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+ New York City's 80x50 Legislation



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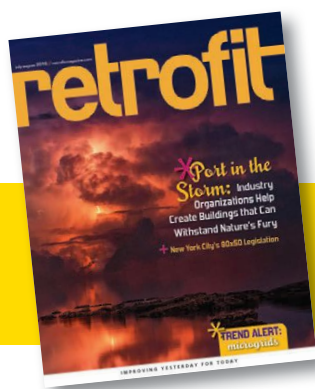
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COVER PHOTO: JOHANNES PLENIO

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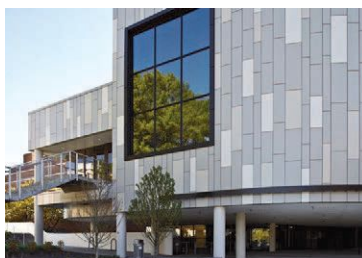
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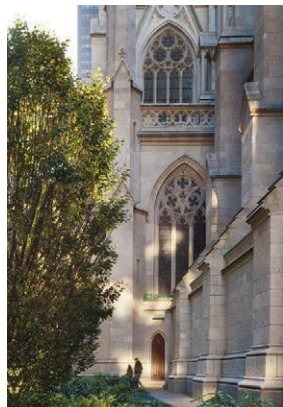
- Durham City Hall, Durham, N.C.
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## MOTHER NATURE'S FURY

Three weeks ago, I traveled to Eppley Airfield in Omaha, Neb., for a business trip to Lightfair International 2019. As I drove I-29 South from Iowa into Nebraska, I noticed the west side of the interstate was not planted with corn or soybeans as in years past. Instead, the interstate was bordered by a lake; no hint of a field was apparent as far as the eye could see. If I had been traveling this road for the first time, I probably would have marveled at the beautiful lake along the route.

Unfortunately, this “lake” belongs to my brother- and sister-in-law, Mike and Theresa. Mike told me he had only been able to plant 100 acres by May 19. If he couldn’t plant more of his land by June 2, a percentage of his crop insurance would kick in, providing more relief as the days passed without planting. (Two weeks later, when I traveled back to Omaha for my trip to A’19, I-29 was completely closed because of flooding from the Missouri River. At the time of this writing, the interstate still is closed. You’d be surprised how difficult it is to get into and out of Omaha without the interstate!)

The evening before Lightfair began in Philadelphia, I was waiting for my colleagues in the hotel bar. The bartender and I watched the national news, which was warning about long-track tornadoes expected that night through the southern plains; this was after 40-some tornadoes barreled through eight states over the weekend. The bartender looked at me and said, “I’d never live anywhere where there are tornadoes! How do you prepare for something like that?” Despite living in the Midwest my whole life, I didn’t have an answer for her. I have a basement in my home but—based on the images of total destruction of homes shown on the news—I wouldn’t feel safe in it. The very next week, I saw Philadelphia was included in tornado warnings issued in Pennsylvania. I assume the bartender has begun packing her bags to move. But where? There is no place on Earth from which you can escape Mother Nature’s fury.

And, therefore, in my humble opinion, it is time for our industry to lead the charge to make our buildings and infrastructure strong enough to withstand the many natural hazards our nation faces. This special issue of **retrofit** highlights a few of the building industry’s organizations that are offering insight and assistance to you, building practitioners, to make existing buildings safer for the people and intellectual property inside. Beginning on page 48, our “Special Report” provides guidance from the American Institute of Architects, Washington, D.C.; U.S. Resiliency Council, San Francisco; Alliance for National & Community Resilience, Washington; EPDM Roofing Association, Washington; and U.S. Green Building Council, Washington.

In addition, on page 66, Jeff Rios, P.E., LEED AP, partner, and Charlie Marino, CEA, LEED AP O+M, service leader, Energy Services, with AKF Engineering, New York, explain New York City’s innovative 80x50 legislation, a package of bills designed to curb city carbon emissions 40 percent by 2030 and 80 percent by 2050 in the hopes of reducing the number of extreme weather events we encounter.

We all have our opinions about climate change—whether it exists or doesn’t exist, whether we contribute to it or not. Regardless of where you stand, the fact is extreme weather across our nation has been the national news headline for months. Doesn’t it make more sense to retrofit buildings and infrastructure to withstand Mother Nature’s fury instead of dealing with the financial and, more importantly, the emotional toll afterward? This is the time for our industry to truly shine as heroes and protectors against the weather, which is proving to be the most formidable of foes.

**CHRISTINA KOCH**  
Editorial Director, **retrofit**

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## CONTRIBUTING WRITERS



Adams County, Colo., consolidated its Human Services, Head Start, Child and Family Center, and the Workforce and Business Services divisions into a repurposed 3-story, 315,000-square-foot former telephone equipment manufacturing facility. **KJ Fields**, a Portland, Ore.-based **retrofit** contributor, explains how the design team at DLR Group used the property's history as an orchard to disrupt the institutional feel of the massive space in our "Government" featured project, page 18.

At New York's iconic St. Patrick's Cathedral, a newly installed state-of-the-art geothermal system improves facility performance while preserving the 1870s church's historic character. **Jeffrey Murphy**, FAIA, is a partner at MBB (Murphy Burnham & Buttrick Architects), an international award-winning architecture firm based in New York City, and describes the comprehensive effort that impacts the entire city-block-sized campus in "Component", page 34.



**Allison H. Anderson**, FAIA, LEED AP, is the founding principal of unabridged Architecture, Bay St Louis, Miss., a firm recognized for civic projects that are defensible against climate challenges. She is the chair of the Washington, D.C.-based American Institute of Architects' Resilience and Adaptation Advisory Group and, as such, pens "Architects on the Front Lines of Disaster Mitigation" as part of our resilient buildings "Special Report", page 48. In the article, Anderson provides practical ideas to help buildings resist flooding, our nation's No. 1 climate hazard.

The U.S. Resiliency Council, San Francisco, was founded in 2011 to make the public aware of their potential risks in natural disasters and provide them with information to make better-informed decisions about owning, renting, leasing and insuring properties. In "U.S. Resiliency Council: Thinking about Future Generations", page 52, **Evan Reis**, SE, USRC's executive director, explains why USRC's Earthquake Performance Rating System, and its pending wind and wildfire rating systems, minimize building damage and recovery time after a disaster.



**Ryan M. Colker**, J.D., CAE, serves as vice president of innovation and executive director of the Alliance for National & Community Resilience (ANCR), Washington, D.C. ANCR is developing benchmarks to support communities in understanding their current resilience and identifying opportunities to improve. In "ANCR 'Kills Two Birds with One Stone'", page 56, Colker explains how retrofits that consider building resilience and energy efficiency capture multiple benefits.

The Washington, D.C.-based EPDM Roofing Association is intensifying its efforts to alert the roofing community to the need for resilience in existing and new roofs. **Louisa Hart**, ERA's communications director, outlines the organization's strategy in "ERA: Strengthening the Roofing Industry", which is part of our resilient buildings "Special Report", page 60.



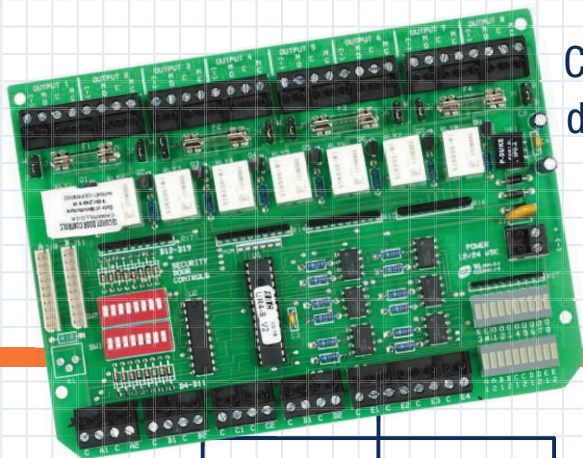
**Sarah Stanley** manages the development and execution of media and communications activities for programs of the U.S. Green Building Council, Washington, D.C. In our resilience "Special Report", page 62, Stanley writes "USGBC: Green Buildings as Climate Solution", explaining results from a third-party survey that underscore the need to position the green building industry as a global environmental solution.

New York City has passed "The Climate Mobilization Act", a package of bills designed to curb city carbon emissions 40 percent by 2030 and 80 percent by 2050. In "A New Era for Retrofitting", page 66, **Jeff Rios** (left), P.E., LEED AP, partner, and **Charlie Marino**, CEA, LEED AP O+M, service leader, Energy Services, with AKF Engineering, New York, explain what the legislation means for building owners, facility managers and building practitioners. Marino provides insight as co-chair of the NYC Mayor's Office 80x50 Technical Working Groups and a member of the planning committee.

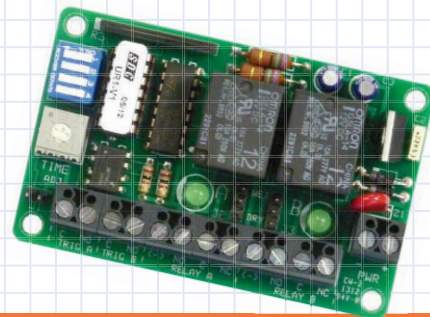




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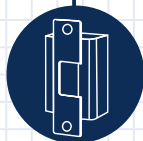


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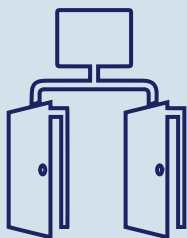


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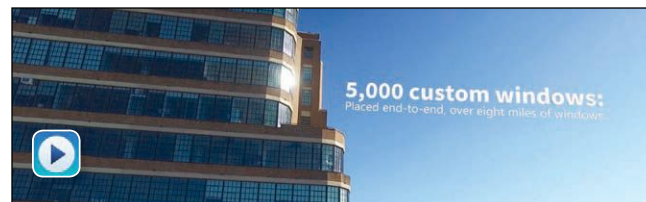
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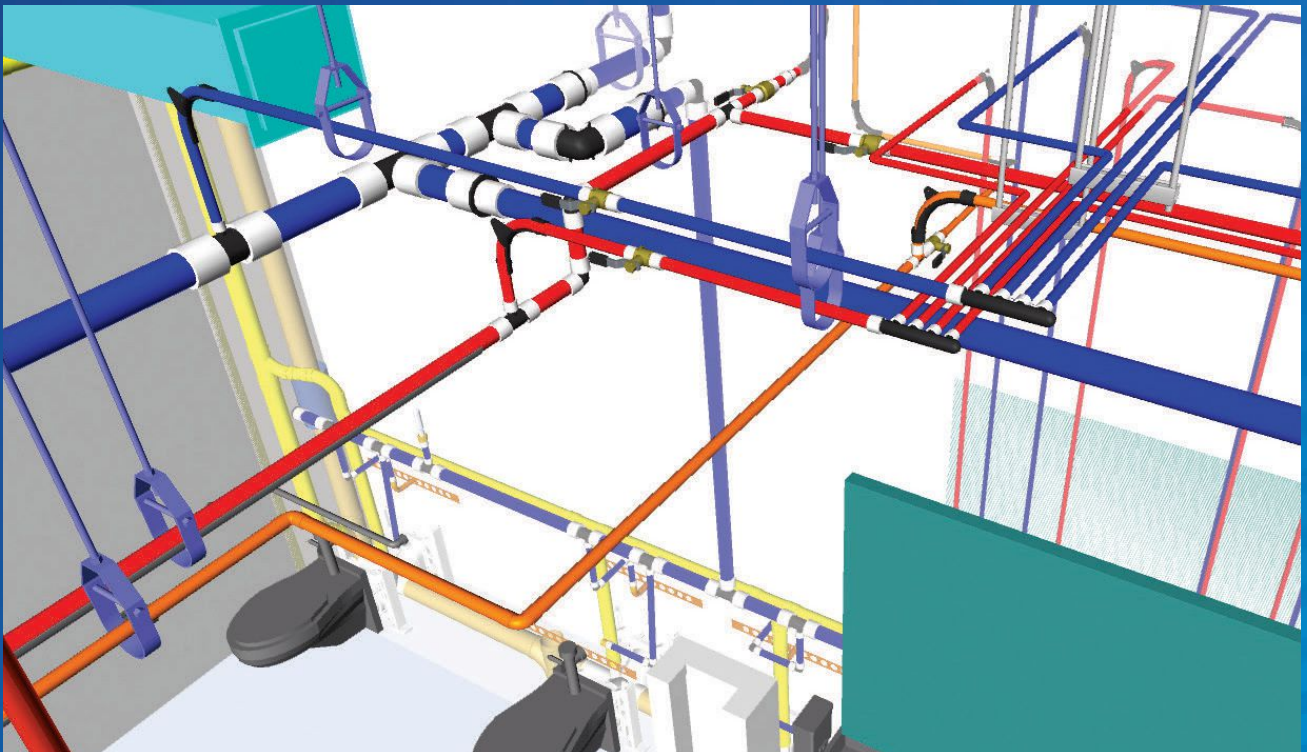
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## ASLA Applauds Living Shorelines Act

The Washington, D.C.-based American Society of Landscape Architects (ASLA) recently voiced enthusiastic support for the Living Shorelines Act, introduced by Sens. Kamala Harris (D-Calif.) and Chris Murphy (D-Conn.) in the Senate and Rep. Frank Pallone Jr. (D-N.J.) in the House of Representatives. ¶ A recent study by the National Academy of Sciences, Washington, found that sea-level rise could be worse than predicted by the International Panel on Climate Change (IPCC), Geneva. The worst plausible estimates put as much territory as is contained in Western Europe under water, a disaster which could leave 187 million people homeless by the year 2100. This, combined with the increased frequency of severe weather events, makes landscape architecture projects that mitigate flood damage, preserve coastlines and protect communities more important than ever before. ¶ "Landscape architects help communities incorporate natural materials and nature-based designs to protect shorelines and preserve coastal ecosystems. The Living Shorelines Act would help fund those vital



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**ASLA LANDMARK AWARD WINNER: CHARLESTON WATERFRONT PARK IN CHARLESTON, S.C., BY SASAKI ASSOCIATES INC., WATERTOWN, MASS.**

projects," explains Nancy Somerville, Hon. ASLA, executive vice president and CEO of ASLA. "ASLA commends Senator Harris, Senator Murphy, and Congressman Pallone on introducing this legislation and for adding provisions to allow more equitable access to these grants for low- and middle-income communities." ¶ This legislation would authorize up to \$50 million per year to help states, towns and non-profits implement climate-resilient living shoreline projects that use nature-based solutions. Solutions may include incorporating materials, such as wetland plants, aquatic vegetation, oysters and other shellfish, as well as planting native grasses, shrubs and trees in infrastructure projects. ¶ Sens. Harris and Murphy and Congressman Pallone introduced versions of the Living Shorelines Act in the last Congress, also with ASLA's support. The new bill goes even further than previous versions by including provisions that lower barriers to accessing funding for living shoreline projects, especially for low- and middle-income communities. ¶ Learn more at [bit.ly/2Mul4iq](http://bit.ly/2Mul4iq) and [www.asla.org](http://www.asla.org).

## AIA FIGHTS DISCRIMINATION IN ARCHITECTURE

The Washington, D.C.-based American Institute of Architects (AIA) took another step to fight harassment and discrimination in the profession. In an effort to promote the highest professional working standards throughout the profession, and among its members, AIA is launching a comprehensive review of the processes by which all honors and award recipients are selected.

The review will be led by Washington-based Covington & Burling LLP and its partner Eric Holder Jr.—who previously served as the U.S. Attorney General—to conduct a comprehen-

sive review of AIA's honors and awards programs and to provide actionable recommendations for enhancing program processes.

"Amidst a national movement to address safety, diversity and equity in the workplace, we want to make certain we are recognizing and elevating only the very best from our profession," says AIA 2019 President William Bates, FAIA. "Working with Eric Holder and our AIA member advisory group will help us to identify opportunities to improve our honors and awards processes."

As part of this endeavor, members of AIA's Board of Directors and National Ethics Council will be working with Attorney General Holder. Those individuals include AIA 2019

President William Bates, FAIA; 2019 First Vice President Jane Frederick, FAIA; 2018-20 At-large-director Emily Grandstaff-Rice, FAIA; and 2019 National Ethics Council Chair Anzilla Gilmore, FAIA, NOMA.

It is expected Covington & Burling will provide actionable recommendations for AIA's adoption. Specifically, AIA seeks to enhance the vetting process for all future honors and awards candidates, as well as members of the College of Fellows, to ensure the best possible alignment between AIA's values and ethics and those recognized. This action will build upon AIA's board-directed commitment to overcome inequities in the profession and improve firm culture.

"I look forward to working with the American Institute of Architects on this important project," says Eric Holder, partner at Covington & Burling. "I applaud the AIA for its leadership."

"With Eric Holder's expertise and guidance, we will create an enhanced honors and awards vetting program that will serve as a model for other organizations and professions," adds AIA Executive Vice President and CEO Robert Ivy, FAIA.

AIA is expected to announce all process changes later this year. The AIA board of directors will be responsible for reviewing the recommendations and determining the appropriate course of action. Learn more at [www.aia.org](http://www.aia.org).



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# HOME | GROWN

**A** century ago, the site of the Adams County Human Services Center in Westminster, Colo., was filled with apple orchards where nearby Denver families would gather sustenance during the fall harvest. True to these roots, the human services department now helps to nurture individuals and families from one new center.

"We drew from an overall concept of 'Orchards to Innovation' and invested a lot of time upfront to dig into what the concept meant for the project and Adams County," explains Amy Hoffman, principal of DLR Group's Denver office. "The new center is a resource and a beacon for the entire community, and the concept resonated with all of us, which made decision-making flow seamlessly."

## CROSS POLLINATION

Adams County's Human Services, Head Start, Child and Family Center, and the Workforce and Business Services divisions had been housed in separate spaces. The project consolidated these services into a repurposed 3-story, 315,000-square-foot former telephone equipment manufacturing facility.

In addition to the four main divisions and several smaller programs, Adams County invited 17 non-profit community partners to co-locate a few of their direct-service staff within the new center. Brian P. Kenna, deputy director of Adams County's Human Services Department, says the consolidation of department operations was long overdue.

"It was a privilege to design a facility that served our purposes and the needs of our customers from the start," Kenna asserts. "By having our county's programs and community support programs in one place, we provide a direct conduit to our citizens to get the help they need. The co-location also connects service providers to each other more directly."

## ORGANIC APPROACH

Because the building floorplates were so large, the team sought ways to disrupt the institutional feel of the space. The orchard theme provided the answer.





# A Colorado County Adaptive Reuse Reflects the Land's Orchard Heritage

WRITTEN BY | KJ FIELDS



PHOTOS: ED LACASSE unless otherwise noted





The floorplans became branches with hallways that incorporate angles, “neighborhoods” and spaces of visual interest.

The massive L-shaped structure posed a conundrum in terms of creating a clearly defined public entrance, so DLR Group added a 4,000-square-foot atrium at the inside corner of the “L.”

On the exterior of the welcoming entry, designers added a vertical concrete wall as a beacon to arriving visitors. In keeping with the orchard theme, a pattern of an apple crate was cast into the formworks for the concrete wall. “The apple crate theme is reflected inside the breakrooms, too,” notes Terri Ammon, project architect at DLR Group’s Colorado Springs, Colo., office. “Walls painted in different apple colors peek through reclaimed wood boards spaced out reminiscent of a crate. It’s a subtle connection that provides a feeling of cohesiveness.”

## WITHIN REACH

A welcoming customer experience and ease of use was paramount in the center’s programming. Like a mall, all the services

options are readily available on the main level and the atrium serves as the central hub for “one-stop shopping.”

“Traditionally, human services’ delivery is separated with divisions like workforce development in one location and food assistance in another,” Kenna says. “This [building] is an innovative approach because they aren’t just housed in one location, they’re all on one level for easy access, and we can direct customers to all the services they might not even know were available.”

In addition to an information desk with a greeter and self-service kiosks, differently colored graphics identify each division. “Colored graphics offer more personable wayfinding,” Ammon says. “It’s easier for people to remember colors than directions and it makes them feel like they are headed in the right direction.”

While customer-facing branches reside on the main level, the remaining divisions’ staff work on other floors. The building includes a business center for job fairs and community events, as well as a suite that serves the non-profit community partners.

