effective. "When people move into housing after years on the streets, they need a lot of help," notes Lipka. Support is

essential and it needs funding, so by approaching the building of Step Up on Vine, they sought to save money over the long term. They have incorporated the service costs in the operating expenses; that is, what they save in energy expenses they put into supportive services.

In 2010, Step Up on Vine, along with the Clinton Global Initiative, USGBC, and Shangri-La, committed to building 200 green units for supportive housing for those most in need. "Shangri-La really opened these doors and their focus on LEED certification has made them fantastic partners during this whole process," says Lipka, with deep gratitude.

The building's ground floor serves as a day center and includes a full industrial kitchen, showers, and laundry facilities for the currently homeless, as well as a café that is open to the public and provides a source of "supportive employment" for tenants. Of special note is the aeroponic roof garden (also a source of employment), where all-organic produce is grown and used in meals for tenants. A complete solar array for electricity and water is also among its sustainable features.

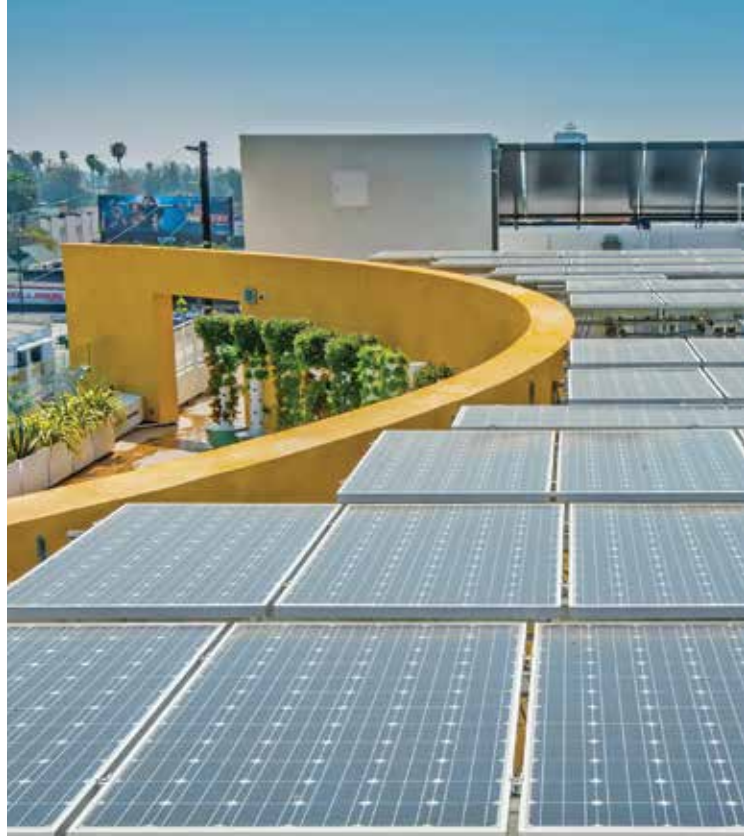
Of the value the building has added to the community, Lipka says, "We ended 250 years of cumulative homelessness among the tenants who moved in from the streets of Hollywood. We've created an emerald on this street corner that's a very visible upgrade to what was a downtrodden building. It's a vast improvement physically and architecturally."

Lipka notes the Clinton Global Initiative and Kobe Bryant family foundation were major supporters of the project, which he says has "raised the awareness not only of homelessness but also sustainability in design and LEED certification, and how you can really have great synergy between the sustainability component of housing with interactive service support." He wants it known that both he and the staff feel very honored, as a nonprofit, to have been able to partner with USGBC. "We think that LEED certification and green buildings are really critical not only for the future of the community but as an integral part of solving homelessness."

Andrew H. Wilson Charter School

Andrew H. Wilson Charter School in New Orleans was one of the first five Quick Start schools to be rebuilt after Hurricane Katrina. It received LEED for Schools Gold certification in 2010, and is the result of a joint effort on the part of the Recovery School District (RSD) and the New Orleans Parish School Board.

RSD required that local architects team up with nationally well-known green architects so they could learn from sustainability experts. New Orleans-based HMS Architects teamed with North Carolina-based Innovative Design to co-design the school, which was one part new construction, one part historic



Step Up on Vine's sustainable features include a cool roof with a 50-kw solar array. Photo: Shangri-La Construction, LP

adaptation. "They wanted to build them very quickly and showcase sustainability," notes Bae-Won Koh, principal of Innovative Design. "They wanted to exemplify these five schools first."

