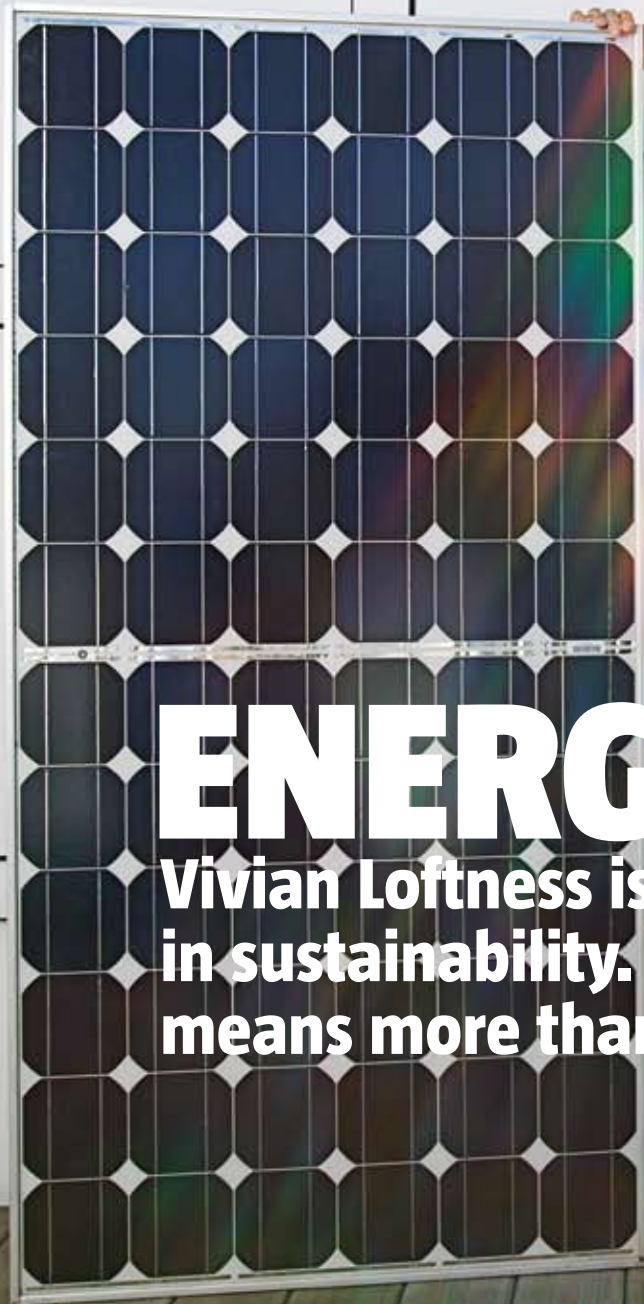


Greening Your Office 51 A God Among Model-makers 71
Big Box Rebirth 84 Hei From Helsinki 63 Vinyl on Trial 88

