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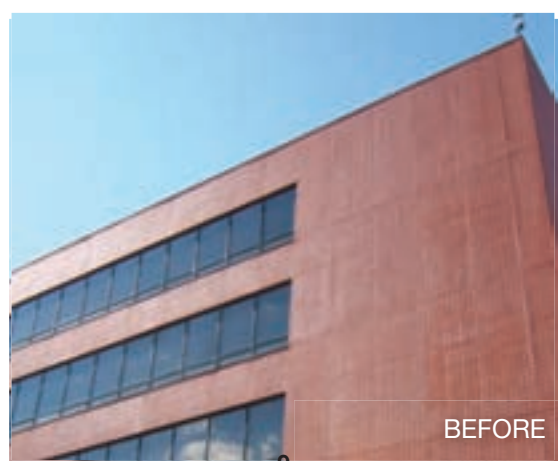
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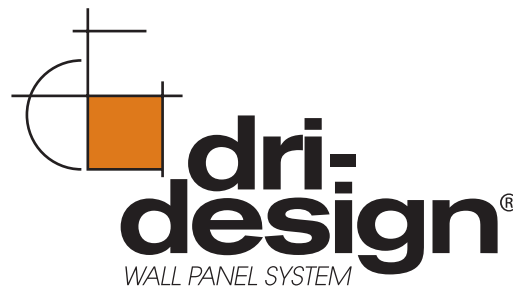
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← cover

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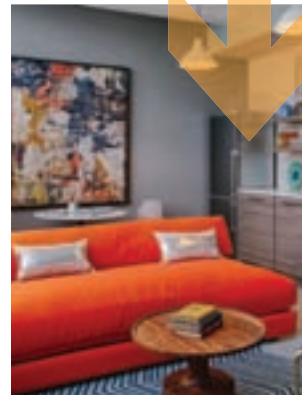
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IMPROVING BUILDINGS AT MACRO AND MICRO LEVELS

If you're a frequent airline traveler and are convinced flying has been worsening, there are numbers to prove you're right. Daytona Beach, Fla.-based Embry-Riddle Aeronautical University released a report in April about 2014 airline travel. The report found only 76.2 percent of flights arrived on time; lost, stolen or delayed luggage rose 13 percent; overbooking, which bumps passengers to another flight, increased 3 percent; and consumer complaints to the government about airlines climbed 22 percent. The report's authors, who gleaned information airlines sent to the U.S. Department of Transportation, Washington, D.C., paint a bleak picture of air travel.

However, if you've been stuck in an airport lately, you've probably noticed many terminals have evolved beyond a simple loading zone. Airport authorities around the country increasingly understand the importance of design to keep passengers comfortable, relaxed and entertained. Consider this issue's cover story about Raleigh-Durham International Airport's Terminal 1 redesign. The Airport Authority challenged the Raleigh, N.C., office of Clark Nexsen to reimagine what had been known as the "blue box" to improve the passenger experience. Jeffrey S. Lee, FAIA, architect on the project, explains on page 26 how the design team took advantage of the building's existing interior volume and created a grand daylit hall on the landside while adding new cladding and curtainwall to the airside to establish expansive views of the airfield. Lee and his colleagues thoughtfully specified durable, yet beautiful, interior materials and partnered with a Public Arts Program to showcase the works of local artists, bringing community flair to the terminal.

As you'll see in the transportation projects that follow the cover story, beginning on page 34, energy efficiency remains a major endeavor of all transportation-building types. Consequently, more building owners and facility managers are seeking ways in which to monitor and control their buildings more easily. In "Trend Alert", page 82, Robert Nieminen, *retrofit's* contributing editor, spoke to several industry experts from the InsideIQ Building Automation Alliance, an international association of independent building-automation contractors, to learn what the future holds for wireless and mobile building-automation controls. Apps and software for advanced Building Automation Systems follow on page 90.

The city of Burlington, Vt.—population approximately 42,000—is thinking beyond individual buildings and taking steps to become one of the most energy-efficient and -conscious cities in America. In September 2014, city representatives announced Burlington was sourcing 100 percent of its energy needs from renewable power, including hydro, solar, wind and biomass. For "Energy", page 56, I interviewed Neale F. Lunderville, Burlington Electric Department's general manager, about the city's 10-year effort to achieve this goal, its advanced distribution network and its lofty plans for the future.

To reduce exorbitant energy consumption by buildings, 13 cities, two states and one county have mandated energy reporting and disclosure, also known as benchmarking. However, according to *retrofit* Editorial Advisory Board Member Nathan Gillette, AIA, LEED AP O+M, CEM, challenges with tools and reporting consistency have been uncovered. Gillette explains how these challenges should be looked upon as opportunities to provide better benchmarking tools and training in his "Business" article, page 20.





Whether you're improving buildings on a large or small scale, this issue should provide plenty of inspiration. And if you're traveling to the buildings you plan to retrofit, I hope you're at least able to experience a comfortable and beautiful terminal, like RDU Terminal 1.

CHRISTINA KOCH
Editor in Chief

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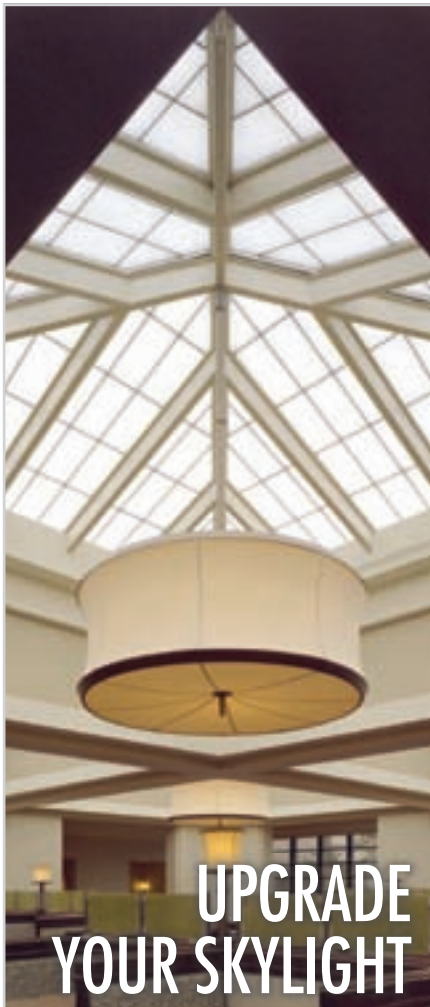
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Thirteen cities, one county and two states have taken a stand against exorbitant energy use by mandating building owners and facility managers track and disclose usage. But challenges with tools and inconsistencies in reporting have emerged. **Nathan M. Gillette**, AIA, LEED AP O+M, CEM, director of Natura Architectural Consulting, Grand Rapids, Mich., and a **retrofit** editorial advisor, explains in "Business," page 20, that these growing pains will lead to more energy-efficient buildings of the future.



Jeffrey S. Lee, FAIA, is a nationally recognized architect and design advocate whose work has been honored with more than 50 AIA design awards. Based in Washington, D.C., Lee is a principal and design director of architecture and engineering firm Clark Nexsen. In our cover story, page 26, he writes about the firm's recent renovation of Terminal 1 at Raleigh-Durham International Airport, which not only connects passengers to the world, but through its design also connects them to the local community.



PHOTO: LASZLO BODO, COURTESY WINTERTHUR MUSEUM

Lois Olcott Price is the Charles F. Hummel Director of Conservation at the Winterthur Museum, Garden & Library, Wilmington, Del., where she pursues issues related to sustainable preservation environments and more. In "Energy", page 61, Price outlines how Winterthur achieved a 20 percent energy reduction while maintaining the delicate environment necessary for its expansive collection.



PHOTO: LASZLO BODO, COURTESY WINTERTHUR MUSEUM

John W. Castle, P.E., is director of facilities at the Winterthur Museum, Garden & Library, Wilmington, Del. Under his leadership, Winterthur implemented 33 facilities improvement measures that helped it achieve the Corporate Energy Manager of the Year Award from the Greater Philadelphia Chapter of the Association of Energy Engineers. Read about the measures' results in "Energy", page 61.



Don Eberly is president and chief operating officer of Atlanta-based Eberly & Collard Public Relations, which specializes in the architecture, engineering, interior design, and residential/commercial product manufacturing industries. In "Residential", page 66, Eberly writes about design firm Stevens & Wilkinson's transformation of a former Sears building into the live-work-eat-shop-play destination in Atlanta known as Ponce City Market.



KJ Fields, who writes about design, sustainability and health from Portland, Ore., tackles the renovation of a 1903 firehouse pumping station into a restaurant and plaza on Philadelphia's Delaware River waterfront in "Transformation", page 72. The design archived and repurposed many of the existing industrial materials to create a gritty French bistro.

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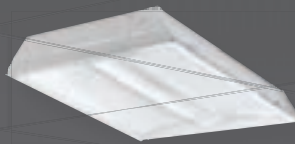


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Energy Efficiency Improvement Act of 2015 Passes Senate



Bipartisan energy-efficiency legislation authored by U.S. Senators Jeanne Shaheen (D-N.H.) and Rob Portman (R-Ohio) has passed the U.S. Senate. The Energy Efficiency Improvement Act of 2015 contains key energy-efficiency provisions that will strengthen the economy and reduce pollution. ¶ The provisions that passed come from H.R. 2126, which passed the U.S. House of Representatives with overwhelming support last Congress. ¶ “Energy efficiency has received such strong bipartisan support because it’s the cheapest and fastest way to address our nation’s energy challenges,” Shaheen says. “We passed a bill that will create jobs; save consumers money; and reduce pollution in a smart, effective and affordable way. Energy efficiency holds enormous potential for America’s energy future and the Senate has taken an important step toward realizing that future.” ¶ “This bill has garnered such widespread support because of a simple fact—it is good for the economy and good for the environment. It’s part of an energy plan for America that can help bring the jobs back, help fix our trade deficit, help make our manufacturers more competitive and actually help to protect the environment,” Portman adds. “I’m pleased that these key portions of our energy-efficiency bill passed the Senate.” ¶ The Energy Efficiency Improvement Act of 2015 includes four simple but effective provisions that have been scored by the Congressional Budget Office to be budget neutral. Title I establishes a voluntary, market-driven approach to aligning the interests of commercial building owners and their tenants to reduce energy consumption. Title II exempts certain electric-resistance water heaters used for demand response from pending Washington, D.C.-based U.S. Department of Energy regulation. Title III requires federal agencies to coordinate with the Office of Management and Budget, DOE and the U.S. Environmental Protection Agency, Washington, to develop an implementation strategy that includes best practices, measurement and verification techniques for the maintenance, purchase, and use of energy-efficient and energy saving information technologies. Title IV requires that federally leased buildings without ENERGY STAR labels benchmark and disclose their energy-usage data where practical. ¶ To learn more about the Energy Efficiency Improvement Act of 2015, visit www.govtrack.us/congress/bills/114/s535/text.

SOLAR BEST PRACTICES GUIDELINES SEEK TO INCREASE INVESTOR CONFIDENCE

The Solar Access to Public Capital (SAPC) working group has released new best practices guidelines for solar photovoltaic systems with the goal of increasing investor confidence in the long-term viability of PV systems. The guides—SAPC Best Practices in PV System Installation and SAPC Best Practices in PV Operations and Maintenance—were developed by SAPC subcommittees, each involving dozens of solar and finance entities.

The SAPC working group, convened by the U.S. Department of Energy’s National Renewable Energy Laboratory, Golden, Colo., is comprised of 425 members of the PV market chain, including development; legal; financial; accounting; engineering; and other communities engaged in solar asset deployment, finance and operation.

“The best practices may provide valuable uniformity in the way solar assets are developed. In turn, investors can be confident that solar-

energy systems are deployed and maintained with consistency and in a manner that protects long-term system production and asset cash flows,” says NREL Project Technical Lead Michael Mendelsohn. “As investors become more familiar with and confident in the industry-developed SAPC protocols, the hope is that due diligence costs, project-review time and the required yield to raise capital will all decrease.”

According to Christopher Doyle of San Francisco-based Dividend Solar and the Institute for Building Technology and Safety, Ashburn, Va., which led the SAPC installation best practices subcommittee, “The creation of these guides tells a great story of collaboration between the solar industry, capital providers, and rating agencies to ensure the quality of solar PV systems and ultimately the long-term health of the market.”

The guides include recommended contractor and provider qualifications,

key performance indicators, links to external resources and additional best practices. Additional SAPC activities include standardization of solar contract templates, development of performance datasets and engaging rating agencies via a mock securitization process to comprehend their risk perspectives of the asset class.

This work is supported by DOE’s SunShot Initiative, which is a national effort to make solar energy cost-competitive with traditional energy sources by the end of the decade. Through SunShot, DOE supports private companies, universities and national laboratories working to drive down the cost of solar electricity to 6 cents per kilowatt-hour. Learn more at energy.gov/sunshot.

To download the best practices and standard contracts or learn more about SAPC, visit financeRE.nrel.gov. To participate in SAPC, contact francisco.flores-espino@nrel.gov.

The Cutting Edge

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BENCHMARKING Challenges and Opportunities

Today's Building Energy-use Tracking and Disclosure Challenges Will Provide Better Tools and Reporting Consistency in the Future

WRITTEN BY **NATHAN GILLETTE, AIA, LEED AP O+M, CEM**

Energy use in modern buildings is staggering. Each year in America we spend close to \$450 billion dollars on energy consumed in buildings. However, 13 cities, one county and two states have taken a stand against exorbitant energy use by

mandating commercial building owners and facility managers track and report usage. Although these areas of the country are making meaningful strides to reduce energy use, they also are discovering challenges with tools and reporting consistency. However, these

challenges should be looked upon as opportunities to provide better benchmarking tools and training. Ultimately, this will lead more buildings in more parts of the country toward energy efficiency.

The Beginnings

Mandatory energy disclosure

and benchmarking began in California. In 2007, the state passed AB 1103 legislation requiring energy disclosure in real-estate transactions involving a commercial building sale or a whole building lease. Several delays kept the legislation from going into effect until 2014. *(continues on page 22)*



Benchmarking Ordinances

The following cities, county and states require some form of tracking and disclosure of building energy usage.