The team was given a very short period of time to earn LEED Silver certification and achieve 30 percent energy efficiency—the goal set by RSD. But Andrew H. Wilson achieved LEED Gold certification—the only one of the five to do so. Koh attributes that success to their method of utilizing energy modeling and daylighting analysis as a design tool rather than an analytical tool employed after project completion, as is typical of many architecture firms. "A lot of companies do the modeling at the end of the project to show the energy numbers and to submit for certification, but our company utilizes those in the schematic design and design development to choose the most energy-efficient strategies."

This project is also unique in terms of its site. "It is not a totally new project," explains Koh. "It is a renovation of a 100-year-old historic building plus a new addition." It was a bare bones building without insulation. "The thermal envelope was challenging for us because we could not add anything to the exterior of the historic building. We had to do everything to the interior," says Koh. They used high-thermal value insulation and different glasses were chosen not only in terms of orientation but also with respect to function. The historic portion of the building faces east and



The Andrew H. Wilson Charter School is a 100-year-old renovated building.

west, which makes controlling low-angled sunlight difficult. “We came up with a very unique vertical baffle design on east and west classroom walls,” notes Koh, who explains that daylight controls are typically placed on a building’s exterior. Their solution diffuses the light into the classroom so there is no direct sunlight, which often causes physical discomfort and glare. Depending on the room’s function and orientation, they adopted four different daylighting strategies throughout the school, all of which provide diffused lighting. (Koh’s firm is made up of daylighting specialists, which explains the emphasis on natural lighting throughout.)

LEED for Schools certification, unlike commercial certification, includes a prerequisite that calls for high acoustic performance. “Our project went above and beyond,” says Koh of its approach to the acoustics requirement. “There is a credit, which achieves a little more stringent requirement than the prerequisite, and our project achieved that credit as well.” As an example of how they earned that credit, Koh describes intentionally situating storage rooms as buffers between regular classrooms and music classrooms, and using high-level acoustical insulation for the partition walls between classrooms.

Experiential learning elements play a large role in the design and use of the building, too. Interpretive signage throughout the school allows students to learn about its green features. They are in locations like the

aboveground rainwater cistern, where they learn how water is collected from the roof and used for irrigation. There is a sundial on the south exterior wall where kids are taught to tell time by the sun. In the media center, they created a small hole on the exterior wall with a Plexiglass cover so students can see inside the wall and learn about the insulation materials—signage explains how the architects achieved the thermal envelope. Signs also explain how daylighting works and the green materials that were used. The team even put together a brochure for educators to use as a teaching tool with both students and the greater community.

The school has had a major impact on the Broadmoor neighborhood in which it is located. It is the epicenter of that community, and has been for many years. After Katrina, many people left. Once the school was rebuilt, many returned. It is a space that is shared with the public. Koh’s team designed the gymnasium, cafeteria, media center, and courtyard to support community activities held outside of school hours; the Broadmoor Community Association uses it regularly for their general meetings. The return rate for the Broadmoor community after Katrina was much higher than the rest of the city—a fact Koh contributes to the new school. “A lot of people have had an attachment to that school for years and years. I believe this school’s restoration gave them their attachment back to the community again.”



The Dexter Horton Building has a LEED Dynamic Plaque.

stairwell lighting and elevator cabs, and the installation of a cooling tower with variable frequency drive.

Value-added improvements to the former commercial office building include: the conversion of ground-floor retail space into a bike room with lockers and showers; the addition of an indoor/outdoor rooftop amenity space; the creation of an indoor canine relief area; and the removal of drop ceilings and exposure of original concrete columns and metal lattice, among other details. Of those changes, Loveland says, “The renovations performed at the building have provided tenants with more amenities and more opportunities to connect with one another. The work created 21 full-time jobs and resulted in \$3.5 million in fiscal impacts to the local community.”

Being so accessible, the LEED Dynamic Plaque enables building occupants to use smartphones to track the performance data. “It can be onerous to track and gather all the data,” says Loveland. This is an alternative shortcut of sorts. “We’re excited the LEED Dynamic Plaque allows us to show our tenants that their daily actions really do affect building performance and that they have a direct role in the certification outcome.”

The Dexter Horton Building

The historic Dexter Horton building in downtown Seattle is the first project to use the LEED Dynamic Plaque to keep its LEED certification up to date. The plaque is a faster means by which to assess a structure’s environmental sustainability (versus the full LEED for Existing Buildings recertification process), and allows real-time readings for measuring performance.