ARCHITECT

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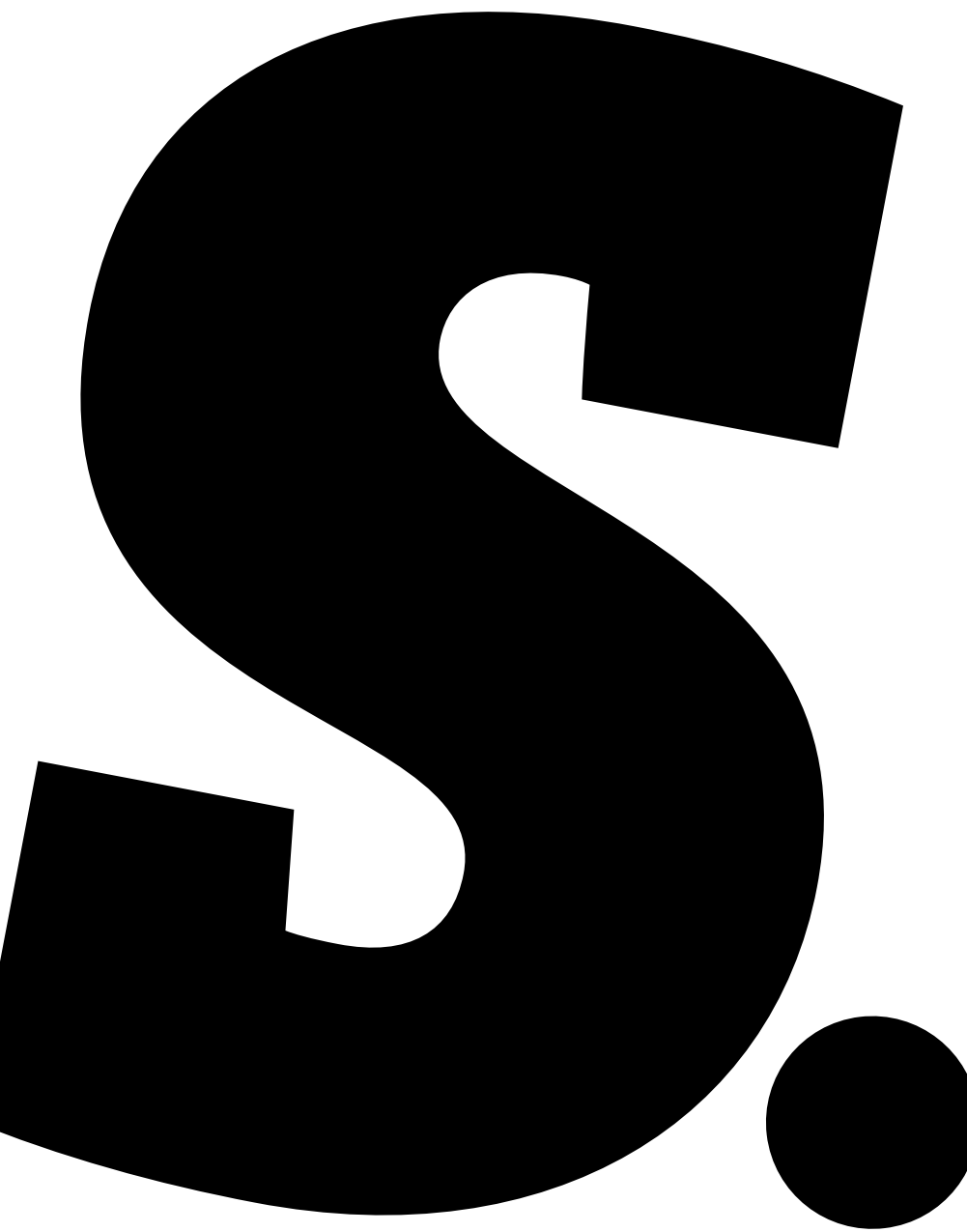
ENERGY STARS

Vivian Loftness is putting the science in sustainability. Because green means more than a bike rack.

PROMISE

BENCHMARKS IN SUSTAINABILITY

- **1992** • EPA launches Energy Star program, aimed at reducing energy consumption and greenhouse gas emissions
- **1998** • U.S. Green Building Council launches LEED Pilot Program (later renamed LEED-NC Version 1.0)
- **2000** • Green Globes for Existing Buildings launched in Canada; the Green Building Initiative (GBI) acquires the rights to distribute Green Globes in the United States four years later
- **2002** • First edition of *Cradle to Cradle: Remaking the Way We Make Things*, by William McDonough and Michael Braungart
- **2005** • LEED-NC Version 2.2 effective • GBI is first green building organization to be accredited as a standards developer by American National Standards Institute
- **2006** • Architecture 2030 Challenge issued • *An Inconvenient Truth* released
- **2007** • ASHRAE Standard 90.1 2007 released • *An Inconvenient Truth* wins Academy Award; Al Gore wins Nobel Peace Prize • Energy Independence and Security Act signed; requires all new and renovated federal buildings to reduce fossil fuel use by 55 percent (from 2003 levels) by 2010 and to be carbon neutral by 2030
- **2009** • LEED for New Construction and Major Renovation 2009 effective
- **2010** • Architecture 2030 goal: All new buildings and major renovations have reduced fossil fuel consumption by 50 percent
- **2018** • Al Gore's goal: 100 percent of electricity is produced from renewable energy and carbon-free sources
- **2030** • Architecture 2030 goal: All new buildings are carbon neutral



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Text Edward Keegan Portraits William Anthony

A DEEPER SHADE OF GREEN

WE ALL KNOW THAT BUILDINGS ACCOUNT FOR 40 PERCENT OF THE ENERGY CONSUMED IN THIS COUNTRY. BUT LEED BUILDINGS—SURELY *THEY* CAN'T BE ENERGY HOGS? THE TRUTH IS, THE EFFECT OF RATING SYSTEMS LIKE LEED ON ACTUAL PERFORMANCE HAS NOT BEEN SCIENTIFICALLY DETERMINED ... YET.