## TIMELESS APPLICATIONS

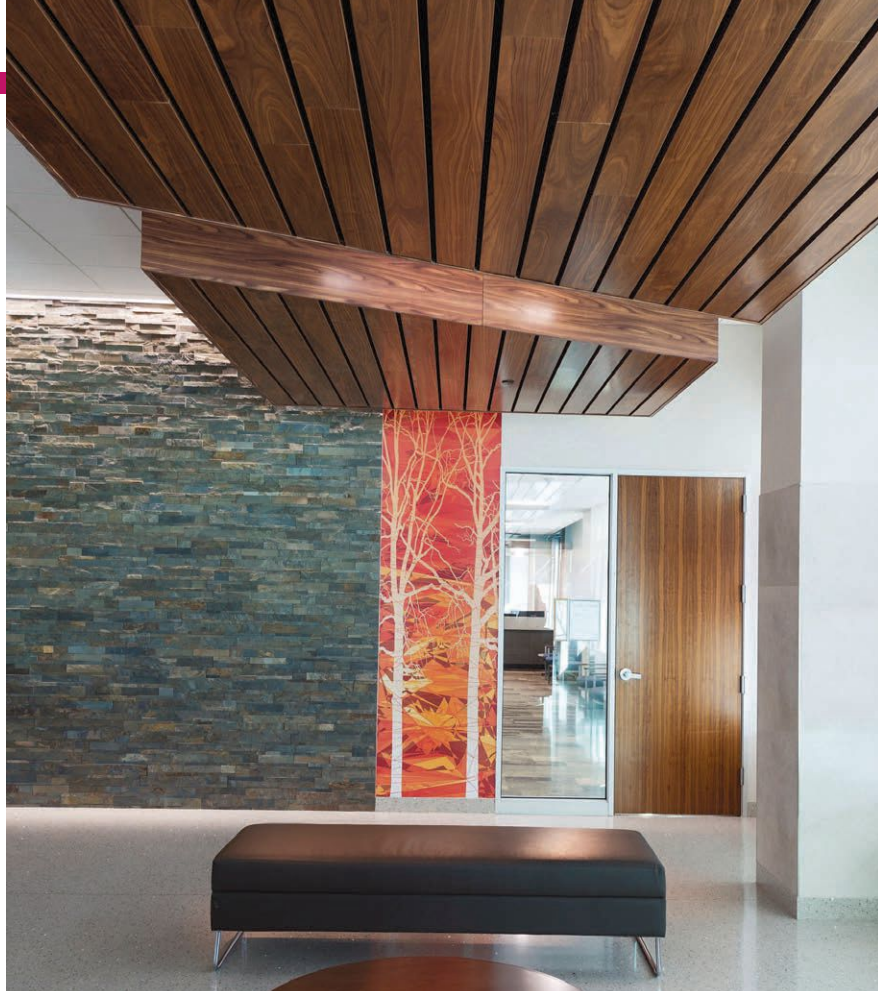
As long-term owners of the center, Adams County requested the design and construction deliver a 100-year building while keeping initial costs down.

Throughout the building, the color palette is sourced from orchards with blossoms and hues drawn from apple reds and greens predominant on walls and accents. A faux wood ceiling in the atrium instills a sense of nature but is much lighter and much less expensive than hardwood. The lobby’s terrazzo flooring contains a pattern that appears like shadows of tree branches on the ground. The terrazzo’s no-wax finish requires only damp mopping for quick and simple maintenance.

New skylights bring daylight deep into the workspaces to improve wellbeing. Vivid murals—25 in all—computerized artistic representations of indigenous trees into abstract fractals.

“We wanted to create a timeless design with neutral colors in the foundation and allow the strong colors to pop in the furniture and art,” Hoffman says. “Combined





with warm lighting levels, the design keeps the mood upbeat and envelops visitors in a comforting and inspiring environment.

## UNEVEN CONDITIONS

During field measurements, the team discovered the building dropped out of level by 6 inches. Because the structure's east-west leg is 665-linear-feet long and 193-feet wide (the length of two football fields) and contained a basement, pumpjacking the foundation to make it level would have been a very expensive option. An elegant solution was to add new exterior composite metal panels with energy-efficient windows. "The shop drawings from the composite metal panel company incorporate the very careful addition of mathematics in intricate dimensions from one end to the other, so that the panels absorb the discrepancy," Ammon explains.

The 6-inch difference in level also offered challenges with the flooring. Terrazzo flooring was the design response. "Because terrazzo has a self-leveling component to it, we were able to save the client over \$100,000," Hoffman recalls. "The flooring still needed a little preparation, but it solved slope and slab issues on the interior."





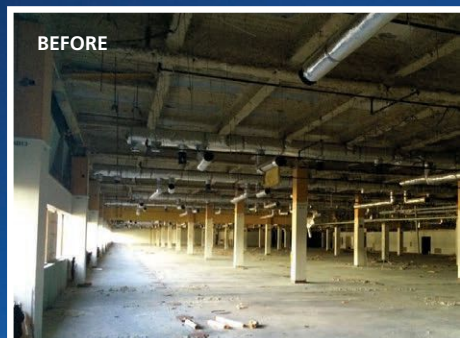
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Contrary to as-built drawings, multiple renovations performed over the years left the team with several unforeseen challenges. On the building's second level, the concrete floor was out of slope, and the team had to grind out the top inch of flooring and level it with concrete topping. A ballasted roof in very poor condition also had to be removed to install a new TPO roofing membrane, which was easier for the county to maintain.

## A PLACE OF HONOR


Breaking convention with prevalent lack-luster human services facilities across the country was incredibly important to Adams County. Because the people they service are in need of protection, have lost their jobs and need to find work, or need interim childcare or food assistance, citizens are often distraught when they arrive.

"There's a perception among many public agencies' human services that they don't need uplifting locations to serve rundown communities, and they often don't provide the atmosphere that all humans deserve,"

Kenna says. "We are doing something innovative through this uplifting space that focuses on what we believe people can become, rather than the condition that brings them to our door."

The county also wanted to enhance the staff experience for the center's 750 employees. "In many cases, the staff are dealing with stressful and highly emotional situations, and the goal was to give them a workplace that supports the job itself but also give them places where they can regroup and refresh," Hoffman notes.

DLR Group added quiet rooms away from the public flow where staff can find a comfortable chair, some solace and listen to music. Wellness rooms provide privacy for lactating moms or administering a diabetic shot. Huddle rooms/breakout spaces are ideal for small private conversations. Employees also have restrooms that are not publicly accessible, which offers a space away from the fray.

"The center makes it very clear we want to take care of our employees, as well," says Kenna. "They do a lot for others and help us strengthen our community." 

## Retrofit Team

**ARCHITECT, INTERIOR DESIGN AND STRUCTURAL ENGINEER** // DLR Group, [www.dlrgroup.com](http://www.dlrgroup.com)

**GENERAL CONTRACTOR** // Saunders Construction, Englewood, Colo., [www.saundersinc.com](http://www.saundersinc.com)

**MEP ENGINEERING/LIFE SAFETY** // BCER Engineers, Arvada, Colo., [bcer.com](http://bcer.com)

**CIVIL ENGINEER** // Anderson & Hastings Consultants Inc., Lakewood, Colo., [www.ahceinc.com](http://www.ahceinc.com)

**LANDSCAPE ARCHITECTURE** // Logan Simpson, Fort Collins, Colo., [logansimpson.com](http://logansimpson.com)

## Materials

**TERRAZZO FLOORING** // Colorado Design Inc. Tile & Terrazzo, [www.coloradotileandterrazzo.com](http://www.coloradotileandterrazzo.com)

**CARPET** // Tandus, [www.tandus-centiva.com](http://www.tandus-centiva.com)

**FURNITURE** // Knoll, [www.knoll.com](http://www.knoll.com)

**TILE** // Florida Tile, [www.floridatile.com](http://www.floridatile.com), and Daltile, [www.daltile.com](http://www.daltile.com)

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GOVERNMENT

# DURHAM CITY HALL | Durham, N.C.



PHOTOS: DRI-DESIGN



24 RETROFIT // July-August 2019







### » RETROFIT TEAM

ARCHITECT: Roughton Nickelson De Luca Architects PC, Durham, [www.rndpa.com](http://www.rndpa.com)

GENERAL CONTRACTOR: Balfour Beatty US, Raleigh, N.C., [www.balfourbeattyus.com](http://www.balfourbeattyus.com)

ALUMINUM WALL PANEL INSTALLER: SPS Corp., Apex, N.C., (919) 367-8885

### » MATERIALS

A complete exterior and interior renovation was needed for Durham City Hall, which opened in 1975. Looking for a maintenance-free material that would soften the building's feel while giving the structure a strong presence, the design team selected metal wall panels from Dri-Design.

"The desire to have a rainscreen system where the water barrier was behind the metal panel with few caulk joints was important to the design team," says Rhonda Zack, project manager and designer with Roughton Nickelson De Luca Architects. "In addition, the Dri-Design panel ... had an interior gutter system that kept rainwater off the face of the panels directing flow through the gutter system to the bottom of the screenwall. The panels interlocked and made for a tight rainscreen that would stand up over time."

The original city hall façade was a cementitious aggregate panel called Arlite. The weight of the panels caused sagging and open surfaces for water to penetrate the building, leading to leaks and water damage.

The openings had been caulked many times, but waterfalls reportedly still occurred inside the building.

After the Arlite was removed, the teams at Balfour Beatty and SPS Corp. had to determine how to use the building's original framing for the metal wall panel installation. Because of 40 years of leaking and sagging, the framing was not straight. In fact, it was out of alignment by as much as 4 inches over 3 stories in some areas. Additional framing was worked into the existing framing to create a straight panel installation.

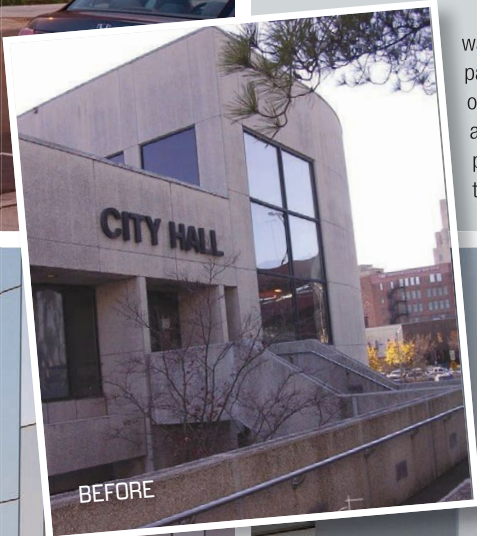
Together, Balfour Beatty and SPS installed 23,535 square feet of post-painted aluminum wall panels. The primary wall color is Dorian Gray with Agreeable Gray and Amazing Gray worked into the panel layout. Dark Bronze wall panels were selected as an accent to the gray panels.

ALUMINUM WALL PANEL MANUFACTURER: Dri-Design, [www.dri-design.com](http://www.dri-design.com)

### » THE RETROFIT

The project won the People's Choice Durham Golden Leaf Award and the Adaptive Re-Use Durham Golden Leaf Award.

Zack says: "The design of the new façade has brought new attention to a building that was neglected for far too long. The design team took the opportunity during this redesign to soften up the Brutalist language of the original design and add more pedestrian-friendly areas so that the city hall would feel like a building for the people. The metal panels allowed us to bring the look into the 21st century with a durable product that allowed for a variety of design options."





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University of Texas - Tyler  
Architect: Smithgroup JJR  
Location: Tyler, TX

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PHOTOS: YKK AP



## AGENCY OF HUMAN SERVICES AND DEPARTMENT OF PUBLIC SAFETY | Waterbury, Vt.

### ►► RETROFIT TEAM

ARCHITECT: Freeman French Freeman Inc., Burlington, Vt., [www.fffinc.com](http://www.fffinc.com)  
 PRESERVATION ARCHITECT: Goody Clancy, Boston, [www.goodyclancy.com](http://www.goodyclancy.com)  
 GENERAL CONTRACTOR: PC Construction Co., South Burlington, Vt., [www.pcconstruction.com](http://www.pcconstruction.com)  
 ENVELOPE CONSULTANTS: Zero By Degrees, [zerobydegrees.com](http://zerobydegrees.com), and Energy Balance  
 GLAZING CONTRACTOR: D.S. Specialties Inc., Moores, N.Y., [www.dsspecialties.com](http://www.dsspecialties.com)

### ►► MATERIALS

Originally built in 1890 as a psychiatric hospital, the Waterbury State Office Complex served as home to state of Vermont employees for years. In 2011, Tropical Storm Irene ravaged Vermont. Waterbury was among the hardest-hit areas and 40 buildings that made up the state office complex were flooded and more than 1,400 employees were displaced.

Because of the rich history of the complex, the goal was to rebuild and restore the complex in a way that would honor its history. It was also important to achieve high energy efficiency within a specific budget and timeframe. Resilience was crucial to creating durable buildings to protect against future

flooding and other natural disasters. Additionally, while the flood had made its mark on the buildings, it wasn't just the visible damage that needed to be repaired. Occupant comfort had long been an issue. Old, single-pane windows along with antiquated central heat and a lack of central air conditioning made working conditions less than optimal throughout the year. LEED Gold certification was a goal from the onset of the project.

The state of Vermont set out to achieve a fenestration assembly U-factor of 0.24 Btu per hour square foot Fahrenheit or better at NFRC 100 model sizes. YKK AP America Inc. was chosen to provide its enerG-facade brand of energy-efficient building solutions to meet this strict requirement while providing the desired aesthetic for new and existing facilities. YKK AP's YOW 350 XT fixed and operable windows, YCW 750 XT and YOW 750 OG curtainwalls, and YES 45 F-I/S storefront were used to complete the complex.

Today the Waterbury State Office Complex is significantly more efficient, achieving a modeled 56 percent energy-use savings over the code-compliant baseline, resulting in 41 percent energy-cost savings.

FENESTRATION MANUFACTURER: YKK AP, [www.ykkap.com](http://www.ykkap.com)

### ►► THE RETROFIT

In 2013, construction commenced. Twenty-one flood-prone buildings were deconstructed to make space for a new 86,000-square-foot office building to house approximately 1,000 employees at the Vermont Agency of Human Services. Thirteen historic structures were preserved, adapted and reused.

As part of the desire to develop a more comfortable working environment for state employees and ensure long-term use of the facility, a 20,000-square-foot central heating and cooling facility was added. The central plant houses two wood-fired biomass boilers fueled with low-cost, locally and sustainably harvested wood chips. All buildings were built above the 500-year flood plane to protect against future damage.

The historic 100-acre campus represents one of the state of Vermont's largest construction projects to date. With an estimated total cost of \$130 million, it serves as an innovative example of a successful adaptive reuse project.



# DECKER CENTER

Richland County, S.C.



PHOTOS: CENTRIA  
unless otherwise noted



## ► RETROFIT TEAM

ARCHITECT: Boudreaux, Columbia, S.C.,  
www.boudreauxgroup.com  
GENERAL CONTRACTOR: H.G. Reynolds Co. Inc.,  
Aiken, S.C., www.hgreynolds.net  
METAL PANEL INSTALLER AND DEALER: SECO  
Architectural Systems Inc., Snellville, Ga., secoinc.biz

## ► MATERIALS

Transforming a big box mall, previously composed of a Kroger supermarket and many small stores, into the Decker Center created unique architectural challenges.

Architects from Boudreaux specified Formawall and Versawall insulated metal panels to create a seamless façade for what would become a police station, the municipal court, traffic court, sheriff's regional headquarters and, most importantly, the magistrate

court, which was to be relocated from a less desirable downtown area. In addition, the facility is a community gathering hub, inside and out, hosting numerous community events.

"Visually, the building needed to be unified while eliminating any semblance of its former purpose," says Justin Lucas, senior project architect with Boudreaux. "We achieved this by blending the metal panels in an artful way, allowing the building's exterior aesthetic to act as a metaphor for the multicultural area in which it is situated. To add character to the facility, we aimed to break down the scale and have it become a true piece of architecture. This was achieved with the CENTRIA products we used, which allowed us to create an almost musical rhythm and to add a chameleon-like quality to the building."

Formawall panels in an Off White color with a smooth finish were contrasted with Formawall panels in Chromium Gray across the main building façade. "The panels formed a very specific pattern, which was achieved with different shades and colors. CENTRIA's selection of standard finishes satisfied our needs," Lucas adds. "Additionally, the panels were installed quickly."

Versawall embossed commercial/industrial insulated metal panels in Silver with a metallic Sundance AM coating were used around the rear of the building.

Lucas adds: "Versawall was at a very appealing price point. It was a nice surprise to remain on budget with this volume of panels. It also has the sharp look we were hoping for with its continuous gray tone."

Dedicated on September 29, 2017, the Decker Center is slightly more than 112,000 square feet.

INSULATED METAL WALL PANEL MANUFACTURER: CENTRIA, www.centria.com



PHOTO: BOUDREAUX



# HURLBURT FIELD AIR FORCE BASE |

## Okaloosa County, Fla.



PHOTOS: ROOF HUGGER LLC

### ► RETROFIT TEAM

ROOFING INSTALLER: Royster Contracting LLC, Fort Walton Beach, Fla., [www.roysterconst.com](http://www.roysterconst.com)  
GENERAL CONTRACTOR: CCI Mechanical LLC, Shalimar, Fla., [www.cci-alliance.com](http://www.cci-alliance.com)

### ► MATERIALS

The existing 7,800-square-foot metal building needed a new metal roof. In lieu of removing the existing metal roof and replacing it, the Base Facility Construction Department moved forward with a metal-over-metal retrofit in which a new metal roof is installed over new structural sub-framing that attaches directly to the existing roof's support system without removing the existing metal roof. In addition,

the retrofit roof system was engineered to withstand a Category 5 hurricane of 157-mph wind speed.

Approximately 2,700 lineal feet of standard Model "C" sub-framing, manufactured to fit over 12-inch on-center PBR rib panels, was installed on the existing roof. Then 3 inches of fiberglass insulation was applied before 24-inch-wide Central Seam Plus trapezoidal standing-seam panels—24 gauge in Brite White—completed the system.

SUB-FRAMING MANUFACTURER: Roof Hugger LLC, [www.roofhugger.com](http://www.roofhugger.com)  
STANDING-SEAM ROOF MANUFACTURER: Central States Manufacturing Inc., [www.centralstatesmfg.com](http://www.centralstatesmfg.com)

### ► THE RETROFIT

Increasing wind-uplift resistance on metal-over-metal retrofit roofs in the coastal states is very common. Many older buildings engineered for a 90- to 100-mph wind speed must be upgraded to minimum code requirements of 120-mph inland and 130 mph for coastal areas. Some parts of Florida and Texas have requirements of 155 mph or greater. U.S. government facilities typically exceed locally adopted codes.

When Category 5 Hurricane Michael struck the Florida Panhandle in October 2018, it caused catastrophic damage at Tyndall Air Force Base, which only is 82 miles from Hurlburt Field Air Force Base. Even with Michael's documented peak wind speed of 155 mph, Hurlburt's metal-over-metal retrofit roof suffered no damage.



# MARCH AIR RESERVE BASE | Riverside County, Calif.

## ► MATERIALS

During the last decade, security standards for facilities have increased, especially within aging military installations built prior to World War II. To ensure these buildings are secure for today's threats, the Washington, D.C.-based U.S. Department of Defense created the Unified Facilities Criteria (UFC). However, this has created a new problem for facilities on the

National Register of Historic Places. The National Historic Preservation Act, or NHPA, stipulates any building determined to be a historic property requires consideration of the effects of anti-terrorism measures upon the building, and any adverse effects should be avoided or minimized. Further complicating the matter, the UFC standard does not supersede compliance with NHPA.

March Air Reserve Base is on the national register and subject to UFC codes and, therefore, was facing a challenge of securing the Primary Gathering Building against new threats. Its representatives needed to find a door that met UFC and NHPA standards.

Krieger Specialty Products was called in to develop a new pair of doors that would achieve the historic design style and comply with the UFC blast-resistance requirements. To do this, Krieger representatives first started with the company's custom-manufactured blast-resistant metal door and then added metal moldings that mimicked the original wooden moldings. The pair of doors also contained windows and a transom that needed to be updated, as well. In each case, Krieger ensured the size, style and color were recreated.

The new doors not only match the old doors, but also are now blast resistant up to 1.0 psi. In addition, the doors are metal, not wood, and should stand up to normal wear and tear.

DOOR MANUFACTURER: Krieger Specialty Products, [www.kriegerproducts.com](http://www.kriegerproducts.com)



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## ► THE RETROFIT

March Field was established on March 20, 1918, in honor of Second Lieutenant Peyton C. March Jr. who died in a flying accident in Texas. However, a few months after the signing of the World War I armistice on November 11, 1918, the activities at March Field were phased down and the base was almost closed in April 1923, leaving just one sergeant in charge. The base became active again in July 1926 when Congress created the Army Air Corps and approved the Army's expansion in pilot training and development of tactical units at March Field.

Much of March Field's current appearance, including the first phase of permanent buildings, was completed in 1934. This development enabled March Field to serve as a final training location for many WWII bombardment groups headed for the Pacific. In fact, at its height, March Field supported 85,000 troops. After WWII, March Field reverted to its original role as a Tactical Air Command base and during the next 50 years would be used as a Strategic Air Command for the Vietnam War and the Cold War. March Field then was selected for realignment and, on April 1, 1996, March Field officially became March Air Reserve Base.





