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FEATURE

34 SUMMER, SUMMER, SUMMERTIME
Itching to get away while the weather is warm but don’t want to travel far? Try these environmentally conscious and fun destinations across the U.S.

7 LETTER FROM OUR LEADERS
Stefanie Young
Vice President, Technical Solutions
U.S. Green Building Council

ON THE COVER
Illustration by Todd Davidson
14 community
Local food production and waste management systems promise an independent economy and healthy population in Hawaii.

20 resilience
Green building strategies and new data solutions point the way for the Golden State.

10 LEED Fellow spotlight
Chris Ladner, LEED Fellow, founding partner of Entegrity

55 up close
Taiwan’s first LEED v4 Platinum project is also the world’s first LEED v4 Platinum super-tall building.

62 solving sustainability
Test your knowledge of magazine content and more with a crossword puzzle.

64 professional pulse
Elizabeth Heider, FAIA, LEED Fellow; Chief Sustainability Officer of Skanska USA Inc.
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Summer of Innovation — Time to Explore

With summer in full swing, it’s time to explore. Sometimes exploration takes us far from home, into the mountains or to the ocean. A sense of adventure and curiosity can take us to a new city or call us back to a place we’ve already been for a second look. Some of the best adventures can take place in our own backyards, or between the covers of a magazine. In this issue of USGBC+, we are excited to take you on a journey through both familiar and uncharted territory.

Over the past several months, in my capacity as technical solutions lead for USGBC, I have joined our president and CEO, Mahesh Ramanujam, on a whirlwind tour of the U.S., delivering LEED v4.1 education across the country. We have presented more than a dozen workshops on the rating system, and we’ve met and engaged with more than 250 LEED users. As I’ve traveled from state to state, I’ve been reminded of the many destinations and attractions that have embraced LEED over the years, several of which are profiled in our feature article.

From zoos and aquariums, to theatres and museums, LEED works for every space type, improving the environmental performance and human experience of every project. LEED-certified attractions are everywhere. Some are more famous than others, but all are inspiring. Now is as good a time as any to explore the LEED projects in your own neighborhood, or to add a few stops to your next trip.

Apart from travel, summer is a time for growth and preparation, two themes I see in our articles on California and Hawaii. Both states face unique challenges because of their geography and climate, but each state is embracing innovative solutions to ensure the health, safety, and prosperity of their populations for generations to come.

As a native of California, witnessing the devastation the wildfires have brought to my home state has been heartbreaking. As California’s wildfire season stretches to encompass most of the calendar year, the need for places of refuge with excellent indoor air quality will only increase. LEED buildings can offer sanctuary.

Beyond being temporary places of respite, LEED buildings can also be the place we come home to at the end of a journey. My home is LEED Certified, as is my neighborhood, and knowing this gives me confidence that where I choose to live is a part of the solution to so many of our environmental and societal problems.

All of this underscores something we know to be true: Green buildings are all about people. They can keep us safe and healthy in the face of poor conditions, even as they work to improve our natural environment. They can play host to activities and attractions that delight and educate us, even as they reduce our footprint. They can be our own personal retreat from the world—our home and our platform for the betterment of our community.

No matter where you live or where you roam in the summer months, there is almost certainly something interesting going on with green building nearby. In the spirit of summer, may this issue of USGBC+ inspire you to explore, grow, and prepare for great things ahead.

LEED ON,
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Boston Public Market Association (Owner), Architerra (Architect), Chuck Choi (Photographer)

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LEED FELLOW SPOTLIGHT

Endless Energy

Hailing from Arkansas, LEED Fellow Chris Ladner champions sustainability one unique solution at a time.

WRITTEN BY CATHERINE SHANE
Want to know what gets Chris Ladner fired up? Composting systems. More specifically, composting systems installed in Arkansas’s correctional centers. It’s not the actual system itself that thrills him, but the way it serves as an ideal example of what makes his work so meaningful.

“This facility was pouring maybe two tons of food waste a day, plus water, down a concrete channel to send it all to a wastewater plant,” he says. “My engineers saw that and said ‘Hmm, what’s going on here?’ Why not install composters?” The facility just didn’t know any better—nor how much money it could save them that could then go to other necessary upgrades. That was just the way they had always done it.”

But that’s precisely the mission of Ladner’s energy services company, Entegrity, headquartered in Little Rock, Arkansas: to complete high-level reviews of clients’ builds—largely existing buildings which range from a 5,000-square-foot Girls & Boys Club to a 4-million-square-foot office facility for a Fortune 500 Company—and determine a uniquely tailored set of solutions that result in massive energy savings. Of course, there’s the low-hanging fruit—the obvious solutions like switching all lighting over to more efficient LED bulbs or updating a dated HVAC system. But then there are the not-so-obvious ones, like the composters in the prisons. “My engineers leave no stone unturned to find solutions in unexpected places for our clients,” says the 54-year-old. “And when we do, it’s really energizing. That’s why I love what I do.”

Calling himself a “serial volunteer,” in addition to his work as a founding partner at Entegrity, Ladner has been involved in all sorts of local and national sustainability efforts, including helping to develop the local U.S. Green Building Council (USGBC) chapter back in 2004–2005, serving as a commissioner on the Governor’s Commission on Global Warming in 2008, and as chairman of the Alternative Energy Commission, formed in 2009. He was also a past consultant for the Clinton Climate Initiative, and he’s spoken on sustainable design and construction for various organizations and groups, including the Greenbuild International Conference & Expo. He’s also participated in various Leadership in Energy and Environmental Design (LEED) projects including those for neighborhood development, commercial interiors, new construction, existing buildings, and homes. He helped develop LEED v2009 and was on the Energy and Atmosphere technical advisory group TAG from 2011–2015.

All these positions and postings haven’t gone unnoticed: In 2013, Ladner received the LEED Fellow distinction, the first LEED Fellow in his home state of Arkansas.

So how does a New Orleans–born kid who moved all over the place during his upbringing—from St. Croix to Bermuda to Chicago (his father worked for the U.S. Department of Agriculture)—get to where he is today? He credits a lot to an early boss.

After earning a degree in industrial engineering from Iowa State in 1988 (“Go Cyclones,” he jokes), he went to work for the Arkansas franchise of Trane, the heating and air conditioning manufacturer, where he was a sales engineer (meaning he was involved with the design, installation, and support of HVAC equipment and controls).

“My boss at the time, Bill Harrison [now of Harrison Energy Partners], is just a quality human being,” he says. “He knew how to run a business, but was also flexible about my desire to do and learn different things. He was involved in the development of our local chapter of USGBC and encouraged me to get involved, too.” And that’s where Ladner realized that sustainable design and construction really resonated with him. “I found it fascinating. It was that fuel I needed to light that fire.”

My engineers leave no stone unturned to find solutions in unexpected places for our clients.
And when we do, it’s really energizing. That’s why I love what I do.
Once lit, that fire led to him starting up his own energy consulting firm in 2007: Viridian, which provided commissioning, energy modeling, energy audits, and building testing. This company would eventually evolve into Entegrity. “We were purely consulting at the time—you know, basically doing an audit of their building and handing them our findings,” says Ladner. While he loved seeking those unique solutions for his unique clients, what he didn’t love was when there was a lack of implementation. “We’d find all these great opportunities, then hand it off to our client in a binder. But then that binder would just go sit somewhere,” he says. “We were missing the execution piece.”

In 2008, Ladner connected with Matt Bell, another Little Rock local, who boasted more than 20 years in the construction industry. In 2013, the two joined forces, evolving Viridian into Entegrity, where, today, they both serve as founding partners. Since then, Entegrity has been recognized as Sustainable Business of the Year in 2012, ranked on Inc. 5000’s list of fastest-growing companies in America, and was nominated for Arkansas Business of the Year.

Below: Southwest Power Pool Corporate Headquarters was designed by Witsell Evans Rasco Architects and constructed by Nabholz Construction. Entegrity provided LEED consulting, fundamental and enhanced commissioning, indoor air quality testing, and daylight testing on the project. The facility earned LEED Gold in 2013.
That’s a result of the company’s comprehensive approach: first, doing the audit—what Ladner calls “the discovery phase”—to determine what solutions would improve energy efficiency, then using their construction expertise to implement those upgrades.

"Operating as a singular entity that does it all, it simplifies the process for the clients," says Ladner, "and it makes sure those solutions we worked so hard to determine get implemented."

While a lot of their completed projects naturally center around the central and mid-to-south part of the country because of where they’re headquartered, Entegrity has worked on projects nationwide and internationally (including in the Cayman Islands). "We’ve worked on projects in over 40 states—300 of which were LEED Certified," notes Ladner. The projects range from commercial to K–12 education and government to higher education, and are set in metropolitan cities, rural markets, and everything in between. As for their biggest annual savings for clients? It’s been as high as $18 million.

“I get excited about finding a unique solution,” says Ladner. “But when our clients see the savings—and start dreaming about what kinds of capital improvements those savings could go to—that’s when they get excited. Really excited.”

