Bouncing Forward from Disasters
Finding opportunities in the spate of recent devastating natural disasters.

by Alex Wilson

In re-reading the feature article I wrote this time last year for The BuildingGreen Report after President Trump was elected, 20 Ways to Advance Sustainability in the Next Four Years, I was reminded of just how optimistic—indeed quixotic—I can be. Perhaps it is this serial optimism that has allowed me to keep at it some 40 years after I first became interested in renewable energy and sustainable building.

I was grossly wrong (or at least grossly premature) when I suggested that Trump might wake up to the realities of climate change and the urgent need to address this looming crisis. If anything, his actions, and those of his administration, have been even more extreme and more harmful than we had braced ourselves for as they work to undo years of negotiations and policymaking to address global warming.

But that doesn’t mean that there can’t be a silver lining—that something good can’t come out of these dark times. My colleague, Nadav Malin, made this point in his article Opting Out of Paris Accord Fortifies Global Warming Battle in which he showed how states, cities, and corporations stepped up to fill the void when Trump abdicated global leadership on this issue.

It is with this in mind that I reflect on some of the natural disasters of 2017 and the opportunities that can emerge from them. Rather than just bouncing back from such disturbances, we can bounce forward.
The BuildingGreen Report

Founding Editor · Alex Wilson
President, Editorial Director · Nadav Malin
Managing Editor · Nancy Eve Cohen
Products & Materials Specialist · Brent Ehrlich
Associate Editor · James Wilson
Research Analyst · Paula Melton
Designer & Proofer · Bets Greer
Production Assistant · Fran Bellin

Vice President, Technical Services · Peter Yost
Operations Director · Angela Battisto
Design Director · Andrea Lemon
Outreach Director · Jerelyn Wilson
Marketing Director · Sonja Faraloro
Accounting & HR Director · Sarah Rice
Customer Support Manager · Charlotte Snyder
Web Developer · Ben Hewitt
Project Coordinator · RoseAnn Grimes

Advisory Board
Steve Baczek, R.A., Reading, MA
Bob Berkebile, FAIA, Kansas City, MO
Arlene Blum, Ph.D., Berkeley, CA
John Boecker, AIA, Harrisburg, PA
Terry Brennan, Rome, NY
Bill Browning, Hon. AIA, Washington, DC
Nancy Clanton, P.E., Boulder, CO
Raymond Cole, Ph.D., Vancouver, BC
David Eisenberg, Tucson, AZ
Drew George, P.E., San Diego, CA
Harry Gordon, FAIA, Washington, DC
Bruce King, P.E., San Rafael, CA
John L. Knott, Jr., Charleston, SC
Sandra Mendler, AIA, San Francisco, CA
Rick Norris, Ph.D., N. Berwick, ME
Russell Perry, FAIA, Washington, DC
Peter Pfeiffer, FAIA, Austin, TX
Bill Reed, AIA, Arlington, MA
Jonathan Rose, Katonah, NY
Marc Rosenbaum, P.E., W. Tisbury, MA
John Straube, Ph.D., P.Eng., Waterloo, ON
Michael Totten, Denver, CO
Gail Vittori, Austin, TX

The BuildingGreen Report (ISSN 1062-3957), formerly Environmental Building News, is published monthly by BuildingGreen, Inc. TBGR does not accept advertising. Copyright ©2017, BuildingGreen, Inc. All rights reserved. No material in this publication may be reproduced, electronically transmitted, or otherwise reproduced by any means without written permission from the Publisher. However, license to photocopy items for internal use or by institutions of higher education as part of collective works is granted.

Disclaimer
Every effort has been made to ensure that the information presented in TBGR is accurate and that design and construction details meet generally accepted standards. However, the information presented in TBGR, by itself, should not be relied on for final design, engineering, or building decisions.

Editorial & Subscription Office
122 Birge St., Suite 30, Brattleboro, VT 05301
802-257-7300 · 802-257-7304 (fax)
news@BuildingGreen.com · www.BuildingGreen.com

officials and legislators about resilience that I participated in during the Greenbuild Conference in Boston this past November.