According to Renee Loveland, the sustainability manager for Portland, Oregon-based Gerding Edlen, which specializes in real estate investment and development and has as part of its portfolio the Dexter Horton building, the plaque turns a building’s performance into a conversation. “It doesn’t consist of a lot of paperwork,” she notes. “It’s more focused on the results you’re getting.”

In just a year’s time, the Dexter Horton building jumped from an energy rating of 60 to 78, and has maintained its original LEED Gold certification with a total of 70 points; its current ENERGY STAR rating is 79. Since 2007, per tenant electric consumption has been reduced by 34 percent. Energy-saving measures include retrofitted

King Abdullah University of Science and Technology

King Abdullah University of Science and Technology (KAUST) is the largest LEED Platinum project in Saudi Arabia; the campus comprises 26 separate buildings. Certified in 2010, KAUST’s sustainable development is integral to its overall mission “to nurture innovation in science and technology, and support research in areas such as energy and the environment.”

The end of 2006 saw the beginnings of KAUST, which was built from the ground up. Aramco, the largest oil company in Saudi Arabia, was tapped to manage the project because they were accustomed to working on such a large scale. In 2007, the very first person to be named a KAUST affiliate was put into position and became part of KAUST’s leadership team. The design process began in April 2007, they broke ground at the end of July 2007, and it opened in September 2009—an extremely fast trajectory from conception to completion.



KAUST's core campus, located on the Red Sea at Thuwal, consists of 5.5 million square feet, with 2.5 million devoted to laboratories.

The purpose of the entire facility was to move Saudi Arabia away from an oil-based economy. It was government mandated, as were a number of other similar projects. "It was intended as a means for finding a different economic future," says Bill Odell, director of science and technology at HOK—the design firm responsible for KAUST. The project proper consists of 5.5 million square feet, 2.5 million of which is devoted to laboratories; the rest comprise support facilities. (It's called a university but it's a graduate level research institute.)

As the building design was evolving, so too was the research direction for the institute. The government issued a "very broad mandate" from the king in 2006

to put forth a new beacon of learning—to move the country away from using oil as a fuel, and look for ways to use it as other materials by altering its chemistry (e.g., surgical instruments). "The goal is to develop high-value, non-toxic products to be used for good over and over again," explains Odell.

"What was important to the process was also important to the success of LEED," notes Odell. The project's key players included: Aramco, the client (eventually became KAUST); Aramco project managers; OGER International of Paris; and their sister company, Saudi OGER, the builders. "The dynamic between all of those parties was a very, very good relationship that allowed the project to get done on time and produce



KAUST's university buildings have been specifically constructed to utilize natural light and ventilation. They support a roof capable of carrying 12,000 square meters of solar thermal and photovoltaic arrays that can use the sun to produce 3,300 megawatt hours of clean energy every year.

the LEED Platinum project that it became," says Odell. The decision making for everything happened very quickly. While Aramco was supportive of LEED, they didn't know a lot about it. They put their trust in HOK, which moved things along. "It was their faith in our direction that helped a lot," he notes.

The design was put together with input from five different institutes, each of which focused on one of the following areas: alternative energy; water and desalination; bioremediation; sustainable agriculture; and materials and membranes. The sheer speed with which it was put together is something Odell feels distinguishes the project. "And the cost was a bargain; it was not throwing money at this problem. It cost much less than similar facilities. Part of the reason for that is because it did so well with LEED and sustainable strategies. "Because of the time restraints, suppliers gave the very best price, the very first time they bid. There was a lot of, in a sense, customization around the environmental issues that we were concerned about."

The original site plan had the new facility sitting right on the edge of some of the world's most pristine coral reefs—a major design consideration. So they

moved the site slightly, pulling back from the edge, and built a harbor to avoid impacting the coral, as well as a waterway that constantly flushes the water to keep it clean. Also, they sought to protect the mangroves that grow along the perimeter. The bay they created was to be part of the marine biology research center. (KAUST partners with Woods Hole Marine Biological Laboratory to help preserve the Red Sea ecology.)

According to Odell, the campus itself has become a major recruiting tool when trying to get talent to do their research in Saudi Arabia. Most of the research being conducted there is around sustainability issues. "You have people who are predisposed to value the campus in that way," he says. The project has raised awareness in all of Saudi Arabia. "It's given visibility to not only the problems they face, but also the solutions that can be had out there," notes Odell. Since the building of KAUST, many Saudi-based projects are framed in terms of it. Clients are generally well educated around its value in fostering sustainable strategies, says Odell. "They are looking to incorporate those things into their projects and take it all a step further."