Top: Entegrity’s newly renovated headquarters in Little Rock, Arkansas, has earned LEED Zero Energy certification, making it the second building in the world and the first in the United States to earn the designation. Right: Entegrity provided services such as fundamental commissioning, enhanced commissioning, and building envelope commissioning to the University of Arkansas’s Jerry & Gene Jones Family Student-Athlete Success Center.
Hawaii Representative Chris Lee speaks hopefully about his state's aggressive approach to an autonomous, sustainable future. He explains that, in 2005, Hawaii developed a sustainability plan targeting nine benchmark goals to be reached by 2020. Much more was proven possible. "We have since blown far past what we thought we could do by adopting the Aloha+ Challenge goals," says Rep. Lee. "By changing our laws to be the first state to require the transition to 100 percent renewable energy and a carbon-neutral economy, and to create mechanisms such as the nation’s first organic farming tax credit, as well as grant programs to help schools grow their own food, plus the first mandate to require all schools to become net-zero facilities—all these pieces of the puzzle work together to drive the change that we are starting to see."

Rep. Lee makes the point that Hawaii depends on imported food, fuel, and energy, among other resources, and he recognizes the system as unsustainable and economically unsound. Furthermore, should a hurricane or other weather event close the ports, the population would be extremely vulnerable. "For us, changing this paradigm is about survival more than anything else," he explains. "But it is also about creating jobs and developing a new, sustainable economy, and ultimately providing a model for the rest of the country and the world to follow." He sees Hawaii’s size as key to this role—it's big enough to serve as an example for cities yet small enough to effect change quickly.

The Aloha+ Challenge works toward that end. Rep. Lee describes the initiative as a series of well-vetted ways to collect data and provide a basic score of where things stand in key areas that include energy, water, food, and waste, among others. "It has been enormously successful in catalyzing interest in making this shift, but also in being able to identify our weaknesses—where we are not investing resources and where we are not making progress," Rep. Lee notes. "The Aloha+ Challenge goals give us a means to an end. They provide a deep dive into each of the policy areas that we need to radically change in order to achieve those broad goals. Two of those in particular are food sustainability and waste."

Knowing that close to 90 percent of the island's food is imported, Hawaii set up systems for determining what is entering the state, what is being grown locally, and how to double its food production. With a 100-plus-year history of plantation farming for export—primarily pineapple and sugar cane—small-scale food production for local consumption is a significant move. Rep. Lee notes it is not only about growing the food, it's also about creating the distribution and market mechanisms that enable the food to travel. "That's been a huge hurdle we have been trying to tackle, but it's not something everybody sees right up front."

Right: Maui Pineapple produces their fruit according to sustainable land management practices. For instance, they till organic mulch back into the rows of pineapples to restore nutrients and moisture to the soil, which also counteracts the effects of monocropping.
As an example of the ability to make sweeping changes by creating markets, Rep. Lee points to Hawaii’s school system. “We serve hundreds of thousands of meals every day in our public schools—we have one statewide school district, which means we can change one contract to require local food be incorporated into those meals. That creates an immense market that we don’t even have the farm capacity to meet right now.” Despite that deficiency, progress is evident. A number of prominent farms are producing greens and other produce specifically for public schools, some of which are now zero-waste facilities—a response to the 90 percent by weight waste that had been the standard previously. “Once we build out the capacity to produce what we need, we can move into private-sector supermarkets and farmers’ markets and onto people’s plates,” says Rep. Lee.

The introduction of Beyond Green Partners into the state’s school, prison, and hospital institutions is a prime example of how the Hawaiian government’s creation of marketplaces is driving investment in local, sustainable food production and waste management.

**Nourishing a Community**

In 2017, Beyond Green Partners went to Hawaii to implement model programs in the school district—a collaboration between the Lieutenant Governor’s Office, The Kohala Center, the Hawaii Department of Education, and private donors. Beyond Green Partners—a sustainability consultancy working with schools, hospitals, and prisons that have in–house dining services—employs systems thinking–based solutions to help transform food service into a sustainable production. “From the top of government leadership down to the local people, everyone is working on this,” says Marnie Record, the nonprofit’s communications director. “They want every institution—every school, hospital, and prison—to follow this program to bring health to their communities and achieve food security.”

Among those institutions is Kona Community Hospital. In 2018, it engaged Beyond Green Partners as part of another wellness initiative it had adopted—the Blue Zones Project, which targets several different community sites including schools, workplaces, grocery stores, and places of worship to improve the well-being of a community and the longevity of its members. As one of those sites, Kona Community Hospital had many sustainable practices already in place when Beyond Green Partners came on board to help launch a better eating initiative. The hospital’s ultimate goal was to have its Ginger Café certified as a Blue Zones Restaurant. “We wanted to do an employee-engagement project inside the Blue Zones that would touch the most lives possible,” explains Judy Donovan, the hospital’s marketing and strategic planning director. “Where would it be? The cafeteria, of course, because everybody goes there.”

Donovan and her colleagues chose Beyond Green Partners because they valued the way in which founder Greg Christian and his team look at the whole food system. “We thought, if we are going to do this, let’s go big,” she recalls. Christian and a project manager assessed the hospital’s kitchen and spoke with cook staff, leadership teams, and other hospital employees to get a handle on existing conditions. “He pushes 100 percent scratch cooking and purchasing and eating local foods,” Donovan notes. “That was going to be a big change for us because we have an industrial kitchen.” They started with meals for employees and visitors, postponing patient menus until they saw results in the café. There was a lot of taste-testing and survey-taking to collect data. In the end, the hospital decided in favor of 100 percent scratch cooking, and the
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patient menus were ultimately revamped to include vegan options, which are remarkably popular.

Their initial efforts included taking the kitchen staff on farm visits and to local stores to establish sources for seasonal foods. They also worked to inspire culinary creativity and ownership. “Greg is awesome at encouraging them to come up with their own recipes, and we are working on that now. We want to cycle into the menu one staff recipe per month,” Donovan explains, noting that because the kitchen staff were so practiced at opening boxes and heating processed foods there were some growing pains, but they have since come around to the pleasures of working with fresh ingredients.

As for efficiencies, Donovan remarks: “They don’t come into the kitchen and tell you to replace everything. They say, ‘What do you have? What’s working for you now? What could make it work better?’” As a result, the hospital bought some new equipment to expedite scratch cooking, and they pinpointed areas of waste. Subsequently, they cut the number of entrées to a single meal; rather than four different options there are just two—the same dish prepared in two ways, standard and vegetarian or vegan. Additionally, leftovers are saved and either served again or used in a new dish. Food waste is at a minimum, and the project manager is helping to determine how much they need to cook on a day-to-day basis to further reduce waste. The team is also scaling back portion sizes.

At the end of the two-phase, six-month implementation period, the hospital has found that it is spending either the equivalent or a bit less than what it had been spending prior. And the feedback from the 460-member staff has been excellent; initial employee satisfaction measurements indicate the Kona Community Hospital workforce enjoys their jobs more under the new program. “You can tell by their smiles that they are proud of the food they are making,” Donovan notes.

Record describes the success at Kona Community Hospital in terms of its economic potential: “Now, 20 percent of all food purchases are from local food vendors—that’s $6,000 to $8,000 dollars per month. As Hawaii looks to expand this program, $6,000 to $8,000 a month is just a tiny percentage of what [could be part of the state’s whole economy], given how many people are fed every day through schools, hospitals, and prisons.”

Beyond Green Partners is now three months into establishing similar programs at two more state hospitals: Kauai Veterans Memorial Hospital and Samuel Mahelona Memorial Hospital. Though they are under one leadership, they are located in two separate and culturally distinct regions of the island. One hospital is adapting quickly, while the other requires more energy on the front end to make people comfortable with the new systems. This points to the fact that education is a big component of what Beyond Green Partners does. If institutions are to adopt their program, they must help staff understand the greater good aspect of this approach. As Record says, changing minds and habits is hard work.

Yet the approach is gaining momentum in Hawaii—the hospital network’s corporate office is also looking to adopt the program. “If you can feed people better food and you can do it either at the same efficiency or better, it just makes a lot of sense,” Donovan concludes. “And if, across the United States, we are looking at ways to improve the health of our communities, this is a really great way to start.”

Representative Lee concurs, adding: “Efforts like those being made by Beyond Green Partners are catalyzing the kind of change we want to see, on the timeline that it needs to happen.”
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On the morning of November 8, 2018, a blaze started north of the community of Paradise that would grow to be California’s deadliest and most destructive wildfire to date. In disbelief, Heather Green watched footage of the Camp Fire as it spread across Northern California. “It was horrific,” she says. “People lost their homes, livelihood, everything.”

Quickly, her attention turned to a different image: maps of the smoke drifting south and overwhelming San Francisco. That’s where Green works as the city’s capital planning director and deputy resilience officer. “We realized that the smoke was going to be around for a long time, and it was going to get worse. It was already bad on the second day,” she says. “That was terrifying. The schools closed.”

San Francisco’s Department of Emergency Management responded by publishing a list of park facilities, libraries, art museums, and other private buildings where residents could find respite from the smoke-filled air outside.

**The Need for Adaptation**

San Francisco was one of the only Bay Area cities to publish a list of buildings with filtered, clean air. Still, Mayor London Breed recognized that severe wildfires are a new normal here and the city could do more. After the Camp Fire, she ordered a study of how to improve the city’s response. She wrote: “In the last few years, California has experienced multiple wildfires throughout the state causing unprecedented and sustained poor air quality in the Bay Area. While we provide support and resources to those lives and communities directly impacted by wildfires, we must also improve our City’s ability to adapt and respond to growing climate threats, especially wildfires.”

Before 2017, San Francisco’s air quality rarely registered problems on the Air Quality Index, a tool that represents air pollution on a range from “good” to “hazardous.” But during the Camp Fire, San Francisco’s air pollution was in the “unhealthy” range for nearly two straight weeks.