The communities in California leveled by wildfire pose a different challenge. How can one create resilient communities in regions prone to wildfire in a way that doesn’t feel too sterile? Experts have long argued against building in the “wildland-urban interface,” but some of the municipalities so affected by the September wildfires, including Santa Rosa, were not in that interface area. They still burned. Finding solutions to this quandary will require concerted effort from the smartest landscape architects, ecologists, architects, and planners. We don’t want to live in gravel parking lots from which the last sprigs of vegetation have been removed. But I believe that creative solutions are possible that will enable those vulnerable California communities to end up better off than they are today.

While earthquakes didn’t affect the United States significantly in 2017, the same cannot be said of our southern neighbors in Mexico. Seismic design practices that have been implemented in the past 30 years in Mexico (since a devastating 1985 earthquake that killed 10,000 people) prevented the September 2017 Central Mexico earthquake, with a magnitude of 7.1, from killing a whole lot more people than the 370 who died.

But the continued seismic upgrades required for buildings could be expanded to address other performance issues—improving energy performance, for example, or addressing how to ensure continued functionality of a building following an earthquake, rather than simply ensuring that people can get out safely. This sort of seismic resilience is the goal of Arup’s REDi Rating System that was incorporated into the LEED Pilot Credits on Resilient Design—which are about to be integrated into the RELi Rating System (see USGBC Announces RELi as its Resilient Design Rating System).

If climate scientists are to be believed, the relentless onslaught of storms and fires could be a harbinger of what is to come. Very soon, resilience planning will become an overriding priority for policymakers, planners, and design professionals. Yes, let’s figure out how to create more resilient buildings and communities that will bounce back from the next disaster, but at the same time let’s carry out that rebuilding in a way that solves our other challenges, like reducing energy and water consumption. Let’s just bounce back; let’s bounce forward.

NEWS ANALYSIS

Thoughts on the Future of the Zero Energy Market

A Q&A with Brad Liljequist, director of the Zero Energy Program at ILFI.

by Nancy Eve Cohen

The net-zero-energy building market has come a long way since the first commercial projects to target net zero were constructed nearly two decades ago. They include the Oberlin College Adam Joseph Lewis Center for Environmental Studies in 2000 and the Audubon Center at Debs Park in Los Angeles, which earned a LEED Platinum rating in 2003.

Today, the International Living Future Institute (ILFI) has certified 64 projects,
with another 426 in the pipeline. The latest numbers from the New Buildings Institute (NBI), from 2016, total 53 verified projects, with another 279 buildings and districts “emerging”—meaning they’re working on meeting the goal of net zero.

Brad Liljequist of ILFI describes his job as “trying to make zero energy buildings the norm.” Liljequist talked with BuildingGreen about the current and future state of the net-zero market.

Recently, Grand View Research Inc. forecast $78.8 billion of growth in the global net-zero-energy building market by 2025. That’s compared to $8.04 billion in 2016, according to the report. What do you think of this analysis?

Setting aside the literal ‘is the right number X or is the right number Y?’ the reality is we are really seeing a quiet revolution in the design and technology since undertaking a lot of what I think of as zero-energy design; it is an all-electric building, it has a substantially improved envelope, it tends to have a separated ventilation, and heating and cooling systems ... and better daylighting so their lighting loads go down. The heating, cooling, and hot water systems are heat-pump based.

I think zero energy as an idea is helping to drive a technological and design transformation, and that industry is massive. And I also think what’s going to end up happening, as the technology uptake occurs, it’s going to get cheaper and cheaper, and it’s going to make zero-energy buildings truly more the norm.

Over the long haul, the numbers the report is talking about ... are absolutely going to happen. Who knows what year that will be, when it is $80 billion dollars. We’re in the middle of the transformation right now.

You do believe it’s a multibillion-dollar industry?

If you look at the California market alone, California has a policy to codify net-zero-energy residential by 2020. Now, how they will actually do that and how it’s actually defined, I think there’s a big question mark around that, and we’ll see what it actually is. But even if you just take that fact alone and multiply it broadly, yeah—I do think the market is going to be that big.

Just in the last few months, we’re seeing a big uptake in Zero Energy-registered projects [at ILFI]. Our customer service inquiries, this is kind of anecdotal, but they are really going up. We are just having a lot of people contact us and many, many conversations. Last Friday alone (December 15, 2017) we had five projects contact ILFI to register.