- Atlanta
- Austin, Texas
- Berkeley, Calif.
- Boston
- Chicago
- Minneapolis
- New York City
- Philadelphia
- Portland, Ore.
- Seattle
- San Francisco
- Washington, D.C.
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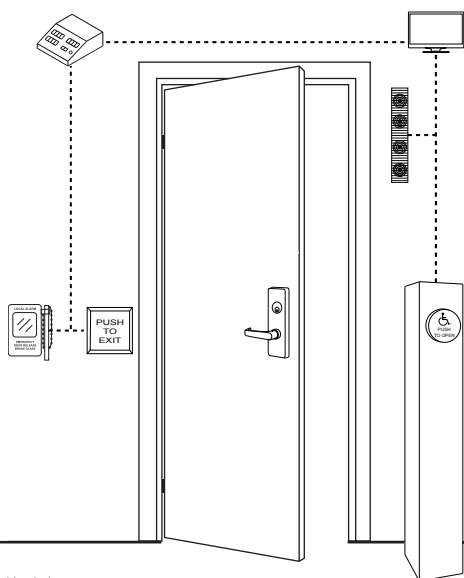
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ENERGY DISCLOSURE HELPS A POTENTIAL BUILDING OWNER BECOME AWARE OF THE ENERGY-USE CHARACTERISTICS OF A PARTICULAR PROPERTY.

One of the major delays with implementing the legislation was simply that the utility providers did not have a suitable method to share energy-consumption data for this type of use. The entire notion of energy disclosure was vague and not well defined. If someone turns over a filing cabinet full of utility bills,

does that meet the intent of the law? Standardization and definition were desperately needed for all stakeholders and, consequently, delayed the implementation of AB 1103 until these issues could be addressed.

In 2011, during the same time California was wrestling with these issues,

ASTM International, West Conshohocken, Pa., formed a committee to develop a standard for commercial-building energy disclosure in a format that could be used universally. The end product was the ASTM E2797 Building Energy Performance Assessment (BEPA). Although traction initially was slow, BEPA is becoming a more widely recognized reporting format for building owners to disclose energy use and ensure compliance with applicable laws. Energy disclosure helps a potential building owner become aware of the energy-use characteristics of a particular property. However, it has limitations for tracking long-term energy use and benchmarking. For that, we need to look to ENERGY STAR.

Comparison

Comparing energy use among buildings isn't a new idea. ENERGY STAR first introduced its building-certification rating almost 16 years ago, and its Portfolio Manager is a widely used free tool to help building owners track energy use, compare buildings against peers and achieve ENERGY STAR Certification.

However, Portfolio Manager is not without its issues. It would seem logical that as more buildings get entered into the database, there would be more buildings to compare against. This is not the case. Citing privacy reasons, any building that is entered into Portfolio Manager will not be benchmarked against others in the database but only against buildings in a comparison index. The comparison index used by Portfolio Manager is the Commercial Building Energy Consumption Survey, or CBECS, which, in some instances, only contains building data as recent as the late 1990s. Comparing a 2015 building's data against old data isn't exactly a fair comparison. There is talk of updating the ENERGY STAR data to the 2012 CBECS data but this has not happened to date. Portfolio Manager has potential to be a

(continues on page 24)



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very robust and relevant tool if only it were able to anonymously use all data that have been entered by users into the database.

Although most of the areas that require benchmarking only ask for public disclosure of energy-consumption information, New York City's Greener, Greater Buildings Plan requires ongoing energy auditing and recommissioning of building systems. Think of the recommissioning process as a tune up for your building where all of the building's energy-consuming systems are brought back

into operation the way their designers intended.

Chicago has taken a slightly different path with its energy-benchmarking ordinance, which passed in September 2013 and has no mandates for energy reduction. "The policy's goals are to raise awareness of energy performance, help building owners save operational dollars, create local jobs, protect the health of its citizens [by reducing emissions from power plants] and promote the city of Chicago as one the greenest cities on the planet," remarks Katie

Kaluzny, associate director of the U.S. Green Building Council Illinois Chapter.

As the Chicago ordinance was being planned, several trade organizations came together to educate the public about the ordinance and promote energy efficiency. What started out as a collaboration between USGBC Illinois, ASHRAE Illinois, and AIA Chicago has morphed and grown into a larger network of stakeholders now known as the Chicago Energy Benchmarking Workgroup. This workgroup is leading the charge to make sure building


owners have the education and resources they need to comply with the law.

Growing Pains

One of the issues widely reported with energy benchmarking programs across the nation is data verification and quality. For building owners who have not analyzed utility bills before, entering data accurately can be tricky.

For example, according to an Energy Manager Today column (bit.ly/1H4A24o), New York City normalized nearly 25 percent of property

ONE OF THE ISSUES WIDELY REPORTED WITH ENERGY BENCHMARKING PROGRAMS ACROSS THE NATION IS DATA VERIFICATION AND QUALITY.



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submissions in its first year of private-sector benchmarking because of “inaccuracies due to unintentional errors, difficulty of obtaining correct information, and a general lack of familiarity with the Portfolio Manager tool.” Consequently, the Center for Building Knowledge at New Jersey Institute of Technology, Newark, with the Consortium for Building Energy Innovation, Philadelphia, established the Certificate of Proficiency in Benchmarking, an online tool that helps building-industry professionals learn how to collect energy- and water-use information and successfully benchmark most building types.

“In the real world, there are subtle differences between elderly assisted multifamily facilities and nursing homes,” Kaluzny states. “However, when comparing these facilities in the ENERGY STAR Portfolio Manager, there are big differences.” Building systems in elderly multifamily buildings have a tendency to be more residential in nature while nursing homes tend to have larger, complex heating and cooling systems with a completely different energy-use characteristic.

To combat this issue in Chicago, the Chicago Energy Benchmarking Workgroup has developed training presentations and offers resources and guidance to help building owners through the benchmarking process. Because compliance with the Chicago Energy Benchmarking ordinance is phased, only the largest buildings—

non-residential buildings larger than 250,000 square feet—have so far been required to report energy use (about 300 buildings within the city of Chicago). “What we found was that many of these buildings were currently or had in the past been tracking energy use in Portfolio Manager and had a working familiarity with the program,” Kaluzny notes. “However, in 2015, residential buildings larger than 250,000 square feet and non-residential buildings larger than 50,000 square feet are required to start reporting. This opens up the program to a lot more users that may not have experience with the tools.”

Kaluzny adds 1 percent of the buildings in a typical city consume 20 percent of the city’s energy use. “Think of the impact you could have reducing that number to something more manageable,” she says.

By most early accounts, building owners are taking note and complying with the laws. New York City, which has required buildings greater than 50,000 square feet to report energy usage since 2011, has reported close to an 84 percent compliance rate with its energy-benchmarking mandate. Chicago, which is still phasing in its ordinance, has seen compliance with non-residential buildings larger than 250,000 square feet close to 95 percent. In general, with all other things equal, energy-efficient buildings will become more desirable in the marketplace. Time will tell if benchmarking ordinances help prove this theory. 

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TYPICAL CITY CONSUME 20 PERCENT OF
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FIRST IN FLIGHT

Raleigh-Durham International Airport's Reimagined Terminal 1 Connects Passengers to the Local Community



Before

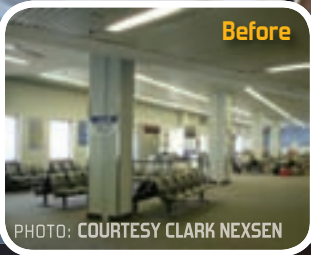


PHOTO: COURTESY CLARK NEXSEN

RDU AIRPORT REPRESENTATIVES' CHALLENGE TO THE DESIGN TEAM WAS CLEAR: REIMAGINE THE TERMINAL WITH THE GOAL OF TRANSFORMING THE **PASSENGER EXPERIENCE**.



WRITTEN BY | JEFFREY S. LEE, FAIA

For travelers to a new destination, airports are often the front door to a city and region. A thoughtful, well-designed air terminal can make a lasting and positive impression upon the traveling public. As public buildings, airport terminals can say a great deal about the communities they serve. Through their architectural expression, they can speak to a sense of place, as well as broader community values. The reimagined Terminal 1 at Raleigh-Durham International Airport (RDU) accomplishes both.

RDU is located between Raleigh and Durham, N.C., at the edge of the world-renowned Research Triangle Park (RTP). RTP is an often-copied research model, on the cutting edge of numerous research initiatives. It plays a significant role in the economy of the region, as do the area's three major universities. RDU is the shared communities' connection to the world.

Terminal 1 has an interesting history. The building was originally designed as a hangar and airplane maintenance facility. As such, there are numerous long-span conditions on the airside of the building to accommodate airplane hangar doors. Concrete floor slabs are reinforced and 8-inches thick to handle the concentrated loading of commercial aircraft. For reasons still unclear, the building has an odd column bay dimension of 26 feet, 8 inches. Within several years of its completion, owing to a dramatic increase in passenger count and the building's central, runway-adjacent location, it was converted for use as a "temporary" terminal.

Over the years, many changes occurred to this building. Additions were made to expand gate capacity. Several interior renovations were implemented to aesthetically update the terminal and provide for

passenger amenities, such as retail options and food services. Post 9/11, TSA security systems were installed in an awkward fashion and location. Changes were made in a piecemeal fashion, making wayfinding and passenger circulation confusing. The same unclear circulation patterns impact airline employees, airport workers and vendors.

In 2011, following the completion of the new Terminal 2, the Airport Authority turned its attention toward the extensive renovation of the "temporary" Terminal 1. As envisioned, Terminal 1 would serve economy airlines, and Terminal 2 would serve mainline air carriers willing to pay higher gate fees for the added amenities made available to their passengers.

Throughout this project, Clark Nexsen's Raleigh office worked closely with key members of the RDU airport staff. Airport representatives have a history of supporting and understanding the added value that design can bring to their projects. Their challenge to the design team was clear: reimagine the terminal with the goal of transforming the passenger experience.

Reimagining the Blue Box

The 165,000-square-foot Terminal 1 had been known as the "Blue Box" because it had been clad in blue corrugated metal and was simply rectangular in form. The interiors were dated and worn. Moving through the sequence of arrival/ticketing/TSA screening/hold-room waiting/boarding was confusing and, for many travelers, stressful. Landside interiors were dark and segregated. Hold-room lounges infringed upon the concourse and offered limited views to the airfield. In short, this facility did not meet the expectations of current-day air travelers.

FACT
RENOVATING TERMINAL 1 PROVIDED AN ESTIMATED 40 PERCENT COST SAVINGS VERSUS NEW CONSTRUCTION.



Our team at Clark Nexsen began the design process by taking full advantage of one characteristic the building offered: a large interior volume. We immediately realized that the renovation would be as much about the building section as it would be about the plan configuration. We seized upon the opportunity of creating a grand, daylit hall on the landside, extending from one end of the building to the other. To achieve this vision, the building was stripped down to its structure and completely re-clad. The grand space is interrupted only at its center by the second-floor-level TSA screening facility. The ceiling plan above carries consistently from end to end. Functions included on the ground level are ticketing; baggage claim; and back-of-house activities, such as baggage handling, screening, and airport and airline operations.

This large landside hall is filled with natural light. Daylight is direct and diffused owing to a combination of a glass curtain-wall and light-transmitting translucent fiberglass panels. At night, the space glows like a giant lantern on the airport landscape.

On the second level, in addition to TSA screening, the concourse runs the length of the building, connecting hold rooms and organizing a variety of retail shops and food services. Clarity of circulation is important here, so signage was carefully considered and integrated into the architecture of the space.

Similar to the landside façade, the airside façade also was stripped down to its structure. New cladding consists of insulated metal panels and glass curtainwall, which provides expansive views of the airfield from hold rooms and restaurant seating areas. This access to daylight and views is in marked contrast to the dark pre-renovation condition. Glare and heat gain are controlled by fixed aluminum sunscreens and sensor-controlled operable window shades.

AS PART OF A PUBLIC ARTS PROGRAM, THREE ARTISTS WERE SELECTED TO PRODUCE PIECES FOR SPECIFIC LOCATIONS IN THE TERMINAL.

FROM THE LANDSIDE APPROACH TO THE TERMINAL,
THE PROJECT PRESENTS A NEW AND ARCHITECTURALLY
EXCITING FACE.

FACT

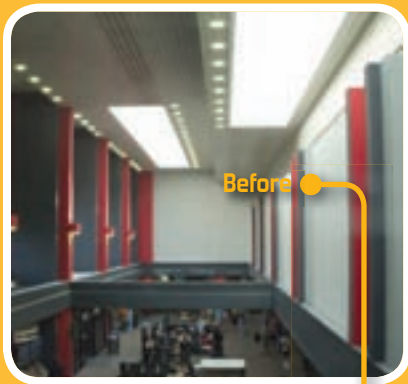
THE RENOVATED TERMINAL 1 RECEIVED **LEED CERTIFICATION** FROM THE U.S. GREEN BUILDING COUNCIL, WASHINGTON, D.C. SUSTAINABILITY WAS A FACTOR IN RALEIGH-DURHAM INTERNATIONAL AIRPORT'S DECISION TO RENOVATE THE EXISTING TERMINAL.



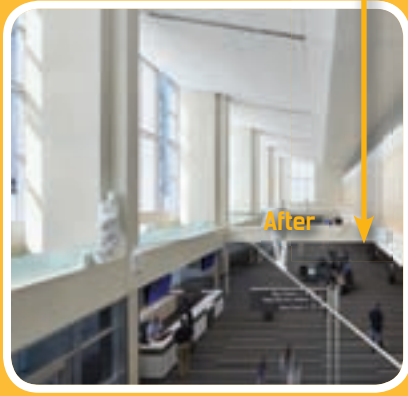
Before



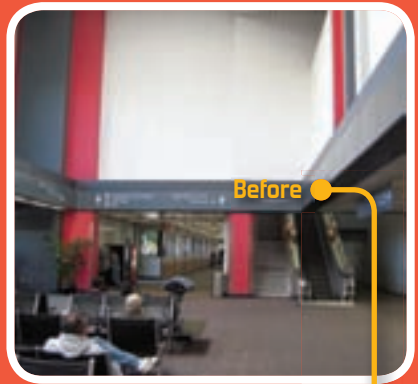
After



Before



After



Before



After

Differences in ceiling materials and configurations were used to help differentiate between adjacent spaces. For example, the lower ceiling in the concourse stops short of the concourse wall. The ceiling in the hold rooms “bends” and slopes upward toward the airside curtainwall. Both conditions provide visual interest and carefully integrate lighting.

Thoughtful Specification

Owing to the sheer number of travelers moving through an airport terminal, careful consideration is demanded of finish selections. Durability is a key consideration, particularly for floor and wall surfaces. In Terminal 1, walls are clad with high-impact panels. These panels are clip supported and, if damaged, can easily be

replaced. Base throughout the building is stainless steel.

The majority of flooring in the terminal is carpet. It is understood that it has a limited lifespan and will eventually be replaced. It was, nonetheless, a very important design decision. Working directly with carpet manufacturers, we custom designed

(continues on page 32)



AT NIGHT, THE SPACE GLOWS LIKE A GIANT LANTERN ON THE AIRPORT LANDSCAPE.