PERFORMANCE

WE MAY LOOK BACK AT 2008 as the year when America finally woke up to the reality of energy. Gasoline prices topped \$4 per gallon in many locales around the nation, and something fundamental seemed to change. Americans drove less per month starting in November 2007—resulting in the greatest drop in miles driven since the Federal Highway

Administration started keeping records in 1942 and the highest volume of public transit use in 50 years (see page 44). Suddenly, energy conservation isn't just the rallying cry of nonprofit organizations or the subject of an indie film hit featuring a former vice president—it's part of everybody's changing daily habits.

Some architects have seen it coming for a decade or more. William McDonough cast himself as the profession's John the Baptist figure early in the 1990s. In 1993, the U.S. Green Building Council (USGBC) opened its doors as a small organization with significant input from architects. Now, it's not unusual for design firms to have more LEED-accredited professionals than licensed architects.

The profession's part of the problem is directly tied to a startling set of numbers reported by the Environmental Protection Agency (EPA). It's typical to find those involved in the building industry repeating them as a mantra: Buildings consume 12 percent of our water, account for 40 percent of our total yearly energy usage, and produce 48 percent of our total greenhouse gas (GHG) emissions.

Announced two years ago, the Architecture 2030 Challenge is rapidly gaining acceptance by building professionals. It stipulates reducing new building and renovation's GHG-emitting energy consumption 50 percent by 2010 and achieving carbon-neutral new buildings by 2030. Is this laudable goal even remotely possible? Have the steps we've taken during the past decade and a half given us the start that's required?

Therein lies our own inconvenient truth. From a marketing and political perspective, the green movement has won major battles. But the time has come for the profession to deliver the goods, and the science of sustainable building is still in its infancy.

LEED'S FIRST REPORT CARD

Despite its growing ubiquity, the USGBC's LEED program still touches on only a small percentage of buildings in the United States. As of September 2008, there were 1,705 LEED certified buildings, with 13,741 registered in the LEED certification process. (USGBC estimates that LEED represents 5 percent to 6 percent of all new commercial construction.) In March 2008, the nine-year-old labeling system got its first report card. Titled "Energy Performance of LEED for New Construction Buildings," the report was commissioned by the USGBC and conducted by the New Buildings Institute (NBI). Its results raise questions about the profession's awareness of the building sci-



LEADING THE ACADEMY

Vivian Loftness

University Professor, Carnegie Mellon University, Pittsburgh

Age: 56

Education: B.S. and M.Arch., Massachusetts Institute of Technology

Vivian Loftness joined the Carnegie Mellon faculty in 1981. "One of the main goals of my work is proving that quality buildings have positive outcomes in terms of energy, sustainability, health, productivity," she says. Loftness headed the School of Architecture from 1994 to 2004 but stepped down to devote more time to teaching and research. (She does find time to be on the USGBC's board of directors and lecture on sustainability around the world.) "I'm amazed at the impact of LEED in promoting team design ... very early in the design process," she says, noting the contrast to the traditional model of architectural creation, which holds that the best ideas come out of the brain of an individual (at midnight or later).

Loftness sees today's college-age generation as a driver of necessary change within the academy. "They're demanding courses that cut across disciplines," she says, even though universities are still organized on disciplinary lines. But one simple solution could change the playing field. "If Congress told NIH [the National Institutes of Health] and NSF [the National Science Foundation] to put 1 percent of their budgets next year to ... built environment issues, you would see building science pop up all over the country," she says. "It would be across disciplines, and you could totally transform the mind-set."

ence issues that will be central to solving our side of the global warming equation.

“The study started from a discussion about how we make the rating system better if we don’t know what’s wrong with it now,” says the USGBC’s vice president for technical development, Brendan Owens. Mark Frankel, the NBI’s technical director and a co-author of the report, notes that **one of the most shocking results was not the data itself, but the meager quantity available.** The NBI asked the owners and operators of 552 LEED-certified buildings (as many as existed when the study began) to participate. About half—250—were willing, but only 121 of that group could supply the data necessary.

Since one common complaint of the LEED process is the onerous paperwork required to achieve certification, it seems odd that the owners and operators of these lauded buildings would balk at providing the uncomplicated data requested—i.e., recent energy bills.