Can you compare the U.S. and Canadian markets versus the European and Asia-Pacific markets—which of those is largest and why?

I think ‘zero energy’ is mostly an American definition, although some of the original concepts originated in Europe. As an idea, where it’s gotten the most traction, has been the United States. But I think just because they are not necessarily using that terminology, I mean the market for high performance buildings is by far the strongest in Europe. I mean they are five to ten years ahead of us.

Why is that?

I think they see the climate crisis for what it is; it’s a threat to civilization. And they’re mounting a serious response to it. They’re implementing policies at a central government level to actually make the change happen.

The U.S. is really great at primary technology, like coming up with initial ideas.... The Europeans and the Japanese have a demonstrated track record for being able to bring to market substantial technology
improvements. Whether it’s high-performance windows, the best HRV [heat-recovery ventilator] technologies, Passive House design and the materials to go with it … those are coming from Europe. And I think the Japanese really led the way on the best heat pumps. We kind of lag. Those things originated in those locations; they’ve had market adoption that’s just ahead of ours.

Our federal government is not leading us with laws that would push zero energy?

I think that’s accurate. Right now, within the United States the leadership is coming from localities and states. And there’s a beauty to that. You get competition.

The reality is if you have a strong, central authority just kind of lay down the law and say this is how we are going to do it, it makes a huge difference.

What about the growth of commercial net-zero projects versus residential in the U.S.? Which is experiencing faster growth?

I think it’s 50/50. The value proposition is equally strong in both. That’s borne out in the numbers for our registered projects, of which we have 426 at this point, and it’s pretty evenly distributed across all the different development types.

Do you think one or the other will have a higher growth rate in the future?

I really expect the rate of growth to be the same. If I were going to identify any submarket, it would actually be the institutional market because there the math for zero-energy buildings just is the most compelling.

By institutional, I mean public buildings and other long-term owner-occupied buildings. They could easily be corporate buildings or a family-owned business that might really expect to be in a location for a long period of time.

Let’s say you are building a new city hall or a new library. It’s typically a building that’s of a high standard. It’s an icon of the community. They want it to be well built. They typically are going to issue a bond for it. So they have a fairly long-term repayment time frame, maybe 20 to 25 years. And if you look at the total cost of ownership, under that ownership structure, a zero-energy building will almost always have a lower total cost of ownership because of the utility savings. The utility savings, over that amount of time, easily offset the increase in construction costs.

And college campuses as well?

Absolutely higher education. I’m glad you raised that. I actually think higher education might be the biggest growth market because it’s so aligned with the values.

We have campuses going through divestment from fossil fuel companies. They are very aligned with the exact same set of values.

As we go forward, where do you think we should be focusing: individual buildings or communities?

The whole orientation that individual buildings don’t matter is kind of missing the point. Of course, a single zero-energy building is a tiny drop in the bucket, but these early zero-energy buildings are, to me … they’re beacons of hope. They’re showing people what is possible. You’re putting the change you want to see out in front of everybody.

At ILFI, we strongly believe in these early prototypes as a way to really catalyze attitudes and understanding. So, yes, the community scale is what’s most important, and even bigger than that, everything is more important, but you’re not going to get there in one fell swoop. It’s a series of actions, and we believe pretty strongly one of the first actions is building prototype examples.

I think we need to continue to build the examples, and we need to build them in every state, in different climate zones and in different building types. My hope is that zero energy starts to become a household name on par with Energy Star or LEED.

And also, parallel to that, we are starting to see early pioneers start to codify it; California, for example. And Washington, D.C. is putting together Appendix Z, which is basically their zero-energy stretch code.
As someone who is working to make net-zero buildings the norm, what was your reaction when you saw the recent analysis forecasting the market will be close to $80 billion by 2025?

I think there is this other part, that is the wild card, that the report doesn’t address and can’t really address. And nobody knows when this will happen, but I do think we will, in the next five years, hit some type of tipping point where there is a rapid realization that we have to rapidly accelerate this technology solution.