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OWNER // Raleigh-Durham Airport Authority, www.rdu.com

DESIGN ARCHITECT // Clark Nexsen, Raleigh, N.C., www.clarknexsen.com

CONTRACTOR/CM AT RISK // Balfour Beatty Construction, Charlotte, N.C., www.balfourbeattyus.com

CONSULTING INTERIOR ARCHITECT // The Freelon Group (now Perkins + Will), Durham, N.C., perkinswill.com

PROGRAM MANAGER // Parsons Corp., Morrisville, N.C., www.parsons.com

STRUCTURAL ENGINEER // LHC Structural Engineers, Raleigh, www.lhcengineers.com

CIVIL ENGINEER // RS&H, Raleigh, www.rsandh.com

MECHANICAL, ELECTRICAL, PLUMBING ENGINEER // O'Brien/Atkins Associates, Durham, www.obrienatkins.com

a high-traffic carpet pattern. The linear pattern uses a range of colors one might expect to see in vintage flight-attendant uniforms. Because of the manufacturing process, the carpet is not made in tiles. Custom large-scale “tiles” were created by having the 12-foot-wide rolls cut into 12-foot squares. These oversized “tiles” were then laid in the large open spaces in a staggered pattern, creating a unique application of a custom carpet.

Stairs, elevators and escalators are consistently detailed in stainless steel. Stair treads are dark-gray basalt stone, and railings are tempered glass and stainless steel. Vertical circulation is particularly prone to wear and abuse. The choice of stainless steel was made to minimize this impact.

Toilet rooms are important features of an air terminal. They must be easy to find and designed with additional clearances for adults with children and the passage of luggage. At Terminal 1, they are brightly lit, easy to clean and maintain, and designed to minimize traffic congestion. Floors are terrazzo with fine-grain aggregate and matching base. Walls are ceramic tile and back-painted glass. Toilet partitions are stainless steel.

Retail shops and dining options can greatly enhance the travel experience. In Terminal 1, the airport authority has made a concerted effort to bring in local vendors. This strategy contributes to generating a more genuine sense of place with local color and flavor proudly on display. Architectural guidelines were developed by the design team to allow for some degree of individual expression but not so much as to distract from a cohesive sense of architectural order.

As part of a Public Arts Program, three artists were selected to produce pieces for specific locations in the terminal. Two of the pieces are glassworks. The third is a unique sculptural installation. The biggest of the glassworks is located next

STAIRS, ELEVATORS AND ESCALATORS ARE CONSISTENTLY DETAILED IN STAINLESS STEEL. VERTICAL CIRCULATION IS PARTICULARLY PRONE TO WEAR AND ABUSE.


to the departure stair and escalator. It is a brightly colored composition incorporating a variety of colors and images of local interests, including relief maps of the region. The second glass installation is adjacent to TSA screening. It is photographically enlarged and enhanced images of raindrops hitting a pool of water. The images are laser etched in a manner that produces the effect of "movement" as you walk by. The sculptural installation above the baggage claim area is of monochromatic life-sized human characters in various poses. The most provocative of these characters are the high-wire walkers traversing the space some 20-feet above the floor.

Meeting Today's Expectations

From the landside approach to the terminal, the project presents a new and architecturally exciting face. A new building canopy and commercial curb canopy extend along the length of the terminal. The canopies are

very expressive of their structural tectonics and clad in reflective aluminum panels. Signage, lighting, security fencing and street furnishings are carefully integrated into the canopy designs.

The reflective underside of the canopies serves a very specific purpose. The canopies themselves made it impossible to use pole-mounted fixtures to light the roadway. The solution to this problem is achieved by a combination of direct linear fluorescent lighting from the canopy edges and indirect lighting reflected off the canopy undersides.

The renovated Terminal 1, which reopened to travelers in April 2014, has been well received by the community and the traveling public. In its renovated configuration, it offers the range of amenities and the architectural aesthetic expected by today's air passengers. It represents a complete transformation from the previous terminal and an enduring one we hope will engage and facilitate those who use it. 

» MATERIALS

INSULATED METAL PANELS // CENTRIA, www.centriaperformance.com

INSULATED FIBERGLASS PANELS // Kalwall, www.kalwall.com

GLASS CURTAINWALL // EfcO, www.efco.com

NON-INSULATED ALUMINUM PANELS // Alpoli, www.alpoli-america.com

FLOORING/CARPET // Powerbond VCTT (Variable Cushion Tufted Textile) from Tandu's Flooring, www.tandus-centiva.com

ACOUSTICAL CEILINGS // Armstrong, www.armstrong.com

TERRAZZO FLOORING // David Allen Co., www.davidallen.com

CERAMIC TILE // Daltile, www.daltile.com

BACK-PAINTED GLASS // Tate Ornamental Inc., www.tateornamental.com

ELEVATORS // Schindler, www.schindler.com

TOILET PARTITIONS // Accurate Partitions Corp., www.accuratepartitions.com

HIGH-IMPACT WALL CLADDING // Environmental Interiors Inc., www.ei-ofusa.com



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O'HARE INTERNATIONAL AIRPORT, TERMINAL 5 | Chicago

» Retrofit Team

PROJECT MANAGER: Westfield Concession Management, www.chicagot5.com
 ARCHITECT, INTERIOR DESIGNER AND STRUCTURAL ENGINEER: Epstein, Chicago, www.epsteinglobal.com
 GENERAL CONTRACTOR: James McHugh Construction Co., Chicago, www.mchughconstruction.com
 CEILING INSTALLER: Ornelas Construction Co., New Lenox, Ill., www.ornelasconstruction.com
 CEILING SYSTEMS DISTRIBUTOR: Reinke Supply Cos., Chicago, reinkesupply.com

» Materials

To contribute to the terminal's world-class traveler experience, a new open plenum metal ceiling system was installed above the redesigned TSA Checkpoint and a metal baffle ceiling system was installed above the renovated and expanded Concessions Program.

With a goal of providing a hospitality feel to O'Hare's original design palette of black, white and gray, a custom Oyster Metallic finish was selected for the ceiling baffles in the concession area. The team did not have much ceiling space with which to play. The linear

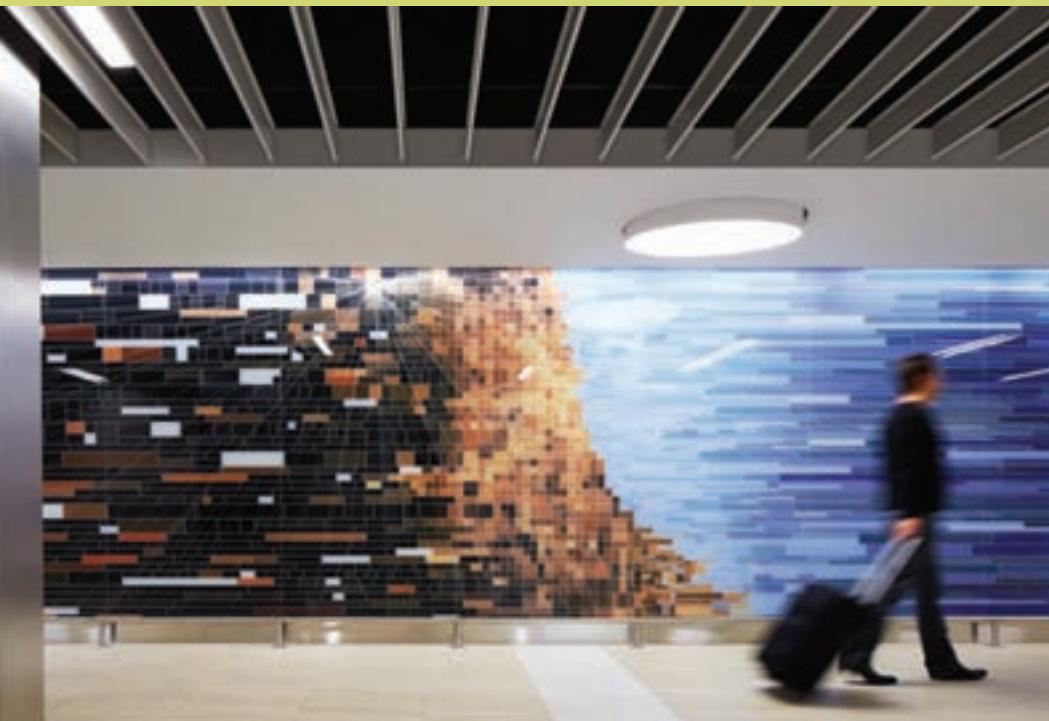
baffle ceiling hides the structure above and makes it feel like a higher ceiling. The above structure was painted black, adding to the height illusion.

More than 4,100 square feet of metal baffles was installed in odd shapes and curves. "The ceiling's non-standard shapes take their cues from the floor pattern and the millwork," explains John Kolb, IIDA, LEED AP, Epstein's associate vice president. "They all sort of mimic each other. Appearance and cost also were considered in the baffles' spacing."

In addition to the baffles, Ornelas Construction installed 1,200 square feet of ceiling systems and 300 linear feet of engineered perimeter trim. This open plenum masking system is positioned above the TSA Checkpoint and also surrounds the concession area's ceiling baffles. To support the perception of a high ceiling, the panels are painted black and blend with the black perimeter trim.

Working onsite, the contractor installed the perimeter trim and assembled U-shaped blades into 6- by 6-inch cells to form 2- by 4-foot panels, which are installed into a 9/16-inch ceiling suspension. The suspension and panels blend to provide a continuous open-cell ceiling appearance, as well as easy access to the HVAC, security and other systems above. The metal baffles, panels and trim, which contain no organic compounds to support mold and microbial growth, contain 100 percent recycled aluminum content and are 100 percent locally recyclable.

CEILING PRODUCTS AND MANUFACTURER: Intaline Round-Base metal baffles, Magna T-Cell and Paired Infinity trim from Rockfon, www.rockfon.com



PHOTOS: HEDRICH BLESSING, COURTESY OF EPSTEIN



» The Retrofit

Westfield Concession Management oversees concessions at Terminal 5 and guided the terminal's transformation and expansion from 15,000 to 26,000 square feet. The group and its tenant partners are investing more than \$26 million into the terminal's redevelopment.

Westfield selected Epstein's interior design and structural engineering team for the project. "Terminal 5 was designed 21 years ago by Perkins+Will," Kolb notes. "Its modern, clean design is recognized and appreciated. We did not want this to feel like a renovation that didn't consider the existing architecture. Instead, we wanted to adhere to it but make it better. We wanted to take the vocabulary of the original building and continue it through the mezzanine renovation and expansion."

Epstein's scope of work included base building improvements and modifications required to prepare the new and reconfigured concession spaces, as well as redeveloped common areas and a new TSA Checkpoint. Performance considerations for the terminal's ceilings included easy installation and maintenance; accessibility to lighting, HVAC and security systems; and compliance with the Chicago Department of Aviation's Sustainable Airport Manual.

Terminal 5 operated throughout the construction, challenging the contracting team to minimize disruptions with a carefully choreographed building sequence. The ceiling panel distributor supported this with phased material deliveries. The final details of the concession area's interior build-out were completed in First Quarter 2014.

"The reconfigured Terminal 5 raises the bar for airport concessions programs in Chicago and across the country," concludes Chicago Department of Aviation's Commissioner Rosemarie S. Andolino.



PHOTOS: RAUL J. GARCIA



FORT COLLINS-LOVELAND AIRPORT | Colorado

» Retrofit Team

ARCHITECT: VAUGHT FRYE LARSON Architects, Fort Collins, Colo., vfla.com

GENERAL CONTRACTOR: Brinkman Construction, Fort Collins, www.brinkmanpartners.com

METAL INSTALLER: B & C Steel Corp., Scottsbluff, Neb., www.b-csteel.com

» Materials

More than 65,000 square feet of metal roof and wall panels provide performance and a sleek look for the corporate airplane hangar. The panels will endure the temperature variations of the Colorado climate and have a long lifespan. The panels are 100 percent recyclable and contain up to 30 percent recycled content. The Mistique Plus, Ash Grey and Linen White PVDF (Kynar 500) colors used for the project are ENERGY STAR listed and come with a 45-year finish warranty.

"Metal was an ideal choice for the hangar facility," says Chris Aronson, project manager with VAUGHT FRYE LARSON Architects. "Unlike other cladding materials, it allowed us to economically cover a large amount of space to save time and money."

METAL ROOF AND WALL PANELS' MANUFACTURER: Metal Sales, www.metalsales.us.com.

» The Retrofit

The facility is comprised of three distinct segments: an existing 15,000-square-foot hangar, a new 25,000-square-foot hangar and new 11,500-square-foot office space. The large sloping roof of the new hangar visually brings the segments together and acts as a transition element between rooflines.

The new hangar has a clear span of 168 feet and provides storage for up to six planes. It is protected by more than 28,000 square feet of 22-gauge, 18-inch Magna-Loc standing-seam roof panels in Ash Grey. The panels feature a concealed fastening system that eliminates the need to penetrate the metal and allows the panels to slide freely during expansion and contraction.

The combination of 22-gauge T5 wall panels installed horizontally and TLC-1 wall panels installed vertically continue the new hangar's modern aesthetic in Mistique Plus and Ash Grey colors. The interior walls are clad with 22-gauge TLC-1 wall panels in Linen White.

The connecting 3-story office building features TLC-1 soffit panels on the horizontal lower edge of the curved Magna-Loc roof. The building's mechanical equipment is concealed with a mechanical screen featuring T5 panels in Mistique Plus.

In addition, more than 6,500 square feet of customized TL-17 panels in Dark Bronze was installed on the fascia of the new hangar and office building. The standard coverage of the TL-17 panel is 12 inches, but the manufacturer produced custom panels with 10-inch coverage to allow full panels to be installed for the 30-inch fascia.

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WALKWAY TO TRAIN PLATFORM | Beverly, Mass.

» Retrofit Team

ARCHITECT: AECOM, Boston,
www.aecom.com

» Materials

Working with an existing precast concrete panel bridge, the manufacturer fabricated the walkway columns, beams and supporting roof structure, as well as the mesh and louvers along the walkway's sides.

The white-glazed canopy is made from single-panel 16-millimeter Pentaglas and was required to meet a strict wind-uplift load of 86 psf. The full corridor runs 237-feet long and 12-feet wide, crossing over a main street. Another 1,500 square feet of Pentaglas was installed on the parking garage's top floor bringing daylight into an otherwise dark space.

WALKWAY MANUFACTURER AND
INSTALLER: CPI Daylighting,
www.cpidaylighting.com

» The Retrofit

The Massachusetts Bay Transportation Authority desired "a safe, comfortable and accessible passage between the parking garage and the commuter rail platform with an affordable product that would also fit aesthetically within the up-and-coming neighborhood," explains Christopher Souza, an architect with AECOM.

AECOM relied on the corridor manufacturer for its one-source approach because of the fast-paced design and construction schedule. "The versatility of the Pentaglas canopy and framing system allowed us to get creative with the concept from the aluminum louver infill panels to the custom stainless-steel wire mesh protective screening," Souza adds. "The stainless-steel wire mesh screening was particularly challenging to get detailed correctly."