Now, San Francisco is assessing its city facilities and identifying buildings with air filtration systems. City officials are poring over data to find public- and private-partner buildings that are large enough to function as community gathering spaces.

“The emergency plan for the city will be revised to acknowledge that this is a priority and a concern. We will have guidelines for what to do next time,” Green says. “Where should people go? Why should they go there? With the fires last year, there was a lot of information coming all at once from different sources and it was sometimes contradictory. We need to get ahead of that. We need to have clear recommendations.”
Nearly a year before the Camp Fire, in December of 2017, the Thomas Fire ripped across Ventura County in Southern California.

A few months earlier, the Ventura County Medical Center celebrated the opening of a $305 million new wing, which broke ground in 2013. The fire burned not far from the hospital, at one point consuming a nearby hillside.

Mara Baum thought the fire might overtake the hospital. Baum, a principal at HOK, a global architecture and planning firm, worked on the project. Thankfully, it did not. And because of good filters, the hospital operated throughout the fire. “In fact, they took in patients from other hospitals,” Baum says.

Filters are key, she explains. Filter efficiency is graded on the MERV metric scale of 1-16. The higher the number, the finer the particle filtration. Commonly, buildings are coded for MERV 8, but a MERV 13 filter is recommended for filtering wildfire soot or other combustion byproduct. Activated carbon filters are used to remove odor from the air, including volatile organic compounds, chlorine, and other gases.

**Resilient Public Spaces**

These are examples of how resilient buildings can be used to help communities during environmental disasters. At a moment of increasingly unpredictable and severe weather, San Francisco and Ventura County highlight the need for cities to incorporate sustainably constructed buildings into their emergency response plans.

For years, leveraging public buildings during disaster relief has been a point of discussion in the resilient design community. Increasingly, leaders see the U.S. Green Building Council’s (USGBC) Leadership in Energy and Environmental Design (LEED) rating system playing a crucial role in supporting communities.

“A LEED-certified building that has a good filtration system is capable of providing so much beyond just the day-to-day improved air quality,” says Brendan Owens, senior vice president of strategic partnership and growth with USGBC. “It is a resilience that is absent in many buildings that are out there.”

Wes Sullens, director of codes technical development at USGBC, says that LEED credits create the potential for better air quality, and communities can and should use these resources. “The buildings can be used in a disaster scenario like this,” says Sullens. “But it all comes down to maintenance and upkeep.”

Sullens added that recertification is important. “There’s a performance aspect,” he says.

**Resilience Through Data**

While wildfires are a major concern in California, they aren’t the only emergency for which sustainably designed buildings can be community resources.
California has about 10,000 earthquakes annually. While most are only small tremors, California has three major fault lines in the San Andreas, the Hayward, and the San Jacinto. A century has passed since California’s faults created a major, city-shaking quake, but that could mean that the next Big One is up this century. For this reason, seismic retrofitting is key for keeping people safe.

In the municipality of Portola Valley, California, an hour south of San Francisco, town manager Jeremy Dennis can see the line of the San Andreas fault from his office window. “Obviously, it’s had an impact on our thinking around emergency preparedness,” he says. A major earthquake in the Bay Area could affect millions, so this rural community of about 4,500 understands it could be on its own. “Getting the best information about what an earthquake could do to us, and how to prepare and respond, is critical,” says Dennis.

So when One Concern, an innovative tech company from across the highway in Silicon Valley, came out with a software service that uses artificial intelligence (AI) and machine learning to help communities predict and prepare for disaster impacts, Portola Valley partnered with the neighboring town of Woodside and the Woodside Fire Protection District (which includes the area’s unincorporated communities) to become one of the company’s first customers.

One Concern is an AI for disaster resilience company, says co-founder and CEO Ahmad Wani. Its AI-enabled platform models the behavior and impact of earthquakes and floods, with a wildfire program in the works, to help communities build for long-term resilience. One of a small number of such ventures (with others including Geospiza, The Field Innovation Team, forest fire researchers at the Universities of Alberta and Oklahoma, and some Microsoft-supported initiatives under development), the company responds to a growing need: Worldwide, the annual number of natural disasters has increased since the mid-twentieth century by an order of magnitude.

Wani’s personal experience of two of those disasters gave rise to his sense of mission. The devastation caused by an earthquake in his native Kashmir in 2005 inspired him to become a structural engineer; being flood-stranded for a week on the roof of his family’s house while visiting in 2014 highlighted for him the difficulty rescue services often have in knowing who needs help, and where.
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After completing graduate studies at Stanford, Wani, in collaboration with computer scientist Nicole Hu and earthquake engineer Tim Frank, founded One Concern to bring the capabilities of AI and machine learning to emergency preparedness and response.

With a client base that now includes such disaster-conscious cities as San Francisco and Los Angeles, One Concern’s platform draws on data sets covering hundreds of attributes across three key vectors: the natural environment, with data from such sources as topographical maps, soil surveys, and the U.S. Geological Survey’s seismic sensors; the built environment, with building code and permit data, zoning maps, and satellite imagery; and demographics, with inputs from the U.S. Census Bureau. “The good thing is that One Concern already has this data for every jurisdiction in the United States,” says Digambar Ganjre, the company’s director of customer success. “So we don’t need this data from the cities, and that drastically reduces the time-to-value for our customers.”

By combining data on the three vectors, the software is able to predict the impact of a range of events on specific buildings or pieces of infrastructure. It then aggregates its predictions to the census-block level, with an accuracy estimated at about 85 percent, and presents them on a map showing where and to what degree damage is expected—either in the immediate aftermath of an event, or in advance, through simulations that foster enhanced preparedness.

“It’s phenomenal,” says Woodside Fire Prevention District Chief Dan Ghiorso. “I can get on this platform and within 15 minutes I can tell you where in my district we’re going to have some challenges.” The Woodside-Portola Valley team meets regularly, once a month for the first year and now bi-annually, to run tailored simulations of a range of earthquake magnitudes, locations, and depths, and to review and plan for the projected impacts. “Historically, there would be a fair degree of creativity in coming up with these scenarios, or a degree of rigorous analysis around one scenario that may or may not happen,” says Ganjre. “With our platform, you can look at the thousand most likely earthquakes, and then understand the aggregate overlapping risks—so you really home in on what’s most likely to affect your community.”

In some cases, the software’s predictions jive with what the team already knows. Some older school and college buildings show up as problematic, for example, and their owners are aware of the issue, with an upgrade plan already in place. In other cases, the simulations have offered some surprises.
“The data lets you think about emergencies in a way that wasn’t possible before,” Dennis says.

While preparation for future contingencies is the simulations’ main point, some benefits have manifested already. Regular meetings, shared problem solving, even a plan for a shared Emergency Operations Center after one scenario predicted the loss of Portola Valley’s town hall: “It’s created a great working relationship between the two towns,” says Ghiorso. Looking ahead, the townships plan to continue running their practice simulations, layering in One Concern’s wildfire program once it’s operational, preparing for what the AI predicts, and looking for contingencies they haven’t yet considered. “We hope we never have to use this thing in real life,” says Dennis, “but because of this system and the conversations that have come out of it, I think we’re as ready as we can be.”

For example, of only two routes connecting two of the three fire stations in the 32-square-mile district, the direct road, which crosses a marshy area, may in some scenarios be lost to liquefaction. “Not one person in the room had thought of that until we saw it in the simulation,” says Ghiorso. “Imagine finding out on the day of a disaster, ‘Oh my God, the road’s gone!’ Or having one of the fire engines driving when the road goes down.” Forewarned, the emergency management team has planned for an alternate route. “Not that we wouldn’t have figured it out at the time,” says Ghiorso, “but now we don’t have to.”

Another surprise was the degree of variation in projected impacts. “When you prepare for an emergency, you tend to think about it in a monolithic way,” says Dennis. “But in some scenarios, a particular area of town could have a unique geologic impact.” That impact might mean the difference between having a road open or not, or having gas lines rupture in one area when elsewhere they’re fine. “The realization is that your planning efforts have to be more nuanced than simply ‘earthquake,’” says Dennis. “They have to be much more thoughtful.”

The demographic modeling has also yielded some fresh perspective, helping to identify vulnerable populations. “Understanding that you have a senior population in a particular part of town may mean going to those residents and providing them with upfront information,” says Dennis, “not just assuming they’re getting the information they need from the internet.” The demographic information also helps emergency planners anticipate where support may be needed after an event, such as at child-care centers.

Left: Recently retired Woodside Fire Chief Dan Ghiorso was part of an ongoing effort to run tailored simulations of a range of earthquake magnitudes, locations, and depths, and to review and plan for the projected impacts using One Concern’s software.
Photo: Nader Khouri

Keeping California Cool

Erik Ring is a principal and director of engineering at LPA, an architecture and design firm that works on private and public projects, including many schools. He notes two key areas for resilient building design in California beyond air quality: seismic retrofitting and air conditioning.

California’s weather is typically pleasant, especially in the Bay Area’s Mediterranean climate. Summers are temperate and dry, and winters are mild. But in recent years, California has experienced a series of early, record-setting heat waves. Sultry days in California tax an already stressed power grid, which can cause outages, exacerbate smog, and increase the danger of wildfire. Many homes aren’t equipped with air conditioning, which can cause heat stress for people, especially seniors.

A solution: using schools as community cooling centers. “The idea is that in the event of an emergency or a natural disaster the schools could serve the community by providing a place of refuge,” Ring says. “During a heat wave, if people in the community don’t have access to air conditioning, they go to their local public school to find cooling.”