Taipei 101 is a landmark supertall skyscraper in Xinyi District, Taipei, Taiwan. Photo: Henry Tsui

TAIPEI 101

Taiwan's TAIPEI 101 is an iconic building currently pursuing LEED v4, USGBC's latest version of the rating system. With 101 floors occupying over 2 million square feet of space, it is one of the world's tallest buildings. "TAIPEI 101 is the first super-tall building in the world to attempt recertification while upgrading to the new LEED v4 standard," explains Tim Shen, director of sustainability for Asia at CBRE. "In choosing to certify up to the new v4 system, not only has the team been encouraged to raise their game on several existing performance factors, but we've also been presented with totally new ideas to investigate and new challenges around innovation to explore. All of this emphasizes the fact that the pursuit of sustainability in commercial real estate is very much a constant journey."

Completed in 2004, TAIPEI 101's Shen's team sought and earned LEED for Existing Buildings: Operations & Maintenance certification in hopes of demonstrating the relationships between individuals, buildings, and the environment, thereby getting people to think about those relationships. The new certification, says Shen, "provides a good opportunity for the team to refocus their green operations programs to find new efficiencies, higher levels of performance, as well as reengage with tenants, vendors, and other stakeholders on environmental issues."

From 2008 to 2010, the team concentrated on retrofitting the building to save energy and water. Today, using Energy Management and Control Systems (EMCS), building managers are able to adjust temperatures, modify chiller plant operating schedules, as well as monitor water distribution according to tenant demand. At that time, the team also reviewed public lighting, which was ultimately converted to more energy-efficient luminaires and lighting controls. (The reduction in energy consumption is anticipated to be 33.41 million kilowatt hours per year, and they are expected to save more than 2 million dollars in operating expenses per year.) Furthermore, low-mercury and no-mercury lamp fixtures were installed throughout the building to reduce exposure levels and potential pollution.





The David and Lucile Packard Foundation features 90 percent California native plants to eliminate pesticides needed by foreign plants; the landscape also uses rain gardens and permeable paving to reduce runoff and to filter pollutants.

The introduction of low-flow water fixtures together with dedicated water management systems decreased potable water usage by approximately 30 percent (about 28 million liters of potable water annually)—significantly less than the average tenant high-rise building. They were able to do so without sacrificing tenant satisfaction.

TAIPEI 101 is currently working with the national utility company on becoming the first commercial building in Taiwan to sign up for a demand-response program. “This could be a potential game changer for the industry, with ramifications for the citizens of Taipei,” says Shen. If TAIPEI 101, with such a large number of the highest caliber tenants, can make a demand-response program work, it opens the way for a great many other office buildings to do the same.”

As a result of these efforts and based on the U.S. Environmental Protection Agency’s ENERGY STAR system, TAIPEI 101 ranks in the top 30 percent of high-rise office buildings.

Of special note is the way in which the team approached the landscape. In response to limited onsite green space, they implemented sustainable landscaping practices in the city—the idea being

that by doing so, they would achieve the overall sustainability goal of the project, as well as highlight their efforts citywide. As part of its building management initiatives, it adopted part of the Zhong Qiang Park to restore and protect habitats that support native flora and fauna. “The land trust has gained a lot of publicity, which has helped to raise the trust’s profile in Taiwan, and that of preserving natural habitats in general,” says Shen.

The David and Lucile Packard Foundation

For nearly 50 years, the David and Lucile Packard Foundation has supported organizations and individuals working to protect and restore natural ecosystems. So it only makes sense that their Los Altos headquarters are “green.” The 49,000-square-foot Packard Foundation is the largest building, to date, to receive Net Zero Energy Building certification. The LEED Platinum structure, designed by EHDD Architecture, was meant to produce at least as much power as it consumes annually. Today, 100 percent of the building’s energy needs are met by electricity produced from 915 rooftop solar panels, and heating



The David and Lucile Packard Foundation provides a comfortable, healthful environment for employees by using 100 percent outside air for ventilation and desktop alerts to indicate when doors and windows can be opened.

and cooling systems are made efficient using chilled-beam technology. "In each of its first three years of existence, our building has demonstrated that Zero Net Energy can be readily achieved while providing a beautiful, comfortable, and functional headquarters facility," says CFO Craig Neyman.