Working within a short timeline while confined to a tight space surrounded by apartment buildings required a high level of coordination and thoughtful scheduling.



PHOTOS: CPI DAYLIGHTING



PHOTOS: VARCO PRUDEN



AUTO TECH REPAIR | Newport News, Va.

» Retrofit Team

METAL-BUILDING CONTRACTOR: EPOC Construction Inc., Newport News, epocconstruction.com

» Materials

Auto Tech Repair was a three-bay auto service shop built in the 1960s; it was in desperate need of restoration. The building's owners wanted renovations to the existing repair shop, upgrades to the exterior of the building and the addition of two bays.

The structure now features the Rigid Frame system, Panel Rib wall system in Cool Egyptian White and SSR standing-seam roof system in Galvalume. Stepped-width frames were used for angled rear walls and along rear bays, and wind beams were incorporated for the stud/parapet front façade.

METAL COMPONENTS' MANUFACTURER: Varco Pruden, vp.com

» The Retrofit

This project was made possible by a city grant program for façade improvement. Auto Tech Repair was eligible for matching funds of up to \$60,000. The architectural appearance and materials for the repair shop required program approval.

"The original design was for structural steel, but when the project bid initially came in over budget, Varco Pruden's pre-engineered metal building system [PEMB] alternative achieved significant savings," says Ken Bingman, president of EPOC Construction.

The PEMB system also provided design flexibility for the additional space and support needed to seamlessly blend the sub-structures for the new façade. The system successfully reduced overall building shell costs while maintaining the front façade requirements.

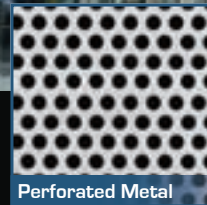
The metal building structure was used to provide a clear-span frame and single-slope roof. The single-slope metal roof eliminates messy flashing details along the front/high-side eave and provides a clean transition over the existing parapet endwall. Metal wall panels were an economical solution for the rear endwall siding.

"Prior to the renovation project, we were a nondescript auto repair shop, like most others in our area," notes Mark White, owner. "Since this makeover, our business has increased by at least one-third from our normal business volume. The entire building renovation has become the benchmark for other businesses looking to renovate, remodel or add on to their existing buildings."



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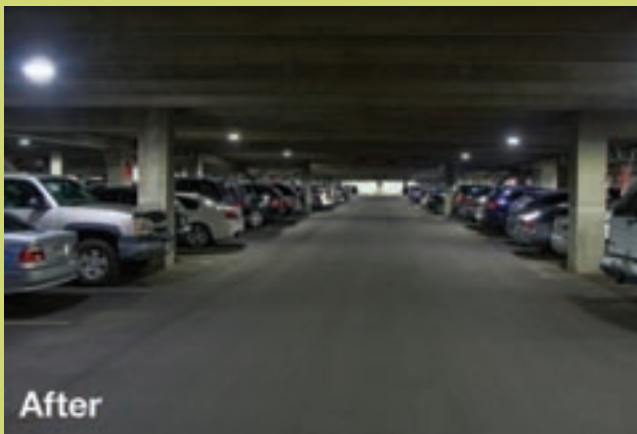


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PHOTOS: COOPER LIGHTING

DENVER INTERNATIONAL AIRPORT

» Retrofit Team

LIGHTING INSTALLERS: Denver International Airport maintenance personnel, www.flydenver.com

» Materials

To improve optical performance and efficiencies at the airport, maintenance personnel replaced more than 5,400 high-pressure sodium parking garage fixtures with almost 5,000 McGraw-Edison Valet LED luminaires. The installation of the LED products will consume only 51 watts compared to the HPS fixtures, which consumed 177W.

The conversion is expected to result in a 45 percent energy savings and reduce annual energy consumption by more than 3.4 million kilowatt hours per year, or 68 million kWh over the expected 20-year life of the McGraw-Edison Valet products. The yearly carbon reduction associated with the project is equivalent to the electricity used by 356 homes or taking 544 cars off the road each year. The long-lasting fixtures also will provide maintenance savings with fewer lamp replacements, reducing labor and material costs. The retrofit is expected to help the airport save approximately \$327,000 annually, or \$6.5 million over 20 years.

Additionally, more than 700 Valet 73W fixtures reduce the wattage used in 250W and 150W HPS products, and 27W Valet products replaced metal halide surface-mounted downlights consuming 115W.

The DesignLights Consortium- (DLC-) listed LEDs brighten and uniformly light the DIA East and West parking garages, increasing visibility and enhancing safety for the airport's customers while shrinking the airport's carbon footprint.

PORT OF SEATTLE, TERMINALS 90 AND 91

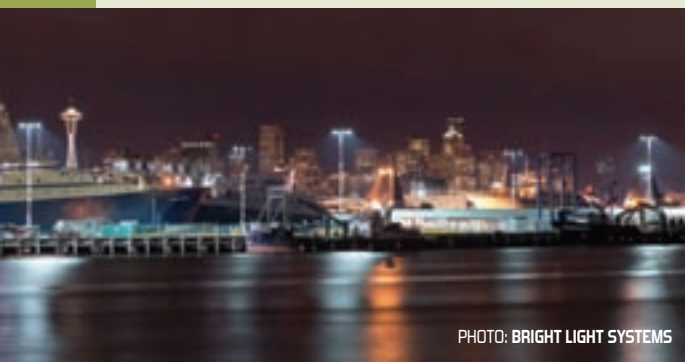


PHOTO: BRIGHT LIGHT SYSTEMS

» Retrofit Team

LIGHTING INSTALLER: Port of Seattle Marine Maintenance, Seattle, www.portseattle.org

» Materials

The terminals, which provide mooring for cruise ships, commercial workboats and fishing vessels, were in need of a lighting upgrade. "We are proud of our port, but the existing high-pressure sodium lighting had reached its useful life span and wasn't delivering the coverage we needed to meet current standards," explains Robert Hoyman, Marine Maintenance project manager, Port of Seattle. "We were also convinced we could save energy costs with new lighting technology."

Light Emitting Plasma (LEP) luminaires were selected for installation on existing poles, which are 65-foot high. LEP luminaires provide increased color recognition, are dimmable to 20 percent and carry a lifetime rating of 50,000 hours. Energy costs are expected to decrease by more than 50 percent. In addition, the installation is dark-sky compliant, and the crisp white light will enhance security cameras' image acuity and the ability to recognize faces.

LIGHTING MANUFACTURER: Eaton's Cooper Lighting business, www.cooperlighting.com

» **The Retrofit**

Because the McGraw-Edison Valet LED lighting fixtures are DLC listed, they qualify for a local utility rebate from Xcel Energy's Lighting Efficiency program. The DLC distinguishes quality, high-performance LED products for commercial and industrial projects and produces a Qualified Products List to save time and provide peace of mind to lighting specifiers and property owners selecting products to support sustainable design practices. As a result, the airport is anticipating a rebate of approximately \$630,000.

Construction of the multimillion-dollar project began in May 2014 and was completed in November 2014.

LEP PRODUCT AND MANUFACTURER: BLP1000 from Bright Light Systems, www.brightlightsystems.com

» **The Retrofit**

Work on the Port of Seattle's docks is often 24/7, and longshoremen have told the port the new plasma lights have significantly improved their working conditions.

Hoyman concludes: "We are very pleased with our new lighting on the piers. The luminaires installed easily onto our existing infrastructure, and we were able to aim the light where it's needed to eliminate dark areas."

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SAN DIEGO INTERNATIONAL AIRPORT, THE GREEN BUILD TERMINAL EXPANSION

» Retrofit Team

ARCHITECTURE, ENGINEERING, PLANNING: HNTB, San Diego, www.hntb.com

GENERAL CONTRACTORS: Turner Construction, San Diego, www.turnerconstruction.com; PCL Construction, San Diego, www.pcl.com; and Flatiron Construction Corp., San Marcos, Calif., www.flatironcorp.com

» Materials

At the heart of the terminal expansion is SunSet Cove, a shopping and dining area with sweeping views of the airfield and neighboring community. Inside the terminal are 140 columns clad in Starlight 7J, a reflective and uniformly textured stainless steel that offers panel-to-panel matching, fingerprint resistance, and smear and discoloration resistance suitable for high-traffic areas. The stainless steel was incorporated into the Premier Dry Seal Column Cover System. A template was created for installation for each of the 70 different column styles.

ENGINEER AND FABRICATOR OF STAINLESS STEEL FOR COLUMNS AND THE PREMIER DRY SEAL COLUMN COVER SYSTEM:

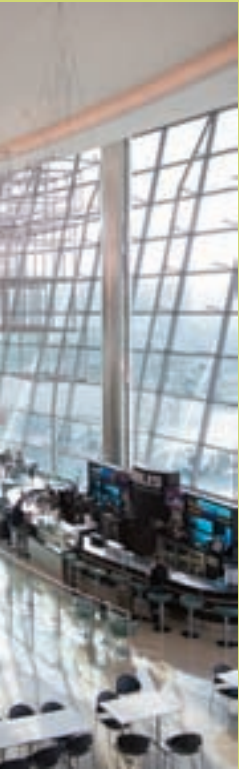
C.R. Laurence Co. Inc., www.crl-arch.com

STAINLESS-STEEL MANUFACTURER: Contrarian Metal Resources, metalresources.net

» The Retrofit

In 2009, the San Diego County Regional Airport Authority broke ground on The Green Build terminal expansion, the largest project in the history of San Diego International Airport. A product of the Airport Authority's Airport Master Plan, which identified ways to help meet current and future demand for air travel, the expansion added 10 new gates, a dual-level roadway to separate arriving and departing passengers, a new USO facility and 9,200-square-foot concessions core, among other things.

In April 2014, San Diego International Airport officially announced it is the first LEED Platinum commercial airport terminal in the world, complementing LEED Gold certification for the dual-level roadway and USO building portion of the project. "One of our objectives was to raise the bar in passenger experience by offering an elegant, high-quality space with a durable, timeless appearance that represents San Diego," explains Bob Bolton, San Diego Airport Authority director of Design and Construction.



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» Retrofit Team

PROJECT MANAGEMENT, PARKING CONSULTANT AND STRUCTURAL ENGINEER: Walker Parking Consultants Inc., Tampa, Fla., www.walkerparking.com

CONCEPT ARCHITECT: OGCB Inc., Memphis, Tenn., ogcbinc.com

ELECTRICAL ENGINEER OF RECORD: LRK Inc., Memphis, www.lrk.com

ARCHITECT OF RECORD: Self + Tucker Architects, Memphis, www.selftucker.com

PROGRAM MANAGER: Parsons Transportation Group Inc., Memphis, www.parsons.com

GENERAL CONTRACTOR: Walker Restoration Consultants Inc., Tampa, walkerrestoration.com

RESTORATION ENGINEERING: Flintco Inc., Memphis, www.flintco.com

GRAPHICS AND WAYFINDING: Clark Dixon Associates, Memphis, clarkdixonarchitects.com

ROADWAYS/CIVIL ENGINEERING: Pickering Firm Inc., Memphis, pickeringinc.com

LANDSCAPE ARCHITECT: Ritchie Smith Associates, Memphis, rsaladesign.com

» Materials

FABRIC SHADE STRUCTURE MANUFACTURER: FabriTec Structures, www.fabritecstructures.com

FAN MANUFACTURER: Big Ass Fans, www.bigassfans.com

» The Retrofit

Pedestrians are the beneficiaries of the airport's convenient plaza between the terminal and the new Consolidated Ground Transportation Center. Portions of an existing short/long-term parking structure were removed to create an attractive, canopy-covered atrium

(continues on page 46)



AFTER PHOTOS: JEFFREY JACOBS PHOTOGRAPHY, COURTESY INTERNATIONAL PARKING INSTITUTE



BEFORE PHOTOS: COURTESY INTERNATIONAL PARKING INSTITUTE



AFTER



*Tectum Interior Wall Como Park Zoo,
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Pictured above: Southern Graphics, Toronto, Ontario, Canada

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with moving walkways, water features, landscaped areas and outdoor speakers that broadcast music from local artists. Its electrical and mechanical systems are controlled from the airport's central control system.

The airport's parking facilities also underwent major repairs, including concrete resurfacing, traffic topping replacement, installation of latex-modified overlays, re-striping, expansion-joint replacement and floor strengthening. Architectural improvements included lighting of pedestrian tunnels, structural upgrades to support vehicle loads on a pedestrian bridge, a new infill valet ramp and license-plate-recognition systems.

To avoid holiday traffic, repairs were selectively phased, and employee and overflow parking were temporarily relocated. Signage and dedicated construction-access roads helped avoid backups, and temporary masking boards separated the usable areas of the garage from the construction zone.

The project earned the 2014 Best Parking Facility Rehabilitation or Restoration Award from the International Parking Institute, Alexandria, Va. 



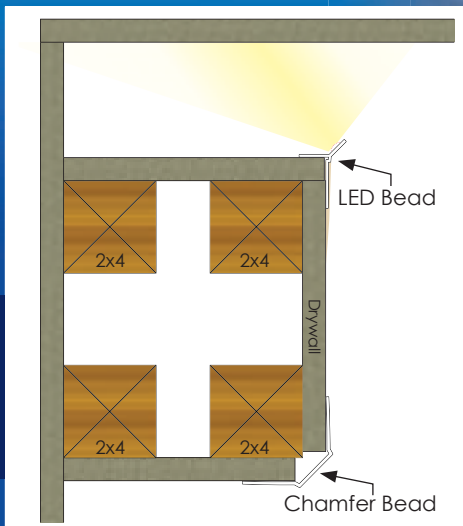
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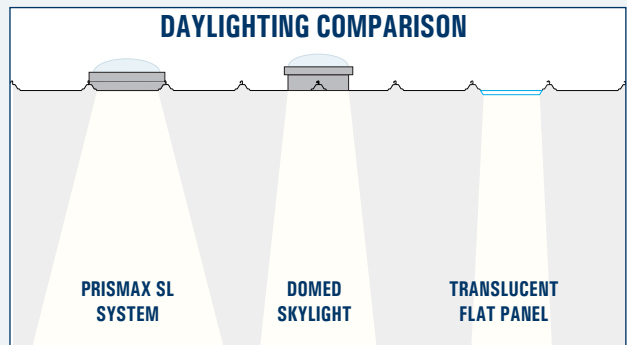
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Historic Window Rehabilitation and Replacement Improves Efficiency while Meeting Strict Design Requirements

WRITTEN BY | ELYSE COOPER

Restoring a window to its original appearance while giving it today's modern efficiency standards is not an easy endeavor but it is one that is tackled across the country with some frequency. The Minnesota State Capitol, St. Paul, and a former Philadelphia office structure turned luxury residential building are two examples of success in historic window replication.