He worked on the Montgomery Middle School in the Sweetwater Unified School District, a LEED Platinum building located in Southern San Diego County. Montgomery was designed as a school and as a community resource with tutoring centers and a public library.

“In a community emergency, it’s a place where people could gather,” Ring says. “That was an element of the design.”
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It was a hot, muggy summer in 1927 when J. Willard Marriott and his wife, Alice, opened an A&W root beer stand to quench the thirst of people in Washington, D.C. The stand, which had nine stools, eventually grew into the Hot Shoppes Restaurant chain. The company’s subsequent growth included milestones like pioneering in-flight catering in 1937, and 20 years later, opening the world’s first motor hotel. Partnering with Sun Line in 1972, Marriott became the first lodging company to enter the cruise business. The first JW Marriott, named in honor of founder J. Willard, opened in downtown Washington, D.C., in 1984, and from that point on, the Marriott name became synonymous with high standards and innovation within the hospitality industry worldwide.

Today, Marriott International owns the most powerful portfolio in the industry, with 30 brands and more than 6,900 properties across 130 countries and territories. Ritz-Carlton, St. Regis, and Courtyard are among the brands under the Marriott umbrella, but the company’s concerns go far beyond providing stellar accommodations to the world’s most discerning travelers.

“As Marriott International, we are the largest hotel company in the world, and with that comes some very significant responsibility,” says Denise Naguib, vice president of sustainability and supplier diversity for Marriott International. Naguib, who has been with the company for 14 years, since implementing Jean-Michel Cousteau’s Ambassadors of the Environment program at The Ritz-Carlton, Grand Cayman, has been the driving force behind creating Marriott International’s sustainability strategy and keeping it relevant.

Since 2007, Marriott has had a 10-member Global Green Council in-house that is focused on minimizing the company’s environmental footprint by sustainably managing their energy and water use, reducing their waste and carbon emissions, and increasing the use of renewable energy. Marriott’s most recent all-encompassing sustainability and social impact platform is called Serve 360: Doing Good in Every Direction. Guided by the United Nations’ Sustainable Development Goals, Serve 360 aims to deliver a targeted set of 2025 Sustainability and Social Impact Goals, including its objective to sustain responsible operations. The platform’s three other key coordinates are “nurture our world,” “empower through opportunity,” and “welcome all and advance human rights.”
“Hotel companies, including Marriott, are setting long-term goals that align with global trends,” says Lindy Farrar, manager at Greenview, a boutique sustainability firm that provides hospitality organizations with consulting and advisory services. “For instance, a wave of consumer focus brought single-use plastics into the spotlight over the past year, and we have seen both governments and industry taking actions to ban or eliminate their use.”

In the late 1960s when straws started being made from plastic, no one thought about how they might impact the environment. They were used for decades, since they worked better than paper and were cheaper to produce. Finally recognizing that something as small as a plastic straw, which will never completely decompose, can have a huge negative impact on the environment, sustainability-minded hoteliers and leaders in other industries began to switch to biodegradable alternatives.

In a similar initiative, Marriott is eliminating small plastic bottles of shampoo, conditioner and body wash and replacing them with larger bottles in wall-mounted racks at some of their brands. To date, 850 hotels have made the switch, removing more than 1 million tiny plastic toiletry bottles—which would eliminate about 200,000 pounds of plastic per year.

Including a drastic scale-back of these plastic products, which will reduce waste to landfill by 45 percent, Marriott’s environmental footprint goals across its portfolio by 2025 break down like this: reduce water intensity by 15 percent; reduce carbon intensity by 30 percent; reduce food waste by 50 percent (from a 2016 baseline).
Far left: Denise Naguib is the vice president of sustainability and supplier diversity for Marriott International.

Left and below: Orlando World Center Marriott utilizes the HyCube modular hydroponic vegetable production system to incorporate mineral-rich nutrient solutions in place of soil to cultivate produce for the nine dining outlets and 450,000 square feet of meeting and event space.

Following UN Sustainable Development Goals, Marriott actively reduces their environmental impact by constructing and operating sustainable hotels that employ innovative technologies to plan, implement, track, and communicate how they operate responsibly.
Strategies to implement these goals are being considered not only at the corporate level but at the community level as well. While Marriott’s communications team issues updates on multimillion-dollar renovations and guest celebrity chefs, it also reports on the company’s involvement in employment initiatives for underserved youth and their investment in and promotion of natural capital initiatives, such as rainforest protection, coral restoration and mangrove reforestation.

At many of its properties worldwide, the designation of 360 Champion is given to those employees who Marriott singles out as “Passionate individuals or teams of individuals volunteering to be the face and energy of Serve 360 on and above property—rallying their fellow associates, organizing events, educating and communicating within the property, reporting and sharing best practices.”

A highlight of the company’s renewable energy initiatives, last year The Courtyard by Marriott in Lancaster, Pennsylvania, became the first Marriott-branded hotel in the United States with 100 percent of its electricity needs generated from solar power. The hotel has also recently been refitted with LED lighting, reducing total electricity consumption by about 15 percent.

Prior to the Lancaster Courtyard by Marriott’s renewable energy feat, solar panels were installed at a number of Marriott’s European properties. Elsewhere outside North America, notable efforts to protect the communities and environments where Marriott properties are located have
been made. In Cape Town, South Africa, for example, Marriott International built a desalination plant to convert seawater into drinking water for guests at one of their properties after a devastating drought this year threatened the fresh-water supply for the city. The plant saved the city about 400,000 liters of water a day according to President and CEO Arne Sorenson.

At 24 Marriott International properties in Thailand, the hotels are supporting the local community in their mangrove reforestation efforts since this valuable ecosystem has been destroyed over the last four decades. Since 2013, Marriott associates have been working with The International Union for Conservation of Nature to plant more than 60,000 mangrove saplings and engage in marine wildlife restoration. Guided by their 2025 Sustainability and Social Impact Goals, as well as the UN Sustainable Development Goals, Marriott International is committed to creating positive and sustainable impact wherever they do business. The company is planning to open more than 1,700 hotels over the next three years. With Serve 360 solidly in place, that’s 280,000 or so new rooms for sustainability-conscious travelers to enjoy and feel good about staying in.

Left and above: Marriott integrates leading environmental and social practices into their supply chain by focusing on sustainable, responsible, and local sourcing. Marriott associates have been working with The International Union for Conservation of Nature to plant more than 60,000 mangrove saplings and engage in marine wildlife restoration. Photos: Ana Grillo
Georgia Aquarium in Atlanta is the second-largest aquarium in the world. Its Ocean Voyager exhibit is designed with 4,574 square feet of viewing windows and a 100-foot-long underwater tunnel.
Summer, Summer, Summertime

Expand your sustainability horizons by visiting environmentally conscious and fun destinations across the U.S.

SUMMERTIME is vacation time. And for people looking to make sustainable choices when traveling, there are plenty of diverse, cost-efficient, and eco-friendly places to visit.

Terms like “sustainable travel” (and its close cousin “ecotourism”) were once mostly reserved for trips to the Costa Rican cloud forest and other back-to-nature destinations. But the growing emphasis on green building and sustainability across industries means that more vacation spots than ever are embracing environmentally friendly practices. Today, it’s not uncommon to find Leadership in Energy and Environmental Design (LEED) plaques—alongside other evidence of sustainable operating methods—in zoos, museums, theatres, and even ballparks. And these popular destinations may be in your own backyard.

Sustainable travel is all about making simple vacation choices to lessen the impact of travel on the planet, and sometimes this means visiting places closer to home. Each person makes only a small difference on his or her own, but the collective impact of travel choices can be enormous. And while it’s impossible to personally control the carbon emissions of planes, the chemicals used by hotels, or the plastics used in the souvenirs sold at gift shops, travelers can choose more eco-friendly “staycation” destinations, transportation options, hotels, and activities.
Cincinnati Zoo & Botanical Garden
CINCINNATI, OHIO
Around 1.8 million visitors annually flock to Cincinnati to what is often cited as “The Greenest Zoo in America.” And many come to see animals like Fiona, who zoo director Thane Maynard calls “the world’s most famous hippo.”

This description is likely accurate. Fiona was born six weeks premature in January 2017—the first hippopotamus to be born at the zoo in 75 years, and the first hippo ever to be scanned in the womb with ultrasound.

At 29 pounds (a third of the size of a typical full-term Nile hippo), Fiona is the smallest ever of the species to survive birth. The zoo staff hand-milked her mother, and the Smithsonian’s National Zoo in Washington, D.C., helped to develop a special baby formula for her. For a time, she had to be fed via IV (with help from Cincinnati Children’s Hospital), and she rapidly gained weight, tipping the scale at 275 pounds when she was introduced to the media four months after her birth. By the end of 2018, she weighed more than 1,000 pounds.

The zoo has documented the hippo’s journey with a seven-part web series called “The Fiona Show,” and the first episode has been viewed more than 4.6 million times.

“Fiona lives in rainwater that was captured underground,” Maynard notes. “So do our penguins, polar bears, and sea lions.”

Although it’s grown considerably in recent years, with polar bears and penguins and swans swimming and splashing in thousands upon thousands of gallons of man-made pools and pond water, the Cincinnati Zoo & Botanical Garden uses an astounding 80 percent less tap water than it did in 2006.