I don’t know if some huge part of the Greenland ice sheet is going to fall into the ocean, but it’s going to be something—some kind of catalyzing event. It could be a stock market crash, where everyone realizes fossil fuels are doomed ... and there is a reconfiguration of a market.

I don’t know what it is, but there will be something that says we have to radically rebuild our buildings and essentially get them to zero-energy performance, and when that happens, $80 billion is going to be small potatoes.

More on net-zero energy

New Zero Energy Certification Powered by ILFI and NBI

Getting to Zero: The Frontier of Zero-Energy Buildings

New York State Launches Initiative to Scale Net-Zero Retrofits

Net-Zero Energy is Achievable: Here’s How

For more information

ILFI Zero Energy Certification

Net-Zero Energy Buildings (NZEBs) Market Analysis by Equipment (Lighting, Walls & Roofs, HVAC systems), By Services, By Type, And Segment Forecasts, 2014-2025 by Grand View Research, Inc.

NBI Stretches Code to Save 20% More Energy

The goal is to move energy codes forward more rapidly.

by Nancy Eve Cohen

When President Trump backpedaled the United States out of the Paris Accord last year, the New Buildings Institute (NBI) was in the midst of designing new provisions for energy codes that would reduce greenhouse gas emissions from buildings.

At the time, NBI was developing energy code strategies for 12 cities from the Zero Cities Project, which had set aggressive goals to meet their Paris Accord commitments.

After the U.S. pulled out of the accord, more than a dozen states and hundreds of U.S. and Canadian cities also committed to the agreement’s greenhouse gas reduction goals, increasing the need for ways to reduce energy use in buildings.

Now, NBI has released a new energy ‘stretch code,’ offering cities and states specific energy-saving strategies to move the building sector forward as quickly as possible.

“Code is really the strongest tool, the strongest policy tool to affect building performance right now,” said Mark Frankel, NBI’s technical director.

A stretch code, sometimes known as a reach or step code, is designed to help states and municipalities stay ahead of the curve and adopt energy-efficiency measures before they become the standard. “Stretch codes can introduce a layer of predictability to the code process,” said Frankel, so architects and manufacturers are ready when codes are updated.

NBI’s new model stretch code provisions are designed to reduce energy consumption by 20%, on average, across building types and climate zones around the country. “We are trying to influence the code discussion,” said Frankel. “We are trying to provide a concrete set of strategies that could be adopted now, to move forward.”

The Pacific Northwest National Laboratory (PNNL), part of the U.S. Department of Energy, analyzed NBI’s new stretch code and confirmed it would achieve a 20% energy savings over ASHRAE 90.1-2013, the most commonly used national model energy code when NBI started the project.

It’s up to states either to adopt an energy code for buildings or to delegate the authority to cities and towns to establish their own.

At times, cities or states compete to have the best code. “They sort of look at each other and say, ‘Well if they can do it there, we can do it here’,” said Frankel.

Frankel said much of NBI’s new stretch code is already going into the codes for New York City and Seattle.

One measure in the stretch code would require architects to reduce the impact of thermal bridges by using thermal breaks and insulation. Another requires air sealing and testing to show that the envelope is tight enough to reduce air leakage. A third requires separating the ventilation system from heating and cooling, so large fans aren’t
running constantly to move air while consuming energy.

A city or state can overlay all of the ‘stretch’ measures on top of existing code—or they can cherry pick specific provisions and write them into their code to increase stringency.

NBI will continue to help jurisdictions that want to adopt it. “We put it out there for anyone to use,” said Frankel. “Let us know if we can help you use it. We just want [to get] it done.”

Looking ahead, Frankel said, in the future, codes will encourage using less and less energy, and offsetting what remains with renewables, striving toward net-zero annual energy use.

More on energy codes

Massachusetts Stretches the Energy Code
Changes Finalized for 2015 Energy Code
Washington Pursuing More Stringent Energy Code

For more information

New Buildings Institute
New Buildings Institute 20% Stretch Code

Concrete Pours through Loophole in New Carbon Law

Buy Clean California requires contractors to specify lower-carbon products, but industry pressure quashed the law’s potential.

by Paula Melton

Portland cement, the major binding agent in concrete, is one of the single largest emitters of greenhouse gases. But thanks to lobbying by industry groups, you won’t find concrete in California’s new carbon legislation, the Buy Clean California Act.