Midwestern Window Retrofit

The Minnesota State Capitol building was completed in 1905 and originally designed by Cass Gilbert, a prominent American architect who also designed the U.S. Supreme Court building. The Capitol's original wood windows were replaced with aluminum windows 30 years ago and they had exceeded their useful life. Window rehabilitation was part of a huge list of work to be done on the Capitol during a large,

multi-stage rehab process that continues today. The project architect had worked with Kansas City, Mo.-based Re-View, a full-service historic window company, in the past and, after a bid process, Re-View was selected to restore the windows to their former glory and then some.

Brooks Gentleman, an owner with Re-View, has more than 25 years' experience in the window industry. "The architects had

(continues on page 50)



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STATE CAPITOL PHOTOS: RE-VIEW

taken an aluminum window out and we told them the wood frame was probably behind there, although we didn't know what condition it would be in," he recalls. Gentleman was correct; the wood frames still existed and were mostly in good condition, except for a few modifications previously made to them when the aluminum frames were installed. Those sections of frame had to be rebuilt.

"A typical window retrofit is pretty

simple," Gentleman says. "We usually want to upgrade the energy performance of a building or we need to replace windows because they're broken or they let air in.

"In this case, there were a lot of different needs and some of them conflicted," he continues. "For instance, because they needed to historically match the original windows, you can't just take a standard window system and put it in there. Profiles and dimensions wouldn't match. It would

alter the look of the building as it was first built. Another goal was energy efficiency. A third element was operable windows."

Energy requirements spurred Re-View to use laminated glass, which also met security and sound-transmission goals. The very glass that met efficiency demands, however, created challenges with window operability.

"Some windows were 6 by 13 feet and more than 250 pounds," Gentleman explains. "For operability, we used the
(continues on page 52)

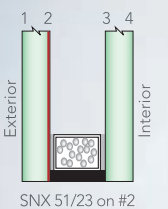
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“ [THE MINNESOTA STATE CAPITOL] TOOK A LOT OF THINKING **OUTSIDE THE BOX** TO ENGINEER A SYSTEM THAT WILL LAST 50 TO 100 YEARS. —Brooks Gentleman, owner, Re-View ”

weight-balance approach with pulleys because there isn't another type of balance that can handle that kind of weight." The Re-View team also had to reinforce the old wood frames with steel plates to provide adequate structural support for the new, heavier windows.

Installation required working around desks inside the building and battling Minneapolis' notoriously cold winters outside. "A lot of work is temperature-related, such as stripping the frames of lead paint and applying restoration epoxies," Gentleman explains. "Then we painted frames. All of that has to be done in temperatures 50 F or higher. We draped the external scaffolding and blew in heat. It was -20 F outside and we heated the base level to about 45 or 50

F. Temperatures on the fourth level would rise to about 75 or 80 F."

Gentleman explains how the work on the Capitol building put to rest a lot of misconceptions people have about windows. "People would think some of these goals were contradictory," he says. "They say you can have a historic window but can't have energy efficiency. Or you can have an insulated, laminated window but can't open it. Those are tradeoffs you'd typically see in a retrofit project. Standard window systems have limitations. This project took a lot of thinking outside the box to engineer a system that will last 50 to 100 years."

The Capitol boasts a lot of old woodwork, and the windows' interior wood had to match the rest of the interior wood. Re-View

located 100-plus-year-old logs in Idaho lakes. A century ago, loggers would cut down trees, chain the logs together and float them down the river. During that process, logs would come loose and sink, where they sat for 100 years. Companies today haul the logs up and mill them. That is the wood Gentleman used for the windows' interior, which he stained to match the existing woodwork.

Quality control was a major part of the project. A third-party independent agency randomly selected about 10 percent of the windows to be tested after installation. The company came to the site, set up test chambers around window openings and used a vacuum that applied pressure similar to the pressure wind-driven rain would create. Once the test pressure is achieved, the company would hit the window with water to see if there were any leaks. The same test method was used to test for air infiltration.

Gentleman explains a typical window would have an air infiltration rating of 0.10. "We were having these windows tested at 0.01, 0.02 and one at 0.04," he says. "These significantly larger windows had half the

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rate of air infiltration.”

Insulated glass with low-E coatings reduce solar heat gain and the sash was manufactured from Accoya wood, which is modified through an acetylation process that results in low thermal conductivity and high dimensional stability. “It’s neat how you can take a 100-plus-year-old design and build it in a way that looks like the old window, but with the performance characteristics of a modern-day replacement,” Gentleman adds.

Although restoration of the approximately 300 windows has taken 2 1/2 years, the window retrofit is not complete. Re-View will manufacture and install interior bullet-resistant ballistic windows made of steel and ballistic glazing in high-security sections of the facility.

After seeing the restoration, Gentleman recalls Capitol employees describing the windows as “amazing,” “incredible” and saying, “I love these windows.”

“When someone starts using terms like ‘I love’ and

having an emotional attachment to a window, that’s what you’re looking for,” he says. “This is a tough crowd, too. They’re politicians! There are protests and bickering and it sometimes seems like a controversial pit. Then, amidst all that, you have all those people coming together and agreeing they love the windows.”

From Office to Residence


Built in 1929, 1616 Walnut St. has long stood as one of Philadelphia’s premier examples of Art Deco architecture. New ownership decided to convert the structure into a luxury residential building in 2013.

The rehabilitation included replicating existing steel windows, which were manufactured by a company that no longer exists. The Washington, D.C.-based U.S. National Park Service had to approve the new window design, which would be used to replace more than 1,300 windows.

Graham Architectural Products, York, Pa., which designed and manufactured the historically accurate windows,

became involved early in the process. Bill Wilder, director of technical sales, explains early involvement is part of what keeps a historic project’s momentum. “The process to design a product that will meet the local historic entities’ and National Park Service’s requirements can be time consuming,” he explains. “The building owner was very savvy and got us working on the project very early on. We visited the site, sketched the existing window and then sketched ours to match it. After that, the historic consultant, Powers and Co. Inc. [Philadelphia], tweaked some designs they thought would help meet the National Park Service’s requirements.”

The time required to get NPS approval



“ THE WINDOW ENDED UP BEING DEEPER FROM THE INSIDE TO OUTSIDE THAN THE ORIGINAL WINDOW, WHICH IS HOW WE GAINED THERMAL PERFORMANCE AND STRENGTH. ”

—Bill Wilder, director of technical sales,
Graham Architectural Products



The design of 1616 Walnut St.'s windows called for neutral colors on the frames' interior and a historically accurate reddish color on the outside.

of the windows can be the biggest risk to the success of historic-tax-credit projects. Putting together an experienced historic window team early can greatly reduce the risk of delay in the approval process. This will help set an accurate budget that can be maintained, and the team also will help efficiently navigate the historic submission process.

There was a little back and forth through approvals, which is a two-step process. The first step is submitting background information to the park service. The second step, which Wilder was deeply involved in, is the technical submission, which includes submitting drawings, photographs and documentation to the National Park Service. "Matching the profiles got a little more refined than our off-the-shelf product, but we reacted quickly to feedback and redesigned the product where we had to," he says. "We've done a lot of historic projects through the years; therefore, we have developed an extensive selection of historic product options and we can meet the historic requirements without it being too difficult or time-consuming." Graham Architectural Products provided full-size mockups to ensure the windows and accessories matched the existing ones.

Two side-by-side casement windows adorned the majority of the building. "The

owners didn't want those to operate, but they wanted them to look operable," Wilder says. "We see that request fairly often. If they are adding a new heating and cooling system, they don't want operable windows. They also save costs on operable hardware."

The original casement windows had hinges that projected about 4 inches from the face of the window, which Graham Architectural Products had to mimic. A hardware manufacturer created a casting to recreate the hinge.

The design called for neutral colors on the frames' interior and a historically accurate reddish color on the outside. "That created some challenges," Wilder notes. "Aluminum is painted prior to assembling the window. If you don't design it correctly, it can be cumbersome from the cost standpoint, especially with high-performance finishes. The thicker insulated glass also made matching the sight lines and profile of the original window more difficult."

Extruding the aluminum frames to the proper specifications that meet the historic profiles was not a difficult job. Wilder explains the challenge comes with marrying the thermal performance to it. "Aluminum can be extruded or cast into nearly any shape, but you have to design in thermal-performance enhancements to achieve energy-efficient windows," he says. "And the window has to be structurally strong

enough for a high-rise building. Aluminum isn't as strong as steel, so you need to build strength into it. The window ended up being deeper from the inside to outside than the original window, which is how we gained thermal performance and strength. Aluminum is also a great conductor of heat and cold so we had to have thermal barriers to counter that and meet the ever-increasing energy codes." High-performance thermal barriers and standard 1-inch insulated low-E glass yielded a window with a U-value of 0.42.

Double-hung windows on the building's main façade had a distinctive raised profile around each pane of glass. Wilder's team mimicked that look on 173 windows. "The NPS has become aware of that type of profile and views it as historically significant on historic projects; these windows are found all over the country," Wilder explains. "The NPS is becoming more demanding on replicating that raised profile. We're continuously trying to raise the bar to accurately reproduce these historically significant details as technologies and manufacturing techniques improve."

Projects across the country, such as the Minnesota State Capitol and Philadelphia residential building, continue to push manufacturers and designers to create the most effective products while staying true to the original look. 

Airport concessionaires' clear pick for movable glass storefronts



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UNPLUGGED

WRITTEN BY | CHRISTINA KOCH

Burlington, Vt., Operates on 100 Percent Renewable Energy

Burlington, Vt.—population approximately 42,000—is a forward-thinking city, known as the birthplace of Ben & Jerry’s ice cream and named in 2010 by *Forbes* magazine as one of America’s “prettiest” towns. Recently, the city has added another, even more impressive, accomplishment to its résumé: Burlington is operating on 100 percent renewable energy—and not just within municipal buildings, but within residential, commercial and industrial buildings, as well.

The feat has been a decade in the making, according to Neale F. Lunderville, Burlington Electric Department’s general manager. The city’s five-person electric commission, which consists of Burlington citizens who are appointed by the city council, decided around 2004 it wanted to take the electric department’s already advanced renewable portfolio further. “We had already been doing a pretty

(continues on page 58)



View a PBS report about Burlington’s renewable-energy feat.

PHOTOS: CATHY CHAMBERLAIN



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ANY CITY CAN TRANSITION TO 100 PERCENT RENEWABLE ENERGY

GENERAL MANAGER NEALE F. LUNDERVILLE and his colleagues at Burlington Electric Department, Burlington, Vt., have joked that they should set up a consulting arm because they receive so many telephone calls about the city's successful transition to 100 percent renewable energy. "We're really happy to share our information," he says, noting that any city—no matter climate or size—can follow Burlington's lead but it must have the will and a plan.

"We had the political will from our electric commission 10 years ago to say we're going to do this; it's not going to be easy but we're going to push until we get there," Lunderville notes. "We had a plan to do it that was developed by our staff. Lastly, we had community support. We have a very progressive community when it comes to energy, and that's a must."

good job with our biomass and other things that have been around for a while," Lunderville says. "We made it a point to buy renewable contracts and source more renewable power. The last piece of the puzzle was purchasing Winooski One, the first dam located on the Winooski River outlet into Lake Champlain, for hydro-power."

Lunderville underscores that the city is sourcing renewable power for 100 percent of its needs. "We don't produce all of it ourselves, but we produce a lot of it ourselves," he says.

Thinking Ahead

Burlington officially began operating on 100 percent renewable energy in September 2014 when it purchased the Winooski One hydro dam, which brought 7.4 megawatts of power into its electric system. The dam provides about 8 percent of Burlington's electric needs. This, along with other hydroelectric power purchased under contract, provides about one-third of the city's electricity. Another third of the city's power comes from a 50MW biomass plant, which is located in Burlington and

50 percent owned by Burlington Electric; other Vermont utilities own the other half, allowing those utilities to claim the power. The final third comes from a mix of wind contracts with Maine and Vermont vendors and solar, which includes Burlington Electric's own solar farm that produces 1/2MW of power, as well as several smaller solar installations.

"We wanted a mix of different renewable sources, so finding the right mix and finding it in New England, which is a fairly confined space, was difficult," Lunderville explains.

Once contracts were negotiated by Burlington Electric's power purchasers, the contracts were approved by the commission—not all were approved by voters. However, voters did approve a long-term contract for hydroelectric power from Hydro-Quebec and were asked to approve a \$12 million bond to finance the purchase of Winooski One, which they did overwhelmingly in March 2014. "That's a great example of where the community came in and said we support Burlington Electric going to 100 percent renewables and we're willing to put our money where our mouth



BURLINGTON OFFICIALLY BEGAN OPERATING ON **100 PERCENT RENEWABLE ENERGY** IN SEPTEMBER 2014 WHEN IT PURCHASED THE WINOOSKI ONE HYDRO DAM, WHICH IS THE FIRST DAM LOCATED ON THE WINOOSKI RIVER OUTLET INTO LAKE CHAMPLAIN.

is,” Lunderville asserts. “It passed with 80 percent of the vote; it was big.”

Lunderville adds Burlington Electric’s customer base is very “plugged in” to energy issues. “We had strong community support to be on the leading edge of innovative ways to manage our power and work toward our climate-change goals.” (Learn about Burlington’s Climate Action Plan at bit.ly/1O8MTEI.)

Consequently, Burlington Electric has rewarded its customers by not raising rates since 2009 and, Lunderville adds, the utility has no plans for a rate increase for at least the next two years. Lunderville credits this to the utility’s revenue stream created by its renewable-energy portfolio (selling renewable-energy credits) and its newfound protection against fossil-fuel pricing volatility. “We’re not worried about the cost of fossil fuels,” he says. “Oil could easily go up to \$300 per barrel; natural gas could go to \$15 per Btu. It wouldn’t matter to us.”

Granted, Burlington Electric’s renewable portfolio is not free. It buys the wood that is burned at the biomass plant, and fuel from the sun, wind and river are purchased through Power Purchase Agreements, which allows Burlington Electric to pay a fixed price per MWh. “We’ve been very cost-conscious here, so even when the cost of renewables was a bit higher than fossil fuels, we’ve been able to manage it on the backend by keeping our costs low,” Lunderville adds.

Challenges and Opportunities

Before sourcing 100 percent renewables to operate Burlington, the electric department had been buying “market power”, a mix of 50 percent natural gas; 30 percent nuclear; part coal and oil; and a small amount of other fuels, such as hydro, biomass, landfill gas, etc. Market power is available in New England, which is its own independent system operator.