Further efforts toward sustainability include: the storing of 20,000 gallons of rainwater onsite for irrigation and toilet flushing; a living green roof and rooftop gutters for rainwater collection; smart controls and drip irrigation for targeted, as-needed watering; rain gardens and permeable paving that reduce runoff and filter pollutants; and the use of recycled materials from preexisting buildings, as well as Forest Stewardship Council-certified wood from Oregon. Additionally, all interior doors are constructed of locally salvaged eucalyptus trees and all finishes are low in VOC emissions, which in combination with a natural air ventilation system, makes for an optimally healthy space for occupants. (Desktop alerts even indicate when doors and windows can be opened for ventilation.) Of the landscape, it can be said that California native

plants comprise 90 percent, making it possible to be pesticide-free.

"The new building is a physical manifestation of our long-term commitment to reduce greenhouse gas emissions around the world, and aligns us even more closely with the important work our grantees do every day," says a Foundation spokesperson.

This cross section of LEED projects makes evident the seemingly boundless scope of the certification's applicability. All manner of enterprises not only benefit from but also thrive as a result of following its forward-thinking philosophy. LEED's suitability for diverse situations begs the question: Where will the innovation demonstrated here lead? In what ways will LEED push on? If the last 15 years are any indication, we can expect its continued success in transforming not just buildings and environments, but mindsets. In fact, LEED certification's physical manifestations are a kind of enlightenment—the understanding that sustainability is so vital it demands changes in the ways we think, design, build, work, and live. It's time to think of a future in which LEED is the standard. It's time to think of LEED leading on every front. 🌱

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Gateway to Sustainability

A St. Louis community has faith-based response to climate change.

By Jeff Harder



The U.S. Green Building Council's (USGBC) Missouri Gateway chapter and Missouri Interfaith Power and Light are both based in St. Louis, and the common ground doesn't stop there.

A national organization with chapters all across the country, Interfaith Power and Light (IPL) advances energy conservation, energy efficiency, and renewable energy in congregations and religious communities as a faith-based response to climate change. "The congregations that support Missouri IPL have a specific interest in reducing their carbon footprint and their buildings' energy use," says Emily Andrews, executive director of the Missouri Gateway chapter. Last year, thanks to a USGBC Impact Grant, the Missouri chapters partnered to provide energy audits for 10 congregations around St. Louis.

"That energy audit was a good starting point. Then the thought became: 'We have this energy audit—what's next? What do we do with this information?'" Andrews says. "That's where USGBC's ADVANCE program proved useful."

The congregations saw sustainability on a spectrum: Some saw how cost savings could help expand their mission, while others had environmental stewardship sewn into the fabric of their ministry. Along the same lines, some had been longtime sustainability proponents, while others were just getting started. "We weren't just one organization with all of its stakeholders at the table: We were a diverse group of organizations with one or two champions at the table,"



Left: Missouri Interfaith Power and Light has environmental stewardship in their ministry's mission. Photo: Kari R. Frey, FREYtography. Above: Johanna Schweiss is a volunteer and outreach coordinator, Emily Andrews is the executive director of the Missouri Gateway Chapter, and Tracey Howe-Koch is the coordinator of the Missouri Interfaith Power & Light. Photos: Kathy Arnold

says Johanna Schweiss, volunteer and outreach coordinator for the Missouri Gateway chapter.

Meanwhile, it was a perfect opportunity for USGBC volunteers around St. Louis to share their building science expertise and gain further experience. "The cool thing about ADVANCE is that it's a portal for both sides: Volunteers find a place that fits their passion and interest, and congregations, nonprofits, and other groups to find the assistance they need to green their buildings and their communities," Andrews says.

At the February PLANBuilder workshop at the Lafayette Park United Methodist Church in St. Louis, USGBC volunteers versed in all sectors of sustainability gathered with representatives from 15 multifaith congregations. After summarizing each LEED credit category, the attendees paired off to talk about the needs of each congregation and set distinct goals. Those goals and the strategies to achieve them were compiled in workbooks detailing the steps each congregation needed to take. For congregations that had yet to receive

an energy audit, benchmarking went to the top of the list of strategies for representatives to share with their congregations.

For congregations that already had energy audits, next steps ran the gamut from low- and no-cost tweaks like changing thermostat and hot-water heater settings, all the way to budgeting for capital investments. "One congregation said they expect to need a new roof within a few years, and after the workshop, they've made getting a high-reflectance roof into a priority," Schweiss says. Additionally, USGBC



Workshops held at the congregations spread the word about mitigating waste, growing vegetables in the church gardens, and carpooling.