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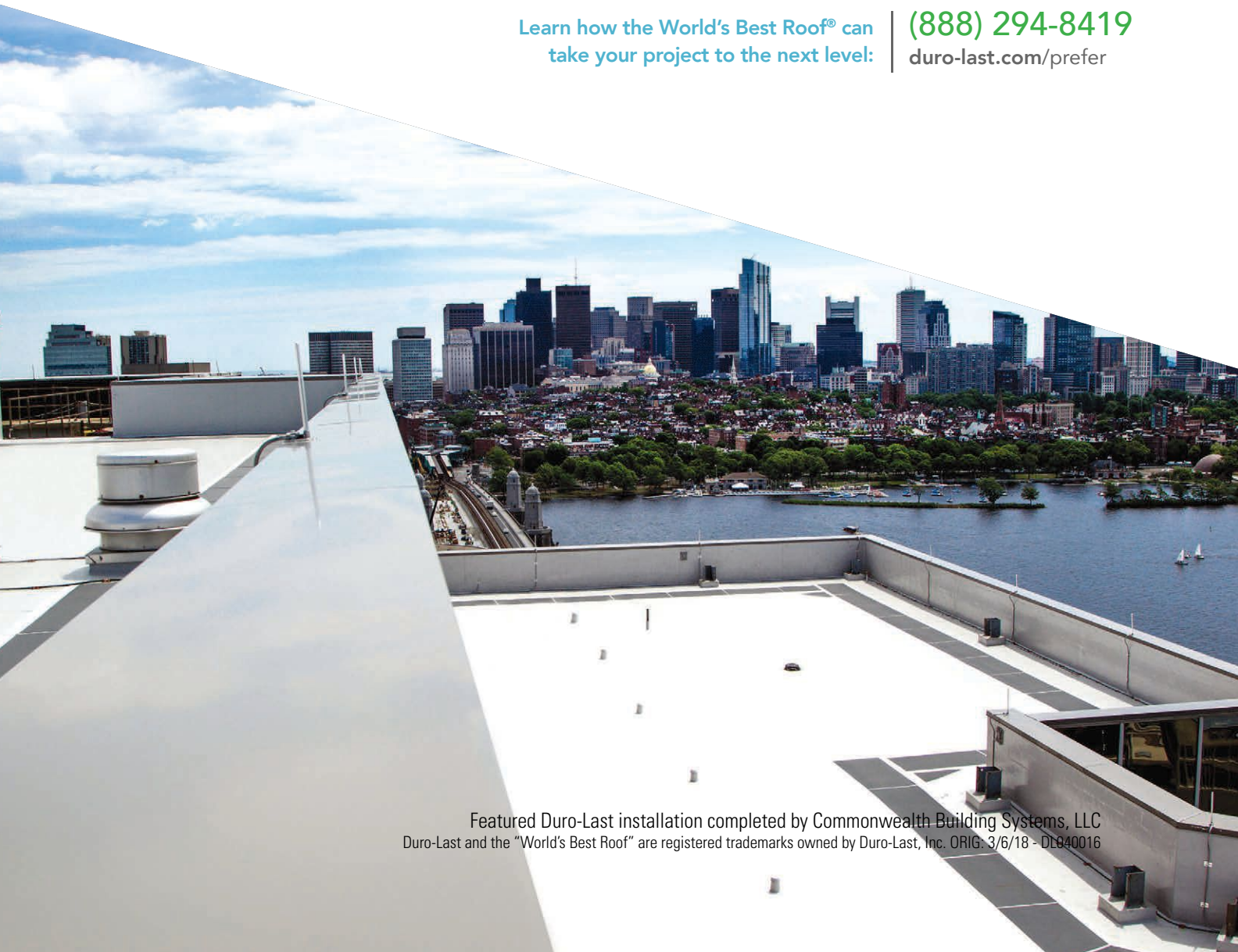
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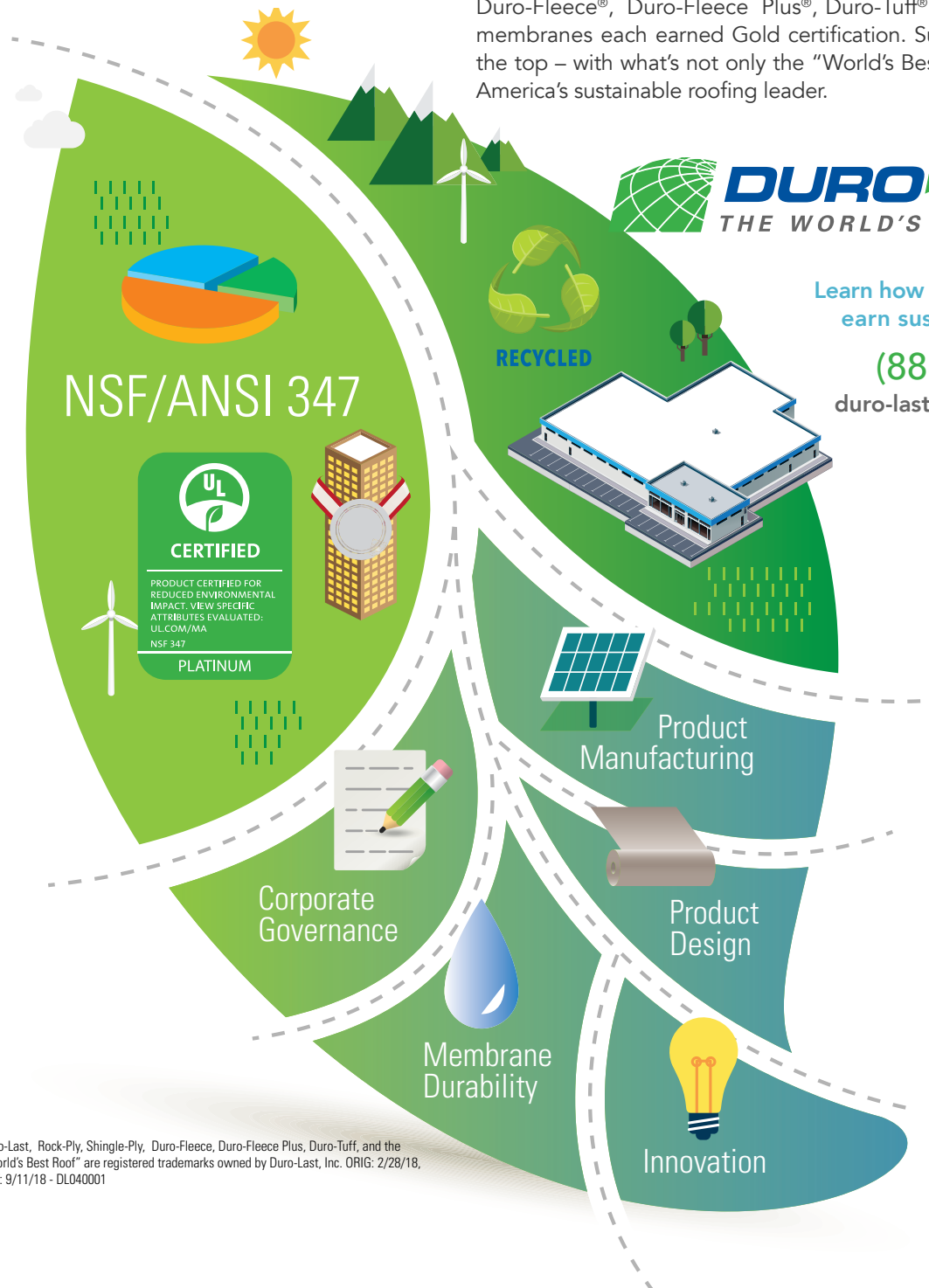
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# LANDMARK CATHEDRAL GOES GREEN

At New York's Iconic St. Patrick's Cathedral,  
a State-of-the-art Geothermal System  
Improves Facility Performance while  
Preserving Historic Character

WRITTEN BY | JEFFREY MURPHY, FAIA

**W**ith its soaring spires in the heart of Manhattan, St. Patrick's Cathedral is among the world's most iconic worship spaces, welcoming nearly 5 million visitors a year. Originally designed in the 1870s by James Renwick Jr. and last renovated in 1949, the cathedral's recent five-year-long, \$177 million renovation combines stringent conservation methods with the city's largest-ever geothermal system to enhance worship and functionality, as well as improve sustainability and resiliency.

Led by MBB (Murphy Burnham & Buttrick Architects), New York, the comprehensive effort impacts the entire city-block-sized campus, achieving a 29 percent reduction in annual



energy use while stabilizing significant historic fabric. Recognized with a 2019 National COTE Top Ten Award from the Washington, D.C.-based American Institute of Architects, the project offers valuable lessons for making significant historic buildings effective, relevant and resilient, as well as pro-

vides a compelling case study about creating sustainable building systems with a focus on long-term, flexible solutions.

## Cathedral Upgrades

A designated city, state and federal landmark, the cathedral is one of New York's most visited destinations. Working closely with the Trustees of St. Patrick's Cathedral and clergy leadership, MBB approached the renovation with a focus on stabilizing the cathedral structure and providing a better experience for clergy, visitors and worshippers while respecting the character of this sacred and iconic building. The project scope included preservation of exterior and interior surfaces—marble, slate, metalwork, ornamental plasterwork, decorative woodwork, cast









The geothermal system's pumps and compressors are located in a former boiler room in the basement and controlled by a building management system.

stone and stained glass. New architectural interventions include mechanized glass entry doors that reduce air infiltration and a glass wall that provides acoustic isolation for the Lady Chapel worship space while life-safety upgrades include the installation of a mist fire-suppression system in the attic and improving egress by upgrading exit paths and instituting a fire marshal program.

The extensive renovation also presented an opportunity to address the cathedral's energy usage in a comprehensive and holistic way. From the project's inception in 2006, the design team was charged by the Trustees of St. Patrick's Cathedral to evaluate the existing mechanical systems as part of a needs and conditions assessment of the cathedral campus. It was clear the air-conditioning system was overdue for an upgrade; much of the HVAC equipment dated back to the 1960s. Leaders sought a permanent solution with a high level of functionality that was also in keeping with how the cathedral building is used. Having a minimal impact on the historic fabric was important. As the renovation gathered steam, the project team assessed geothermal technology as a potential means to meet the trustees' objectives.

At the time, there were few examples in New York City of large, established

institutions deploying this technology. The project team initially considered a design for a conventional system using a large fan wall adjacent to the Cardinal's Residence near the southeast corner of the block. Because of the required size of the plant, mechanical elements would have been visible; modifications to the cathedral architecture would have been required, along with extensive and costly rock excavation; and the fan wall would have generated noise—a series of modifications that would not only impact the city's Landmarks Preservation Commission approval process, but also the ongoing experience of cathedral visitors and clergy residents.

By contrast, a quiet, low-impact geothermal system obviated the need for noisy, obtrusive mechanical equipment and promoted efficient use of space. Conducted in collaboration with construction manager Structure Tone Inc., New York, the project team's feasibility study examined upfront costs; long-term costs, including equipment replacement, operation and maintenance; and qualitative and quantitative criteria, such as impact on the cathedral's fabric and the duration of the overall approvals process. The geothermal plant option brought the best long-term benefit in terms of cost, energy efficiency and minimal impact to people. Just as important, this proposal engendered the

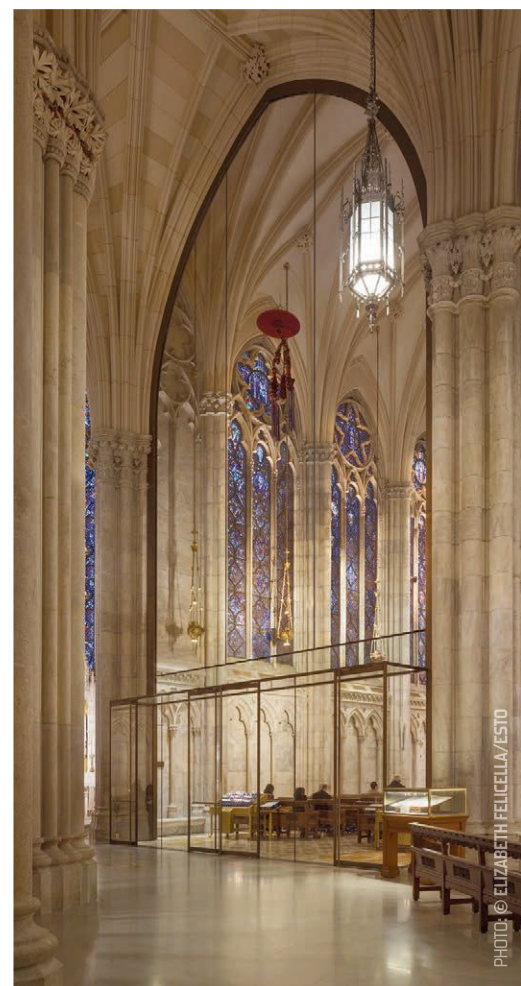
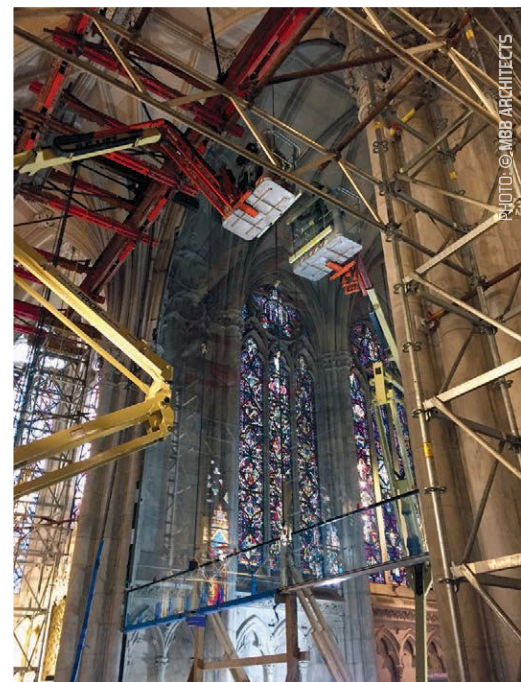
support of community groups and local officials, including the Landmarks Preservation Commission.

### Geothermal Details

With the cathedral remaining open throughout construction to accommodate community members and 18 masses every week and given the complexity of designing and installing a geothermal system in a historic structure with such a high intensity of use, an experienced team of collaborators was key to the project's success. As design team leader, MBB enlisted a top-tier group of experts, including geothermal plant designer Landmark Facilities Group, Norwalk, Conn.; well-drilling consultant P.W. Grosser Consulting Inc., Bohemia, N.Y.; structural engineer Silman, New York; and geotechnical engineer Langan Engineering, Parsippany, N.J., who collaborated with Zubatkin Owner Representation LLC, New York, and construction manager Structure Tone to conceptualize and design the geothermal system.

The geothermal system itself comprises 10 wells in terraces flanking the north and south sides of the cathedral; Samuel Stothoff Co., Flemington, N.J., drilled 9-inch-diameter boreholes through dense Manhattan schist at a depth of up to 2,250 feet through bedrock. Pumps and compressors were located in a former





New architectural interventions include mechanized glass entry doors that reduce air infiltration and a glass wall that provides acoustic isolation for the Lady Chapel worship space. Top right: A rolling scaffold supported work on ducts and restoration of stained glass and the ceiling while keeping the cathedral open and its nave clear.



## RETROFIT TEAM

**ARCHITECT //** MBB (Murphy Burnham & Buttrick Architects), New York, [www.mbbarch.com](http://www.mbbarch.com)

**CONSTRUCTION MANAGER //** Structure Tone Inc., New York, [www.structuretone.com](http://www.structuretone.com)

**GEOTHERMAL PLANT DESIGNER //** Landmark Facilities Group, Norwalk, Conn., [www.lfginc.com](http://www.lfginc.com)

**WELL-DRILLING CONSULTANT //** P.W. Grosser Consulting Inc., Bohemia, N.Y., [www.pwgrosser.com](http://www.pwgrosser.com)

**WELL DRILLING //** Samuel Stothoff Co., Flemington, N.J., [www.stothoffwellwater.com](http://www.stothoffwellwater.com)

**STRUCTURAL ENGINEER //** Silman, New York, [www.silman.com](http://www.silman.com)

**GEOTECHNICAL ENGINEER //** Langan Engineering, Parsippany, N.J., [www.langan.com](http://www.langan.com)

**OWNER REPRESENTATIVE //** Zubatkin Owner Representation LLC, New York, [zubatkin.com](http://zubatkin.com)

## MATERIALS

**SPRINKLER SYSTEM //** ABCO Peerless Sprinkler Corp., [www.abcopeerless.com](http://www.abcopeerless.com)

**GLASS DOORS AND WALLS //** Seele Glass, [www.seele.com](http://www.seele.com)

**HEAT-RECOVERY CHILLER //** Multistack, [www.multistack.com](http://www.multistack.com)

**CIRCULATOR PUMPS //** Bell & Gossett Ecocirc, [www.bellgossett.com](http://www.bellgossett.com)

**HEAT EXCHANGER //** Alfa Laval (titanium plate), [www.alfalaval.us](http://www.alfalaval.us)

**BUILDING AUTOMATION SYSTEM //** Niagara, [www.tridium.com](http://www.tridium.com)

**ENTRANCE DOORS //** Narthex with Invisible Wall System by Vitrocsa USA, [www.vitrocсаusa.com](http://www.vitrocсаusa.com)

**CHAPEL ENCLOSURE DOORS //** CRL Jackson 900 Series Spring-powered Recess Floor Mounted Door Closer by C.R. Laurence Co. Inc., [bit.ly/30P110P](http://bit.ly/30P110P)

boiler room in the basement, controlled by a building management system that determines whether and how much to heat or cool based on thermostats set around the cathedral, heating or cooling different zones independently.

Producing air conditioning and heating for the entire campus, the system is capable of generating 2.9 million Btus per hour of air conditioning and 3.2 million Btus per hour of heat when operating at full capacity. To increase durability and mitigate corrosion, stainless-steel pumps and an HDPE ground loop were used. To increase resiliency, the project team included gas-fired boilers and an evaporative fluid cooler to back up the primary system by adding extra cooling or heating to the wells at peak demand, if required. The geothermal plant itself was designed for longevity and ease of maintenance with durable titanium plate modular heat exchangers and other modular, small-scale elements. The modular design enables single wells to be taken offline to work on component parts.

Throughout the installation process, careful staging and an interim building system helped enlighten visitors about the work's scope and impact, even during presidential and papal visits. Construction sequencing minimized disruption to cathedral operations; for example, a rolling scaffold supported work on ducts and restoration of stained glass and the ceiling, keeping the cathedral open and its nave clear—and avoiding the cost of scaffolding the full interior. Respecting existing historic structures, geothermal system wells are piped through the undercroft and unused crawl space, increasing their utility and mitigating needs to build externally.

The project team's thoughtful approach emphasizes seamless integration of new HVAC elements, and the attention to detail is apparent throughout the renovated cathedral. New air-handling units were ducted to custom grilles fitted to the ribs of the triforium. Fan-coil units were built into millwork during the restoration, preserving the cathedral's original detailing, and piping was run in the undercroft, reducing run length and keeping them out of sight. This leveraging of existing space served preservation and environmental goals of the project team.



## BLEED VERSUS NO-BLEED GEOTHERMAL

**BLEED** is the mechanism by which open-loop geothermal systems help keep maximum and minimum temperatures within operating range. It can be thought of as a “relief valve”, which is accomplished by diverting some water to the sewer system and allowing “fresh” groundwater to enter the loop through the wells. Because St. Patrick's Cathedral's geothermal system was designed to operate without relying on bleed, New York-based MBB was able to avoid the associated water waste.

The choice of a no-bleed geothermal system represents a significant reduction of water use. A comparably sized cooling tower would have required 3.8 million gallons of makeup water annually and bleeding the geothermal system would have used 1.3 million gallons, but the system that was designed and installed at St. Patrick's uses only 300 gallons per year. Furthermore, the condensate losses inherent in district steam are eliminated by switching over to ground-source heat.


Installing the geothermal well field required removal of two planting areas marked by compacted soils and dense ivy mattings. This presented a further opportunity to improve the cathedral site's appearance, sustainability and functionality. With the geothermal system in place, the project team recreated planting areas, using absorbent soils and native plantings and trees. Consistent with local hydrologies, the new flora helps absorb runoff from adjacent hardscape and requires minimal irrigation. A 600-square-foot green roof covering the new secure vehicle entry further improves stormwater management while new soils and a native plant palette attract birds, squirrels, and other animal and insect life. New bluestone walkways and curbs aid pedestrian access.

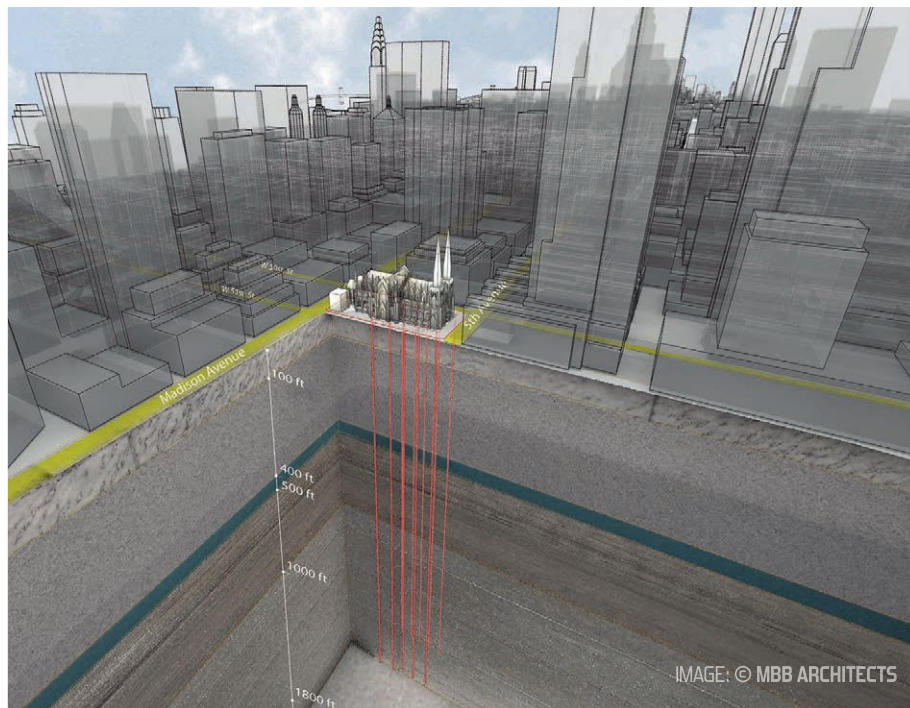
### Shining Example

A remarkable success story, since the geothermal system launched in 2017, it has provided all of the cathedral's heating




and cooling, without the need to engage the backup system. Post-occupancy performance includes the cathedral's largest attendance ever, visits by heads of state, and expanded programming while maintaining stable environmental control and energy-use reductions equivalent to 772,211 kilograms of CO<sub>2</sub>. Based on working environment metrics—temperature and ventilation control, acoustics, lighting and visitor response—cathedral staff report high levels of satisfaction in operations, and New York City Mayor Bill de Blasio has lauded its decreased emissions and support for a greener community.