Although the city has moved away from market power, critics still find faults with Burlington Electric’s forms of power generation. Lunderville explains: “Some people don’t like wind turbines on ridge lines; other folks don’t like hydro because it upsets the flow of the river and fish



We’re not worried about the **COST OF FOSSIL FUELS**. Oil could easily go up to \$300 per barrel; natural gas could go to \$15 per Btu. It wouldn’t matter to us.—*Neale F. Lunderville, general manager, Burlington Electric Department*



AFTER A DIRECTIVE FROM THE CITY’S FIVE-PERSON ELECTRIC COMMISSION, BURLINGTON ELECTRIC DEPARTMENT’S STAFF IMPLEMENTED THE PLAN TO SOURCE **100 PERCENT RENEWABLE POWER** FOR THE CITY’S ELECTRICAL NEEDS.



BURLINGTON’S CHURCH STREET MARKETPLACE BOASTS MORE THAN 100 PLACES AT WHICH TO DINE AND SHOP—ALL OF WHICH NOW ARE **POWERED BY RENEWABLE ENERGY**.

VERMONT SCHOOLS ACHIEVE ENERGY STAR DESIGNATION, A GOAL FOR ALL



Representatives of the Vermont Department of Education, Barre; Vermont Superintendents Association, Montpelier; and the U.S. Environmental Protection Agency, Washington, D.C., joined Burlington-based Efficiency Vermont in February at an award ceremony to recognize 22 schools for their excellent energy performance. Each school received an ENERGY STAR designation for meeting stringent standards for energy use and creating healthy learning environments. The ceremony, held at U-32 High School in Montpelier, also celebrated the continued progress of Project Green School, an initiative that aims to help all Vermont schools achieve the ENERGY STAR designation.

Burlington Electric Department played a key role in helping the nine Burlington-based schools achieve the ENERGY STAR designation.

With the 11 schools recognized in 2013 as Vermont's first ENERGY STAR schools, approximately 10 percent of Vermont schools now are certified. These schools have implemented a wide variety of cost-effective strategies, demonstrating that creating a healthy, energy-efficient school is within reach for every school in Vermont. The economic benefits are clear: Top-rated ENERGY STAR schools spend 40 cents less per square foot in energy costs than an average school. For a 50,000-square-foot school, this equals approximately \$20,000 in annual savings.

"I'm so impressed to see that the number of ENERGY STAR-certified schools in Vermont has tripled over the past year," says EPA Regional Administrator Curt Spalding. "Improving energy efficiency saves their local community money, while also helping to reduce greenhouse-gas emissions that cause climate change. These Vermont

communities are showing real leadership."

"We are excited to see support and interest in this important effort continue to grow," adds Vermont Education Secretary Rebecca Holcombe. "The ENERGY STAR designation aligns with our goal to ensure that every Vermont student has access to a healthy and comfortable learning environment—all while improving their understanding of the impacts of energy use on the environment and their communities."

Vermont schools have long been a leader in the implementation of energy-efficiency measures and the adoption of renewable-energy generation. During the last 14 years, Efficiency Vermont and the Vermont Superintendents Association's School Energy Management Program has supported more than 1,200 energy-efficiency projects at over 350 schools, delivering in excess of \$43 million dollars in energy savings during the lifetime of the projects. In the area of renewable energy, Vermont has pioneered the use of modern wood heating systems and more than 54 Vermont schools currently use wood for heating fuel.


"By attaining ENERGY STAR designation, these Vermont schools are not only bringing educational and health benefits to students, but also economic benefits to local taxpayers," asserts Jeff Francis, executive director of the Vermont Superintendents Association. "Energy-efficiency projects allow schools to take control of their energy costs, freeing up crucial funds and supporting Vermont communities."

To learn more about Project Green School, visit www.encyvermont.com/projectgreenschool.

passage; some folks don't like biomass because they don't believe we should be cutting down trees; some people don't like solar farms because we shouldn't be taking up green spaces. However, these are all better alternatives to buying power from natural gas- or coal-fired facilities. We have yet to invent the perfect energy source. We would love to have impact-free electricity generation but it doesn't exist. Instead, we're going to continue to push toward finding ways that have the least impact."

In that vein, Winooski One has achieved its third five-year term of Low Impact Certification from the Old Tappan, N.J.-based Low Impact Hydropower Institute. The non-profit 501(c)(3) organization certifies hydropower projects that meet or exceed criteria in eight areas: river flows, water quality, fish passage and protection, watershed protection, threatened and endangered species protection, cultural resource protection, recreation and facilities recommended for removal.

The city of Burlington and its electric department have much of which to be proud. In addition to sourcing 100 percent renewable energy for its electric needs, 95 percent of Burlington's homes and businesses have smart meters, providing customers more awareness and greater control of their energy usage. The city also has its own energy-efficiency utility that has been active for more than 15 years. In fact, Burlington uses less power today than it did in 1989 because of its energy-conservation efforts.

"We own a lot of renewable generation and we have a really advanced distribution network. By tying all these things together we're looking to see how we can support community-scale power on a much greater level than we have today," Lunderville says. "For example, how can we support solar for more of our customers and how do we integrate those resources into our network in a way that improves the resiliency of our grid and minimizes the long-term cost risks for us? Those are our next challenges, but we look forward to taking them on." 

PUTTING THEORY INTO PRACTICE

WRITTEN BY | LOIS OLCOTT PRICE
AND JOHN W. CASTLE, P.E.

Winterthur Museum, Garden & Library Sustains Collections while Saving Energy

Winterthur Museum, Garden & Library is located in the rolling hills of the Brandywine Valley just north of Wilmington, Del. Originally, the property was the family home of Henry Francis DuPont, a renowned collector of American art and decorative arts, a horticulturist known for extraordinary naturalistic gardens and a dairyman who created bloodlines that still influence American milk production. Winterthur opened as a public institution in 1951. The 1,000-acre campus includes 118 structures; 10 miles of paved roads; a dedicated water and sewer system; and extensive collections that require a specialized preservation environment, creating complex control and sustainability challenges for Winterthur's Facilities Director John Castle and his staff.

The core museum complex consists of three interconnected buildings constructed at different times primarily during the 20th century: the Galleries with 35,000 square feet of displays; the Museum with 175 rooms containing distinctive architectural features and furnished with approximately 85,000 objects; and the Research Building, which houses the Winterthur Library and extensive conservation, research and education facilities. Winterthur's collection spans more



WINTERTHUR'S CORE BUILDINGS WERE THE PRIMARY FOCUS OF THE ENERGY-CONSERVATION PROJECT.

than two centuries of American decorative arts and contains some of the most important pieces of American furniture and fine art, including a set of six matching tankards by Paul Revere, the standing portrait of George Washington at Verplank Point by John Trumbull and the finest high-style American Chippendale furniture. The independent research library contains more than 90,000 volumes and 1 million manuscripts and images related to American history, technology, decorative arts and architecture.

Winterthur's facilities staff working with conservators had undertaken several efforts during the last decade to develop energy-saving protocols but was consistently frustrated by the inability of monitoring systems to provide reliable real-time environmental information that would ensure collection safety while conserving energy. A unique team of engineers, facility and energy managers, collection conservators and preservation environment consultants had to come together and learn each other's languages to move toward a common goal. Ultimately, they created a solution that resulted in a 20 percent energy reduction and led to Winterthur receiving the prestigious Corporate Energy Manager of the Year Award from the Greater Philadelphia Chapter of the Association of Energy Engineers.

LEARN MORE For more information about the Wilmington, Del.-based **Winterthur Museum, Garden & Library**, visit www.winterthur.org. More information about the **Image Permanence Institute**, Rochester, N.Y., can be found at www.imagepermanenceinstitute.org.

Expert Collaboration

Winterthur's collections require a stable environment that controls temperature and relative humidity within fairly narrow parameters. The complex physical plant and inadequate monitoring and control systems challenged the mechanical equipment's ability to provide adequate environmental control and required massive amounts of energy that strained the institutional budget and gave Winterthur a significant carbon footprint.

The mechanical infrastructure includes a central steam plant, two central chilled-water plants, multiple high- and low-pressure air-handling units, hundreds of induction units, multiple fan coils and many pumps. These systems are tied together through a network of false walls, pipe chases, tunnels and hidden mechanical alcoves previously operated by three obsolete pneumatic controllers that could not communicate with each other. It is a complex system to which many un-

documented and often counterproductive changes and adjustments have been made during many decades.

In early 2012, Castle initiated a comprehensive audit of the HVAC system, contracting with the Warrington, Pa., office of Limbach Engineering & Design Services, which already provided backend maintenance services for the system and was familiar with its issues. Castle shared Limbach Engineering & Design Services' detailed report with Lois Olcott Price, director of conservation, an advocate for a more stable and sustainable collection environment. The recommended mechanical upgrades were fairly straightforward, ranging from boiler-burner and air-handler control upgrades to variable-frequency-drive installation. However, the monitoring and system control issues required radically new thinking.

The heart of the recommendations, therefore, was installation of a unified web-based system that monitored and controlled every fan, valve, motor, damper, air handler, boiler and chiller in the system, allowing the entire mechanical system to be monitored and adjusted from any place and using any device with Internet access. The web-based Building Automation System was developed by Richmond, Va.-based Tridium on the open-source Niagara framework. (Learn more about BAS apps and software on page 90.)

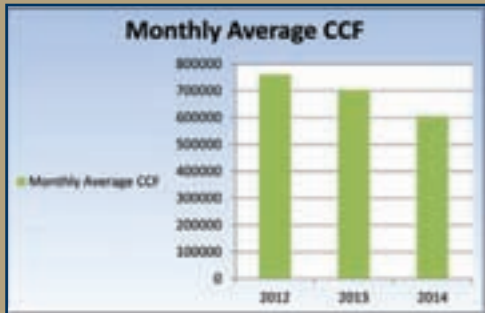
Although reasonably confident in Limbach Engineering & Design Services' findings and recommendations, Winterthur enlisted James Reilly of the Rochester, N.Y.-based Image Permanence Institute (IPI), which provides cultural institutions, preservation scientists, and consumer preservation industries with research, publications and tools to preserve image collections and material culture, and Peter Herzog of St. Paul, Minn.-based Herzog/Wheeler Associates, which is an energy consultancy, to review the proposal and meet with Limbach Engineering & Design Services and Winterthur's facilities and conservation staff.

Reilly, who often partners with Herzog, has become a leading consultant for cultural heritage institutions working on energy and sustainability projects. Research at IPI has led to a much better understanding of the environmental needs and tolerances of collection materials; explored the ability of structures under favorable weather

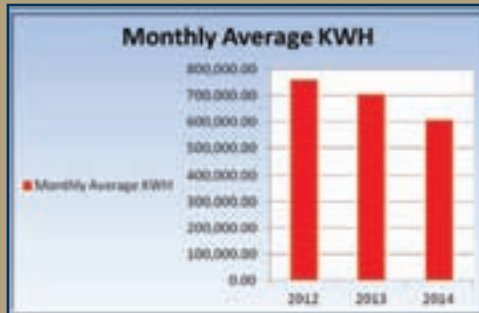
PHOTO: GAVIN ASHWORTH, COURTESY WINTERTHUR MUSEUM, GARDEN & LIBRARY



↑ THE CHINESE PARLOR IS ONE OF 175 MUSEUM ROOMS IN THE FORMER HOME OF HENRY FRANCIS DUPONT IN WHICH A STABLE CLIMATE IS A CRITICAL PART OF COLLECTION PRESERVATION.



Monthly Average CCF: From 2012-14, Winterthur's average gas consumption fell from 750,000 to 600,000 cubic feet.



Monthly Average kWh: Electrical usage at Winterthur fell about 750,000 kilowatt-hours to about 600,000 kWh during 2012-14.



Monthly Average Cost: Winterthur's average monthly utility bill dropped from \$105,000 to under \$80,000 during 2012-14.

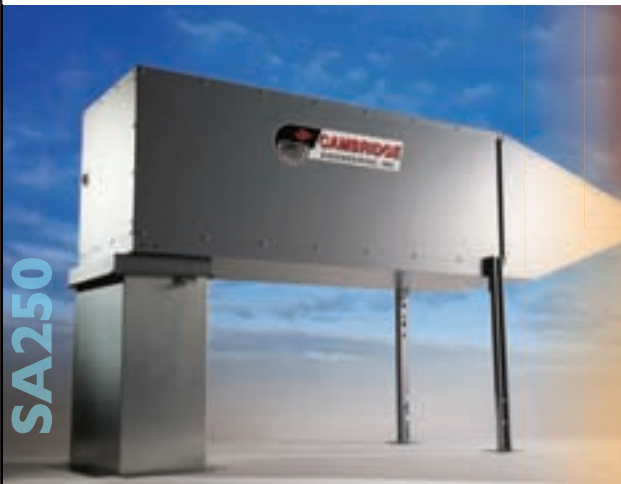
conditions to buffer the environment without the intervention of HVAC systems; and developed tools, such as e-Climate Notebook, that help quantify the response of objects to different conditions and balance that with reduced energy consumption that will not compromise collection preservation. Reilly and Herzog raised some useful questions and made a game-changing suggestion: Why not create an interface that would automatically populate e-Climate Notebook with data gathered by the web-based control system?

e-Climate Notebook assesses the risk of natural aging (oxidation), corrosion, mold and mechanical damage caused by large fluctuations in relative humidity. An analytic tool incorporated into the program predicts the risk associated with various combinations of temperature, relative humidity and dewpoint to inform cost-benefit decisions. Data has traditionally been entered into e-Climate from data-loggers downloaded at regular intervals, but an interface would allow collection managers to see real-time conditions in collection areas

and immediately assess risks and benefits from changes in control settings.

Thus began several months of intensive preparation to apply for a grant from the Washington, D.C.-based National Endowment for the Humanities (NEH) program for Sustaining Cultural Heritage Collections. The grant would fund a significant part of the control upgrades and the ongoing monitoring and system refinement. Ultimately, Winterthur's experiences would develop protocols and procedures useful for other cultural institutions. In September 2012,

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Winterthur received a \$350,000 grant from NEH. The success of the grant application was the result of open and intensive collaboration between Winterthur's facilities and conservation departments and Limbach Engineering & Design Services, coupled with input from credible and respected consultants.

The Outcome

Under Castle and Price's leadership and working with Limbach Engineering & Design Services' talented and innovative staff, Winterthur has implemented 33 facilities improvement measures (FIMs) during the last two years. The FIMs have helped Winterthur reduce energy consumption by 20 percent while stabilizing and often improving the environment in collection spaces.

With volatile weather and energy costs, a payback period is difficult to predict, but the project has exceeded initial estimates. These FIMs changed the environment, upgraded infrastructure, reduced energy consumption, instituted effective real-time system monitoring, and gave facilities staff and conservators the tools to track and understand what is happening in their unique museum.

In addition to the web-based control system, the most significant FIMs include:

- Mapping the entire mechanical system to identify problem areas and anomalies.
- Increasing the number of sensors in 175 Museum rooms from 29 to 78.
- Repairing return dampers on two major air handlers to reduce outside air and restore balance.
- Replacing boiler-burner controls to allow a 1:10 turndown ratio, replacing the 1:3 controls and installing a VFD.
- Installing VFDs on all air handlers and soft starts to accommodate energy cycling.