Carnegie Mellon professor and architect Vivian Loftness, an expert on building performance, characterizes the report’s conclusions as, “Predominantly, we’re doing pretty well.” On average, the 121 buildings in the survey are showing better energy performance than a model code baseline building. Of course, an average is just that. In fact, a number of buildings are performing much better, while a similar number are faring worse. **This disconnect—between actual building performance and design-phase energy modeling—offers the most important and challenging lesson for the USGBC, architects, engineers, owners, and other building professionals.**

Frankel explains that more than a third of the included buildings had achieved LEED M&V credits, which require a measurement and verification plan that extends at least one year into building occupancy. “I thought we’d get a lot of M&V reports,” says Frankel. “We got four.” Three of those four were from a single firm that has a reputation for good follow-up. The fourth was a real cause for concern: The NBI’s analysts crunched the numbers and assigned it an approximate Energy Star score—which was shockingly low. Convinced that the data were incorrect, the NBI contacted the owners, who verified the numbers.

“They had no idea their M&V report was telling them their building was a dog,” says Frankel. “There was no context.” Within a day, that building owner had their design team on the phone and they set about discovering what wasn’t operating properly. Within a few months, they had reduced their energy use by 30 percent.

While just a single anecdote involving one participant in the study, it demonstrates the fundamental disconnect—between predicted and quantifiable performance—that still pervades the industry.

The USGBC is continuing the study with the NBI, seeking the reasons behind



MONITORING THE PRACTICE

Stephen Kieran

Partner, KieranTimberlake Associates, Philadelphia

Age: 57

Education: B.S., Yale University; M.Arch., University of Pennsylvania

Long known for its interest in research, Philadelphia’s KieranTimberlake has begun doing independent performance monitoring on its buildings in the past two years. Installing the monitors is neither difficult nor expensive, according to Stephen Kieran. “They can be purchased online and delivered in a day,” he says. “We’re talking a few thousand dollars.” The firm’s staff—which includes environmental scientists as well as architects—is responsible for the installation, monitoring, and analysis of the data.

Making the connection between design assumptions and actual performance is critical to Kieran’s concept of the profession’s role today. He compares architecture to medicine, where diagnosis and initial treatment are just the start of the process. “The building is never ‘done,’” says Kieran. “It needs to be monitored and managed, and we can play an important role in making suggestions on how to upgrade and tune its performance.”

RUNNING THE BUILDINGS

Larry Bridge

Workplace and Infrastructure Solutions Manager, Procter & Gamble, Cincinnati

Age: 42

Education: B.S., Michigan State University

Trained as a mechanical engineer, Larry Bridge has worked in facilities and real estate for Procter & Gamble (P&G) for 22 years. He's currently in charge of some 1.5 million gross square feet of general office space that accommodates 4,200 people. The company's headquarters complex in Cincinnati recently gained Energy Star certification for its increasingly sophisticated set of energy-efficient controls and practices.

All of P&G's green upgrades have been made as part of a standard maintenance program. They include better daylighting, through open office layouts, and automated systems that more tightly control everything from bathroom and conference room lighting to office temperatures, which can be tweaked a bit warmer in the summer and cooler in the winter. "You've got acceptance from employees for automation and controls," he says. "They're bothered if they don't see it." Bridge views both renewable energy and better materials as places for a lot more improvement. But it's all part of a continuing process—for him and P&G.

"You build it, make sure it's working the way it was designed, then you have to continually validate that it's operating the way it should," he says.



both over- and underperforming buildings in the LEED program. "We're trying to pin down specifics," says Owens. "There are lessons both ways." Loftness concludes, "There's a major handoff problem between engineering excellence and construction, and management excellence."

PLUSES AND MINUSES

While only about half his firm's clients choose to participate in LEED, Stephen Kieran, a partner of KieranTimberlake Associates in Philadelphia, finds that the decision increases their aspirations in a verifiable way. Two of the firm's recent buildings—one for Sidwell Friends

School in Washington, D.C., and the other for Yale University—achieved a platinum rating. "Yale wanted a silver building, but we were able to get it [to platinum] without a lot of extra money," he says. But Kieran doesn't applaud the additive nature of the LEED system. "You get points by adding additional features to the building," he says, whereas Kieran-Timberlake prefers a holistic process, looking carefully at orientation, shading, and sophisticated envelopes. To achieve energy efficiency, "We build [it] into the form of the building without adding horsepower or material," Kieran says.