The highly public modernization, which created national awareness of cutting-edge sustainability solutions, points in new and promising directions for retooling historically significant architecture and conserving natural resources. Ready to serve the public for generations to come, St. Patrick's Cathedral now shines as an example to other world-class organizations of how institutional leadership can harness technology to take a long-term, sustainable approach to architectural stewardship. 



The geothermal system comprises 10 wells in terraces flanking the north and south sides of the cathedral. Samuel Stothoff Co., Flemington, N.J., drilled 9-inch-diameter boreholes at a depth of up to 2,250 feet through bedrock.

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# ASTOR PLACE | New York

## » RETROFIT TEAM

PROJECT LEAD: Xylem Inc./Bell & Gossett,  
bellgossett.com

BUILDING MANAGEMENT: Related Cos., New York,  
www.related.com

RESEARCHER: Michael Waite, Sustainable  
Engineering Lab, Columbia University, New York,  
qsel.columbia.edu

MANUFACTURER'S REPRESENTATIVE:  
Wallace Eannace Associates Inc., Plainview, N.Y.,  
wallaceeannace.com

CONSULTANT: Steven Winter Associates Inc.,  
New York, www.swinter.com

MECHANICAL CONTRACTOR: Fresh Meadow  
Mechanical Corp., Fresh Meadows, N.Y.,  
www.fmmcorp.com

BUILDING AUTOMATION CONTRACTOR:  
Advanced Control Solutions, Bayshore, N.Y.,  
www.advancedcontrolsolutions.com

ELECTRICAL AND HVAC CONTRACTOR: Blake  
Electrical Contracting & HVAC, Bronx, N.Y.,  
(718) 292-8080

## » THE RETROFIT

The 21-story Astor Place tower in New York City was completed by Related Cos. in 2005. It includes 39 residential units with commercial space on the building's first and second floors. The HVAC system used hydronic space heating through boilers and cooling with central absorption chillers. Fan-coil units provide HVAC to residential floors; HVAC in the common and commercial spaces employs air-handling units. A retrofit of the central-plant equipment and air-handling equipment in the commercial and common spaces was conducted to reduce overall energy use with the data aiding Columbia University researchers as they tested assumptions on energy efficiency.

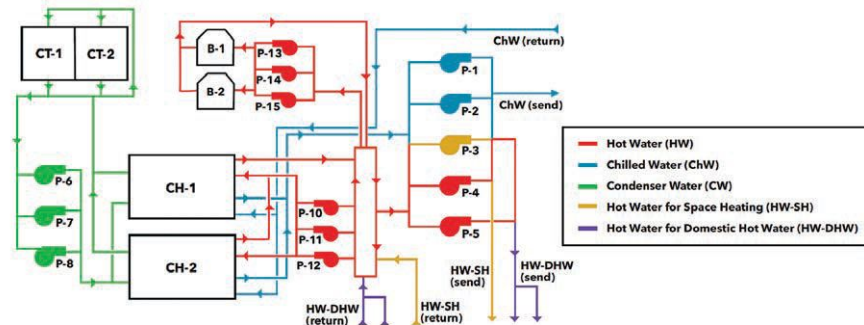
Xylem/Bell & Gossett provided engineering expertise, along with the pumps, drives and monitoring equipment for the project conducted in partnership with Related and Columbia University's Sustainable Engineering Lab.

On the cooling side, the original 30-horsepower condenser water pumps were replaced with Xylem Bell & Gossett e-1510 20-hp pumps. The lower horsepower but more technologically advanced pumps immediately delivered savings in electricity use—from 25.3 kW to 18.0 kW.

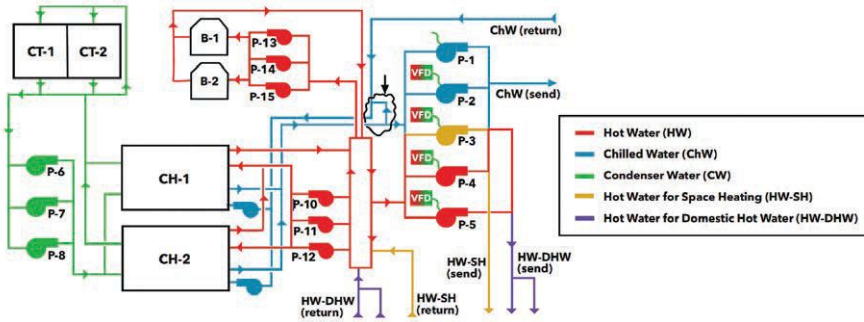
Other modifications included new piping to create primary/secondary chilled water loops



## ORIGINAL SYSTEM SCHEMATIC



## POST-RETROFIT SYSTEM SCHEMATIC



out of the original primary only system and the addition of Bell & Gossett Series 80 7.5-hp primary pumps. Constant primary chilled water flow optimizes chiller performance. Decoupling the loops in the original one-loop system allowed for the installation of variable flow technologies on the secondary loop. Bell & Gossett e-1510 15-hp pumps replaced the original 20-hp distribution pumps and were outfitted with variable frequency drives.

The Astor Place Energy Improvement Project consisted of three primary steps: conducting an initial energy assessment of the hydronic system, updating the system with technologically advanced pumps and controls, and adjusting the system in real time to evaluate the effects of the HVAC modifications.

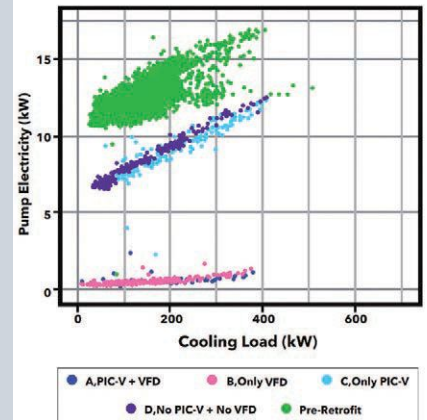
Monitoring system behavior at Astor Place yielded three primary benefits: It determined whether equipment was operating as designed, assessed the amount of energy being used and the dynamic adjustments to the load's demands, and gained a broader understanding of system behavior.

Prior to the retrofit, nearly 30 percent of the building's common system utility costs were for pumping electricity, primarily because of the system and the constant-speed operation at partial loads. Oversized pumps were found to cause unnecessarily high pressure differentials and flow rates in the system. Right-sized pumps paired with VFDs powering the chilled-water portion of a hydraulically balanced system delivered a dramatic 95 percent reduction in pumping energy.

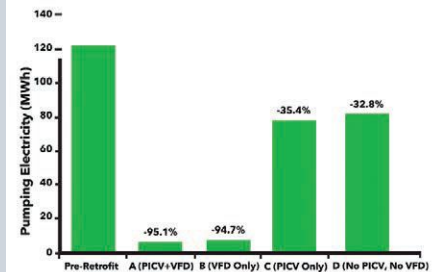
When considering heating and cooling, the retrofit resulted in a computed annual pumping electricity usage of 316 MWh, a 41 percent improvement in pumping energy requirements and an estimated 12 percent reduction in the building's central operations' energy bills. The results from the Astor Place Energy Improvement Project can help inform decisions about new equipment and its energy-savings potential.

PUMPS, DRIVES AND MONITORING EQUIPMENT  
MANUFACTURER: Xylem Inc./Bell & Gossett,  
bellgossett.com

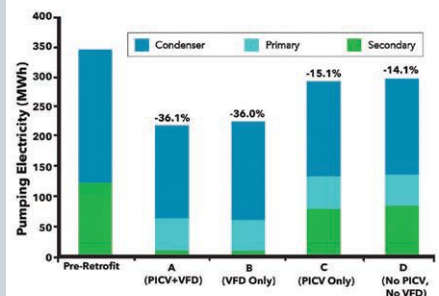
## PUMP ELECTRICITY VERSUS COOLING LOAD [hourly resolution]



## CHILLED WATER DISTRIBUTION ANNUAL PUMPING ELECTRICITY



## TOTAL ANNUAL COOLING SYSTEM PUMPING ENERGY





PHOTOS: CAMBRIDGE ENGINEERING

## SWIRE COCA-COLA |

### Salt Lake City

#### ► RETROFIT TEAM

**MECHANICAL ENGINEER:** Colvin Engineering Associates, Salt Lake City, [www.cea-ut.com](http://www.cea-ut.com)  
**HVAC INSTALLER:** Western Sheet Metal Inc., Salt Lake City, [westernsheetmetal.net](http://westernsheetmetal.net)  
**GENERAL CONTRACTOR:** Big-D Construction, Salt Lake City, [big-d.com](http://big-d.com)

#### ► THE RETROFIT

Swire Coca-Cola produces, sells and distributes Coca-Cola and other beverages in 13 states across the western U.S. Company representatives opted to retrofit their existing 300,000-square-foot distribution center for efficiencies. In addition, they wanted to ensure a new 300,000-square-

foot distribution center also was as efficient as possible. In both buildings, proper ventilation also was very important, so the company's facility manager, environmental manager, and mechanical engineer reviewed all potential heating and ventilation options.

Their ultimate decision was to utilize a high-temperature heating and ventilation (HTHV) direct-fired gas system that had a proven record of bringing energy savings and improved indoor air quality to large commercial and industrial spaces.

Nine HTHV units from Cambridge Engineering were installed on the existing facility and the new distribution center's rooftops. These units utilize 100 percent outside air to produce a discharge temperature of 160 F. The units provide uniform air temperatures throughout both facilities through destratification, without the use of supplemental fans. Additionally, once the new units were installed, Swire Coca-Cola representatives removed their air-rotation unit from the existing facility and regained the valuable floor space that the rotation unit once occupied.

"The Cambridge Engineering support team worked well

with our building automation system installers and maintenance team to find the optimal working conditions for our HTHV system," explains Jon Boettcher, corporate facilities manager of Swire Coca-Cola. "This has allowed us to not only heat this space far more efficiently than we did with the previous air-rotation system, but also take advantage of free cooling that makes our warehouse space much more comfortable in the summer months. The nine Cambridge HTHV units are quite reliable, requiring minimal attention from our maintenance team and also providing redundancy not seen with the massive single air-rotation unit previously installed within this facility."

After the first full heating season, Swire Coca-Cola's energy costs for the existing and new facility remained the same as the prior year—when only one building was operating. Although they did not conduct a formal energy study, Swire Coca-Cola representatives believe the HTHV technology was a large contributor to their energy savings. In fact, they were so pleased with the efficiency, they later installed Cambridge Engineering HTHV units in their Johnstown, Colo., facility and are expecting reduced energy costs there, as well.

**HTHV UNIT MANUFACTURER:** Cambridge Engineering, [www.cambridge-eng.com](http://www.cambridge-eng.com)





# 155 NORTH WACKER DRIVE | Chicago



## » RETROFIT TEAM

ENGINEER: Able Services, Chicago, [ableserve.com](http://ableserve.com)

## » THE RETROFIT

Twenty-two HLR (HVAC Load Reduction) modules were installed and commissioned at 155 North Wacker Drive, a 1.2-million-square-foot, 46-story office building. The project is the first HLR technology deployment in the metropolitan Chicago area.

HLR technology enables immediate capital-cost savings on new HVAC systems and provides up to 40 percent energy savings and improved indoor air quality in buildings. For 155 North Wacker, HLR modules will provide the desired IAQ while reducing energy costs by removing unwanted indoor air contaminants without requiring wholesale replacement of indoor air, which is a very energy-intensive process. The 155 North Wacker project was supported by incentives from the ComEd Energy Efficiency Program's Emerging Technologies team, which will also be performing an energy-savings analysis to better understand how this technology could help other ComEd customers save energy and money.

HLR technology allows for downsizing of HVAC systems by eliminating the parasitic load associated with the practice of "air replacement". Downsizing of HVAC systems delivers immediate capital-cost savings on new HVAC systems and up to 40 percent ongoing energy savings. Furthermore, recycling indoor air also means reducing the building's intake of polluted outside air.

"We are proud to kick off the adoption of HLR solutions in Chicago", says John Orabutt, chief engineer at 155 North Wacker. "The repeated success of HLR systems in New York, Boston, Miami and elsewhere convinced the building owners to deploy it here at 155 North Wacker, and we look forward to reaping the benefits of energy savings and indoor air quality."

HLR MANUFACTURER: enVerid Systems Inc., [www.enverid.com](http://www.enverid.com)



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# ARCHITECTS ON THE FRONT LINES OF DISASTER MITIGATION

BY ALLISON H. ANDERSON, FAIA, LEED AP

*Flooding is the No. 1 Climate Hazard in the U.S.; Here is How Architects Can Prepare Existing Buildings*



Existing buildings surround us, from historically significant structures worthy of careful preservation to speculative commercial buildings that might not outlive their air-conditioning units. Many of these buildings were constructed without the benefit of modern building codes or licensed design professionals; many are not prepared for a future with intensifying climate challenges, such as flooding, higher temperatures or wildfires. How do building owners, design professionals and communities improve these buildings' resilience if only 2 percent of the existing building stock is replaced each year? What will scale up the transition to sustainable and resilient buildings? The answer is in retrofitting these existing facilities.

PHOTO: GEORGE DESIPRIS FROM PEXELS



Existing buildings are susceptible to the same risks as new construction but may be less prepared to manage hazards because of factors related to their age or maintenance conditions: inadequate foundations, poor-quality repairs, lack of reinforcing, lack of a continuous load path, or deterioration and weathering.

There are several points in the life cycle of a building when it makes sense to consider features that mitigate hazards: in the initial design phase, during remodeling or alterations, when building functions change and when repairing damage from a hazard event. Small modifications, such as a new roof or HVAC system replacement, may trigger incremental upgrades, such as reinforcing the roof deck and installing an ice and water shield beneath a new roof covering or even adding a more efficient HVAC system to manage wider temperature ranges.

There is a measurable “resilience dividend” for investments aimed at increasing resilience without the immediate threat of a disaster, which yields short-term economic benefits. Every \$1 invested by the federal government in pre-disaster mitigation saved society \$6 in post-disaster recovery costs with the most favorable cost/

benefit ratios addressing river flooding. For every \$1 spent on improving building codes to better withstand disasters, society saved \$4 with the most favorable cost/benefit ratio addressing storm surge. (Learn more about cost savings of pre-disaster mitigation in the Washington, D.C.-based National Institute of Building Sciences’ “Natural Hazard Mitigation Saves: 2017 Interim Report”, [bit.ly/30nj1jh](http://bit.ly/30nj1jh).) When considering hazard-mitigation measures, building owners should know it costs an average of 50 percent more to rebuild in the wake of a disaster.

The first step toward improving resilience is to define the threats through a Vulnerability Assessment. It is rare that a structure faces only one threat; chronic stresses multiply over time in existing structures, and acute shocks can trigger failures of several systems at once. A vulnerability assessment, such as outlined in the Whole Building Design Guide ([www.wbdg.org/resources/threat-vulnerability-assessments-and-risk-analysis](http://www.wbdg.org/resources/threat-vulnerability-assessments-and-risk-analysis)), completed with the help of an architect, helps building owners and tenants decide if they can accept the risk climate presents to their assets. Making decisions about incorporating resilient features begins with answers to three questions:

- Will this reduce the potential impacts from hazards?
- How much damage can be avoided through this design strategy?
- Are there other benefits associated with incorporating this strategy?

### FLOODING: MOST COMMON U.S. NATURAL HAZARD

Every adaptation to climate is hazard- and site-specific. The most common hazards are floods (43 percent of disaster worldwide), storms (28 percent), followed by earthquakes, extreme temperatures, landslides, droughts, wildfires and volcanic activity. (Learn more from the Geneva-based United Nations Office for Disaster Risk Reduction’s report, “The Human Cost of Weather Related Disasters”, [bit.ly/2VC7miJ](http://bit.ly/2VC7miJ).) Design strategies can Protect (robustly defend the building from a hazard) or Accommodate (design for interaction with the hazard in ways that reduce risks for occupants or damage to the structure). In acute conditions, building owners may elect to Retreat, or relocate to avoid hazard exposure.

Flood-related events, including hurricanes and intense storms, accounted for more than seven of 10 presidential disaster declarations in the period 2008-17. This is



The Mississippi Gulf Coast was landfall for **HURRICANE KATRINA** in 2005. Many structures that survived hurricanes Betsy and Camille were lost in Katrina because of the overwhelming storm surge from flooding.

# NOW IS THE IDEAL TIME TO ADAPT TO CLIMATE CHANGE.

not just a coastal problem: The states with the most flood-related disaster declarations include Arkansas (No. 1) followed closely by Iowa, Tennessee, Oklahoma and Kentucky. (The Pew Charitable Trusts, Washington, provides more information about this statistic at [bit.ly/2JN2K2v](http://bit.ly/2JN2K2v).) Architects must prepare for rainfall events that are more intense, more frequent and longer in duration. At the same time, we must consider the rapid growth in the amount of impervious surface that prevents stormwater infiltration and increases the velocity and quantity of surface water on sites and streets.

Storms arrive regularly in the South, for example. Weeks at a time there are incessant downpours that swamp yards and make rivers out of streets. Deluges of 4 to 6 inches a day are not unknown. As air temperatures climb because of climate change, this will only get worse; hot air holds more moisture than cooler air. Traditional building techniques in the South accounted for a degree of uncertainty: local builders sited structures away from low areas, raised the first-floor level, and sheltered windows and doorways with a wide porch or overhang. They placed inessential functions below the building and designed undercrofts with hard surfaces, like brick, that easily could be cleaned after an inun-

dation. Occupants sandbagged doorways, wells and other essentials.

Flood protection hasn't experienced a radical disruption; traditional techniques still form the basis of effective practice. Architects' tools may be slightly more sophisticated than sandbags but the general approach remains the same. Proper siting for buildings is still the best defense against flooding. The optimal site location is a balance of variables: natural topographic advantage but not on a steep slope and near the water for views and access but not close enough for overspills. Elevation remains the most durable protection against flooding, but most existing buildings do not have the luxury of elevating out of the encroaching floodplain: It is difficult if the building is not already elevated—and expensive, triggering a host of associated repairs, from plumbing to plastering.

**DRY FLOODPROOFING** If elevation isn't an option, commercial buildings can explore dry floodproofing. The Washington-based Federal Emergency Management Agency definition of dry floodproofing is to create a watertight enclosure, substantially impermeable to the entrance of floodwater (a maximum of 4 inches in a 24-hour period). (Learn more about dry floodproof-

ing from FEMA at [bit.ly/2YprDoM](http://bit.ly/2YprDoM).) The walls are reinforced to resist hydrodynamic forces, usually to a height of 3 feet; load calculations should address the lateral force exerted by water plus buoyancy, velocity, debris impact and waves, depending on the site. A waterproof coating seals the wall, including all joints and cracks, from water penetration. Doors and windows must be armored, as well, with new options: flood logs, flood gates, flood barriers or submarine doors with bulkhead thresholds. Backflow preventer valves must be installed below the Base Flood Elevation, or BFE, and sump pumps installed to prevent accumulation in low areas.

Protecting an existing building from flooding begins outside the building envelope at the extended site. Floodwalls around the perimeter of a building include manual or passive barriers that deploy automatically against rising water: modular barriers, glass floodwalls, flip-up flood barriers (recessed in the ground when not in use), drop-down barriers (poised above an opening for quick response), and inflatable or water-filled barriers to fill gaps in a perimeter wall. These are ideal for retrofitting; floodwalls do not satisfy the National Flood Insurance Program requirements for new construction.

## AIA Offers Continuing Education about Building Resilience

The Washington, D.C.-based **AMERICAN INSTITUTE OF ARCHITECTS** has released a nine-course continuing education series about Resilience and Adaptation. The series covers hazard mitigation, community resilience and adaptation. Course 7: Existing Buildings: Hazard Mitigation Retrofits may be of particular interest to this audience. Take the entire series to understand the best practices for mitigating risk for hazards, shocks and stresses, as well as adapting to changing conditions. Find the series at [www.aia.org/continuing-education](http://www.aia.org/continuing-education).

The ground floor of **SAINT STANISLAUS SCHOOL** in Bay St Louis, Miss., took on 10 feet of water in Katrina. Renovations after the storm included using flood damage-resistant materials, dry floodproofing the electrical and mechanical rooms, and changing the windows to meet missile impact-resistant standards.



PHOTO: ANN MADDEN



Strategies to accommodate water require planning ahead so the impact of flooding on a structure is minimized. Reducing impervious surfaces at parking, patios and paving intercepts stormwater; bioswales and retention direct water away from the building to a dedicated storage area where it can evaporate without affecting the building or its occupants. The realization that concrete and asphalt exacerbated flooding has led to new products for stormwater retention: storage, such as interlocking pavers and grids to construct durable surfaces that maintain permeability; french drains with perforated pipes and geotextiles to prevent sediment from clogging openings; constructed bioswales with water storage and densely planted vegetation to reduce surface runoff by up to 99 percent. (Learn more from a study about the “Performance of Two Bioswales on Urban Runoff Management”, published by MDPI at [bit.ly/2vVK4p3](http://bit.ly/2vVK4p3).)

**WET FLOODPROOFING** accommodates water by employing flood-resistant materials to resist damage while allowing floodwater to enter the structure; this allows a quick cleanup and recovery without significant gutting and renovation. Materials should be able to survive wetting and drying and be cleanable to remove harmful contaminants, mold and other indoor air quality concerns. Acceptable finish materials include ceramic tile, marine-grade plywood, water-resistant fiber-reinforced exterior gypsum sheathing and waterproof adhesives. The only insulation that meets the requirements is closed-cell spray foam. A cautionary note: Spray-applied products are not generally acceptable for use in historic structures. (Discover more materials in FEMA’s report, “Flood Damage-Resistant Materials Requirements ...”, [bit.ly/2LJW4Va](http://bit.ly/2LJW4Va).)