The law requires contractors to get environmental product declarations (EPDs) for certain materials and use the EPDs to choose lower-carbon materials for state building and infrastructure projects.

Not enough EPDs?

“Nobody’s really ready,” said Charley Rea, director of communications and policy at CalCIMA—a trade association representing manufacturers of aggregate and ready-mix concrete in California. There were several reasons that CalCIMA opposed including concrete in the law, according to Rea, but chief among them was that only 3 of its 80 member companies have EPDs so far. “Most people are probably calculating in their future plans that they’re going to have to do something,” Rea told BuildingGreen, but for now, the concrete industry in California is not in a position to provide the necessary documents.

Rea said members also objected to the idea of EPDs being used as a basis of comparison when it’s not clear that this is scientifically valid. He added that the “top-down approach” rankled concrete manufacturers, suggesting that the state should work with each industry to determine “the best way to measure things for each material and do it so it’s workable and fair for everyone.”

The Portland cement industry also opposed the inclusion of concrete in the bill. Thomas Tietz, executive director of the California Nevada Cement Association, whose members manufacture Portland cement, declined to be interviewed for this article.

Disappointment in the industry

But some concrete manufacturers do have EPDs and support including concrete in the law. U.S. Concrete and others joined a coalition to back it.

“For every ton of cement that’s manufactured, approximately a ton of CO2 is released into the atmosphere,” said Jeff Davis, vice president of U.S. Concrete. “Portland cement has a high carbon footprint, which is the reason our company focuses on alternative materials.” U.S. Concrete offers lower-carbon concrete mixes made with fly ash and other cement replacements.

Davis thinks that increased transparency and the comparison of EPDs would “drive innovation and the opportunity to drive lower and lower carbon footprints of concrete. This is very significant given the volume California currently purchases for its projects.”

U.S. Concrete was also a founding member of the Carbon Leadership Forum, which developed the product category rule for concrete EPDs. “I’m disappointed that our industry has not migrated to a greater use of EPDs,” Davis said.

EPD production continues

Despite promoting early adoption of EPDs, the National Ready Mixed Concrete Association (NRCMA) remained neutral on including concrete in the Buy Clean California Act.

“This is a major achievement that should not be squandered,” NRCMA said.

But some concrete manufacturers do have EPDs and support including concrete in the law. U.S. Concrete and others joined a coalition to back it.

“For every ton of cement that’s manufactured, approximately a ton of CO2 is released into the atmosphere,” said Jeff Davis, vice president of U.S. Concrete. “Portland cement has a high carbon footprint, which is the reason our company focuses on alternative materials.” U.S. Concrete offers lower-carbon concrete mixes made with fly ash and other cement replacements.

Davis thinks that increased transparency and the comparison of EPDs would “drive innovation and the opportunity to drive lower and lower carbon footprints of concrete. This is very significant given the volume California currently purchases for its projects.”

U.S. Concrete was also a founding member of the Carbon Leadership Forum, which developed the product category rule for concrete EPDs. “I’m disappointed that our industry has not migrated to a greater use of EPDs,” Davis said.

EPD production continues

Despite promoting early adoption of EPDs, the National Ready Mixed Concrete Association (NRCMA) remained neutral on including concrete in the Buy Clean California Act.

“This is a major achievement that should not be squandered,” NRCMA said.
whole-building life-cycle assessment (WBLCA) instead of just comparing EPDs, “as this would be the only way to ensure the legislation would lower environmental impacts” overall, Lemay said. When WBLCA was taken off the table, NRCMA decided on neutrality.

However, Lemay said the association is seeing rapid uptake of EPDs among its membership. He stated that 40 companies across the country have EPDs that cover 8,850 individual concrete mixes.

**A sequel in the works?**

“One way or another, this is going to happen,” claimed lobbyist Matthew Lewis, a political consultant to the Sierra Club and other members of the coalition that supported the Buy Clean California Act. “There is no way to leave concrete off the table.” He added that the coalition will be meeting with the original bill’s sponsor, Assembly Member Rob Bonta, in early 2018 to discuss a possible amendment to the law to include concrete.