Even Loftness, a USGBC board member, acknowledges that the current Ver-

sion 2.2 of LEED allows certified buildings to skirt energy performance, since only 10 of the 69 credits are what she calls “hard-nosed energy credits.”

“Some poor performers have gone for other stuff—air quality, or land use, or transportation, or other good things,” she says. “They may be major contributors to our drive for environmental sustainability without having hit the energy checklist.” The next evolution—LEED 2009—addresses this issue by creating mandatory energy credits and increasing the percentage of energy credits within the overall framework of the rating system. (Under 2.2, 17 out of a possible 69 points are “Energy & Atmosphere” credits—that is, a little less than 25 percent. Under 2009, it’s 35 out of 110, or almost 32 percent.)

BUILDING PERFORMANCE RESEARCH

“Right now, there’s a lot of emphasis on high-performance design, but we don’t

according to Owens. Still, it is trying to extend its reach by funding studies with matching on a greater than one-to-one basis for anything it supports.

Loftness points to another thorny problem. “We cannot baseline our buildings,” she says. “It’s a building science and an engineering problem.” EPCAct, the Energy Policy Act, mandates all federal agencies to baseline their buildings, without establishing what that baseline is.

Because energy consumption in federal buildings is often a complex brew of electricity, steam, gas, and chilled water—generally metered in different ways, across multiple buildings and/or sites—establishing a simple metric for each is extraordinarily difficult. The NBI’s Frankel notes that contemporary building automation systems would seem to provide an answer, but the average system now creates as much data in 20 minutes as Shakespeare’s collected works. “When was the last time your building manager had enough time to sit down and read Shakespeare?” he asks.

THE EVOLUTION OF LEED

LEED 2.2

Sustainable Sites	14 points
Water Efficiency	5
Energy & Atmosphere	17
Materials & Resources	13
Indoor Environmental Quality	15
Innovation & Design Process	5
Regional Bonus Credits	0
Total	69

37%	47%	56%	75%
CERTIFIED	SILVER	GOLD	PLATINUM
26–32	33–38	39–51	52+

LEED 2009

Sustainable Sites	26 points
Water Efficiency	10
Energy & Atmosphere	35
Materials & Resources	14
Indoor Environmental Quality	15
Innovation & Design Process	6
Regional Bonus Credits	4
Total	110

37%	45%	54%	73%
CERTIFIED	SILVER	GOLD	PLATINUM
40–49	50–59	60–79	80+

have a comprehensive feedback loop for evaluating that performance and learning from it,” says Kieran. And at the moment, we’re not on a sustainable path to change that.

“The federal investment in building science research is impoverished,” says Loftness, who notes that only 0.2 percent of the federal research budget even touches on issues like water, air, and energy as they affect the built environment. Science and medicine are funded by the federal government because they’re considered fundamental to the nation’s future. The USGBC maintains a \$2 million research endowment, but primary research is not a goal of the organization,

The NBI is trying to establish key performance indicators. “What are the 10 or 20 data points that allow building operators on a daily basis to understand what’s going on?” asks Frankel. And, more importantly for the industry, **how can architects understand what their input provided, and how tenant and owner activities affect building performance in real-world situations?**

In separate discussions, Frankel, Loftness, and former American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) president Kent Peterson all pointed to the buildings of the 1920s as models for energy-efficient design. These structures were designed

with daylight wells, good thermal mass, and natural cross-ventilation. “They’re passive buildings,” says Loftness. “You can run them easily. It’s important to keep them in our portfolio.”

Frankel—who has looked carefully at more LEED buildings than almost anybody—says, “If you look at the characteristics of buildings that are performing well, you don’t see all these funky, cutting-edge technologies that are driving the energy.” Instead, he says, what you see is really good design integration—the designers have taken a bunch of stuff

they know how to do, then put it together in a sensible package that works. “Effective design is what drives energy performance,” he says.

GETTING TO 2030

According to the NBI report, most LEED platinum and gold buildings are already meeting the Architecture 2030 Challenge’s interim target of reducing carbon emissions to 50 percent of current averages by 2010. “But LEED is still not the mainstream driver,” says Loftness. “It doesn’t matter how many times



CRUNCHING THE NUMBERS

Mark Frankel

Technical Director, New Buildings Institute, White Salmon, Wash.