Many communities have experienced changes to the extent of the floodplain, with corresponding changes to the BFE. This may not immediately affect buildings that are grandfathered in under previous floodplain regulations, but major renovations require updates. In addition, the potential savings from insurance or the anticipated costs of business interruption may lead building owners to undertake mitigation. FEMA guidelines for wet floodproofing include breakaway walls

and floors below the BFE; alternately, flood vents are another way to allow hydrostatic pressure to equalize on both sides of a wall and reduce the chance of structural failure. Foundation vents remain closed until rising water activates a set of internal latches that open the vent; flood water flows through the engineered openings, designed to provide 1 square inch of opening per 1 square foot of enclosed space. Vents are located on opposite sides of a structure, within 12 inches of the adjacent grade.

Urban growth has driven development into areas that are unsuitable for permanent occupation. Retreat from flooding is

## IMPROVE BUILDING RESILIENCE BEFORE A DISASTER


Now is the ideal time to adapt to climate change. Waiting until after a disaster might seem like the most promising time to improve resilience, but there is a desire to return to a state of normalcy as quickly as possible. Design professionals must accept that even after a catastrophic event, communities are not a blank slate upon which to rewrite the future. Buildings, roadways and property lines still exist, even if they are not whole, and emotions run high.

Architects assume multiple roles in helping to retrofit buildings and communities

In Bay St Louis, Miss., the **DOWNTOWN CIVIC CENTER AND PARKING GARAGE** uses parking to raise a community center well above the floodplain. This elevation also provides exceptional views to the Gulf of Mexico and barrier islands. Designed by unabridged Architecture PLLC, Bay St Louis, and built with flood damage-resistant materials, the building features a three-day uninterruptible power supply and photovoltaic array.



a last-ditch solution for existing buildings considered “stranded assets.” If a structure has been subject to repetitive losses from flooding, it may be worth considering a buyout program (often available after a disaster event) and relocation to an alternate site. A cost-benefit analysis may identify the overall cost savings of a move, even if the initial costs are high: fewer interruptions, unimpeded access during storms, continuity of operations and—as more people transition out of the floodplain—better access to potential customers and service.

for better resilience. As a resource for the community, we help residents envision the future and encourage broad participation in its creation. As an adviser to clients, we share information about predicted future conditions that may affect the project and recommend mitigation strategies. We use professional skills to design adaptation measures: conceptualizing; testing; and implementing projects to not just mitigate risks, but improve future performance. Architects are uniquely qualified to imagine and implement more resilient buildings and communities. 



# U.S. RESILIENCY COUNCIL: THINKING ABOUT FUTURE GENERATIONS

## *Building Rating Systems Promote the Benefits of Retrofitting Buildings to Withstand Disasters*

BY EVAN REIS, SE



Following devastating floods of 1935, when Houston's population was about 400,000, city leaders constructed two large reservoirs outside the city to act as detention ponds for future events. In the decades that followed, however, different leaders—more interested in capitalizing on the oil and gas boom—encroached upon these reservoirs, even permitting development within the basins themselves. Predictably, when Hurricane Harvey blew through Harris County in 2017 (Houston's population at the time was 2.3 million), the reservoirs and the surrounding area filled with water, displacing thousands and causing more than \$125 billion in damage and economic loss. *The New York Times* wrote, "Resettling neighborhoods, making certain places off-limits to development, creating dikes and reservoirs is difficult, both financially and politically. It takes longer than most election cycles ... . Politicians want votes, not trouble."



# GREAT LEADERS KNOW THEIR LASTING LEGACY WILL BE IN PART MEASURED BY HOW THEY THOUGHT ABOUT THE LONG-TERM—AND THE ECONOMIC AND SOCIAL SECURITY OF FUTURE GENERATIONS.

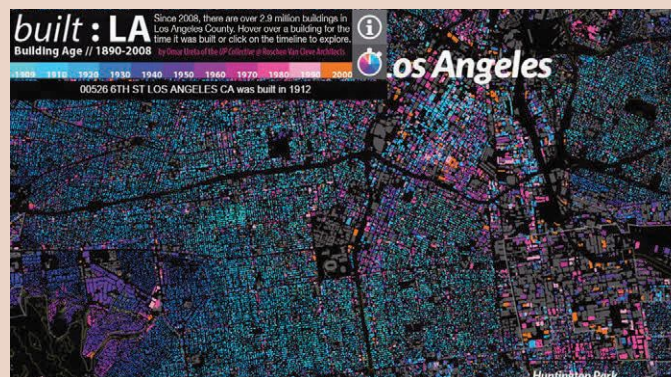
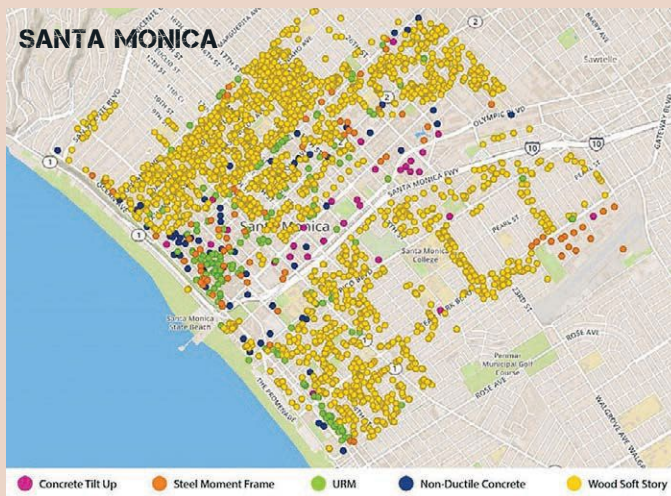


When the 1994 Northridge Earthquake struck, Santa Monica, Calif., avoided a direct hit. Nonetheless, many unreinforced masonry, steel and multistory wood-framed buildings were damaged. Aware that it was only a matter of time before one of the faults under or nearer the city ruptured, Santa Monica's leaders passed regulations requiring the mandatory retrofit of the community's most vulnerable buildings. This culminated in a 2017 ordinance considered one of the nation's most extensive. Mayor Ted Winterer, said at the time, "We want to do as much as we can to limit the loss of life and infrastructure, so in the event of a disaster, we bounce back strong."

Leaders often focus on addressing chronic stresses because the return is more immediate and the benefits accrue to them. Great leaders, however, know their lasting legacy will be in part measured by how they thought about the long-term—and the economic and social security of future generations.

## RESILIENCE IS SUSTAINABILITY

It is a common misconception that modern buildings will be "proof" against natural disasters. Modern building codes, typically those enacted in the mid 1990s and later, are intended to prevent collapse in the largest events, not to minimize damage and recovery time. It is also a common misconception that cities wouldn't allow potentially unsafe buildings to remain in use. In fact, in most cities, the overwhelming percentage of the building stock was built well before modern life safety codes



were adopted. The image above shows the age of buildings in Los Angeles. Most were built prior to the advent of modern building codes.

Events like Hurricane Harvey, the California wildfires and the Napa Earthquake have made it painfully clear it is not enough for our buildings to have a low impact on the environment; the environment must also have a low impact on our buildings. In other words, true sustainability requires both green and resilient design. Individuals and companies who have lost their most valuable assets or their businesses in natural disasters—and cities like New Orleans that have seen their social and economic vitality diminished or destroyed—

realize they must implement long-term resilience strategies.

## BUILDING RATING SYSTEMS

Cities seeking support from their residents and businesses for retrofit incentives and ordinances must raise awareness about the risks they face and the ways in which these risks can be mitigated. Already part of our everyday lives, ratings communicate the quality and expected performance of a product or service. We have ratings for car crash performance, hotel quality, restaurant cleanliness and financial transactions that enable users to compare investment options and quantitatively assess their risks.

The U.S. Resiliency Council, [www.usrc.org](http://www.usrc.org), located in the San Francisco Bay area, was established to increase awareness of the benefits of resilient design and to develop rating systems for earthquakes and

other natural hazards. The rating systems credibly and consistently communicate building performance in ways that are meaningful to stakeholders across the built environment: owners, lenders, insurers, designers, tenants, risk managers, governments and the public. USRC's Earthquake Performance Rating System was developed with the collaboration of more than 40 of the nation's leading engineering companies and earthquake professional organizations. USRC is currently developing rating systems for wind and wildfire.

One of the most important benefits of a building rating system that is able to quantify performance across dimensions of damage and recovery time, is the ability

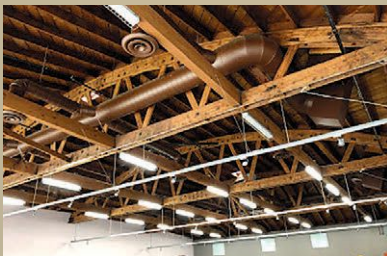
## SHOP 1841'S OWNERS ARE PROACTIVE AGAINST EARTHQUAKES

### SHOP 1841

is a 2-story retail building in the

Southern California city of San Gabriel. The building site is located near a major earthquake fault. The original 1940s construction consists of a long-span wood truss roof supported by lightly reinforced concrete walls. The building was partially remodeled and seismically retrofitted in 2010 with steel moment frames added at the open storefront, plywood shear walls throughout the building, and struts and ties at the ceiling and roof.

The building was evaluated by Irvine, Calif.-based IDS Group engineers using the U.S. Resiliency Council Earthquake Performance Rating System and obtained four, four and three stars, respectively, for the dimensions of Safety, Damage and Recovery, resulting in a Silver Rating. The approach to seismic risk mitigation taken by the building owner, Star Building Group, is "just as we prepare and protect our buildings from the effects of weather, we should prepare for earthquakes, which are bound to occur in this region without warning."



SOME BUILDING OWNERS ARE CONCERNED THAT IF THEY EVALUATE THEIR OLDER BUILDINGS AND FIND THEY MAY BE UNSAFE IN A NATURAL DISASTER, THIS KNOWLEDGE WILL INCREASE THEIR LEGAL LIABILITY. THE REALITY IS BUILDING OWNERS IN VULNERABLE BUILDINGS ASSUME LIABILITY ONCE THEY PURCHASE THE BUILDING.






to perform benefit-cost and return-on-investment studies when evaluating retrofit options. Researchers at the California Institute of Technology, Pasadena, recently determined that for every dollar spent in retrofitting soft-story structures, property owners could expect to save up to \$7, even without considering the reduction in contents losses, alternate living expenses, or deaths and injuries. (Read more in "Soft-Story Residential Buildings in Earthquakes—Risk Management and Public Policy Opportunities," [bit.ly/2Hxyx4s](http://bit.ly/2Hxyx4s).)

The Federal Emergency Management Agency, Washington, D.C., found similar cost benefits in its report, "A Benefit Cost Model for the Seismic Rehabilitation of Buildings," [bit.ly/2VMtSG5](http://bit.ly/2VMtSG5). The two-year analysis of seismic retrofit scenarios applied to a variety of building types in locations throughout the U.S.

In its seminal report, "Natural Hazard Mitigation Saves", the National Institute of Building Sciences, Washington, estimates that for every dollar spent on mitigation, society sees a resilience benefit of \$4 to \$11, depending on what you consider. Learn more at [bit.ly/2M0dkAY](http://bit.ly/2M0dkAY). These figures show that retrofits can make good business sense.


Some building owners are concerned that if they evaluate their older buildings and find they may be unsafe in a natural disaster, this knowledge will increase their legal liability. The reality is building owners in vulnerable buildings assume liability once they purchase the building. In a precedent-setting case in California, a jury found the owners of a clothing store liable when two employees were crushed to death by falling bricks during an earthquake in 2003. The jury determined the store owners were negligent

USRC BUILDING RATING SYSTEM			
	SAFETY	DAMAGE	RECOVERY
	★★★★★	Blocking exit paths unlikely	Minimal Damage (<5%)
	★★★★	Serious injuries unlikely	Immediate to Days
	★★★	Loss of life unlikely	Moderate Damage (<10%)
	★★	Isolated loss of life	Significant Damage (<20%)
	★	Loss of life likely	Substantial Damage (<40%)
		Severe Damage (40%+)	Within weeks to months
			Within months to a year
			More than a year



because a reasonably diligent owner could have evaluated the building to determine whether it posed a safety hazard, in the same way an owner would have been responsible to check that the sprinkler systems were functioning. A building rating system, when used to make buyers, tenants, employees and visitors more aware of risks, can actually have the benefit of reducing an owner's liability because it adds a measure of informed consent.

And retrofitting older buildings can increase their market value. When more than 90 percent of the building stock in a typical city is older than modern codes, most tenants or buyers don't have the luxury of leasing or buying a brand new building. Those owners that can distinguish their buildings by retrofitting them to meet higher performance ratings will be able to take advantage of the increased public demand for resilience. In July, the U.S. Resiliency Council will be awarding Silver ratings to four masonry buildings in downtown Portland, Ore., that have been retrofitted in the past 10 years. These include both affordable and market-rate housing, retail and office space.

The preservation of our existing building stock is an essential component of creating more resilient communities. Rating systems like those developed by the U.S. Resiliency Council provide credible, consistent and meaningful data to owners about the benefits and costs of retrofit and are key to raising awareness of the public at large. 



IT IS NOT ENOUGH FOR OUR BUILDINGS TO HAVE A LOW IMPACT ON THE ENVIRONMENT; THE ENVIRONMENT MUST ALSO HAVE A LOW IMPACT ON OUR BUILDINGS.



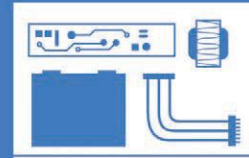
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# ANCR 'KILLS TWO BIRDS WITH ONE STONE'

BY RYAN M. COLKER, J.D., CAE

## *Retrofits that Consider Building Resilience and Energy Efficiency Capture Multiple Benefits*



Hardly a day goes by that a news story doesn't cover a disaster event somewhere in the world. The U.S. has certainly had its share of disasters recently. In 2017, there were 16 disasters costing \$1 billion or more—totaling over \$300 billion in damages. In 2018 there were 14 such disasters. Already in 2019, before the start of hurricane and wildfire seasons, two such events have occurred. In fact, since 1980 the U.S. has experienced 246 disasters causing \$1 billion damages or more, for a total impact exceeding \$1.6 trillion, per the Washington, D.C.-based National Oceanic and Atmospheric Administration, [www.ncdc.noaa.gov/billions](http://www.ncdc.noaa.gov/billions).

The impacts of such events are felt throughout the community. Lives are disrupted as the community works toward recovery. Building owners are particularly impacted. Damaged buildings can trigger costly repairs and lost revenues as tenants must relocate (or, worse, close up shop completely). Research has shown that following a disaster, roughly

PHOTO: ARTHUR MARSHALL ON UNPLASH



# RETROFITS AT THE ENERGY/RESILIENCE NEXUS PROVIDE MULTIPLE BENEFITS—BENEFITS THAT ARE CAPTURED ACROSS A BUILDING'S LIFE CYCLE.



40 to 60 percent of small businesses never reopen and 90 percent fail within a year if they can't resume operations within five days. Keeping businesses open supports a community's ability to "bounce back"—a key component of what it means to be resilient.

Although a building owner may not fully recognize his or her disaster risks (and there are few places without some risk), one thing is certain, operating costs—particularly energy—are an ongoing burden. Fortunately, there are opportunities to "kill two birds with one stone." An expanding body of research is examining the ability to capture both energy efficiency and resilience benefits, or co-benefits, through the application of certain measures. This focus on the energy/resilience nexus provides new avenues for retrofits that capture multiple benefits.

## RETROFITS AT THE ENERGY/RESILIENCE NEXUS

As building owners undertake retrofit activities, investments in mitigation can provide multiple returns. Some insurers may recognize the protections provided by resilience measures in the form of premium reductions; tenants or future buyers may place increased value on resilient properties (particularly when they are aware of such enhancements); and owners and tenants may save on energy costs. Updating an existing building to comply with provisions of the most recent edition of an energy code, like the International Energy Conservation Code (IECC), can help deliver significant energy savings.

Increased energy efficiency in general when coupled with provisions for onsite electricity generation (whether through generators, CHP, or onsite renewables and storage) can extend the supply of onsite power generation by reducing the overall energy needs to provide essential func-

tions. This could allow for a reduction in fuel storage needs or allow for longer operations without grid-provided electricity. Such a holistic strategy may also have benefits in non-hazard conditions, allowing increased participation in demand-response programs or reducing peak loads.

Either following a disaster event or in times of extreme heat or cold events, loss of power or reductions in service can impact the ability of a facility to remain safe for occupancy. The concept of passive survivability means that a facility continues to provide the services necessary (particularly air and thermal quality and water and sewage services) despite a loss in power. A study by the Urban Green Council and Atelier Ten, both of New York, found that in New York City buildings, during a winter blackout, a typical high-rise apartment would drop to 45 F within three days and continue to fall. In a summer blackout, a typical high-rise apartment would reach 95 F by the fourth day and peak at over 100 F. (Learn more about the study at [www.urbangreencouncil.org/babyitscoldinside](http://www.urbangreencouncil.org/babyitscoldinside).) Strategies applicable to building retrofits can help keep temperature changes more gradual. Increased insulation, reducing air leakage (in conjunction with a proper passive ventilation strategy) and operable windows can all be part of a passive survivability strategy. Proper use of daylighting and avoiding blocking light that could reach into spaces could also make a facility more comfortable during a blackout.

Attention to detail on sealing and insulation can also limit the potential for rot, mold and mildew following extreme temperatures or some water-related events. Heat, air and moisture transfer can all contribute to indoor environmental quality issues.

Reducing the impacts of urban heat islands can provide energy efficiency and resilience benefits. Roof replacements can

contribute to passive survivability, reducing the impacts of extreme heat at both the community and the building level.

## FINANCING MITIGATION ACTIVITIES

These are just a few strategies that can be deployed during retrofit projects that capture co-benefits of enhanced resilience and energy savings. Despite these benefits, securing internal funding for disaster mitigation and energy-efficiency improvements may be challenging.

Recognizing the benefits mitigation measures provide to building owners and communities, many Property Assessed

### Who Is ANCR?

The Washington, D.C.-based **ALLIANCE FOR NATIONAL & COMMUNITY RESILIENCE** is developing the tools to assist communities in evaluating and improving their resilience. Founded by the International Code Council, U.S. Resiliency Council and the Meridian Institute, ANCR is a 501(c)(3) national coalition of public- and private-sector stakeholders working to advance community resilience. Learn more at [www.resilientalliance.org](http://www.resilientalliance.org).

Clean Energy (or now more appropriately called Property Assessed Capital Expenditure) programs are starting to include mitigation as an eligible PACE project. PACE programs in California support seismic retrofits that can be done alongside or independent of energy- and water-efficiency improvements. Florida PACE programs allow hurricane mitigation measures. Other states are beginning to follow suit. At a community level, a recent study found that avoided property damage from hurricanes

THE CONCEPT OF PASSIVE SURVIVABILITY MEANS THAT A FACILITY CONTINUES TO PROVIDE THE SERVICES NECESSARY (PARTICULARLY AIR AND THERMAL QUALITY AND WATER AND SEWAGE SERVICES) DESPITE A LOSS IN POWER.



## Make Your Business Resilient

Roughly 40 to 60 percent of small businesses never reopen their doors following a disaster. But you can.

### How to Be Prepared

- Make an evacuation plan and exercise it regularly
- Know how you'll notify your employees, customers, and stakeholders of an emergency
- Have redundancy for key resources like power, equipment, and supplies
- Create a Business Continuity Plan to become operational again quickly

### Be Prepared for Everyday Disasters

- Burst pipes
- Server failure
- Fires
- Flu

### Have a Continuity Plan

Following a disaster, 90% of smaller companies fail within a year unless they can resume operations within 5 days.

Meanwhile, 20% of larger companies spend over 10 days per month on their continuity plans.

### Disaster Recovery Plan:

#### IMPORTANT RECORDS

Insurance policies, contracts, employee records

#### EMERGENCY SUPPLIES

Cash, water, first aid kit, paper towels, garbage bags, battery-powered radio, 3-day supply of non-perishable food, etc.

#### IT REDUNDANCY

Installation disks, software licensing keys, hardware inventory with serial numbers, and equipment

### Emergency Kits for Employees

Encourage your employees to have grab-and-go emergency kits at the office, in the event of a disaster during the work day:

Include a small first aid kit, cash, energy bars, bottle of water, phone charger, etc.

**FEMA**

This information is only a portion of what you need to be prepared; for more information and resources, visit [Ready.gov](https://www.ready.gov) and [FEMA.gov](https://www.fema.gov).

INFOGRAPHIC: FEMA/PETER HERRICK JR.

due to the Florida PACE program topped \$507 million. [Read "Impacts of the Property Assessed Clean Energy (PACE) Program on the Economies of California and Florida", published by the Sol Price School of Public Policy at [bit.ly/2JE7as5](https://bit.ly/2JE7as5).]

The Washington-based U.S. Department of Energy offers a toolkit on Commercial-PAVE for resilience, including case studies, at [bit.ly/2JBxnYx](https://bit.ly/2JBxnYx). One case study covers the retrofit of the Southern Oaks Rehab and Nursing Center in Pensacola, Fla. Southern Oaks partnered with Counterpointe SRE to secure a \$500,000 PACE deal, which paid for a full retrofit of the building's windows and roof. The installed windows are rated to withstand winds of up to 200 mph and have a low-e/argon glazing U-value of .28. The low U-value windows provide greater resistance to heat flow, resulting in cooler interior temperatures and less demand from cooling units.