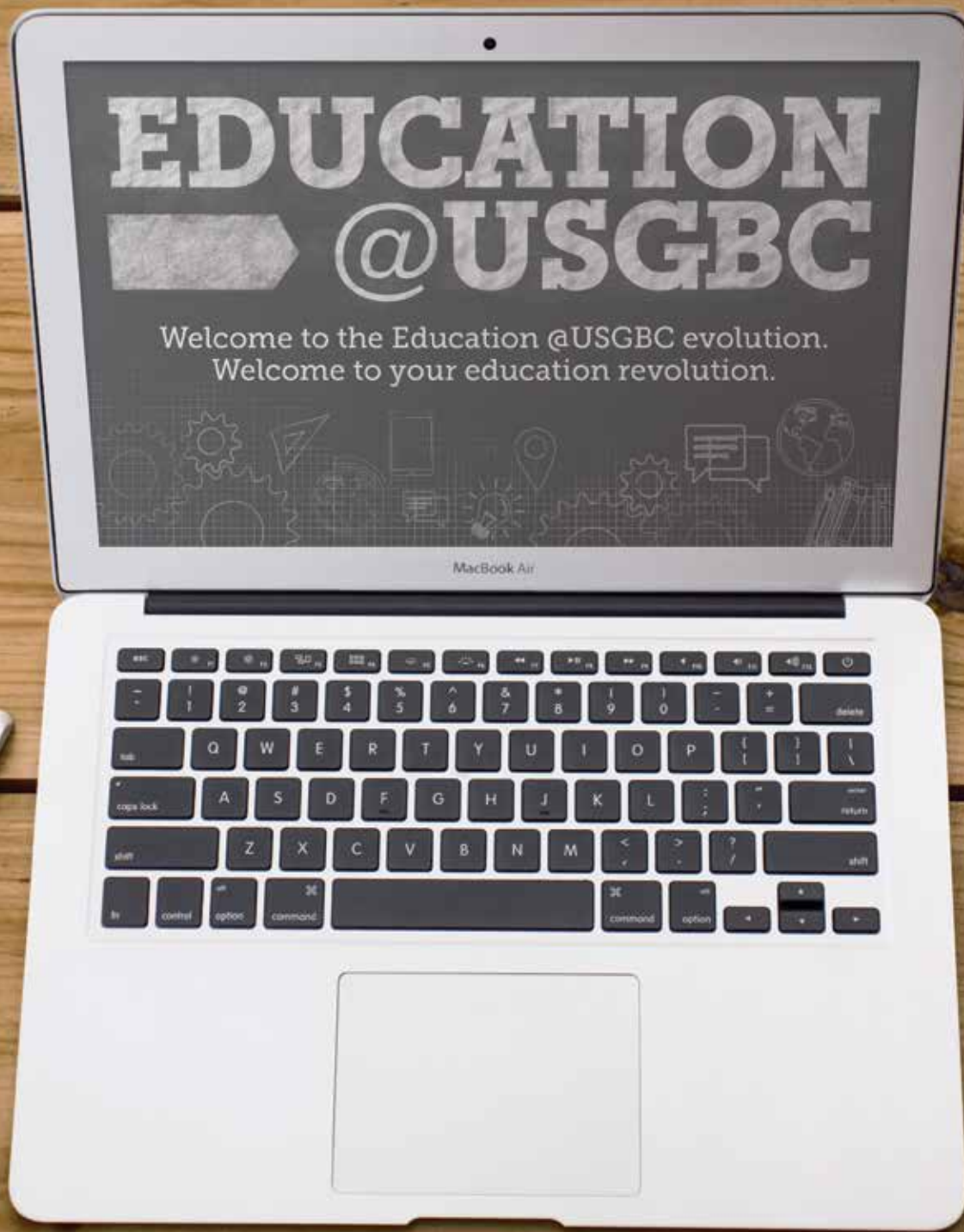
Top right photo: Kathy Arnold; Left and bottom right photos: Kari R. Frey, FREYtography

encouraged every congregation to take the 25 x 20 Pledge, a benchmarking initiative that's part of its campaign in St. Louis to reduce buildings' energy consumption 25 percent by the year 2020.

The workshop also allowed congregations to share some of their sustainability success stories, like organizing initiatives to mitigate the

waste generated during after-service coffee hours, using church gardens to grow food for local food banks, and using carpooling as a way to help needy congregation members make it to Sunday services—while reducing single-occupancy vehicles in the parking lot. “We had such great things already happening, and it was lovely to see people share those projects

and give each other the appreciation they deserved for work they had already done,” Schweiss says. Thanks to ADVANCE, the experts and the enthusiasts have a rapport with one another, a vital step in bringing those PLANBuilder strategies to fruition. Now, it's time to make the community they all cherish a deeper shade of green. ●



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The New Capital of Energy Conservation

How Atlanta is leading the south in energy efficiency policy.