Age: 46

Education: B.A. (environmental policy), Pomona College; M.Arch., University of Utah

“Most people think I’m a mechanical engineer, but I’m not,” says Frankel, a Salt Lake City native. Prior to joining the New Buildings Institute, he worked for two Seattle-based energy consulting firms and “learned more about mechanical design than any architect has a right to.” At one of them, Paladino & Co., he was in charge of the firm’s third-party review of the first 75 LEED projects. Since 2006, Frankel has been technical director of the NBI, where he’s able to bring his expertise to national program and policy work for organizations such as the AIA, the USGBC, the Environmental Protection Agency, and the Department of Energy.

“[The] NBI is about translating the information that’s out there into something architects can use,” Frankel says. “There’s a critical need for that.” As one of the authors of the recent report “Energy Performance of LEED for New Construction Buildings,” he doesn’t shy away from the more troubling results. Discussing some of the “scatter”—the buildings that are either underperforming or overperforming their supposedly green designs—he attributes these anomalies to the disconnect between design assumptions and the reality of buildings in operation. “If we had good feedback systems, the scatter would tighten down considerably,” he says.

we tweak LEED, it's not going to be enough unless there's a federal focus on the whole."

Platinum and gold buildings are still considered state-of-the-art. It's implausible to imagine 2030's interim goal being met on a wide scale within two years.

Although LEED may still seem to fit a boutique niche, the growth of its techniques is more widespread than the reported numbers. While only half of KieranTimberlake's clients aim for certification, the firm designs all their projects with a similar ethic and approach. Procter & Gamble is an example of a corporate citizen that takes a similar view. "Our design standards are very consistent with LEED," says Larry Bridge, workplace and infrastructure solutions manager for the company, which has not sought LEED on a project to date.

Tech company Integrated Environmental Solutions offers free software that can predict the energy use and carbon emissions of a building model in SketchUp or Revit. CEO Don McLean acknowledges that, while his VE-Ware is a good tool for implementing these strategies, tools alone won't get it done: "We've got to get back to the fundamentals of architectural design," he says. "It's about looking at building mass, shape, form."

Owens notes that **the USGBC is doing everything it can to speed up the process.** With LEED 2009, the existing buildings category gets more attention because it offers a quicker feedback loop for improvements (not to mention the previously noted advantages that many older buildings have over new construction). While Owens remains optimistic, he notes that the scientific community is constantly recalculating the levels of greenhouse gas that need to be met. The current level of carbon dioxide in the atmosphere is 385 parts per million (ppm); a new paper suggests that the right target level might be 325 ppm. "We've been shooting at 550 for the past two years, so our trajectory is all wrong to begin with," he says.

Which gets us back to science—and specifically, building science. Our still nascent knowledge of this discipline is our inconvenient truth. For more than half a century, we've built with ever cheaper and thinner and slicker materials while we've asked our engineering colleagues to pump them full of whatever heating and cooling was necessary. In doing so, we lost a balance between buildings and nature that had been part of an architect's repertoire since before Vitruvius.

We can take some solace in the fact that architects have stepped up in the past decade and begun to rapidly address these problems. But what we don't know

GROWING THE SYSTEM

Brendan Owens
Vice President, Technical
Development, U.S. Green Building
Council, Washington, D.C.
Age: 33
Education: B.S. (engineering),
Purdue University



An engineer by training, Brendan Owens worked for a half dozen years with a contractor who did energy service retrofits in the Washington, D.C., area. When he joined the USGBC six years ago, there were just seven staff members. "We were the people whose phone calls weren't being returned," he recalls of his first days with the nonprofit. He's now one of 10 vice presidents, and the rapidly growing organization has more than 165 employees.

"The thing that's exciting about the conversation we're having now is that it's such an integrated discussion," says Owens. He considers the LEED framework an essential building block for this evolving dialogue between the profession and the public. LEED 2009 is the next big step, but Owens considers the LEED-Online system that will debut with the revised rating systems just as important. "We're giving the market the tools to deliver an exponentially larger number of green buildings," he says.

right now—what former Secretary of Defense Donald Rumsfeld once famously called the "unknown unknowns"—remains vast and is a result of decades when our educators and professionals chose to favor aesthetics and expedience over firmness and commodity.

"There's an urgency with 2030," says Frankel. And our responsibility to learn and change is imperative. 🏠