Although these upgrades were critical, the most significant change has been in the assumptions that govern control of the HVAC system. For many decades, cultural institutions demanded flat-line energy control at 70 F and 50 percent relative humidity with very tight tolerances. Winterthur's system was designed and run to meet those standards, meaning that all components—chillers, air handlers and boilers—functioned at near 100 percent capacity much of the time and controls were set to the worst-case scenario. For example, reheats were set at 82 F winter and summer,

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requiring induction units that adjust the air temperature in each room to overcome a large temperature differential to cool the spaces in the summer. Reheats are now programmed to coordinate with the supply air and outside temperature, providing more nuanced control and significant energy savings.

The proof of the conservation program's results can be found in the numbers. From 2012-14, the number of degree days (temperatures above and below 60 F that call for heating and cooling) rose from about 5,050 to about 5,750. However, Winterthur's average gas consumption fell from 750,000 to 600,000 cubic feet, and its average monthly electrical usage fell from about 750,000 kilowatt-hours to about 600,000 kWh. Ultimately, the average monthly utility bill dropped from \$105,000 to under \$80,000.

Next Steps

With mechanical upgrades nearly complete and a vastly improved monitoring and control system, Winterthur is now positioned to continue lowering its energy consumption. Energy cycling began in January 2014 to test the buffering capacity (ability to maintain

adequate temperature and relative humidity) of the Museum if the chiller and air handlers are turned off at night. The team discovered that during winter months, buffering for this building was adequate to 25 F and during summer months up to 80 F. Similar testing continues for all seasons and buildings, taking outside temperature, relative humidity and dewpoint into consideration. More nuanced control will further enhance savings; on cool, dry summer mornings the system may come on later and the chilled water temperature may be allowed to rise 1 degree (10 percent energy savings) if the forecast is moderate.

Limbach Engineering & Design Services continues to work closely with Winterthur under a continuous commissioning agreement to ensure mechanical systems function at maximum efficiency, address the shrinking list of anomalies and problem areas, and tune the control system to maximize energy savings. This program promises to keep the facilities and conservation teams in front of operational and control strategies while maintaining a preservation environment for the collections, making Winterthur a leader in the museum energy-conservation arena. 



A CLOSER VIEW SHOWS THE DAMAGE TO THE WOODEN SUBSTRATE AND LACQUER COATING CAUSED BY UNSTABLE ENVIRONMENTAL CONDITIONS.



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WRITTEN BY | DON EBERLY

PHOTOS AND ILLUSTRATION: PONCE CITY MARKET



Positioned on essentially a full city block in Atlanta, the expansive landmark Sears, Roebuck & Co. building has seen its share of occupants and tenants. Beginning in 1925 as the company's catalog store and Southeast distribution point, then sold in 1991 to the city of Atlanta for use as City Hall East, the building's bygone and more appreciated era on the part of locals had become something of the past.

The year 2011 saw a new owner, Atlanta-based Jamestown, an investor of high-quality real estate, taking the reins. Jamestown set out by consulting with neighborhood residents to determine the best uses for the building, followed

by one of the region's most impressive renovations, transforming the industrial space into a mixed-use complex to include retail, restaurants, residences, offices and green space.

The building has been bestowed



Retrofit Team

OWNER // Jamestown, Atlanta, www.jamestownlp.com

ARCHITECT // Stevens & Wilkinson, Atlanta, www.stevens-wilkinson.com

CONTRIBUTING INTERIOR DESIGNER // Fogarty Finger, New York, www.fogartyfinger.com

ENGINEERING // Jordan & Skala, Atlanta, www.jordanskala.com, and Browder + LeGuizamon, Atlanta, www.blaengineers.com

PROGRAM MANAGEMENT // Silverman Construction Program Management, Atlanta, www.silvermancpm.com



Materials

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PORCELAIN FLOOR TILE // Casalgrande Padana, www.casalgrandepadana.com

SUBWAY TILE // Roca Tile USA, rocatilegroup.com

CABINETRY AND PULLS // AyA Kitchens & Baths Ltd., www.ayakitchens.com

QUARTZ COUNTERTOPS // Daltile, www.daltile.com

REFRIGERATORS // Kenmore, www.kenmore.com, and Summit Appliance, www.summitappliance.com

DISHWASHER // Bosch, www.bosch-home.com/us (Panel front from AyA)

RANGE // Summit Appliance

MICROWAVE // Panasonic, www.panasonic.com

STACKED WASHER/DRYER // GE, www.geappliances.com

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ENERGY-RECOVERY UNITS // AON, aon.com



JAMESTOWN SET OUT BY CONSULTING WITH NEIGHBORHOOD RESIDENTS TO DETERMINE THE BEST USES FOR THE BUILDING.

a new name, Ponce City Market, given its new uses and famous Ponce de Leon Avenue address. Atlantans have watched the adaptive-reuse plan unfold for more than two years, and the area is abuzz with new interest about what many are calling the building's rebirth.

Possibly the most exciting to select locals is the fact the building now includes residences, offering a comprehensive live-work-eat-shop-play opportunity for those lucky enough to call the FLATS at Ponce City Market home.

Creating the FLATS

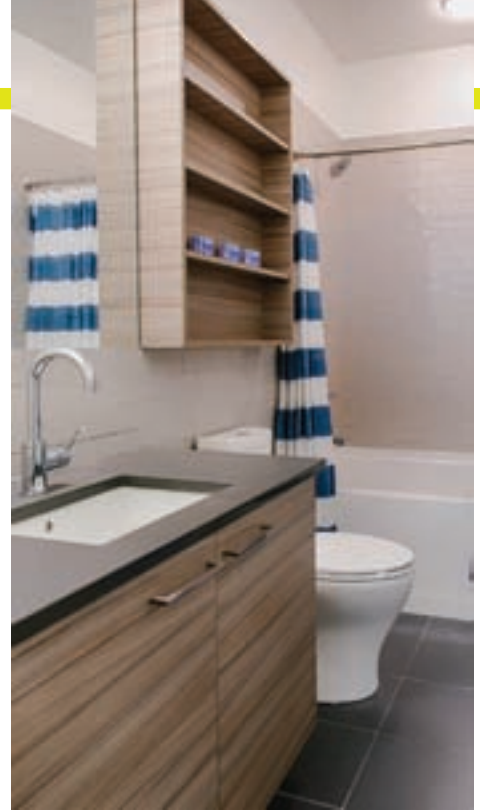
Stevens & Wilkinson, a full-service commercial architecture, engineering and interior design firm based in Atlanta and Columbia, S.C., announced during early winter 2015 its role as architect for the adaptive reuse and historic renovations of the uppermost seven floors of the east and west wings, creating the new FLATS at Ponce City Market. The completion of the apartment homes achieved a major milestone in the overall Ponce City Market project, which will restore 2.1 million square feet of space, creating a vibrant urban centerpiece that combines 300,000 square feet of retail and restaurants, 450,000 square feet of office space and 330,000 square feet for 259 residential units.

As lead architect for Ponce City Market's residential portion of the building, Stevens & Wilkinson oversaw the comprehensive creation of the FLATS to include a mix of studio, one-, two- and three-bedroom units, including 17 two-level lofts. Fogarty Finger, based in New York, contributed to the interior design.

As part of its historic preservation and adaptive-reuse effort, Stevens & Wilkinson embraced the building's 1925 architectural features, including historic masonry, columns and original design elements. Floor plans range from 575-square-foot studios, or flats, to 1,790-square-foot three-bedroom lofted units. All units have at least one large steel window with generous

living areas located near the windows. Bedrooms that do not have an exterior window receive borrowed light through a clerestory window, which also creates the illusion of more open space. The units have one bath per bedroom, typically, and one-bed-plus-den units include larger bathrooms with a double vanity. Done in various shades of gray, characteristics of the bathrooms include frameless glass showers; porcelain tile floors that resemble slate with contrasting subway tile on the walls; modern fixtures; and European cabinetry and counters. Tubs are only in the second





The completion of the apartment homes achieved a major milestone in the overall Ponce City Market project, which will restore 2.1 million square feet of space, creating a vibrant urban centerpiece that combines 300,000 square feet of retail and restaurants, 450,000 square feet of office space and 330,000 square feet for 259 residential units.



AS PART OF ITS HISTORIC PRESERVATION AND ADAPTIVE-REUSE EFFORT, STEVENS & WILKINSON EMBRACED THE BUILDING'S 1925 ARCHITECTURAL FEATURES.

bath of the two-bed units, as the market showed less desire for bathtubs.

Stevens & Wilkinson designed the kitchens with clean lines and ample working area within condensed space. The cabinets are European-style with modern pulls and include a tall pantry for storage, soft-close drawers and a panel-front dishwasher. The stainless-steel appliances in each FLAT comprise a gas range, per market demand; counter-depth refrigerator; and a microwave that fits in the pantry. Open floating shelves above the sink allow residents to display glassware and dinnerware.

In general, the layout of the FLATS was dictated by the limitations of the existing structure. Only certain areas structurally would allow cutting away the floor to run vertical services, and large columns are located 20 feet on center. These factors pro-

duced the unit footprint, and the various design and placement considerations were arranged accordingly.

The market research conducted by Jamestown indicated young professionals and empty nesters were the targeted demographics. The design followed suit and thus provided hip, lofty living space with privacy and unit amenities all residents would desire.

Leading to LEED

The installation of water-efficient fixtures and landscaping, reclamation of rainwater and other building-generated water, as well as the incorporation of LED lighting and proficient HVAC systems in the base building are all part of Ponce City Market's goal to achieve LEED Core & Shell Silver certification. Tenants of the FLATS, offices and commercial

spaces will be vested in state-of-the-art, sustainable and efficient conditions.

Stevens & Wilkinson had LEED certification in mind when finalizing how the FLATS would be designed. The energy-efficient appliances coupled with efficiently engineered mechanical and plumbing systems will contribute to the coveted sustainable design designation.

As the largest adaptive reuse project in Atlanta's history, the entire Ponce City Market project is estimated at more than \$200 million. The overall project is close to finishing construction with the expected completion in mid-2015. [F](#)



The FLATS include a mix of studio, one-, two- and three bedroom units, including 17 two-level lofts. Floor plans range from 575-square-foot studios to 1,790-square-foot three-bedroom lofted units.

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Plot Twist

WRITTEN BY | KJ FIELDS



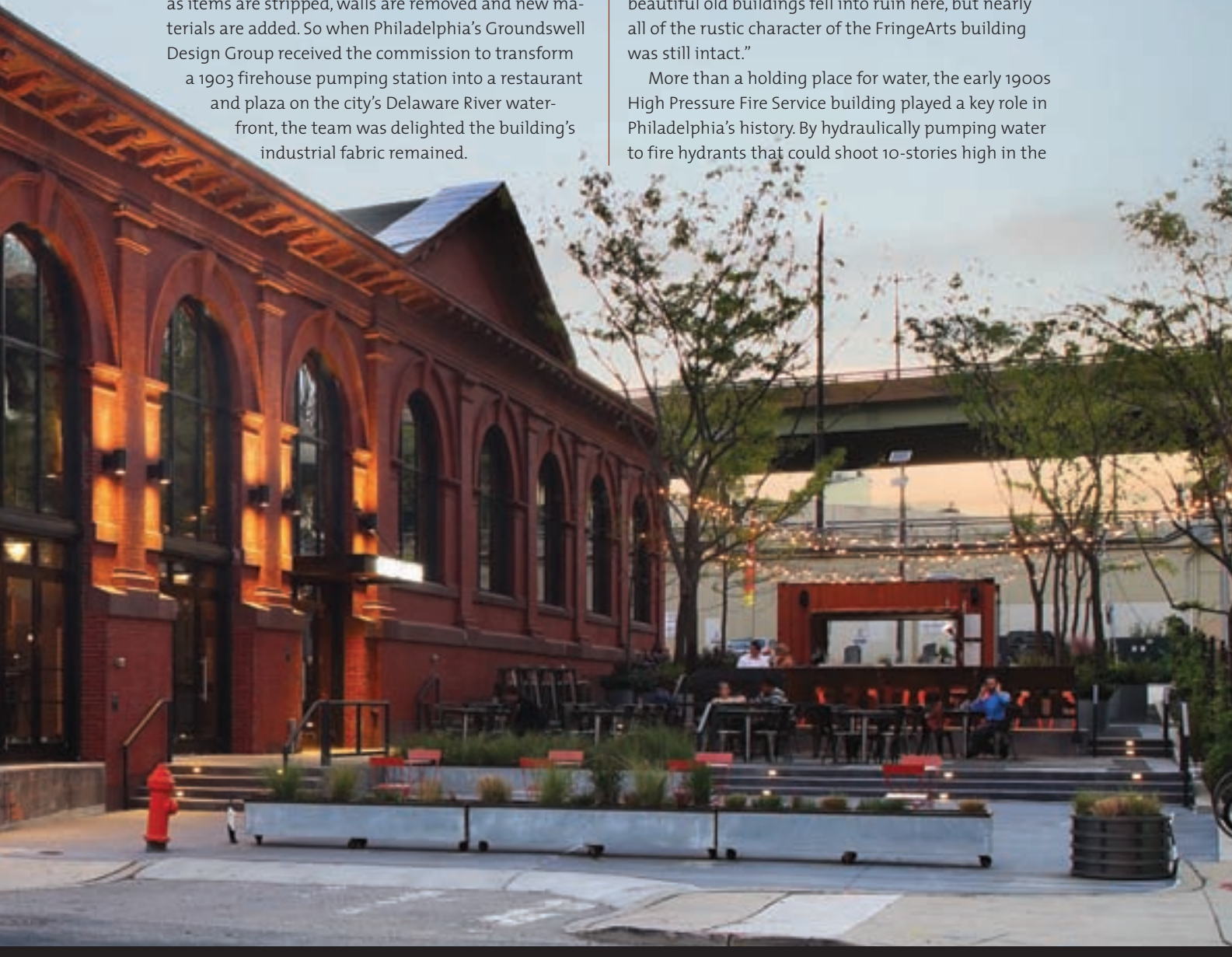
PHOTOS: MATT WARGO

An Emblem of Philadelphia's Past Becomes a Contemporary Restaurant that Chronicles a Bygone Era

Buildings that stand for 100 years often do so by changing with the times. Refashioned from one use to the next across generations, however, obscures a building's original glory as items are stripped, walls are removed and new materials are added. So when Philadelphia's Groundswell Design Group received the commission to transform a 1903 firehouse pumping station into a restaurant and plaza on the city's Delaware River waterfront, the team was delighted the building's industrial fabric remained.