Part of the reduction is due to fixing broken pipes that were, unbeknownst to zoo officials, wasting millions of gallons of water each year—a financial boon for the zoo, in addition to a conservation win. But also, the zoo has aggressively fixed leaks in exhibit pools, installed low-flow faucets and fixtures, and upgraded filtration systems. As a result, the zoo has saved more
than 1 billion gallons of water (enough to cover the yearly indoor and outdoor water use of 10,000 households) in a bit more than a decade.

“People say, ‘I can’t afford to update that system,’ but getting rid of the waste and fixing old equipment is 100 percent cost-effective,” says Maynard. “We went from 220 million gallons of tap water to less than 40 million, and the zoo is substantially bigger now. Water has been a big money saver.”

In general, Maynard says, animal babies tend to attract a lot of attention at the zoo, especially in the spring and early summer. Other zoo highlights include the Cheetah Encounter, Gorilla World, and a show called Blakely’s Barnyard Bonanza, which features a trained goat and the opportunity for young visitors to race against chickens. The Cheetah Encounter is one of the few places in the world where people can watch a cheetah run at full tilt (the record for the fastest animal speed ever recorded was set in 2012 by a Cincinnati Zoo cheetah named Sarah, who hit 61 miles per hour—compared to Usain Bolt’s top speed of 28 miles per hour).

While visitors come to the zoo to interact with and learn about the institution’s 700 species of animals (rather than, say, its water conservation efforts), Maynard says he hopes that visitors also walk away with a better understanding of sustainability issues. “You’re not preaching to the choir at the zoo,” he says. “Everybody comes to the zoo. So it’s an opportunity to say, ‘Here’s what it’s going to take to live sustainably and protect wildlife.’ That’s a good thing.”

**Sustainability Highlights**

Nine buildings at the zoo are participating in LEED with another three projects underway. These include the LEED Platinum Hippo Cove habitat, a LEED Gold project phase of the zoo’s Africa habitat, and the LEED Platinum Gorilla World.

More than 30,000 square feet of pervious pavement allows thousands of gallons of storm-water to be stored at a time.

Solar and wind power provide up to 25 percent of the energy needed to operate the Harold C. Schott Education Center and more than a third of the electricity needed to power the Membership and Ticketing Building. The latest solar project, a 1.56-megawatt array with 6,400 panels installed on a parking lot canopy structure, is the largest urban, publicly accessible array in the nation.

The zoo has completely eliminated plastic bags and plastic straws.

The zoo has a goal of being net zero for energy, water, and waste by 2025.

In 2011, the zoo began an initiative to collect old cell phones to protect gorilla habitats in Africa, where a mineral used to make cell phones is mined. A collection bin is located at Gorilla World, where visitors can see the endangered species that will benefit from their donation. Through this program, the zoo has recycled more than 100,000 phones.
National Museum of African American History and Culture
WASHINGTON, D.C.
When it opened in 2016, the National Museum of African American History and Culture (NMAAHC) provided a long overdue window into an often-overlooked thread of American history. But in addition to casting its gaze on the past, the institution is looking toward the future with design elements that some say have “set the bar” for sustainability in architecture.

Last year, the museum building was officially awarded LEED Gold certification—an impressive achievement considering the size of the building and the special challenges of providing archival conditions. “In a museum you have environmental standards that have to be met for humidity and temperature because of artifacts and organic material that could degrade if you’re not controlling [those factors] precisely,” lead architect Phil Freelon told *Smithsonian* magazine at the time of the announcement.

Through the glass doors of the museum’s elevators, visitors watch the years written on the walls descend as they travel back in time to the 1400s. At the bottom level of the museum, visitors learn about slavery and the path to freedom, viewing artifacts like slave shackles, Nat Turner’s Bible, and Harriet Tubman’s shawl. Traveling upward, exhibits cover segregation and the Civil Rights Movement, followed by a level dedicated to “A Changing America,” which covers the time from the death of Martin Luther King, Jr. through the second election of Barack Obama.

Sustainability Highlights

Partly due to Washington, D.C.’s restrictions on building heights, 60 percent of the museum is underground. But that design choice also has a sustainability impact, with the earth acting as insulation for the belowground galleries.

An underground dual-cistern system allows the museum to collect and filter rainwater and groundwater, then reuse that water to flush toilets and irrigate the museum grounds—saving an estimated 8 million gallons of water per year.

The museum’s flat roof features an array of solar panels.

The building was intentionally designed with a compact, boxy shape to limit energy use for heating and cooling.

The museum offers a self-guided tour highlighting the sustainable features that led to its LEED certification.

A large overhang, dubbed “the porch,” shields the museum’s transparent entrance from sun, while also evoking the welcoming entrance of an African-American home in the South. “In the African-American culture, we’re used to making something out of nothing and doing more with less, whether it’s the food we eat or the materials we use in construction,” Freelon told *Smithsonian*, explaining the passive design choice. “So this building is expressive of that.”
Left, right, and below: The National Museum of African American History and Culture, which opened on September 24, 2016, is located on the National Mall in Washington, D.C.

Right and below: The “Spirit of Tuskegee” is an aircraft of the Tuskegee Airmen, a pioneering group of African Americans whose contributions were central to the war effort during World War II.

The exhibit “Game Changers” spotlights the people, events, and institutions that have forced the sports world and larger society to alter its practices, belief systems, or racial politics.

Photos: Alan Karchmer
The Old Globe
SAN DIEGO

As Shakespeare famously wrote, “All the world’s a stage.”

Maybe so, and The Old Globe in San Diego is dedicated to sustaining both the world and the stage, long into the future.

“I think patrons are interested in the notion of The Old Globe being a good citizen,” says Tim Shields, managing director of the theatre. “And it’s important for us to pursue these things just because we believe in them, as well. Theatre people tend to be people who care. We come at our jobs with a passion for what we do. And we approach environmental causes with that same passion, because we believe in them.”

The Old Globe Theatre, modeled after Shakespeare’s Old Globe in London, was built in 1935 for the performance of abridged versions of Shakespeare’s plays as part of the California Pacific International Exposition. Two years later, a non-profit community theatre company leased the facility. The theatre was destroyed by fire in 1978 and rebuilt, the organization was eventually rebranded The Old Globe, and the facility came to include two additional theatres.

The Old Globe’s LEED Silver 108,000-square-foot complex features three theatres, administrative offices, and an outdoor plaza.

Each season, The Old Globe puts on 15 to 16 productions, attracting more than 250,000 people per year. That includes at least two Shakespeare plays each summer as part of an annual festival, but the theatre presents a broad range of productions, including family-friendly fare like “Dr. Seuss’s How the Grinch Stole Christmas!” Twenty-five plays and musicals that began their runs at The Old Globe have gone on to Broadway.

“Shakespeare has been a hallmark at this theatre since it was founded in 1935,” Shields says. “But we’re also renowned for modern interpretations of classic plays, world premiere plays, and both established and new musicals.”

While theatre is, of course, the top draw at The Old Globe, the organization also puts on programming for people who can’t make it to (or aren’t interested in) the shows. “We try to activate our facility and the plaza outside with activities that support the play itself,” Shields says. “We have events where the public can come in and talk to an actor or an author, and other events where people can come on in and see the type of work we do. The Old Globe exists for all the citizens of San Diego. We want everybody here to feel that we have programs that speak to them and that they have access to. For some people, that means sitting center orchestra on Saturday night. Other people just want to be on the plaza to celebrate Shakespeare’s birthday, or the Day of the Dead. Every year, when we do ‘How the Grinch Stole Christmas!’ we have a tree lighting and put on a couple of numbers from the show, and that event draws 3,500 people every year.”

The Old Globe is located in Balboa Park, which houses a number of other attractions, including the San Diego Zoo.
Sustainability Highlights

- Low-flow fixtures and aerators at the facility have reduced overall water usage by 32 percent.
- Through LED retrofits and the installation of timers, The Old Globe has achieved an energy savings of 14,000 kilowatt hours per year.
- The Old Globe participated in a waste stream audit, identifying and then implementing diversion opportunities that resulted in a 65 percent reduction in waste diverted from landfills.
- Twenty-five percent of The Old Globe’s staff commutes with some alternative to a single-passenger vehicle.

Above: The Old Globe Theatre at Balboa Park in San Diego is modeled after Shakespeare’s Old Globe in London. The LEED Silver 108,000-square-foot complex features three theatres, administrative offices, and an outdoor plaza.
Right: Timothy J. Shields, left, is the managing director of The Old Globe and Barry Edelstein is a stage director, producer, author, and educator there.
Photos: Mike Hausberg
Suncadia Resort
CLE ELUM, WASHINGTON

What’s more relaxing than getting a deep tissue massage or a detox mud wrap? The peace of mind that comes with relaxing and detoxing in a LEED-certified spa.

But then, the LEED Silver Glade Spring Spa is just one of the many places to relax at Suncadia Resort in Cle Elum, Washington. The destination covers more than 6,000 acres of nature, including meadows, rivers, and forested mountains, with many miles of hiking and biking trails and 36 holes of mountain golf.

Eighty percent of Suncadia Resort’s 6,400 acres has been dedicated to open space in perpetuity. Additionally, all streetlights and lit signage at the resort have been converted to LED lighting.

Suncadia visitors have a wealth of options for accommodations. The Inn at Suncadia is an intimate lodge with golf course views, while The Lodge at Suncadia offers panoramic river and mountain views along with the amenities of a full-service luxury hotel and conference center. Vacation rental homes are also available—an especially attractive choice for larger groups.