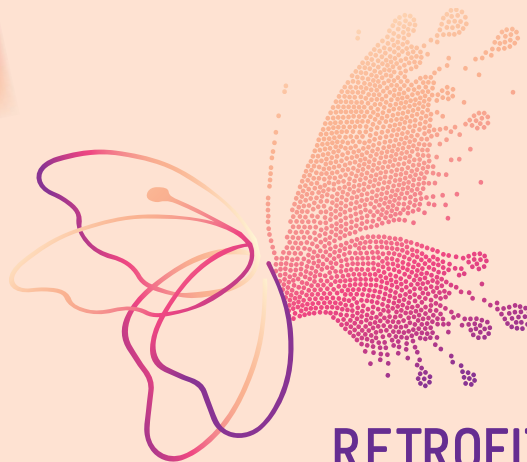
### RESILIENCE DOES PAY OFF

The growing threat of disaster is placing increased pressure on communities and building owners to be prepared to weather the storm. Fortunately, there are measures building owners can take to reduce the risk to their facility while also capturing ongoing benefits through reduced energy costs. Later this year, the National Institute of Building Sciences, Washington, will release the next edition of its widely cited "Natural Hazard Mitigation Saves" study—this time with an examination of the benefits associated with building retrofits. Quantifying these benefits will hopefully provide additional justification for investing in retrofits that capture both energy and resilience benefits.



View a short video about the **ALLIANCE FOR NATIONAL & COMMUNITY RESILIENCE** and its mission.





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Learn more at [www.retrofitmagazine.com/metamorphosis-awards](http://www.retrofitmagazine.com/metamorphosis-awards).



# ERA: STRENGTHENING THE ROOFING INDUSTRY

## *The EPDM Roofing Association Gathers and Disseminates Information to Create Resilient Roofs*

BY LOUISA HART



During the last decade, the construction community has become increasingly aware of the need for resilience in the built environment. Sometimes this awareness has been quickly and painfully raised in the wake of increasingly frequent devastating storms, like hurricanes Sandy and Katrina. Sometimes it has been part of a slower process, as the cumulative effects of severe weather take their relentless toll on existing structures.

However, if there is one date that marks a turning point in the sense of urgency

surrounding resilience, it is May 10, 2016. That was the date when the Obama White House hosted a conference on Resilient Building Codes to underscore the importance of "incorporating resilience and the future impacts of climate change in the codes and standards development process." In the wake of this conference, 40 leading organizations within America's design and construction industry released a report about efforts to achieve resilience in the built environment ([bit.ly/2JMUFWK](http://bit.ly/2JMUFWK)). The report detailed a set of guiding



# ALTHOUGH THERE MAY BE SOME DEBATE ABOUT THE CAUSES OF INCREASINGLY DESTRUCTIVE WEATHER, THERE IS NO DEBATE THAT THE APPROACH TO BUILDING RESILIENT STRUCTURES NEEDS TO REFLECT THE “NEW NORMAL.”



principles, including “developing and advocating for codes and policies that advance resilience; developing ‘whole-systems resilient design’ approaches for the built environment; and providing guidance, beyond the baseline life-safety codes, that recognizes the importance of fortifying property for individual and community resilience.”

Jared Blum, executive director of the Washington, D.C.-based EPDM Roofing Association (ERA), attended the White House conference. Inspired by the mission that was conveyed by the attendees, Blum charged ERA with intensifying its efforts to alert the roofing community to the need for resilience in both existing and replacement roofs.

## ERA'S CHARGE

Responding to that mandate, ERA launched a microsite, [epdmtheresilientroof.com](http://epdmtheresilientroof.com), in May 2017, to provide specific information about resilience. The website details the need for resilience in roofing systems and the specific attributes of EPDM that make it valuable in creating a resilient structure. To add context to the information about EPDM products, the website provides a clearinghouse of sources about resilience, as well as an up-to-date roster of recent articles, blog posts, statements of professional organizations and other pertinent information related to building resilience.

Subsequent to launching the website, in November 2018, ERA produced its first annual report on resilience issues, “Building Resilience: The Roofing Perspective.” Download it at [epdmtheresilientroof.org/building-resilience-roofing-perspective](http://epdmtheresilientroof.org/building-resilience-roofing-perspective). The report includes a section about important events related to resilience during the preceding year. These include the release of the Washington-based National Institute

of Building Sciences’ “Natural Hazard Mitigation Saves: 2017 Interim Report”, [bit.ly/30nj1jh](http://bit.ly/30nj1jh), which details the six-to-one ratio of return on investment in mitigation compared to the cost of repairs following a cataclysmic weather event. The ERA report also includes an update on legislative progress, specifically the Disaster Recovery Reform Act, which provided—for the first time—significant mitigation funds from the federal government.

Finally, the ERA report lists reference resources about the issue of resilience, as well as organizations that are supporting policies that will create a more resilient environment.

## INFORMATION GATHERING

ERA also has increased its efforts to gather scientific information about resilience. The leadership and members of ERA toured the Insurance Institute for Business and Home Safety’s (IBHS’) Research Center in Richburg, S.C., in October 2017. The tour was the third in a series of ERA visits to facilities that are spearheading the effort to incorporate resilience into the built environment. The other visits were to the Building Envelope Systems Research Program at Oak Ridge National Laboratory, Oak Ridge, Tenn., and the National Renewable Energy Laboratory, Golden, Colo.

The visit to IBHS provided in-depth knowledge of state-of-the-art hail and wind testing research, of special interest to ERA members because of EPDM’s performance during hailstorms. Taken together, these three site visits provided ERA members with up-to-date information about resilience in roofing systems. ERA members, in turn, are offering this essential EPDM-focused information to their colleagues and customers.


In 2019, ERA is building on its record of

being the “go-to” source for information about resilience in the roofing industry. The association is in the process of updating its annual report on resilience and will publish a revised edition of the report in November. Additionally, ERA supports the efforts of allied organizations that are disseminating needed information about resilience: In January of this year, ERA sponsored the breakfast meeting during which NIBS announced the data from its “Natural Hazard Mitigation Saves: 2018 Interim Report”,

## ERA and Resilient Roofs

Learn more about the Washington, D.C.-based EPDM Roofing Association’s resilience efforts, as well as how EPDM contributes to resilient buildings, at [epdmtheresilientroof.com](http://epdmtheresilientroof.com).

[www.nibs.org/page/mitigationsaves](http://www.nibs.org/page/mitigationsaves). The announcement that the NIBS project team found a national benefit of \$11 for every \$1 invested in disaster mitigation made national news and helped to inform Congress about the value of mitigation. ERA was proud to be part of this effort and will continue to use its resources to support efforts that inform builders about the importance of strengthening structures before disaster strikes.

Although there may be some debate about the causes of increasingly destructive weather, there is no debate that the approach to building resilient structures needs to reflect the “new normal.” ERA is proud to be a source of information, as well as a source of building materials, to help create resilient 21st century buildings for the people and property these buildings protect. 

# USGBC: GREEN BUILDINGS AS CLIMATE SOLUTION

*CEO Mahesh Ramanujam  
Calls for a Storytelling  
Strategy to Educate  
Everyday Americans*

BY SARAH STANLEY



The latest report from the Geneva-based United Nations' Intergovernmental Panel on Climate Change (IPCC) issued a dire warning about the need to act to reduce greenhouse-gas emissions by 2030. (Read the report at [www.ipcc.ch/sr15](http://www.ipcc.ch/sr15).) As part of that assessment, IPCC called for a "rapid and far-reaching" transformation of the world's buildings. For those working in building design, operations and construction, heeding that warning requires a renewed focus on the development of green buildings.





# USGBC FOUND THE PUBLIC OVERWHELMINGLY AGREES THE ENVIRONMENT IS AN URGENT CONCERN FOR HUMANITY.



For 25 years, the U.S. Green Building Council, Washington, D.C., has helped shape the concept of high-performing green buildings through the LEED green building rating system. With more than 100,000 projects already engaged with LEED, the certification provides a clear path toward sustainable design, construction and operations. In addition, the introduction of LEED v4.1 is underscoring the importance of performance monitoring.

Certifications, like LEED, are driving market transformation, but the IPCC report makes it clear everyone must get involved and increase the pace of a sustainable transition. Accelerating transformation will not only require engaging the professionals working in design, operations and construction, but also the people and tenants within the offices, apartments, schools, hospitals and other building types. By drawing clearer connections between buildings and the impacts they have on individuals, the industry can continue to motivate the far-reaching transformation that is needed. Understanding this connection between people and buildings will be vital. Therefore, this connection was a core part of USGBC's latest Living Standard research.

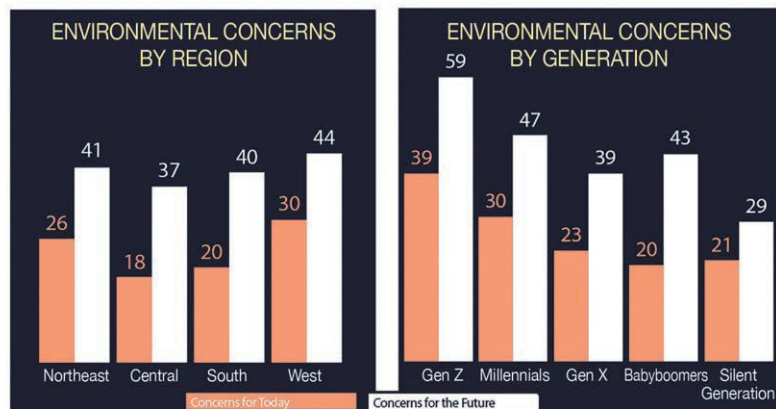
To examine Americans' views on environmental issues and how the green building industry can be better positioned as a global solution, USGBC commissioned a global public-opinion research firm, Clear-Path Strategies, to conduct a nationally representative survey of 1,600 people and 10 focus groups. The qualitative and quantitative study went further than the familiar audience for LEED and green building. It included millennials, community opinion leaders—such as government officials, business owners, philanthropists, etc.—and young parents. USGBC found the public overwhelmingly agrees the environment is an urgent concern for humanity and

people want to live in a healthy environment, but there are roadblocks for meaningful action.

“What we’ve just begun to understand—and I can tell we’ve barely scratched the surface—is how many people out there have a unique perspective on sustainability and how many people we still have yet to reach,” says Mahesh Ramanujam, USGBC’s president and CEO. “This new research questions our conventional wisdom and ex-

an important issue to many, the research revealed a series of contradictions that underscore the need for clarifying the relationship between buildings and people. Despite the fact that green buildings can help achieve these individual goals, such as recycling and reducing waste, Americans rank living in a green building quite low. Furthermore, 51 percent say they would be willing to spend more money on food, products and rent if that meant living in an

## Distinct generations and regions feel slightly differently about environmental concerns but all worry about the future.



perience.” Read the full report at [livingstandard.org/standardissue](http://livingstandard.org/standardissue).

The idea of saving the planet tends to be too overwhelming, too abstract and too distant from peoples’ realities. But they do see it as a critical issue and one that requires action. When presented with various ways to save the planet, respondents focused on actions they can easily take on an individual level, like recycling and reducing waste and energy use.

Although the environment remains

environment that set them up for a longer, healthier life. Yet, only 11 percent associate words like “green building” and “green space” with creating an environment that supports the goal of living healthier. Simply put, Americans do not recognize green buildings as an environmental solution.

“When people think about the environment, they rarely think about buildings. For some, buildings are merely aesthetically fulfilling or there to serve a specific function,” Ramanujam explains. “The look and logic

# SIMPLY PUT, AMERICANS DO NOT RECOGNIZE GREEN BUILDINGS AS AN ENVIRONMENTAL SOLUTION.



of buildings tend to be at the forefront of our minds while their long-term impact on our health and wellbeing is not.”

The success of green buildings has mostly been confined to the industry itself, but with a growing need to reduce greenhouse-gas emissions and address the challenges associated with climate change, USGBC believes it is time to start telling a better story to the general public.

a business perspective, demand for green buildings has been steadily increasing. The Dodge Data & Analytics World Green Building Trends 2018 SmartMarket Report (bit.ly/2SgunBJ) indicates nearly half of 2,000 building professionals surveyed expect that the majority of their projects in the next three years will be green buildings. Design and construction companies understand that using LEED and other green building

demands. How those solutions are communicated is critically important.”

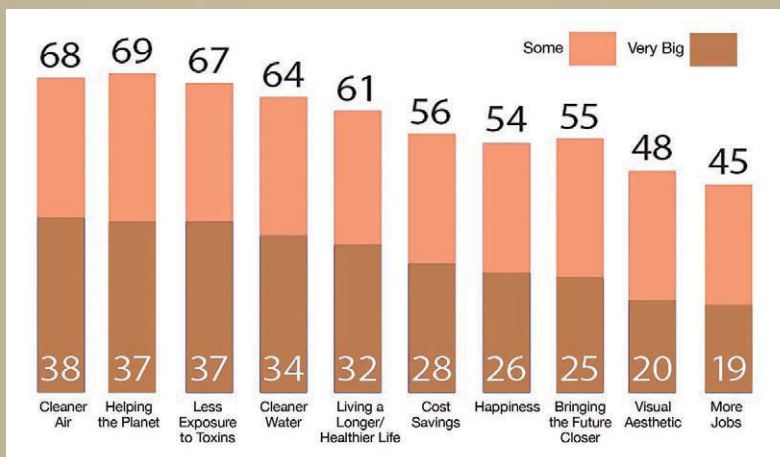
Despite the need to broaden the general green building conversation beyond the industry, the public does see some tangible benefits green buildings can have in their local communities. Part of USGBC’s study spent time explicitly asking about perceptions of green buildings. For instance, around two-thirds of respondents see a link between green buildings and cleaner air, less exposure to toxins and cleaner water in their communities. And, after being read a description of LEED, 59 percent believed it could play a role in helping people live longer and healthier lives. Given that almost one-third of respondents indicated they have direct, personal experience with bad health associated with poor environments or living situations, the tangible benefits should play a key role in any green building conversation.

“We know that green buildings are only part of the solution to lengthening and bettering the lives of every person on the planet. That’s why the heart of the green building community’s efforts must go beyond construction and efficiency,” Ramanujam adds. “We must expand the way we talk about sustainability and focus on human beings because the standard we are most committed to raising is that of quality of life itself.”

USGBC’s research provides the insight needed to understand how the green building conversation must evolve. The environment is an urgent concern for the public, but it has not yet led to corresponding levels of lasting, meaningful actions. Connecting to those still on the sidelines requires speaking about benefits of green buildings and communities in local, human terms, not just in terms of humanity and planetary stakes.

USGBC has identified key areas to talk about how green buildings can help, who they help and why they are necessary:

## How much of an impact do green buildings have on the following criteria?



When asked, the public believes green communities are not just about helping the environment but can have a very big impact on things they care about in their local communities. The research also revealed the industry’s promises to people need to emphasize the most credible, tangible benefits, like cleaner air, less exposure to toxins and cleaner water.

Ramanujam observes that “for too long, most of us in the green building community have simply been talking to ourselves. We are not reaching the broader population effectively enough to change their behavior or decisions on the scale necessary to combat climate-related risks.”

Although the industry grapples with ways to elevate the importance of green buildings in the minds of Americans, from

strategies allows the industry to do well by doing good.

“For people to do more and create big, lasting change, conversations need to center around human terms,” Ramanujam notes. “The green building community can mobilize and inspire this change by connecting the work we’re doing to health outcomes and demonstrating how green building can evolve to best meet public



● **Promote healthy outcomes:** Sustainable cities improve people's lives by providing designed spaces and resources that help people live longer, healthier and happier lives.

- ~ Design teams can create high-quality, healthy spaces through strategies, like using low-emitting materials, daylighting, visual and acoustic comfort, air quality monitoring and more.
- ~ Explaining the benefits of these strategies and how decisions, like using toxin-free materials, can improve physical health and comfort by reducing symptoms of allergies and respiratory-related illnesses, helps elevate the importance of green buildings in the minds of consumers and clients.

● **Future generations:** At the rate the planet is warming, catastrophe is almost certain, yet there is still hesitancy to act decisively today and not wait until tomorrow. This present-future dichotomy changes depending on age, with younger respondents more interested in taking action both now and in the future. Future generations de-

serve to live in a healthy, thriving environment and companies need to show definitive progress today.

- ~ To inspire action, companies and individuals should seek out and promote stories and instances that demonstrate how their efforts are improving quality of life across communities.
- ~ Communicating about sustainability should demonstrate how efforts are not only supporting the triple bottom line now, but how it's helping prepare for the next generation.
- ~ USGBC's Living Standard campaign is actively promoting stories and inviting others to join the effort at [livingstandard.org](http://livingstandard.org).


● **Planetary stakes:** Communities are feeling the effects of climate change with more severe weather events, including floods, fires and storms. Prioritizing and communicating the impact of resilience efforts will fuel the desire to change.

- ~ Sustainable buildings are the cornerstone of enhancing community resilience. Resilient design often

includes the use of durable materials, thoughtful site selection, rainwater collection, demand response, grid islanding, energy efficiency and onsite renewable-energy generation.

- ~ Talking about green building as a part of any city or area's resilience plan can help residents understand how design can help communities prepare and plan for, absorb, recover from and more successfully adapt to adverse events.

USGBC's research is part of the organization's Living Standard initiative ([livingstandard.org](http://livingstandard.org)), which seeks to raise the quality of life for people around the world through research and storytelling. This report is the first of several, which are yet to come. "We believe that storytelling can lead to a more sustainable world," Ramanujam adds. "This research shows us where we're starting from and through storytelling we can get where we need to be."

Companies are encouraged to share their LEED and green building stories by visiting [livingstandard.org](http://livingstandard.org). 

### What are the top three ways you try to create a local environment that lets you live a longer and healthier life?



A young parent from Phoenix who participated in a focus group for the study said, "I try to teach my kids to do things to make the environment better. We recycle and try not to waste water. Turn off the water when you brush your teeth." Reinforcing how green buildings make these actions easier can help Americans better understand and recognize the importance of green buildings.

### Do you think LEED plays a role in creating an environment that lets you live a longer and healthier life?



USGBC's study revealed 58 percent of Americans think LEED plays a "very big" or "some" role in creating an environment that lets you live a longer and healthier life. The organization's Living Standard is focused on expanding the way the green building market talks about sustainability; Living Standard advocates a more human-centric approach.

# A NEW ERA FOR RETROFITTING

## *Is New York City's 80x50 Legislation the Future of Urban America?*

BY JEFF RIOS, P.E., LEED AP, AND  
CHARLIE MARINO, CEA, LEED AP O+M

PHOTO: MALTE SCHMIDT ON UNSPLASH



If you're a building owner or facility manager operating in today's urban built environment, New York City's ambitious campaign to retrofit existing buildings and slash carbon emissions has probably grabbed your attention in recent months. On Earth Day 2019, the mayor's office and city council rolled out New York City's version of a Green New Deal—"The Climate Mobilization Act"—a package of bills designed to curb city carbon emissions 40 percent by 2030 and 80 percent by 2050, or 80x50.

Now the law of the land, these emissions limits have been topic du jour among New York's real estate and AEC circles and have raised many questions about the future of design. Political overtones aside, the task now rests with consulting engineers, along with our architect colleagues, to identify elegant solutions for our clients' buildings.



# TODAY'S COMMONPLACE RETROFITS HAVE A SMALLER CARBON IMPACT THAN MOST REALIZE.



Every building is unique and faces a diverse set of challenges. As we enter a new era of sustainability, it is incumbent upon us, as AEC professionals, to develop guiding principles to lead our clients through this new territory.

### BACKGROUND

The legislative driver behind New York's 80x50—the City Council's Intro-1253—was introduced in 2018 and requires existing buildings over 25,000 square feet to comply with greenhouse-gas-emission targets as determined by New York City Department of Buildings occupancy groups. (See "NYC Department of Buildings Occupancy Groups", right.)

Although a similar measure introduced in the New York City Council in 2017 only curbed fossil-fuel consumption for specific building types, Intro-1253 is more far-reaching; it includes emission limits associated with all energy fuel sources.

Since its introduction, Intro-1253 received several revisions. Notable changes impacting building owners and the design community include the following:

- Defines the role and responsibilities of the newly assigned Office of Building Energy and Emissions Performance. The appointed director must be a registered design professional.
- Specifies building emission intensity limits (tons of CO2 equivalent per square foot per year) per the New York City Department of Buildings occupancy group, rather than bundling groups together, to be more representative of how buildings actually use energy.
- Excludes "rent-regulated accommodations" from established building emission limits similar to building occupancy group R-2 but requiring an advisory board to provide recommendations as part of their key goals.

- Postpones the first compliance period—originally starting in 2022, now 2024—with emission intensity limits resetting accordingly, permitting building owners more time to strategize retrofit capital planning.
- Prescribes greenhouse-gas coefficients of energy consumption per fuel type for calendar years 2024-29 and acknowledges greenhouse-gas coefficients should be re-evaluated and refined by 2023 for future compliance years, thus helping improve accuracy of the electric grid's contribution in the future when additional renewables are part of electric production.
- Establishes building emission intensity limits for compliance years 2030-34, initially ending in 2049.
- Permits deductions for compliance years 2024-29, most notably allowing from 10 percent initially, up to 100 percent for accepted renewable-energy credits as long as they are associated directly deliverable into Zone J load zone (power supplied directly to the NYC grid). Allows deductions for compliance years 2024-29 associated with clean distributed energy resources, allowing electric demand reductions to be part of the plan because they still play a vital role in carbon reduction given the current electric grid system.
- Allows adjustments to the building emission intensity limit for non-profit hospitals and health-care facilities, reducing the limit by up to 15 percent for compliance years 2024-29 and 30 percent for compliance years 2030-34.