By Cecilia Shuttars

From the baking heat and humidity of an Atlanta summer, stepping into the cool, climate-controlled, reprieve of one of its large downtown buildings offers instant relief. Once a largely unchecked box for potential savings and even job growth, Atlanta's commercial building stock is now at the center of the city's newest, boldest energy policy, the Commercial Buildings Energy Efficiency Ordinance. The city projects "a 20 percent reduction in commercial energy consumption by the year 2030," which will "spur the creation of more than 1,000 jobs a year in the first few

years, and reduce carbon emissions by 50 percent from 2013 levels by 2030."

The unanimous passage of the ordinance by the City Council in April of this year makes it the first city in the southeast, and the 12th city in the United States, to pass a version of what is known as benchmarking and disclosure (also known as transparency) policies. Atlanta's announcement precedes Portland, Oregon's and Kansas City, Missouri's recent announcements of similar polices, bringing the total number of cities to 14 as of this writing.

Atlanta Mayor Kasim Reed says, "This ordinance positions the City of Atlanta as a national leader in energy policy and aligns with my goal to make Atlanta a top-tier city for sustainability."

Atlanta's Commercial Buildings Energy Efficiency Ordinance is bold in its scope. It is only the fourth to have a policy inclusive of the powerful triumvirate of benchmarking, transparency, and commissioning, with a retrocommissioning option and the first city to include water audits.

"Cities can be powerful incubators for ground-breaking



**Left: Atlanta, Georgia's state capitol building with the downtown skyline on the right.
Photo: Henryk Sadura.**

**Right: Atlanta mayor, Kasim Reed.
Photo: Stan Kaady**

policy, especially on the energy front,” remarked Stephanie Stuckey Benfield, newly minted director of Atlanta’s Office of Sustainability. “Atlanta’s ordinance is particularly innovative since it includes water efficiency as well as energy efficiency.”

Benchmarking and transparency policies, now in 14 cities, two states, and one county, are the embodiment of the aphorism “you can’t manage what you can’t measure.” The building area covered by benchmarking and transparency (in multiple forms) across the country is equivalent to approximately 6.6 billion square feet of floor space. In its basic form, the first component of these policies, benchmarking, does exactly what it sounds like it might: sets the base against which the progress toward energy efficiency will be compared. Buildings then report their benchmarked consumption, and progress over time, to the administering authority via the transparency portion of the policy.

The third part of the policy puzzle is the energy audits, and in few cases retrocommissioning. The energy audit is defined as a professional appraisal of the existing equipment, operations, and opportunities for improvement. Retrocommissioning is an extension applied to existing buildings, in Atlanta’s policy this is a voluntary add-on, and ultimately was a concession to stakeholders looking for a more “iterative” approach to efficiency upgrades.

The version that Atlanta’s City Council was able to pass is on the high end of the spectrum in terms of its





Atlanta, the capital and largest city of the U.S. state of Georgia, is home to at least 37 skyscrapers over 400 feet tall.

Photo: Lawrence Jackson

requirements and expected outcomes. Specifically, all city-owned or operated buildings and all commercial buildings over 25,000 gross square feet must comply with benchmarking and disclosure using ENERGY STAR Portfolio Manager, and all city-owned or -operated buildings and all commercial buildings over 25,000 gross square feet must submit energy audits once every ten years. Notice of compliance went out early this spring; city-owned buildings had to comply first (by April 2015) and privately owned buildings have until July 20, 2015 to meet the requirements.

When asked about the expected impact, Matt Cox, Buildings Energy Efficiency Project Manager for the city, said, "At full implementation, we're expecting this policy to provide significant across-the-board benefits, not just to building owners, but also in terms of public health benefits from reduced emissions and more jobs that will contribute to Atlanta's economic well-being."

Passing this type of ordinance, though gaining momentum in municipalities across the country, like most innovative ideas, faces resistance. The Institute for Market Transformation (IMT) has been working with governments to overcome challenges and create opportunities for benchmarking and transparency policies.

"One challenge that owners often voice is that they can't control the entire building themselves and that tenants have a big impact on energy use in a building. This points to two market needs and opportunities," describes Cliff Majersik, executive director at IMT. "One, a need and opportunity for green or energy-aligned leases. These tools align the incentives for both tenants and owners to invest in energy efficiency so that both parties come out ahead when a building becomes more energy efficient. These leases also allow owners and tenants to set goals jointly and find pathways to reaching these goals together."