The resort also features an outdoor concert and cinema series, nature programs, fine dining, swimming, and a fitness center.
Sustainability Highlights

Suncadia Resort is managed by Destination Hotels, the country’s fourth-largest hospitality management company. In 2008, the company launched its Destination Earth program, which has grown to more than 100 environmental initiatives.

The company runs a Green Meetings program throughout all its properties, aiming to maximize waste diversion from meetings and conferences and increase environmental awareness among guests.

Suncadia was awarded the Environmental Achievement Award by the Pacific Northwest Section of the Air and Waste Management Association in 2009.

This spread: Suncadia Resort’s Glade Spring Spa focuses on providing an environment that takes guests on a personalized journey of relaxation, rejuvenation, and renewal. Having achieved LEED Silver, the Resort is driven to maintain an exceptional level of environmental awareness, embodied by their Destination Earth commitment to sustainability.
Georgia Aquarium, Atlanta

For a reminder of what’s at stake in sustainability efforts, head to the largest aquarium in the Western Hemisphere and immerse yourself in ecosystems like a tropical coral reef, a riverbank, and the cold waters of the open ocean.

The Georgia Aquarium not only provides visitors with a window into the planet’s biodiversity, but also makes efforts to house and display that biodiversity with minimal impact on the environment. For instance, the facility uses patented technology that helps to reduce water use—a major win for an attraction that measures water by the millions of gallons.

“Patented sulfur denitrification units allow the aquarium to retain and reuse water in its habitats, helping to reduce overall water use,” says John Masson, director of life support systems for the Georgia Aquarium. “The aquarium filters over 250 million gallons of water per day, and 99.8 percent of the 10.2 million gallons of water in the aquarium’s exhibits is retained and recycled through on-site recovery systems.”

The aquarium’s “Aquanaut Adventure” exhibit tests visitors’ science, technology, engineering, and math (STEM) skills as they navigate one of seven different adventures and meet species like poison dart frogs, horseshoe crabs, and American alligators along the way. In “Cold Water Quest,” visitors crawl through acrylic tunnels and peek through pop-up windows to get up-close looks at beluga whales, harbor seals, and African penguins. And the 164,000-gallon “Tropical Diver” exhibit (viewable via a live web stream, for those who can’t make the journey to Atlanta) replicates the Indo-Pacific Barrier Reef. The gallery, one of the largest living reef exhibits in the world, gives visitors the chance to spot colorful fish species like the bicolor angelfish, the lemonpeel angelfish, the pyramid butterfly-fish, and “Nemo” himself—the clown anemonefish.

Premium experiences allow visitors to get even closer to the deep-sea action. In addition to personal encounters with dolphins, penguins, seals, and other aquatic animals, the aquarium offers a “Journey with Gentle Giants” experience, where visitors can actually swim or dive with manta rays and whale sharks.
Sustainability Highlights

The Georgia Aquarium recycles all scrap metals from sources like old motors. The aquarium also recycles bulbs, ballast, cardboard, and even batteries and Styrofoam.

All of the aquarium’s horsepower motors are on variable frequency drives (VFDs) to reduce power consumption and increase efficiency.

Water bottle filling stations at the aquarium have diverted more than 85,000 plastic bottles from landfills.

Upcoming projects include the retrocommissioning of the aquarium’s HVAC system and the installation of LED lighting, which together will reduce overall energy usage.
Fenway Park, Boston

Boston’s Fenway Park is the oldest stadium in Major League Baseball, dating to 1912—seven years before the Red Sox infamously “cursed” themselves by trading all-time great Babe Ruth to the New York Yankees.

The curse has since been lifted several times over, with the Sox bringing a championship trophy to Boston in 2004 after an 86-year drought—and then again in 2007, 2013, and 2018.

The Boston Red Sox are one of only two teams not to build a new stadium in the past century, and along with Chicago’s Wrigley Field, Fenway is generally considered one of the last remaining “baseball cathedrals”—nearly sacred grounds where the history of the game was (and continues to be) written. But although the ballpark is a relic, the Red Sox have kept Fenway up to date, adding modern amenities, installing extra seating wherever possible, and implementing green initiatives.

“The Red Sox have always been leaders in this space,” says Jon Lister, senior director of facility management for the organization. “I started in 2012, and they were already doing a lot before I got here. In 2008, the team installed solar thermal panels to assist with the heating of hot water, which reduced natural gas consumption. And they also implemented a Green Team, which we still have today.”

The Green Team is a first-of-its-kind recycling initiative, with volunteers collecting recyclables from fans during games—resulting in almost 400 tons of diverted waste each season.

The Sox also play their spring training games at the LEED Certified Jet Blue Park at Fenway South in Fort Myers, Florida. The park was designed to use 26 percent less energy than a traditionally designed stadium, saving an estimated $83,000 in annual operating costs. The park also conserves an estimated 1.7 million gallons of water per year, saving another $18,000 annually. The park includes free dedicated bicycle parking, features white reflective roofs and canopies to cool the building and reduce energy use, and was built with a process that diverted 81 percent of construction waste from landfills.

The season provides more than 80 chances to catch a home game at Fenway, but the hottest tickets are usually for match-ups against the rival Yankees. One of the unique charms of attending a game at Fenway is watching the innings tick away on the hand-operated scoreboard on the “Green Monster,” the famous 37-foot wall in left field.

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**Sustainability Highlights**

- Through Green-e certified renewable energy certificates (RECs) from the club’s electricity supply partner, Engie, the Red Sox are offsetting 100 percent of Fenway’s electricity consumption over two years.

- The park offers free bike valet parking for fans who cycle to games.

- In 2015, the Red Sox created a rooftop garden that grows vegetables and herbs throughout the season. The produce is used in food products prepared at the ballpark, including in the team’s EMC Club restaurant.

- Since 2014, the Red Sox have reduced Fenway Park’s total energy consumption by 12 percent through energy conservation projects including lighting retrofits and high-efficiency heating equipment.
The State of Sustainable Travel

Sustainable travel is on the rise! According to the 2018 Sustainable Travel Report from Booking.com, 87 percent of global travelers want to travel sustainably. What’s more, 39 percent say they often or always manage to do so.

The report also found:

For 46 percent of travelers, the term “sustainable travel” means staying in eco-friendly or green accommodations—the most common definition of the term.

The natural wonders encountered on previous trips appear to be a significant motivating factor in people’s sustainability-focused behavior. Sixty percent of travelers say that “being impressed by natural sights” such as coral reefs and rain forests inspires them to travel more sustainably. Fifty-four percent say they are motivated by the visible impact of tourism on destinations they have visited, 47 percent are inspired to travel sustainably after seeing the positive impact that sustainable tourism can have on locals, and 32 percent say they’re motivated by their own guilt over the impact their vacations have on the environment.

Cost is the biggest obstacle to sustainable travel, with 42 percent of travelers citing it as a limiting factor. Other barriers include lack of information (32 percent), lack of time (22 percent), and a desire for comfort or luxury (20 percent).

More than half (53 percent) of global travelers say they buy locally made products instead of mass-produced souvenirs—the most common sustainable vacation activity. Fifty-two percent say they take mass transit instead of taxis, 41 percent go out of their way to eat at restaurants that use locally sourced ingredients, and 30 percent seek out certified eco-friendly accommodations.
It’s not often you hear someone say that in order to consider their campaign a success, they want their campaign to no longer be necessary. But that’s essentially the core goal of materialsCAN (Carbon Action Network), an effort launched in 2018 by a collaborative group of built-space leaders like Interface, Skanska, and Gensler.

“The goal of materialsCAN is to no longer need it one day,” says Stacy Smedley, director of sustainability at Skanska, one of the world’s leading project development and construction groups and a collaborative partner behind the campaign. “That’s what we at Skanska and Interface and the whole group behind this effort look forward to. To, one day, not need to talk about embodied carbon because people are educated about it and it’s simply become a part of the building language. Just how operational carbon is now.”

Because the fact of the matter is: If we don’t seriously reduce ALL carbon emissions—operational and embodied—we produce between now and 2030, we are on a path toward catastrophic climate change.

A study released by the UN’s Intergovernmental Panel on Climate Change (IPCC) in 2018 says the world needs to decrease emissions by 45 percent by 2030, or else the atmosphere could hit 1.5 degrees of warming by then.

“Those in the building sector play one of the most important roles in preventing this from happening,” says Lisa Conway, vice president of sustainability at Interface, referencing the fact that buildings generate nearly 40 percent of the world’s current carbon emissions.

That number will increase as building stock is expected to more than double by 2050, according to Architecture 2030.

“It’s vital that we, as leaders in the built-space environment, make sure that when it comes to reducing carbon emissions, we educate AEC [architecture, engineering, and construction] professionals, find and create solutions, and implement them. Reducing embodied carbon needs to be paid attention to as much as operational carbon already is.”

MaterialsCAN is helping to make that happen.
Why You Should Care
To understand why embodied carbon matters so much right now, you first have to understand what it is. In respect to a building, there are two types of carbon emissions: operational carbon and embodied carbon. Operational carbon is the carbon emitted over the life of the building (from heating, cooling, lighting, etc.), whereas embodied carbon refers to carbon associated with extracting, manufacturing, transporting building materials to the job site, and assembling. The most impactful are materials such as steel and concrete.

“Where we are with embodied carbon—in terms of research and tools, regulation, best practices in design and manufacturing—is the same as where we were with operational carbon decades ago,” says Erin McDade, a senior program director at Architecture 2030, a non–profit founded in 2002 aimed at reducing carbon emissions from buildings through education programs and tools as well as policy support. “We’re behind, and in order to meet our climate goals, we need to prioritize reducing embodied carbon as much as we already do operational carbon.”