**More on concrete’s environmental footprint**

Reducing Environmental Impacts of Cement and Concrete

Setting Carbon Footprint Rules for Concrete

Industry-Average Impacts of Concrete Revealed in EPD

**NEWSBRIEFS**

**Collecting Stories to Improve Design**

New study describes the value of occupant stories in evaluating high-performance buildings.

*by James Wilson*

You can learn a lot by simply talking to people. That’s the idea behind a new take on the value of speaking directly with occupants to understand the impact of design. In the paper “Oh, behave! Survey stories and lessons learned from building occupants in high-performance buildings,” Julia Day, assistant professor at Washington State University, and William O’Brien, associate professor at Carleton University, share findings from studies that focus on how occupants interact with and use high-performance buildings.

What they’ve found is that purely quantitative forms of post-occupancy research often do not reveal the full picture of why certain design strategies are successful or not. They argue for an approach to post-occupancy engagement that combines quantitative methods of data collection, like multiple-choice questionnaires and building measurements, with in-person interviews and open-ended surveys that invite occupants to share their stories of how and why they use a building the way they do.

**Investigating design**

The researchers found that in many cases these stories point to the kinds of design flaws and barriers to energy-efficient behaviors that are very difficult to identify using other methods of investigation. They explain that when face-to-face with occupants, it is possible to ask specific follow-up questions when unexpected or interesting information is shared. And they argue that occupant stories “tend to be very descriptive, provide greater insight about occupant mentality, and are likely to remain memorable long after statistical results have been forgotten.”

In one study of a LEED-certified academic building, interviews with occupants revealed how the natural ventilation strategy was being undermined. A signaling system had been installed to indicate when it was thermally advantageous to open or close windows, but it was being ignored. The occupants were not aware that the signaling system had anything to do with the windows and did not even know the windows were operable.

In a study of an office space, an occupant explained in an interview that, because her office was above a busy street, she often had to choose between acoustic and thermal comfort.
since closing her window to block out noise would then cause the space to get too warm. The authors note that stories like this highlight the importance of doing more than simply asking occupants if they are comfortable or not. It’s better to ask specifics about what makes a building uncomfortable.

What shapes occupant behavior?

The paper describes five basic story types based on the most common themes identified in their interviews with occupants of high-performance buildings:

- Social influence—how behavior is affected by concerns for others’ comfort and/or the culture in a building
- Economic concerns—how behavior is shaped by the extent to which occupants are financially affected by building performance
- Misalignment of occupants and designer/operator—how behavior might be intuitive but differ significantly from design and operational intent
- Lack of control—how behavior and comfort are affected by either lack of control or perceived lack of control
- Pure discomfort—the specifics of how, where, and when discomfort is experienced in a building

The authors emphasize that occupant stories can be valuable beyond the individual building from which they are collected because they often produce higher-level lessons about design techniques and occupant behavior that can benefit the wider building community.

For more information

Energy Research & Social Science (ERSS)
journals.elsevier.com/
energy-research-and-social-science

Architecture as a Hands-on Search for Beauty

Based on Christopher Alexander’s ideas about design, a new degree program combines ecological thought, building skills, and self-awareness.

by James Wilson

How can we prepare the next generation of building professionals to create architecture that is environmentally responsible as well as beautiful and humane?—or “whole” and “living,” to use terms coined by architect and theorist Christopher Alexander.

Alexander—best known for his work producing and testing a “pattern language,” a description of good practices that anyone can use to design and build at any scale—has been studying and writing about the nature of human-centered design since the ‘60s. His ideas form the foundation of a new master’s program at the Sant’Anna Institute in Sorrento, Italy, Building Beauty: Ecologic Design and Construction Process. According to the program’s website, the curriculum “emphasizes the generation of beauty by means of the practical work of making.”

The program aims to teach students a design process that is scientific and evidence-based but also makes use of one’s own intuitive feelings as a way to analyze and judge the quality of a built environment.

Students study the characteristics that make certain objects and experiences universally beautiful and are taught to understand beauty as an objective quality that can be measured and analyzed. Complementing this kind of knowledge, students also work on developing practical self-awareness skills to better understand how a space or environment affects them and are taught how this subjective knowledge is used in the act of design.