The Department of Buildings newly established Office of Building Energy and Emissions Performance, the Mayor's office of Long Term Planning and Sustainability, and an appointed Advisory Board will evaluate and present findings associated with the following that will further shape

- the discussion around retrofits:
- Carbon emission coefficients for sources not provided from a local utility, such as cogeneration plants, and refinements for all coefficients for calendar years 2030 and beyond.

NYC Department of Buildings Occupancy Groups	
Occupancy Group	
A	Assembly
B	Business
E	Educational
I-4	Institutional
I-1	Institutional
F	Factory/Industrial
B*	Other
H	High Hazard
I-2	Institutional
I-3	Institutional
M	Mercantile
R-1	Residential
R-2	Residential
S	Storage
U	Utility/Miscellaneous

- Permitted deductions for annual building emissions limits related to purchase of renewable energy credits, greenhouse-gas offsets or implementation of clean distributed energy resources.
- Carbon trading study that could develop a marketplace for credit trading, pricing mechanisms and credit verification.

# POLITICAL OVERTONES ASIDE, THE TASK NOW RESTS WITH CONSULTING ENGINEERS, ALONG WITH OUR ARCHITECT COLLEAGUES, TO IDENTIFY ELEGANT SOLUTIONS FOR OUR CLIENTS' BUILDINGS.



## CHALLENGES AND OPPORTUNITIES

These new regulations present us with dynamic challenges and opportunities. As consulting engineers, these carbon emissions limits will redefine the way we conduct our business.

Today's commonplace retrofits have a smaller carbon impact than most realize. Retrofitting existing equipment with variable speed drives or replacing equipment with new high-performance versions of the same technology, while effective, may only decrease carbon emissions 5 to 10 percent per office building. Deeper savings requires more comprehensive projects affecting multiple systems, on a scale usually only considered for major capital and infrastructure or repositioning projects.


The biggest future change for engineers is the likely push toward "electrification". Fossil fuels consumed in buildings have a significant carbon emissions impact and will always contribute carbon to the atmosphere, regardless of how many renewable-energy sources are on the electric grid. Electricity, however, will be a moving target as utilities begin bringing renewable generation to the grid.

Consider Intro-1253: The emission factors outlined in the law for each fuel source (electric, natural gas, fuel oil and steam) show electric as the highest emitter per Btu. Simply put, the outdated and crude sources of electric heat (electric resistance heating) are not a carbon improvement. However, more efficient electric heat-pump heating technology is a carbon improvement. Specifically, by their very nature, all fossil-fuel heating sources have an efficiency, or COP, of less than 1 when used to heat a building; heat-pump technologies have wide-ranging heating efficiencies, varying from as low as 1.75 to greater than 5, dependent on operating

conditions. When considering the efficiency and emissions from each of these options, the electric heat-pump source is less carbon intensive at any COP greater than 1.6.

When evaluating electric options, it's also important to consider current and potential utility rates and emissions contributions. In cities, such as Boston and New York, where building owners need to make tough choices, moving forward with an all-electric building may be significantly more costly until utilities see enough critical mass to enhance their grids and revise pricing structures (buying gas is still generally less expensive). The answer might be designing with "electric-ready" strategies that may be converted when the electric grid becomes significantly decarbonized and rates become favorable.

Often, the biggest road block to efficient electric heating in existing buildings is the ability of the present heating infrastructure to accommodate new heating technologies. Recently, there has been a discussion about making infrastructure upgrades from older steam distribution systems, or high temperature hot water, to lower temperature hot-water systems capable of using heat from heat-pump technologies in the coldest climates. Doing this cost-effectively in an existing building, however, would be challenging.

While New York's new measure represents one of the boldest and game-changing impacts to the retrofitting market, it is emblematic of a larger national dialogue about urban sustainability. From Los Angeles to Boston to Washington, D.C., and beyond, local officials and municipalities are taking steps to tackle emissions through various measures, including stricter laws, revamped transit and the use of new technologies, transforming the urban landscape as we've come to know it. 

## Energy-consumption App

Although building owners and facility managers can proactively embrace and adapt to New York City's new 80x50 regulations, it's imperative to recognize what's out of their control. Buildings generally use energy because people use energy. To maintain comfortable working or living conditions, in commercial and residential markets, occupants will have to become key to realizing savings.

Behavioral changes and tools that help bridge communication about energy consumption in real time are critical. Platforms that present energy consumption transparently to all building stakeholders are a must. New York-based AKF Engineering has developed a one-of-a-kind app, which calculates emissions output for existing New York City buildings based on energy bills, predicting the potential carbon fines facing building owners. Use the app at [akf-energyshift-calculator.herokuapp.com](https://akf-energyshift-calculator.herokuapp.com).





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# MACRO ↓ TO MICRO

MICROGRIDS HAVE EMERGED AS A VIABLE OPTION TO THE TRADITIONAL UTILITY GRID AS A SOURCE OF CLEAN, RELIABLE AND RESILIENT ENERGY.

WRITTEN BY | ROBERT NIEMINEN



THE UNIVERSITY OF TEXAS AT AUSTIN IS THE FIRST PEER-CERTIFIED CAMPUS IN THE WORLD (SEE PAGE 73) AND SAVES MILLIONS OF DOLLARS EACH YEAR AS A RESULT OF ITS CERTIFICATION AND USE OF A MICROGRID TO GENERATE POWER ONSITE.



In a 2016 episode of NPR's "Fresh Air", Gretchen Bakke, author of *The Grid*, characterized America's electrical infrastructure as increasingly unstable, underfunded and incapable of taking us into a new energy future. As the need to reduce electricity costs and CO<sub>2</sub> emissions increases along with improving the resilience and reliability of electricity, microgrids have emerged as "a flexible architecture for deploying distributed energy resources that can meet the wide-ranging needs of different communities from metropolitan New York to rural India," according to ScienceDirect, a source for scientific, technical and medical research.

The National Renewable Energy Laboratory, Golden, Colo., suggests microgrids are gaining in popularity because of their adaptability and flexible expandability that make them ideal alternatives to the traditional grid—and utility companies are taking note. In fact, the Washington, D.C.-based Edison Electric Institute (EEI), which represents all U.S. investor-owned electric companies, reports electric companies are active partners in microgrid deployment and are involved in 42 percent of the proj-

ects in the U.S., almost quadrupling since 2014. Additionally, the total installed U.S. microgrid capacity has almost tripled in the past five years, according to EEI.

Although the concept of microgrids isn't new (the military has been using them in forward positions for years), their implementation in commercial building applications is starting to gain traction. However, these are not simple plug-and-play solutions, and they aren't for everyone. Microgrids require significant resources to build and operate, and the payback timeframe is lengthy. But for those with larger real-estate portfolios with co-located buildings that demand clean, reliable and resilient energy sources, this is a trend worth watching—and here's why:

### Drivers: Why Microgrids?

The market is ripe for change as it relates to electric consumption. From technological innovation, economic factors and environmental concerns, large-scale building projects today are well-positioned to make the switch from relying solely on the traditional grid to localized sources of power, like microgrids.

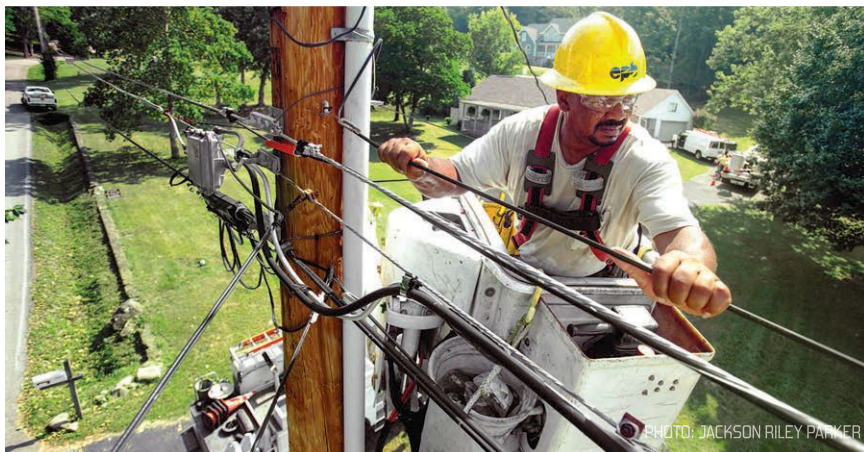
"With today's demand for electricity, coupled with new technologies and innovation, we need a marketplace for buying power with more options," says Ishaq Sulthan, technical manager for Washington-based GBCI, which oversees PEER, a program that certifies power systems (learn more in "PEER: Certifying the Grid", page 73). "Electricity is no longer flowing in one direction. It's sort of going in both directions now, and buildings can be designed to generate their electricity and also to store it so when they have excess power, they can feed it back to the grid. Buildings are getting smarter."

Rodney Oathout, P.E., CEM, global energy services leader and principal of architecture and engineering firm DLR Group, Overland Park, Kan., identifies energy resiliency, economic and environmental concerns as being the top three drivers for the trend toward microgrids. "There are certainly countries throughout the world where the grid is not stable, and microgrids are finding applications in those areas," he explains, adding there are remote places in the U.S., such as Hawaii and Alaska, where the same holds true.



PHOTOS: UNIVERSITY OF TEXAS AT AUSTIN unless otherwise noted

UT AUSTIN CONTINUOUSLY HAS REINVESTED BACK INTO ITS MICROGRID SYSTEM, USING MONEY FROM ENERGY SAVINGS AND REDUCED FUEL COSTS TO PAY FOR NEARLY \$150 MILLION IN ENERGY-EFFICIENCY AND CAPACITY UPGRADES. TODAY, UT AUSTIN'S ISLANDING CAPABILITIES CAN KEEP THE CAMPUS' LIGHTS ON IF THE SURROUNDING AREA WERE TO EXPERIENCE A WIDESPREAD OUTAGE.



IN 2015, ELECTRIC POWER BOARD BECAME THE FIRST PEER-CERTIFIED MUNICIPAL UTILITY IN THE WORLD. ESTABLISHED AS AN INDEPENDENT BOARD OF THE CITY OF CHATTANOOGA, TENN., IN 1935, EPB SERVES 177,000 HOMES AND BUSINESSES ACROSS GREATER CHATTANOOGA AND PARTS OF NORTH GEORGIA.

Of course, energy prices are a major factor, as well, he says. “The cost of natural gas, for instance, that drives a lot of the onsite power production is drastically cheaper than the cost of electricity you could buy off the grid. The economics of that equation are driving the development of microgrids,” Oathout observes.

The need for more localized energy storage and growing renewable content in the energy mix are additional drivers of the trend, according to Gideon Susman, LEED AP BD+C, associate at BuroHappold Engineering, Los Angeles. “I think we’re starting to see incentivization of energy-storage installations on a local level, which would support a microgrid. Community choice aggregation may have played a part, as certainly resilience plays a part, as well,” he adds.

## Anatomy of a Microgrid

By way of definition, the Washington-based U.S. Department of Energy defines a microgrid as “a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that act as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island mode.”

Basically, a microgrid allows a building owner to choose from a suite of energy sources most often co-located onsite with the option to draw from the utility grid. For example, fuel cells, diesel generators, microturbines, photovoltaics (PV), storage systems (batteries) and fossil fuel-based products might be part of a central generating plant to provide energy to a series of nearby buildings (see the illustration below).

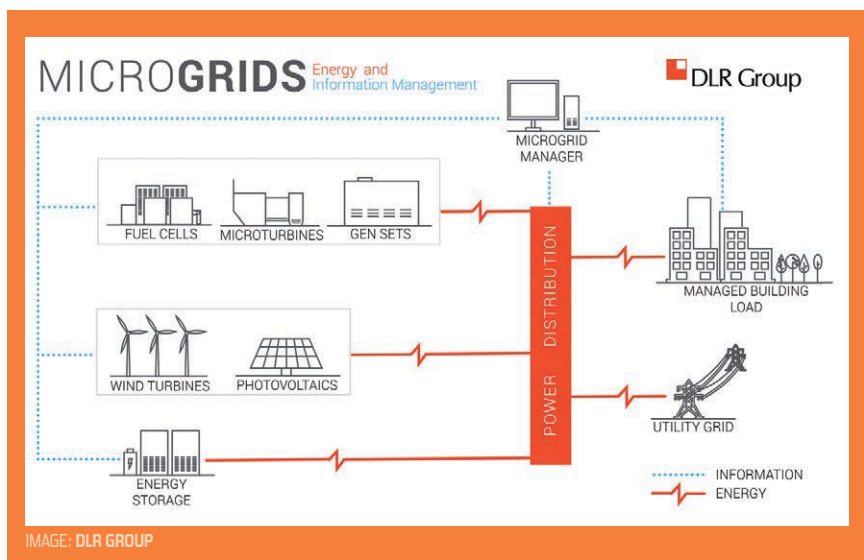
At the heart of the microgrid is a control system that allows building owners to manage these various sources of electricity, Oathout says. “Part of the conversation is the ability to control your energy load, so the control system is not only managing these power-generating resources, but it’s also managing the power-using resources.” He notes if the microgrid isn’t large enough to supply all the power to a campus, it can still borrow power from the utility grid as needed.

Susman says in areas like southern California, PV arrays and storage systems are an obvious choice for setting up a microgrid. “You’d be generating power; you’d be storing it when you don’t need to use it; you’d be releasing that stored power when you do need to use it; and everything would be managed within that microgrid. It functions as a miniature grid that can be completely disconnected from the main grid,” Susman explains.

## Operation and Management

If owning and operating a miniature power station sounds daunting, that’s because it is if you’re not in the utility business. As such, most microgrids being developed today are handled by private entities, according to Oathout. “Very few building owners have the experience and wherewithal to construct and operate all this stuff.”

With the exception of sophisticated facilities, like hospitals, airports or universities with operations staff that deal in energy management, most facility executives are focused on their areas of expertise and looking to outside sources to supply alternative energy solutions.



A MICROGRID, SOMETIMES REFERRED TO AS A DISTRIBUTED RESOURCE, IS A LOCAL ENERGY GRID WITH CONTROL CAPABILITY, WHICH MEANS IT CAN DISCONNECT FROM THE TRADITIONAL GRID AND OPERATE AUTONOMOUSLY USING VARIOUS ENERGY SOURCES.



“Generally, these things are owned by independent power producers that own the asset and then sell the power back to the user through some sort of power purchase agreement,” Oathout explains. “I suggest that’s probably the most common application for this right now.”

Susman says a microgrid in the truest sense of the word is owned and managed by staff on-site. Involvement by third parties, he says, moves into the community aggregate microgrid category. “But the important point is that it’s not [just] the utility anymore—the utility has been taken out of the equation,” in that the microgrid becomes the primary source for choosing how to distribute energy to a portfolio of buildings, rather than the other way around.

## Benefits of Going Micro

Regardless of who owns and manages the microgrid, the benefits microgrids offer are many. From greater flexibility and choice, reduced emissions, improved reliability and energy savings, it’s easy to see why microgrids are emerging as a viable alternative to the traditional grid.

■ **FLEXIBILITY.** Because microgrids have both power generation and storage capacities, they can continue to supply power to buildings in the event of grid failure caused by brown-outs or natural disasters, Oathout says. He adds, “Microgrids are flexible enough that they might have different technologies plug into them

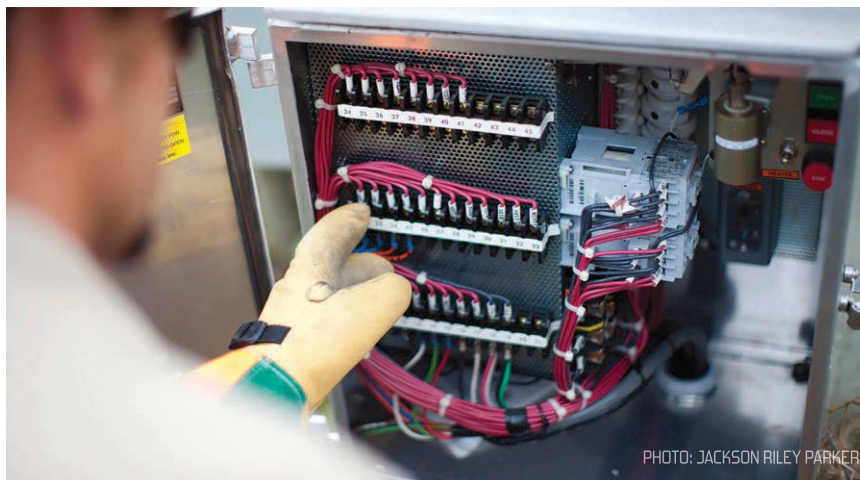


PHOTO: JACKSON RILEY PARKER

based on the type of building, the size of the building and availability of fuels,” which offers resiliency, or the ability to control the fuel sources you’re using at any given time.

■ **CLEAN AND RELIABLE.** Switching to microgrids that utilize renewable-energy sources, gives building owners “an opportunity to significantly mitigate their contribution to climate change and value technologies and strategies that can enable responsible citizenship,” according to Sulthan.

■ **ENERGY SAVINGS.** “By having storage onsite, you might be able to reduce your peak load, so if you’re grid connected, you could essentially level out the load that the grid sees

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**Certifying  
the Grid**

In an effort to drive market transformation in the power and energy sectors, the Washington, D.C.-based U.S. Green Building Council along with GBCI, Washington, and the Perfect Power Institute, New York and other locations worldwide, launched PEER (Performance Excellence in Electricity Renewal) in 2013. Through certification, PEER recognizes industry leaders for improving efficiency, day-to-day reliability and overall resiliency

when it comes to severe events, such as flooding and hurricanes. PEER is for all power systems and includes guidance for cities, utilities, campuses and transit.

“PEER was developed through a consensus-driven process very similar to LEED through several years of research, and it is the first rating system in the world that measures and improves power system performance and electricity infrastructure,” says Mili Majumdar, managing director, GBCI. “The standard looks at issues, such as reliability and resiliency of power systems, energy efficiency, environmental issues, population management, as well as operational effectiveness.”

In the same way the LEED rating system provided a framework for sustainable building design

and construction, Ishaq Sulthan, technical manager for GBCI, says PEER seeks to do the same in the power and energy market. “We believe the power and electricity sector are currently at the similar tipping point as the building industry was 20 years ago and is in need of a tool that defines a common framework for accountability and transparency in modernization and smarter development,” he says. “Our aspiration is to realize wide-scale adoption of PEER, which will facilitate the construction of a modern, clean and resilient grid system. By doing this, we can reduce global emissions, make the world community more resilient, improve safety and security, and create thousands of new green jobs.”

Although still in its relative infancy, PEER is already making

an impact around the world, as indicated by these recent statistics from GBCI:

- PEER projects help in providing reliable and quality power to 55 million people across the globe.
- PEER-certified projects have reduced carbon emissions by 20 million metric tons of CO<sub>2</sub> equivalent per annum.
- PEER-certified projects have generated savings of \$31 million to consumers and business through demand-side management, renewable-energy purchases and energy-efficiency improvements.

For more information or to view case studies, go to [peer.gbci.org](http://peer.gbci.org). Read *retrofit*’s article about PEER in the November-December 2018 issue, page 20, or [bit.ly/2E50wYf](http://bit.ly/2E50wYf).

and you might avoid any demand charges. You could really radically reduce that," Susman says.

Additionally, Oathout notes up to 30 percent of energy is lost in the transfer between a central utility plant and the facilities it serves. "The losses associated with transformers and distribution of electric power primarily suggest that if I can generate that same amount of energy locally versus buying it off the grid where it's generated, maybe hundreds of miles from my location, I can use much fewer natural resources and create a much smaller carbon footprint by omitting those losses during transmission," he explains. "If you understand losses associated with transmitting power across the country and just try and minimize the losses, it's the most economical energy-conservation project you can think of."

### Considerations for Owners

It's important to note onsite microgrids aren't for everyone. Because of their costs and complexity, they work best where multiple buildings are clustered together, such as hospitals, airports and college campuses.


In those applications, a microgrid can be an ideal solution. For example, Susman says the University of California San Diego switched to a microgrid to give it the ability to generate its own power through a cogeneration plant that supplies about 85 percent of the power to the sprawling campus. "They also buy a little bit from the grid, but that microgrid really gives them a kind of resilience against grid failure," he says.

Oathout agrees and suggests most standalone buildings aren't large enough to align with the power generation capacities for most of the equipment used in microgrids. Additionally, he says the cost to acquire and maintain the equipment can be a barrier. "These are 25- to 30-year projects that you're going to build and operate and maintain because most of the equipment that's part of these microgrids has a life cycle at that length," he explains. "The payback on any of these things is not five years; it's much further out than that."

Susman and Oathout note existing buildings should already be optimized for energy efficiencies before considering switching to a microgrid. "All of the things you would consider in terms of a

retrofit that would bring you savings, that becomes extremely relevant when it comes to the microgrid," Susman says. Everything from applying solar film and insulation to more efficient HVAC systems should be addressed prior to making the switch.

"From a technical point of view, if you're going to retrofit some sort of microgrid into an existing building, there's likely going to be all sorts of electrical infrastructure modifications required to plug in all these different power sources," Oathout says. "That's pretty obvious."

At the end of the day, facility executives need to consider their building portfolios and their priorities to determine if a microgrid is worth the effort and expense. "If you're very concerned about reliability and resilience in your energy supply, then a microgrid is an obvious solution, and all the costs that go into that upfront investment are easier to justify," Susman says. "If you've got a small number of buildings, you don't have particularly critical operations and you're OK relying on the grid, it might not be the right solution for you because you might not realize the benefits." 