Annually, embodied carbon accounts for 11 percent of global greenhouse gas emissions, which sounds small when compared with the impact of operational carbon (28 percent). But with building stock going up, Architecture 2030 estimates that embodied carbon will be responsible for at least half of total new construction emissions between now and 2050.

In the building life cycle, embodied carbon is the carbon dioxide equivalent (CO2e) of greenhouse gas (GHG) emissions associated with the non–operational phase of the project. This includes emissions caused by extraction, manufacturing, transportation, assembly, maintenance, replacement, deconstruction, disposal, and end of life aspects of the materials and systems that make up a building.
Conway agrees. “Operational carbon has been so tied to the success of LEED from the beginning. Selecting products that lead to low-operational carbon is a part of building codes now. But selecting products with low-embodied carbon or low carbon footprint has not been as high of a priority. A big part of that is lack of awareness among building professionals about why it matters and also that it’s hard to calculate because those figures are buried in pages of EPDs [Environmental Production Declarations].”

It also hasn’t ranked as high of a priority as operational because of the stats: Annually, embodied carbon accounts for 11 percent of global greenhouse gas emissions, which sounds small when compared with the impact of operational carbon (28 percent). But with building stock going up, Architecture 2030 estimates that embodied carbon will be responsible for at least half of total new construction emissions between now and 2050—meaning that new construction embodied and operational carbon emissions will become roughly equivalent within that time frame.

“We can’t say that embodied carbon is more important than operational because, at the end of the day, they both matter,” says Vincent Martinez, COO of Architecture 2030. “But unlike operational carbon, which is emitted over time and can be reduced over the building’s lifetime, embodied carbon is emitted carbon we can’t get back. As soon as a building is built, embodied carbon emissions are locked into place.”

Mission materialsCAN: Making the Topic of Embodied Carbon Catch Fire

Embodied carbon is simply not an easy conversation for most. “It’s hard to understand, it’s hard to find the metrics, and there may not actually be any monetary savings when it comes to a smart procurement plan like you receive with operational carbon,” says Interface’s Conway. So how do you get people to listen and understand, and more importantly, care enough to activate them to make a change? You bring in some of the biggest players in the built environment to help spread the word. “Interface can’t do it alone. We need top developers and material manufacturers by our side to help educate the masses,” summarizes Conway. “That’s the only way we can grow the effort—and quickly.”

And that’s precisely what Conway did. She started first by recruiting the world’s largest architecture and design firm: Gensler. “I remembered seeing in Gensler’s 2017 Impact by Design report that one of their actions was to collect better metrics on buildings, like embodied carbon. It was just a tiny bullet point, but it told me it was something they cared about,” says Conway. After reaching out, Conway found herself in front of Gensler’s Co-CEO Diane Hoskins in February of 2018. “I said to her, ‘No one is talking about this, but you understand that we need to talk about this, and the clock is ticking.’”

The result was materialsCAN, which launched at Greenbuild 2018 and consists of a group of major building industry partners: Skanska (representing construction), Armstrong (ceilings), CertainTeed (insulation), and USG (wallboard), in addition to Interface and Gensler. Since the original group, Kingspan and Superior Essex have also joined. Together, these partners are primed to address embodied carbon within their companies, but more importantly, others they touch in the built environment. “materialsCAN is a multi-pronged effort, but the first part is simply basic awareness and education on the subject,” explains Conway.

The official kick-start to that was the materialsCAN “launch lunch” at Greenbuild 2018, where the collaborative team invited a cross-section of the industry: major real estate services firms, owners, design firms, general contractors and manufacturers as well as NGOs and sustainability consultants. The subject? Why embodied carbon matters if we’re going to reverse global warming.
“It was met with great reception,” says Conway. “People showed that they cared and they wanted to address the issue, but they weren’t sure how to then act.” Which leads to part two of the multi-pronged materialsCAN approach: a tool that makes it easier to evaluate building materials and their embodied carbon, so that AEC professionals can make smarter building decisions to make a collective difference.

**Embodied Carbon in Calculator Construction (EC3): A Tool for Action**

Say you’re a contractor and you want to make informed decisions on your materials and their respective embodied carbon emissions. You would have to dig through an EPD for each product you are selecting. Most major manufacturers have them, but they’re extremely hard to understand, with generally 17 to 20 pages of data where the embodied carbon info is buried. Not to mention, EPDs can have different background product category rules or data assumptions, so unless you’re a real expert, it’s hard to compare one manufacturer’s EPD to another manufacturer’s EPD, apple to apples. So how do you make informed decisions if the data is hard to navigate, not to mention incomparable? It’s a struggle.

Enter EC3, which stands for “embodied carbon in construction calculator.” While the tool is now being further developed by and hosted at the Carbon Leadership Forum at the University of Washington with support from the Charles Pankow Foundation, it began with materialsCAN member, Skanska.

“We can talk about the importance of reducing embodied carbon all day,” says Skanska’s Smedley. “But we needed to make it actionable for our clients.” Using an internal innovation grant, the team at Skanska partnered with developer C-Change Labs to spearhead a proof of concept for the new software tool to track the embodied carbon emissions of raw building materials. It essentially does the dirty work of digesting those complicated EPDs. And presenting architects, designers, builders, manufacturers, and auditors with an easy-to-navigate database to search and compare low-embodied carbon providers and products. As of June 2019, there were about 17,000 EDPs in the database (and growing), including a variety of concrete, steel, and gypsum. Carpet tile and ceilings are in development now. The best part? The tool will be open-source, free, and accessible to all.

EC3 won’t be available to the public until November 2019. It’s currently in pilot-testing with Microsoft, which is using it to inform the decisions in the remodel of its 72-acre campus in Redmond, just outside of Seattle, Washington. EC3 is being piloted on diverse projects and developed input from pilot partners include architects (Perkins & Will), engineers (MKA), general contractors (Webcor), owners (Alexandria Development) and manufacturers (BASF), and industry support from the American Institute of Steel Construction and the ACI Foundation (concrete) among others.

“It’s going to be a game-changer for embodied carbon,” notes Conway, “allowing users to make directionally accurate decisions for everything from new construction high rises to the interior renovation of a local library.” And hopefully, in no time, prioritizing embodied carbon in specifications will become as commonplace in the building industry as high-efficiency water heaters and HVAC systems.

Since 2002, Interface, Inc., a global commercial flooring company with an integrated collection of carpet tiles and resilient flooring, has offset more than 4.3 million tons of carbon dioxide. Interface has also reduced the greenhouse gas emissions of their manufacturing by 96 percent and reduced their carbon footprint by more than 60 percent—the lowest in the industry.

Photos: Courtesy Interface
LEED v4.1 is here to help you meet your goals. Try it on a new project or apply your choice of credits to a project already in progress.

usgbc.org/LEEDv41
TAIPEI 101 Tower Earns LEED Platinum—Again
Taiwan’s first LEED v4 Platinum project is also the world’s first LEED v4 Platinum super-tall building.

By Kiley Jacques

At 2.1 million square feet, the TAIPEI 101 office tower’s LEED v4 O+M Platinum status is a remarkable achievement. Among the world’s tallest buildings, the 101-story skyscraper houses 125 tenants and 10,000 daily occupants. From its inception to its completion in 2004 by developer and owner Taipei Financial Center Corp (TFCC), the teams behind the super-tall structure pushed sustainability. Though green building strategies were incorporated from the start, LEED certification was not on the table initially. However, having invested in a triple low-e glass façade, a sophisticated rainwater capture system, and a thermal energy storage system, in 2009, they decided to pursue certification under the U.S. Green Building Council’s (USGBC) LEED for existing buildings rating system. That was the beginning of a long-term commitment that would evolve with the rating system’s own evolution.

The next two years saw TFCC implementing multiple operation-related strategies as well as special projects to move the building toward LEED certification. In 2011, they met their target certification for existing buildings—the first step of many more to follow.

It wasn’t long before TFCC began considering recertification, which encourages project teams to monitor performance and to verify that their buildings are performing as intended and that policies and strategies are still effective. For a building of this magnitude, that meant planning far in advance. Despite the many foreseen challenges and associated costs, their pledge to sustainable operations remained intact. “At its best LEED is an ongoing commitment, not just a one-time accomplishment,” says Iping Yang, TAIPEI 101 marketing manager. “Because being the best is part of TAIPEI 101 company culture and we constantly strive to provide the highest quality working environment to our tenants, it was not difficult for us to make the decision to recertify after five years.”

With the release of LEED v4, TFCC faced new certification requirements. To ensure they were hitting appropriate benchmarks along the way, they engaged the consulting services of CBRE Global Energy and Sustainability U.S. “For successful recertification, it’s important to understand the process and timing involved and update critical issues in the right way,” says Gary Thomas, CBRE’s global director of sustainability. “The process requires ongoing monitoring and documenting of sustainability efforts for the entire five-year recertification period, with a special emphasis on the final 18 months prior to recertification submission.” TFCC pinpointed systems and operations that would need to be upgraded and on what timeline. TFCC made clear their commitment to undertaking all necessary measures.

“They agreed that certifying to LEED v4, while retaining the prestigious Platinum designation would maintain the skyscraper’s reputation as a building managed to premier global standards and continue to attract world-class tenants,” Thomas explains. CBRE was instrumental in conveying LEED v4 requirements in specific terms related to the certification of a super-tall building in Asia.