The program is based on the idea that the best way to learn how to design is through hands-on engagement with materials. Students are taught to produce full-scale physical mock-ups as testing and decision-making tools in the design process, and finish their training by participating in a construction project.

For more information

Building Beauty: Ecologic Design and Construction Process
buildingbeauty.org

Ultimate Building Efficiency Requires Team Integration

“Systems efficiency” could be the next big thing in sustainable design, and integrated project delivery is how we’ll get there.

by Paula Melton

How much more efficient can HVAC, lighting, and other building systems get?
The report promotes integrated project delivery as a way to achieve the greatest energy efficiency.

Not much more while still remaining cost effective, according to a recent report from the Alliance to Save Energy (ASE). In the face of these diminishing returns, claims the report, the best way to coax our buildings to save more energy is through systems efficiency. That means finding ways to integrate high-performing systems so that they perform even better as a whole. An example of systems efficiency is capturing heat from wastewater to pre-heat domestic hot water.

The report includes extensive recommendations for building professionals, policymakers, equipment manufacturers, and others.

To maximize the benefits of systems efficiency for a given project, design professionals have a central role to play, according to the report: advocating for and participating in integrated project delivery (IPD). IPD is a contractual structure where key project members align their financial interests. This alignment demands an integrative approach whereby major players collaborate and resolve problems together, with the project owner as a central figure in the process. With IPD, architects, engineers, contractors, and facility management professionals might collaborate on how the architecture and the HVAC system can work together for greatest efficiency.

Other models, such as an integrative design process—where project team members collaborate throughout design and construction—may have a similar effect but do so without a formal multi-party legal structure. With integrative design, the owner may or may not be a key participant in the process.

“Integrated procurement models address fragmentation and process disconnects,” according to a statement from ASE. “The buildings sector is not currently structured to generate systems-focused building solutions.” Instead, with the design-bid-build contractual model still remaining dominant, systems are too often designed without interdisciplinary collaboration. The “non-linear” approach of IPD and other integration models—such as an integrative design process—can help, ASE says.

As part of an IPD or an integrative process, another tool that can promote systems efficiency is early energy modeling, according to the statement. That’s because different strategies can be tested in parallel at early stages of design to identify the most efficient solutions.

Readers can download the report at ase.org/systemsefficiency.

**More about IPD**

How to Make Integrated Project Delivery Work for Your Project

Integrated Project Delivery: A Platform for Efficient Construction

Insurance Breakthrough for Integrated Project Delivery

---

**PRODUCT REVIEW**

### Innovative New Products from Greenbuild 2017

**Highlights from the 2017 Greenbuild Expo floor include dynamic glazing, heat-pump technologies, and blown-in wool insulation.**

*by Brent Ehrlich*

Every year we walk the Greenbuild Expo floor, looking at products and talking with manufacturers to find out what is new in the green building products world. This year’s show added vendors from the Architecture-Boston Expo (ABX), but we found some gems on both floors, including electrochromic glazing, pelletized wool insulation, and cold-climate heat-pump innovations.

**Halio electrochromic glazing**

Halio Smart-Tinting Glass from Kinestral Technologies will be offering a new electrochromic glazing in the third quarter of 2018. Electrochromic glazing tints when a low-voltage current flows through it so a window can become dark with no curtains or sunshades, improving views while reducing solar heat gain. SageGlass, a 2006 BuildingGreen Top 10 product, and View Dynamic Glass both use this technology, but Aaron Smith, sales manager at Kinestral Technologies, claims that Halio sets new standards for

- clarity, with 70% visible light transmittance;
- neutral color, with a gray to black tint (rather than the blue found in other electrochromic glass); and
- fast tinting, fading to dark in only three minutes.

Halio will be available as an exterior window that blocks 97% visible light and as an interior privacy pane (Halio Black) that blocks up to 99.9% visible light.
light. These windows are compatible with smart building controls/building automation systems. The residential versions will work with Siri and Alexa. For thermal performance, the company’s double pane, low-e, argon-filled version is similar to standard glazing (U-value of 0.24), but Smith says Halio can be custom ordered to meet Passive House criteria or other design needs.