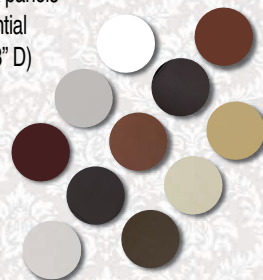
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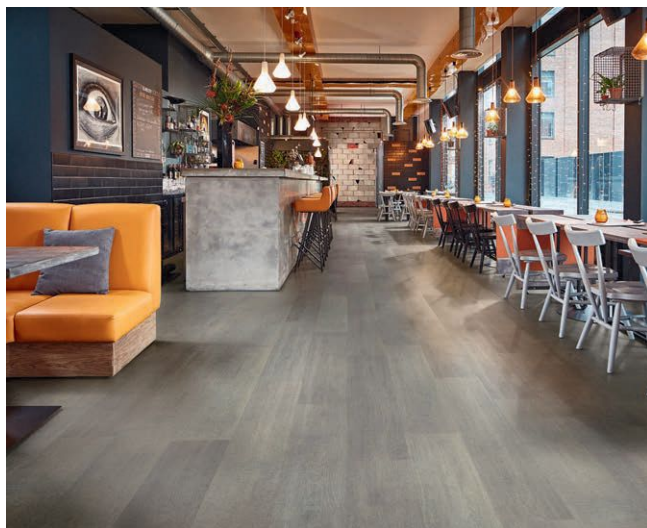
## ➔ ACOUSTICAL CEILING LOOKS LIKE TRADITIONAL DRYWALL

Armstrong Ceiling Solutions has introduced ACOUSTIBuilt Seamless Acoustical Ceilings, a ceiling system that provides the look of drywall but performs like an acoustical ceiling. Finished ACOUSTIBuilt panels offer a smooth, non-directional, monolithic visual and achieve a Noise Reduction Coefficient of up to 0.70, indicating they absorb up to 70 percent of the sound that strikes them. The system also has a Ceiling Attenuation Class up to 48, indicating its ability to ensure speech privacy by preventing sound from entering adjacent spaces. ACOUSTIBuilt ceiling systems, which can be installed similarly to traditional drywall ceilings, are part of the Armstrong Ceilings Sustain portfolio, which meet LEED v4, Living Building Challenge and the WELL Building Standard.

[armstrongceilings.com/acoustibuilt](http://armstrongceilings.com/acoustibuilt) // Circle No. 28



View a short video demonstrating the benefits of ACOUSTIBuilt.



## ⬆ LUXURY VINYL REPLICATES RARE WOODS

Karndeian Designflooring has expanded its click-locking rigid core Korlok Select to include new visuals and a 24- by 6-inch herringbone plank. Replicated from rare and treasured American and European woods, the luxury vinyl is available in Hawaiian Koa, resembling a species of acacia that can no longer be harvested; three American Barnwood options in two sizes, allowing end users to have color continuity from room to room with different lay patterns in each space; English Oak, inspired by weathered stonework; Brushed Oak that offers an embossed texture; Baltic Oak, which appears as a mixing of wood grades; and European Oak that is reflective of the machine brushing and rapid dehydration that occurs within sawn boards. Korlok Select's waterproof, proprietary K-Core technology allows for installation over most existing hard floors and uneven subfloors. Korlok Select's pre-attached acoustic foam backing helps to reduce noise transfer to rooms below by 22dB.

[www.karndeian.com/korlokselect2019](http://www.karndeian.com/korlokselect2019) // Circle No. 30

## ➔ COVER BOARD IS SOURCED FROM WASTE STREAMS

Carlisle SynTec Systems has introduced EcoStorm VSH Cover Board, an engineered composite building material made from a proprietary blend of plastic and cellulose fiber, sourced from postindustrial and post-consumer waste streams. EcoStorm VSH offers moisture and mold resistance, compressive strength of 3,990 psi, a coated glass facer on the top surface of the board and impact resilience.

[www.carlisle syntec.com](http://www.carlisle syntec.com)  
// Circle No. 29



## ⬇ KEEP WORKERS SAFE WITH EMERGENCY ALERTS SERVICE

Zello, a push-to-talk voice messaging service that enables communication and collaboration for workers, teams and communities, has

launched its Emergency Alerts. ZelloWork users in crisis situations now can press a button to send (with high priority) their location and an audio recording to a designated emergency channel. Doing so immediately shares the nature and details of the emergency to all necessary parties who then can respond accordingly. Emergency Alerts is suitable for businesses with lone workers, remote workers and/or field workers. Through mass communication and geolocation sharing, employees can quickly respond to and resolve crises and emergencies.

[zello.com](http://zello.com) // Circle No. 31





## ↓ PORCELAIN RESEMBLES NATURAL MARBLE

Ege Seramik has introduced NORWAY, a glazed porcelain collection defined by its look of natural marble. These 24- by 48-inch and 24- by 24-inch fully polished floor tiles can be partnered with complementing 12- by 24-inch wall tile/field tile along with Oslo and Tropicana deco tiles featuring a 3-D mosaic effect. NORWAY is a hard-wearing porcelain tile, digitally printed via Ege Seramik's inkjet technology, offering high-performance and low maintenance for residential and medium-traffic commercial applications.

[www.egeseramik.com](http://www.egeseramik.com) // Circle No. 32



## ↑ PANELS RESIST DAMAGE IN HIGH-TRAFFIC AREAS

EXTECH/Exterior Technologies Inc. offers its CLEAN-WALL porcelain wall panel system for safety, durability and easy cleaning in transportation centers, pedestrian walkways, parking structures, restrooms and high-traffic publicly accessible applications. The system resists graffiti, vandalism, scratching, chipping, gouging and environmental damage. Its smooth finish, rounded corners, enclosed edges and concealed fasteners provide for no-hassle maintenance. The panels' noncorrosive, heavy-gauge aluminum framing allows for quick installation and individual panel replacement. CLEANWALL's flexible design accommodates variable panel sizes, signs, lighting and other fixtures and devices. EXTECH provides CLEANWALL in fully prefabricated sections ready-to-install over a wide variety of substrates and adaptable to uneven substrates and varying field conditions.

[extechinc.com](http://extechinc.com) // Circle No. 33



## ← TURN ANY SMARTPHONE INTO A MAGNETIC FIELD DETECTOR

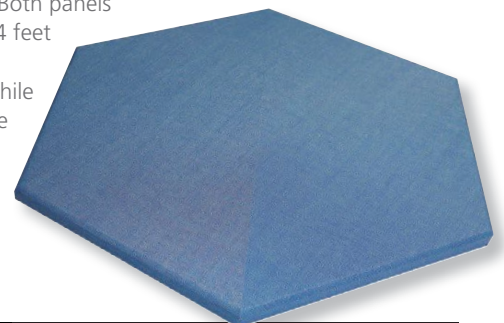
Danfoss' Magnetic Tool app harnesses the power of Android and iOS hardware to turn any smartphone into a precise magnetic field detector. The app serves as an alternative to the variety of tools HVACR technicians rely on to ensure solenoid valves function properly. The app provides detailed information about the magnetic field of the AC or DC coil in a solenoid valve and can indicate the rotation direction of certain types of pumps. Additionally, the Magnetic Tool app documents the repair and installation process for users by taking a photo of the faulty component and sharing it with the system's owner. The Magnetic Tool app is available in the iTunes App Store and Google Play store.

[www.danfoss.com](http://www.danfoss.com) // Circle No. 34

## → ACOUSTIC PANELS COME IN GEOMETRIC SHAPES

G&S Acoustics has created GeoDesign (GD) and GeoDesign Ridge (GDR) acoustical wall panels. Both panels are cut to standard geometric shapes—hexagon, trapezoid, rhombus and polygon—up to 4 by 4 feet across. They also can be cut to a custom shape that fits a specific design. The geometric pieces will fit together to create mosaic patterns across a wall. GD panels are flat and 1-inch thick while the GDR panels have a 1 7/8-inch raised ridge down the center, creating a 3-D surface. The ridge descends to level out at 1 inch at the edges, allowing the GD and GDR panels to be installed contiguously on a wall. The panels' fiberglass core offers an NRC sound absorption range of 0.55 to 0.85, based on standard acoustically transparent fabric. GD and GDR panels can be covered in a fabric of the client's choice in a variety of colors and edge treatments.

[www.gsacoustics.com](http://www.gsacoustics.com) // Circle No. 35





Black Theater Board

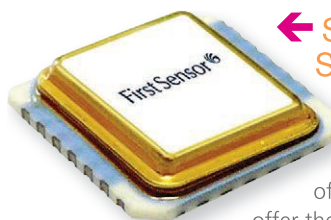
## ← IMPROVE ACOUSTICS WITH BOARD PRODUCTS

Sound Seal has debuted Sound Quality Polyester Acoustical Board (PAB) and Theater Board. PAB offers flexibility in acoustical applications and installations, working as a sound-absorption product for wall ceiling and duct applications. It is an environmentally friendly, polyester acoustical panel developed for building interiors and exteriors. The product works well for retrofit or new construction applications. Theater Board is a sound-absorptive board that provides acoustic performance by reducing reverberation. Theater Board tiles are made from lightweight, black-dyed acoustic fiberglass board and finished with a matte-black fiberglass fabric. Theater Board is an affordable solution to building acoustic ceilings in any residential or commercial space where reverberation or reflected noise is an issue.

[www.soundseal.com](http://www.soundseal.com) // Circle No. 36



Learn more about these acoustical boards in a short video.



## ← SENSORS UNCOVER STRUCTURAL RISKS

First Sensor has launched high-accuracy capacitive silicon inertial sensors aimed at applications in the fast-growing market of smart structural monitoring. The sensors offer the resolution and low-noise density required for recording vibrations or changes of inclination in wind turbines, bridges and high-rise buildings, thereby uncovering risks in the structure or material at an early stage. Integrated in smart solutions, these cost-effective sensors ensure the safety of structures in everyday operation and following storms, earthquakes, large loads or changes in the foundations. The sensors for measuring tilt, acceleration and vibration consist of a silicon sensor element made in accordance with a patented micromechanical process (HARMS, AIM) in conjunction with a signal-processing ASIC in a hermetically sealed SMD housing.

[www.first-sensor.us](http://www.first-sensor.us) // Circle No. 37

## ↓ EMERGENCY BALLAST OPERATES 4-PIN LEDs AFTER POWER LOSS

The new I-4PT-A Emergency Ballast is IOTA's first emergency ballast specifically tailored to operate 4-pin LED retrofit lamp designs. The I-4PT-A works in conjunction with the existing AC ballast technology to operate select 4-pin compact LED lamps for 90 minutes during a loss of normal power. The I-4PT-A is UL Listed as an emergency solution for a wide assortment of popular manufacturer LED lamp designs. The minimal dual-flex design makes the product IOTA's smallest California Title 20-certified solution for LED retrofit applications.

[www.iotaengineering.com](http://www.iotaengineering.com) // Circle No. 38



## ← HEAT PUMPS PROVIDE COMFORT IN EXTREME TEMPERATURES

Mitsubishi Electric Trane HVAC US has expanded the S-Series (PUMY) air-source heat pump outdoor unit to include Hyper-Heating INVERTER (H2i) technology in select models. Part of the CITY MULTI family of products, the PUMY is a single-phase heat pump suitable for light commercial or large residential applications. The addition of H2i technology, now available in PUMY P36 (3-ton) and P48 (4-ton) models, allows the units to provide year-round comfort in cold climates and extreme temperatures. Hyper-heating units offer up to 100 percent of rated heating capacity at 5 F and perform at 78 percent of rated capacity in temperatures as low as -13 F. Other enhancements include INVERTER-driven compressors that optimize energy usage for the space. Additionally, PUMY systems use the CITY MULTI Controls Network (CMCN) and can heat or cool up to 12 individual zones with many options for indoor unit sizes and styles.

[www.metahvac.com](http://www.metahvac.com) // Circle No. 39







## ← HEAT PUMP FITS IN TIGHT SPACES

The YORK brand of Johnson Controls has released the 16 SEER, 13 EER and 9.0 HSPF YHG heat pump to its LX series of residential heating and air-conditioning systems. Matched with high-efficiency standard ECM and constant CFM air handlers and furnaces, the YHG provides a single-stage comfort system that provides low power consumption and quiet operation. The compact

footprint allows the unit to fit in tight spaces without limiting performance, capacity or efficiency. YHG is compatible with conventional

thermostats offering greater flexibility to connect with existing equipment, or the system can be installed with the Alexa-compatible, Wi-Fi-enabled Affinity Hx3 touchscreen smart thermostat.

[www.york.com](http://www.york.com) // Circle No. 40



PHOTO: © CASEY DUNN PHOTOGRAPHY

## ↑ HUMAN-CENTRIC LIGHTING COMBINES FOUR ELEMENTS OF LIGHTING DESIGN

Lutron Electronics has created a holistic approach to human-centric lighting, Lutron HXL. The approach combines four elements of lighting design: Quality Light, Natural Light, Connection to the Outdoors, and Adaptive and Personalized Control. The approach recognizes the importance of biophilia, a human connection to nature; incorporates the Internet of Things with smart technology; and allows people to manage their environment with a variety of personalized control. The HXL approach also supports sustainability by helping reduce energy costs and embracing elements of the natural world, as well as contributes to design supporting WELL and LEED standards.

[lutron.com/HXL](http://lutron.com/HXL) // Circle No. 42



## ↑ HVLS FANS INTEGRATE WITH BUILDING MANAGEMENT SYSTEMS

Greenheck has added two models to its line of high-volume low-speed (HVLS) fans. Model DS-3, a three-blade HVLS fan for large commercial and industrial spaces, offers capacities up to 164,900 cfm and is available in 14- to 24-foot sizes. Model DC-5, a five-blade HVLS fan featuring a lightweight design to complement office spaces, restaurants and more, offers capacities up to 54,900 cfm and is available in 8- to 14-foot sizes. Both models can be paired with a keypad control capable of operating up to five HVLS fans at the same speed setting with the same direction of rotation. A more advanced touchscreen control with BACnet capability is also available. The touchscreen control allows users to integrate their HVLS fans with a building management system for full control over the fans and the ability to monitor fan status, including fault histories.

[www.greenheck.com](http://www.greenheck.com) // Circle No. 41

## ↘ STOP SOUND BETWEEN FLOORS AND CEILINGS

National Gypsum has completed its PURPLE family of noise-reducing products with Gold Bond brand SoundBreak XP Ceiling Board. The product is 3/4-inch sound-damping dry-wall comprised of two pieces of high-density, mold-, mildew- and moisture-resistant gypsum board with a specially designed PURPLE paper, laminated together with a viscoelastic polymer. It installs and finishes like traditional gypsum board and achieves GREENGUARD Gold Certification for indoor air quality. It was developed for floor-ceiling assemblies where airborne sound, such as disturbing voices, and structurally transmitted sound, such as second-floor foot traffic, are a concern.

[purpleproducts.info](http://purpleproducts.info) // Circle No. 43



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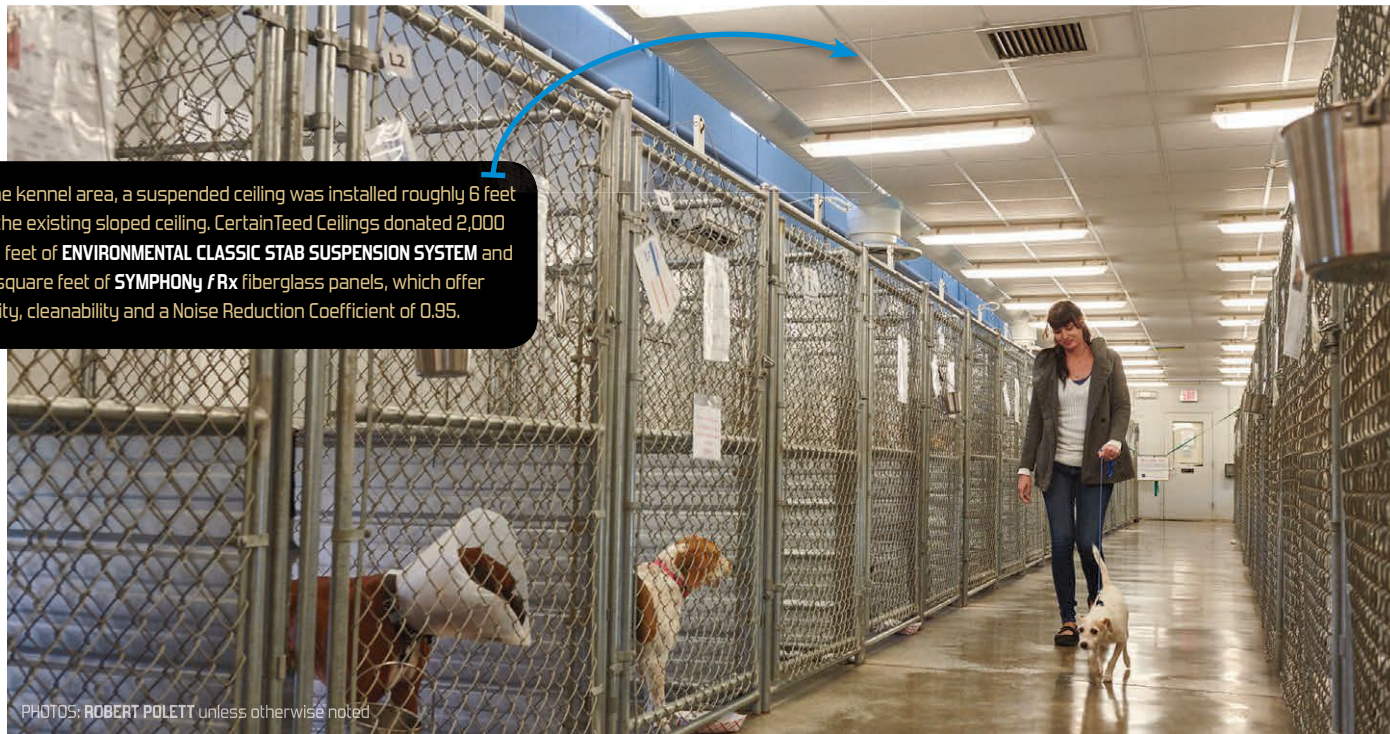
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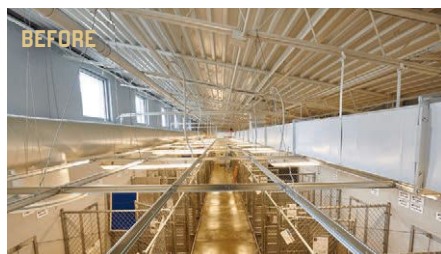
# BARK-MANIA

## Ceiling Donation Makes Dog Adoptions Acoustically Comfortable



Over the kennel area, a suspended ceiling was installed roughly 6 feet below the existing sloped ceiling. CertainTeed Ceilings donated 2,000 square feet of **ENVIRONMENTAL CLASSIC STAB SUSPENSION SYSTEM** and 2,000 square feet of **SYMPHONY / Rx** fiberglass panels, which offer durability, cleanability and a Noise Reduction Coefficient of 0.95.

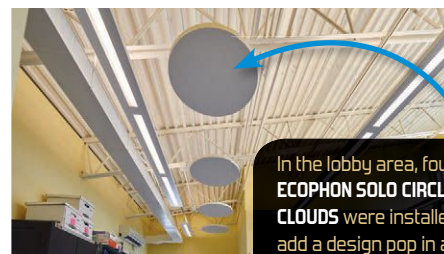
PHOTOS: ROBERT POLETT unless otherwise noted



BEFORE



PHOTO: ANGELA FISHER, COURTESY CERTAINTEED CEILINGS



In the lobby area, four **ECOPHON SOLO CIRCLE CLOUDS** were installed to add a design pop in an otherwise utilitarian space. The clouds' double-sided sound absorption captures a small amount of conversational noise.

**T**he Pennsylvania SPCA Lancaster Center is a no-kill animal shelter in downtown Lancaster. Since opening in 2015, the center has facilitated 50 to 70 animal adoptions per month and offers low-cost veterinary services to the community.

In fall 2018, the staff made a concerted effort to address the shelter's lack of acoustic control, which had been plaguing visitors and staff since the building's opening. The process of adopting a dog was often a deafening experience for potential pet-owners, and communication between staff members was impossible whenever the dogs began to bark.

"People would come in with young children, go into the kennel, immediately come back out and the kids would be crying because it was so loud," recalls Rachel Golub, the site manager. "Some people who were


visiting us frequently in search of a new pet started bringing ear protection to cover their children's ears."

The 6,300-square-foot facility consists of a concrete floor, concrete block walls and a sloped roof of corrugated aluminum—all highly durable, easy-to-clean surfaces that stand up to the extreme demands of paws and claws. These surfaces also are excellent at reflecting sound—and when one dog begins to bark in the kennel area they all tend to join in, unleashing a cacophony of ear-splitting reverberation that ricochets around the space.

When the Malvern, Pa.-based CertainTeed Ceilings team learned about the kennel's acoustic issues, they donated ceiling product and coordinated the labor to install it. The project had two main areas for remediation: First, a suspended ceiling was

installed over the main kennel area to help control acoustics and improve occupancy comfort for visitors. Second, a series of four free-hanging design-forward clouds were hung in the lobby area to provide a more inviting first impression.

After the installation by Tiger Walls & Ceilings LLC, Steelton, Pa., the sound inside the kennel is noticeably tamer. The smaller vertical area and fiberglass surface also create a warmer ambiance in the kennel.

"The first day with the new ceiling, my staff came in and remarked on how quiet it was in comparison to the day before," Golub says. "Dogs still bark—but it doesn't echo and it doesn't come at you twice as loud like it used to." 



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