Of TFCC’s decision to pursue LEED v4, Yang says: “It would have been relatively straightforward to recertify the building using [the] LEED v2009 version again and retain TAIPEI 101’s Platinum rating. However, in evaluating recertification options, TAIPEI 101 quickly decided to opt for the upgrade to the newest LEED v4 system, and they set the challenge to not only receive certification but return their prestigious Platinum status. There is at least a 22-point score drop when switching from v2009 to v4, and the project team carefully reviewed every credit in order to earn these points back.”

Yang weighs in on location-specific challenges: “It is not easy to achieve a high ENERGY STAR score because there isn’t a super-tall building category. The 1-100 ENERGY STAR score compares your building’s energy performance to that of similar buildings nationwide. This is the main challenge that the super-tall buildings in Asia will face.”

Yang explains some of the measures TFCC took during the process of upgrading to LEED v4. They included reviewing policies and plans, updating credits that had no or only minor changes, and discussing the potential for achieving new or significantly revised credits such as the Demand Response credit. “The TAIPEI 101 property management and engineering teams took steps to standardize and augment ongoing
green practices established during their initial certification, which would help to facilitate the eventual recertification process," she says. "This team had been working very hard to maintain, improve upon, and document the green building operations and maintenance practices since the first certification, in particular in the areas of energy management and recycling."

Their energy efficiency management efforts included a two-year retrofit. With insights from ASHRAE Energy Audits and commissioning process, they moved to Energy Management and Control Systems (EMCS), adjusting operating temperatures, and modifying chiller plant operating schedules. According to Yang, these combined efforts have helped to reduce energy consumption by 33.41 million kWh per year and are set to save more than 2 million U.S. dollars annually.

The project team applied strategies from the WELL Building Standard Feature 36 (Water Treatment) to earn an Innovation credit toward their second LEED certification. Some of the more creative strategies tailored to this building that helped earn LEED v4 credits include an advanced drinking water system that serves all tenants on every floor. Yang explains that the system is equipped with activated carbon filters, depth filters—which use anthracite, sand, and garnet to retain solids as small as five microns—V sterilization, a reverse osmosis filtering membrane, and a softener filter to produce exceptionally high-quality drinking water.

They also submitted Credit Interpretation Ruling (CIRs) for Innovation. In addition to the water treatment and distribution system, there is a cutting-edge rainwater management system, which includes vertical façade surfaces designed to capture and manage stormwater runoff in a densely urbanized context. Water that collects on roof terraces and on every eighth-floor terrace is directed into an underground collection tank. It is then reused for irrigation and toilet flushing. "The CIR allows us to communicate with the review team in advance. It uses a more flexible approach for calculation but still meets the credit intent," Yang explains.

On June 15, 2016, TAIPEI 101 Tower was awarded LEED v4 certification for Operations and Maintenance—making it the world’s first LEED v4 Platinum super-tall building. It is also the first LEED v4 certified project of any type in the world to achieve 90 points.

Yang acknowledges the role of smart technologies in making the advancements that help buildings achieve Platinum-level certification. She notes how they aid in managing and tracking the performance of integrated systems, such as the EMCS, which monitors and controls the operation of air conditioning, electricity, lighting, and water supply. "Along with the recent development of IoT technology, we are always evaluating different upgrade options such as air quality, renewable energy, and lighting control to make our building more sustainable."

Asked if TFCC has its sights set on LEED v4.1, Yang responds: "We do plan to recertify in 2021, and we have been evaluating LEED v4.1 since 2018."
TAIPEI 101’s collaboration with artist Kang Mu-xiang began in 2013 with “Infinite Life”—the artist’s first foray into sculpting with copper cable. Thereafter, he developed his idea of “rebirth” using retired steel elevator cables from TAIPEI 101 Tower, home to the world’s fastest high-speed elevators. After carrying more than 6 million passengers, the cables came down and, in the hands of Mu-xiang, were transformed into large-scale artworks. The artist cleaned, softened, bent, and curved the cables to create the expressive biomorphic forms that have proven so captivating across cultures.

Mu-xiang’s works have taken art circles by storm worldwide, and have been exhibited internationally since 2016. Following an invitation from the Ministry of Foreign Affairs, a steel cable sculpture, “Taiwan Ruyi,” was gifted to Karlsruhe, Germany, for the city’s 300th birthday. That piece is now on permanent display at the plaza of the Center of Art and Media Karlsruhe. Soon after, Mu-xiang exhibited another work, “Rebirth from the Ruins,” in Berlin, Germany, and launched a special exhibition tour, “A Steel Cable Connecting the World,” around five continents.

In 2018, he received a joint invitation from New York City and the Garment District Plazas to exhibit the entire “Rebirth” Collection. Those works are twofold: Having been made from recycled cables that had safely carried generations of people, they not only point to the importance of environmental stewardship but also to the preciousness of life.

After the four-month exhibition in the Garment District, “Rebirth” went on display at the Twin Oaks Estate, the University of the District of Columbia, and the Taipei Economic and Cultural Representative Office in Washington, D.C. Part of the collection, “Twin Life,” will be permanently archived at Twin Oaks. Motivated by the idea that conflicts in human society need to be resolved by love, Mu-xiang created “Twin Life” to contrast toughness and tenderness, distortion and perfection.
TAIPEI 101 received LEED v2009 Platinum certification in 2011, becoming the world’s tallest green building. For the recertification in 2016, TAIPEI 101 became the new green building paradigm for the world’s super-tall buildings as it obtained the highest score (90 points) of any LEED v4 at the time. The idea of giving new life to retired steel cables of our high-speed elevators is consistent with TAIPEI 101’s principles of sustainability and environmental protection, and TAIPEI 101 will continue to support such meaningful works of art."

Michael Liu, Chief Operation Officer of TAIPEI 101 Tower Management

INSTALLATION LOCATIONS:

TAIPEI, TAIWAN
NEW YORK, NEW YORK, USA
WASHINGTON, DC, USA
KARLSRUHE AND BERLIN, GERMANY
OPENED: 2013

Left: In 2013, Kang Mu-Xiang was invited by TAIPEI 101 building to create an environmentally friendly artwork with the steel cables that were previously used in the 101 floor elevators. Coated in black viscous oil from their long use, the first step in the artist’s process is to clean the cables.

Below: The exhibition “Infinite Life” is the result of one and a half years of work with TAIPEI 101 elevator cables. The total length of the steel wire reaches 480 KM, equal to the length of Taiwan island.
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What is your greatest fear? Dementia. My mother died after a long struggle with Alzheimer’s disease. It wasn’t pretty and no one had any fun, especially at the end.

Which historical figure do you most identify with? In the aspirational sense, Eleanor of Aquitaine. She accomplished amazing things in a world stacked against her.

Which living person do you most admire? In the aspirational sense, Eleanor of Aquitaine. She accomplished amazing things in a world stacked against her. In the aspirational sense, I am inspired by a host of folks. Two Skanska USA CEOs, former CEO Mike McNally and current CEO Richard Kennedy who lead with great business acumen seasoned by authenticity and empathy. And less visible but extremely impactful colleagues: Jimmy Mitchell, who works quietly with great heart to transform his community and by extension our world, and my program manager, Emily Durand, who is raising the next generation of sustainability “SHer0s” while advancing Skanska’s sustainability agenda on all fronts. I can think of at least a dozen more people to add to this list!

What is your greatest extravagance? My collection of scarves.

What is your favorite journey? Going to Kew Gardens outside London. The trip on the Tube there, the walk from the station to Victoria Gate, and then wandering through the gardens. Having tea overlooking the Palm House. Wandering around the Queen’s Garden behind Kew Palace.

What do you consider the most overrated virtue? I think the world is in desperate need of the virtues extolled by my grandparents: Work hard for something that is bigger than you, don’t bully, be self-reliant, if you don’t have anything nice to say, don’t say it, be honest, tell the truth.

Which words or phrases do you most overuse? Beautiful, delicious. I also tend to retell stories. My college roommate suggested I publish a book: “1001 Stories You Never Cared to Hear and Never Care to Hear Again.”

What is your greatest regret? Not having children.

Which talent would you most like to have? Watercolorist.

What do you consider your greatest achievement? In terms of overcoming personal shortcomings: Lettering in high school field hockey. I wasn’t a jock, but I wanted to prove to my mother (who lettered in five sports at William & Mary) I could do something athletic. The thing that I have most loved doing was serving on USGBC’s board of directors.

What is your most treasured possession? Probably a string of pearls my father gave me as a child. He died when I was 13.

What is your favorite occupation? I love my job at Skanska. The work is made better by the people I get to work with and for and a mission that is so much bigger than self: to build for a better society.

What is your most marked characteristic? A love for colorful expressions.

Who are your heroes in real life? It is a really long list! Rick Fedrizzi, scalable leadership; Judith Webb, storytelling; Rachel Gutter, force of nature; Mahesh Ramanujam, business/organizational strategy; Jean Carroon, sustainable preservation; Kevin Kampschroer, government and thereby market transformation; Eden Brukman, Amanda Sturgeon, and Jason McLennan, a Living Future and Paris Campaign; Vivian Loftness, sustainable research and education; Janine Benyus, biophilia; and I’m just getting warmed up!

What is it that you most dislike? Bullies. Anyone in power that wields injustice.

What is your motto? I don’t know that I have a motto but I’ve always loved this saying from Napoleon Hill: “Whatever the mind of man can conceive and believe, it can achieve.” That would be man and woman in 2019!
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