Having a numeric score, such as an ENERGY STAR score, provided through benchmarking, creates a helpful, measurable target for everyone. The other need and opportunity is for whole-building data access. To fully benchmark a building, you need access to all of its energy use data."

Despite challenges, IMT states that governments across the country are actively pursuing benchmarking and transparency to confront increased attention to water and energy management. In fact, the trend toward even more rigorous add-ons, like retrocommissioning and mandatory audits is becoming more popular as a policy option.

Atlanta is one of those governments. With 2,350 buildings (88 percent of the total commercial building space in the city) required to participate, Atlanta is well positioned to earn the moniker of the new capital of conservation in the southeast and beyond. ●

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ILLUSTRATION BY MELISSA MCGILL

Q&A

Mark Ginsberg,
senior fellow, USGBC
principal, Ginsberg Green
Strategies, LLC

Mark Ginsberg founded Ginsberg Green Strategies in January 2012 to consult on Eco-Cities, energy efficiency, and renewable energy. In Fall 2012, the U.S. Green Building Council designated Ginsberg as the first USGBC senior fellow, where he serves as a senior policy advisor and Ambassador. Prior to that, he served as a senior executive at the U.S. Department of Energy for 20 years and the Arizona Energy Office for 10 years.

Q. What is most remarkable about LEED's trajectory?

It still stuns me to see how far and wide LEED has grown in so little time. When Rob Watson first came to me with the idea for a green building rating system—and the hopeful promise of a full turnkey effort for just \$100,000!—I could never have envisioned it being used in 150 countries with over 13 billion square feet of space rated. From a few early federal buildings and industry leaders, it amazes me to see iconic buildings like the Empire State Building, Shanghai Tower, TAIPEI 101 and Carpe Diem in Paris all LEED rated. The 2002 Olympic Oval Building in Utah, the 2008 Beijing Olympic Village, the 2010 Vancouver Olympics, 2012 London Olympics, and the Olympics and World Cup in Brazil—all LEED. Buildings and neighborhoods around the world are healthier, greener, and more efficient. They offer the occupants clean, productive places to live, work, and play. Now that is a trajectory to be proud of!

Q. What are the biggest barriers and opportunities facing green buildings in India and China?

Both have an enormous opportunity—it's much easier to “build it right the first time” than to retrofit it later. With unprecedented urban growth, those countries face the daunting challenge of building a city the size of New York (or 15 cities of a million people)—every year—as an estimated 15 million people move from rural China to cities. India faces similar urban growth. Also, there is less availability of green professionals and a trained workforce. We have an estimated 2,000 LEED APs in China, for example, but that is not enough for the size of the market. I am optimistic that government and industry leaders want to build green and they are working to overcome these challenges, but I hope our member companies will be able to step up and provide the trained workforce and quality materials so that China and India can share our vision of “a green building for all within this generation.”

Q. The Mark Ginsberg Sustainability Fellowship was named in your honor. What can you tell us about this program and this year's recipient?

What an honor when Rick Fedrizzi announced at the 2004 Greenbuild in Pittsburgh the Ginsberg Sustainability Fellowship “to pursue Mark's vision, spirit, and integrity in perpetuity.” Talk about humbling. Rick's kind gesture has led to the naming of several exceptional professionals to serve as Ginsberg Fellows. It has translated into some very practical and cutting-edge work. I thank Chris Pyke and the selection team for finding “the best and brightest” who have contributed analysis and policy on topics like sustainability, social equity and resilience, research funding and the prospective research agenda, the green connection to health, and how we can connect green building with the real estate and capital markets. The 2016 Fellow, Hossein Shahrokni, will work from the KTH University in Stockholm with GRESB to improve scoring and benchmarking, strengthening our ability to help the real estate industry assess sustainability performance. The work of all the Fellows has expanded the reach of USGBC and I am so impressed and grateful for all they have accomplished.

 For more Q&A, visit plus.usgbc.org.



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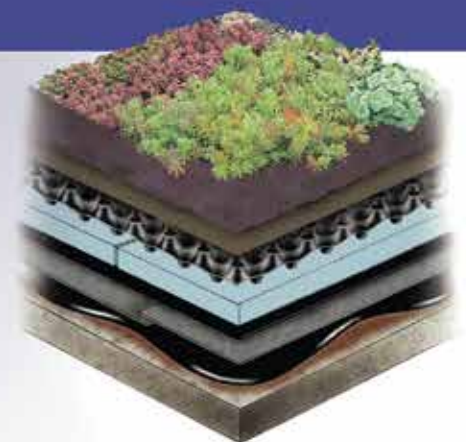
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