Halio will be available in a maximum size of 5’ x 10’ and will be cost competitive with other electrochromic glass, according to Smith.

**Heat pumps and more heat pumps**

Standard heat pumps can have problems generating reliable heat in extreme cold, but LG has joined Daikin and Mitsubishi by offering units that operate in cold temperatures. The company’s LGRED (for LG Reliable to Extreme Degrees) system produces heat in temperatures as low as –13°F. LGRED is available in its residential Art Cool single-zone, “mini-split” units that supply heating and cooling to one room or zone; and in its residential/light commercial Multi F and Multi Max multi-zone, “multi-split” units that can provide heating and cooling to up to eight indoor zones using one outdoor unit.

Speaking of zones, Mitsubishi—one former BuildingGreen Top 10 winner—was highlighting its own multi-split “Zone Comfort Solutions.” Many of Mitsubishi’s heat pumps are available with Hyper-Heat H2i inverters that also operate to –13°F. Though their heat pump technology is not new, Mitsubishi was drawing attention to the controls and indoor units. Indoor heat-pump modules are not known for their good looks, but Mitsubishi was showcasing a variety of different styles and finishes, including ceiling cassette options, wall-mounted units in different colors, and floor-mounted versions.

Daikin has just launched its Aurora line of light commercial variable refrigerant volume (VRV) heat pumps that use its variable refrigerant temperature (VRT) technology. VRV systems are complicated, and VRT adds even more nuanced tech to its systems. The end result, though, is a system that can provide heat down to –22°F.

VRV systems in general are efficient because they can vary the refrigerant flow at partial load to maximize compressor efficiency. This is based on outdoor temperatures and a room’s temperature set point. Daikin takes this technology a step further and monitors the indoor and outdoor temperatures, adjusting the temperature of the refrigerant itself. This VRT technology is geeky stuff, but the company claims units running VRT were 28% more efficient than their previous VRV line.

**Heat-pump water heaters**

Can’t get enough of heat pumps? Well, Rheem is now offering a heat-pump water heater that solves the technology’s biggest problem, venting. Heat-pump water heaters transfer heat (and moisture) from the air into the water, but in the process the cold dry air is vented into the space near the water heater (for more, see BuildingGreen’s primer on heat pump water heaters). This can be okay in a warm, humid climate, but in cold climates it increases the demand on heating equipment and lowers the efficiency of the water heater.

Rheem’s Prestige series can now duct incoming and exhaust air up to 100 feet. In warm climates, it can bring air in from one space and move cool, dry air where needed for air conditioning and dehumidification; in cool climates, the cold air can be vented outside in the winter, reducing heating loads.

The Prestige hybrid water heaters contain an electric backup element, yet have an impressive energy factor of 3.5 (for every 1 kilowatt hour of electricity you get 3.5 times the amount of hot water). It is available in 50-, 65-, and 80-gallon models and connects to controls via the Internet and even NEST thermostats.

**Pelletized wool insulation without pesticides**

Wool insulation has some great attributes: it is naturally flame resistant, has a high R-value, has elasticity so it does not compress, and can manage humidity and moisture. Paragon Pure Wool from New Zealand is offering pelletized wool that is blown in place, rather than installed as batts, and has no flame retardants or pesticides.
Pure Wool is combed into small wool balls that are “springy” and resist settling, according to the company, so much so that the company says they will stay in place for 50 years. Blown into attics or installed behind mesh stapled to framing, it provides a stable R-value of more than 6.

The most exciting part of Pure Wool—it is not treated with pesticides, according to the company. Typically, wool requires pesticides for initial processing and to keep moths and beetles at bay, but Pure Wool is using a proprietary process that includes diatomaceous earth, a silica powder that dehydrates and kills insects, and is widely used in pest control.

**What did you see at Greenbuild?**

These are just a sample of products we saw at Greenbuild. Others include wood treatments from Vermont Natural Coatings, concrete-free foundation framing from PIN Foundations, low-flow toilets, and much, much more. We will be covering some of these in upcoming product reviews, but let us know if you saw a hidden innovation gem hidden in the rough on the Greenbuild Expo floor.