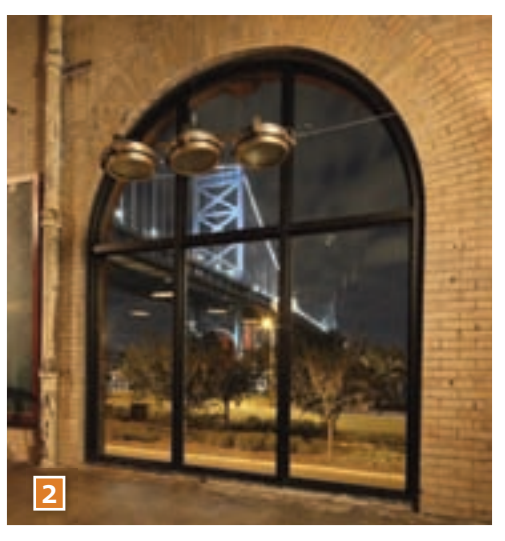
"For decades, this area of town had been neglected and the structure was transferred from a pump house to a storage area for the city," explains Groundswell Design Group's Principal David Fierabend. "A lot of the beautiful old buildings fell into ruin here, but nearly all of the rustic character of the FringeArts building was still intact."

More than a holding place for water, the early 1900s High Pressure Fire Service building played a key role in Philadelphia's history. By hydraulically pumping water to fire hydrants that could shoot 10-stories high in the





1



2



3

city's core, high-rise developments became feasible. Eventually, the advent of sprinkler systems made its function basically obsolete.

In the summer of 2012, the experimental theater group FringeArts purchased the 10,000-square-foot brick building and divided the space between its new 230-seat performing arts center stage and a 130-seat restaurant that became La Peg, a French brasserie under the proprietorship of Chef Peter Woolsey.

Building Blocks

Groundswell Design Group master planned and conceptualized the restaurant and plaza half of the project and brought Stokes Architecture, Philadelphia, into the team. The theater was up and running by the time La Peg's renovation got

underway and, although the two projects are separate, a 30- by 30-foot soundproof motorized door that bisects the building can be opened to create one combined event space.

Fierabend recognized great potential in the 4,200-square-foot cavernous space with its 45-foot ceilings and arched palladium windows. "We looked at all the elements left behind and archived a lot of the materials so we could repurpose them in the restaurant," he says. "The brash, industrial quality fit our aesthetic vibe for the space, so rather than cover them up we used them as visual moments that tell the story of the materials through time."

For example, during the years, parts of the concrete floor had been chiseled away and the holes had been patched with metal diamond plate. Rather than remove

the diamond plate pieces and refinish the floor, Groundswell Design Group left the patchwork exposed. The team created a mezzanine and used existing 1900s metal stairs (that don't comply with current code) as small mezzanine balconies.

The firehouse's metal shelving became mezzanine bookcases and the top of La Peg's new bar. The face of the bar incorporates 1940s wainscoting found in the building. Original doors were restored as restroom doors or those needed for back-of-house functions, like the storage room and wine cellar. Likewise, antique distorted glass with its chicken wire became divisions for storage areas and offices.

"We let the integrity of the space dictate to us what it would ultimately become," Fierabend recalls. "We kept all the glazed brick. We didn't try to hide the old plaster.

- 1 THE 10,000-SQUARE-FOOT FRINGEARTS BUILDING, A FORMER FIREHOUSE PUMPING STATION ON PHILADELPHIA'S DELAWARE RIVER WATERFRONT, NOW IS LA PEG, A FRENCH BRASSERIE.
- 2 THE BUILDING FEATURES ARCHED PALLADIUM WINDOWS THAT PROVIDE VIEWS OF A 1920S METAL SUSPENSION BRIDGE AND TRAINS THAT PASS NEARBY, TAKING PATRONS BACK TO A DIFFERENT ERA.
- 3 THE PROJECT TEAM TOOK ADVANTAGE OF THE CLOSED-TO-TRAFFIC AREA OF RACE STREET TO ADD AN OUTDOOR PLAZA OFF THE RESTAURANT.

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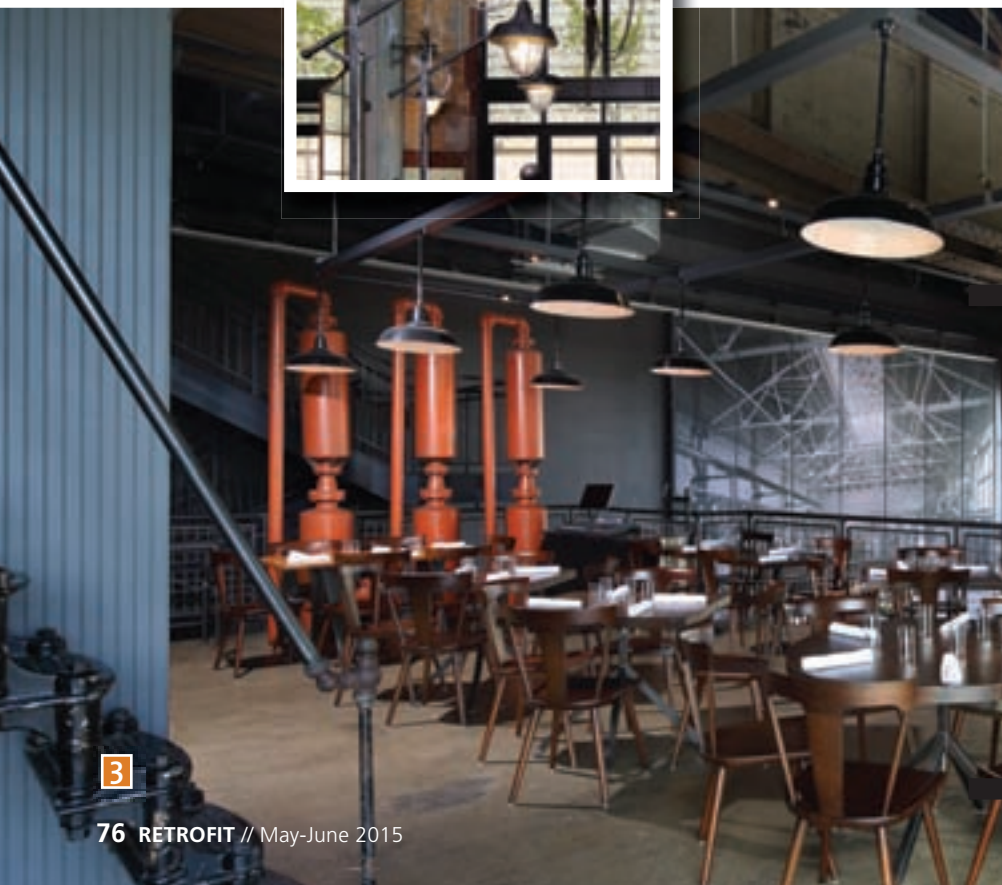
We exposed the nuts, bolts and I-beams. All these things got threaded back in that harken back to the building's history. Now, they're conversation pieces."

Visual Elements

Materials brought into the space also play into the vintage narrative. Conduits, ducts, air conditioning and electrical wiring are on exhibit. Groundswell Design Group salvaged wood joists from a project that was being torn down to make way for new development and had them repurposed into La Peg's tables. Their natural aged texture and apparent wear stands as a testament to the wood fiber's utilitarian past. Exact replicas of early 1900s period lighting were installed throughout the space, including cantilevered lamp-post lighting that bends over the booths.

La Peg's artwork recounts its origins. Groundswell Design Group brought the water-holding tanks back into the space and repositioned them around the restaurant. The team discovered a map of the pumping station's service area in the building, which now decorates one wall. As part of the designers' historic research, they examined old photos and unearthed a black-and-white image taken the day the firehouse pump station opened in 1903. Using vinyl scrim as a canvas, they enlarged the image to 30- by 30-feet and had it cut into panels that fit across the sections of the motorized retractable door to recreate the scene behind the bar.

The FringeArts building is located at the foot of the Benjamin Franklin Bridge



1 THE FIREHOUSE'S METAL SHELVING BECAME THE TOP OF LA PEG'S NEW BAR. THE FACE OF THE BAR INCORPORATES 1940S WAINSCOTING FOUND IN THE BUILDING. **2** EXACT REPLICAS OF EARLY 1900S PERIOD LIGHTING WERE INSTALLED THROUGHOUT THE SPACE, INCLUDING CANTILEVERED LAMP-POST LIGHTING THAT BENDS OVER BOOTHS. **3** GROUNDSWELL DESIGN GROUP SALVAGED WOOD JOISTS FROM A PROJECT THAT WAS BEING TORN DOWN AND HAD THEM REPURPOSED INTO LA PEG'S TABLES. **4** LA PEG IS REMINISCENT OF A GRITTY FRENCH BISTRO, WHICH WORKS BEAUTIFULLY FOR THE SPACE AND MET THE CHEF'S VISION.



4

“The brash, industrial quality fit our **AESTHETIC VIBE** for the space, so rather than cover [the elements] up we used them as visual moments that tell the story of the materials through time.” —David Fierabend, principal, Groundswell Design Group



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and across from Race Street Pier, which was recently made into park and promenade evocative of New York City's High Line's landscape palette. Thanks to its locale, the drama further unfolds through the enormous palladium windows.

"Being in this space creates a rich experience," Fierabend notes. "In addition to the raw and repurposed interior materials, there are stunning views of the 1920s metal suspension bridge, and trains pass nearby, so those sights and sounds take you back to a different era."

Exterior Character

Philadelphia is reinventing the Delaware River waterfront; to enhance a pedestrian-friendly atmosphere, the city closed off vehicle traffic at the "elbow" end portion of Race Street. The project team took advantage of the closed area to add an outdoor plaza off the restaurant. Technically, the city still considers this portion of Race Street "active" with sewer services and a water main activation point running beneath the plaza. So, as part of the design process, it was a requirement that the city retain the ability for trucks to access the area.

Groundswell Design Group transplanted 20- and 30-foot-tall honey locust trees from another site that was being developed into a hotel. The site design placed the trees far enough apart to allow trucks to get through even as the trees grow. "It was a great solution because the trees would've just been cut down, and they are so large that they provide instant shade here," Fierabend says. Groundswell Design Group also brought 4- by 4-foot bluestone slabs from Princeton

(continues on page 80)

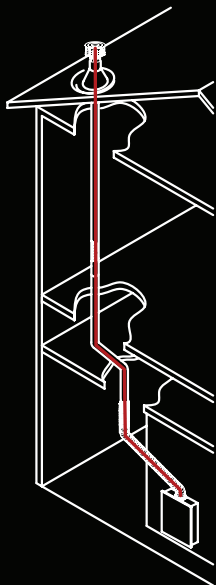
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University's walkways that dated back to the early 1900s into the plaza.

Woolsey, who was a very hands-on restaurateur during the design process, initially envisioned the restaurant as a traditional French brasserie. Respecting the building's illustrious past, Fierabend knew that the space didn't lend itself to that type of design but he also acknowledged that the space needed to resonate with Woolsey on a deep level. To find the perfect balance, the two spent a lot of time together going on tours of other restaurants, looking at books in coffee shops and even hanging out at Woolsey's home. "It's really important that the restaurant represent the soul of the chef," Fierabend asserts. "It was a bit of a dance at first, but La Peg ended up being reminiscent of a gritty French bistro, which works beautifully for the space and met Woolsey's aspirations."

Having the restaurant spill into the outdoor plaza furthers the French ambiance. Tree stumps and wooden picnic tables provide seating and bring organic elements into the urban streetscape. The very informal dining experience inspired Woolsey to serve a different menu of pub food outside that contrasts to the more elegant fare served at La Peg indoors. Site elevation changes produce a 3-foot difference from the lowest point to the center of the building, so Groundswell Design Group created a tiered area with handicap accessibility. Finishing touches came in the form of lighting.

"We gracefully uplit the building and strewed lighting randomly from tree to tree, using outdoor market bulbs that lend the flavor of a European alley or side street," Fierabend explains. "La Peg has done really well, and we're really pleased that people are responding to the design, Chef Woolsey's menus and the history of the place." 

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GET CONNECTED

With Wireless and Handheld Technology Changing the Building-automation Game, Opportunities and Challenges Abound for Upgrading Existing Facilities

WRITTEN BY | ROBERT NIEMINEN



“The building controls market is not building controls anymore—it’s integrations and building operations. Where it used to just be controlling an HVAC unit, now we’re asked to control and monitor an entire facility.”—*Shad Buhlig, president, Automatic Controls Engineering*

Welcome to the new era of building automation. Never before have building owners and facility managers had such sophisticated and integrated systems to keep their buildings operating at peak performance—thanks to ever-evolving digital tools that enable real-time monitoring and control of building systems. The automation of HVAC, lighting, fire and life safety, and security and access controls—particularly when combined with wireless technology—promises to improve energy efficiency and optimization and provide new levels of functionality. And the trend has real traction in the market.

In fact, according to a report from Boulder, Colo.-based Navigant Research, annual revenue from commercial Building Automation Systems worldwide will grow from \$56.9 billion in 2013 to \$100.8 billion by 2021. But the existing building stock is still rife with legacy equipment, outdated thinking, and budget constraints that prevent owners and facility managers from fully capitalizing on the efficiencies these new technologies afford them. Further, inherent challenges with wireless applications exist in retrofitting scenarios that can complicate matters.

Nevertheless, the demand for mobile building-automation controls is high as facilities management professionals seek to capitalize on greater access to real-time data, and opportunities for improving efficiencies abound with these emerging digital solutions. *retrofit* spoke to several industry experts from the InsideIQ Building Automation Alliance, an international association of independent building automation contractors, to find out what they had to say about this emerging trend.

Cutting the Cord

As wireless and mobile technology continues to develop at an increasingly rapid pace, building owners and facility managers expect those advancements to extend to building automation, as well. In fact, 43 percent of respondents to a 2013 Building Efficiency Panel IT Mobility Survey by Milwaukee-based Johnson Controls said their operations currently use mobile tools with their Building Automation System (BAS) or Building Management System (BMS), and another 30 percent said such systems would be very important in the future.

Additionally, the survey revealed mobile devices are already being used to access a wide variety of building-related data, including BAS/BMS (43 percent); HVAC equipment/controls (42 percent); work order scheduling/management (40 percent); energy usage/consumption (26 percent); lighting (23 percent); security (23 percent); utility costs (12 percent); and fire (11 percent). In fact, less than one-third (27 percent) of respondents said mobile devices are not being used for any of the above categories in their facilities.

“There’s a great deal of interest in the market with regard to wireless technologies and mobile access technologies,” explains Shad Buhlig, president of Automatic Controls Engineering, Hayward, Calif. “Building operators do not want to be tied to the aging computer nobody wants to touch down in the boiler room that isn’t even necessarily on the network. They want to leapfrog to 2015 and get their existing, aging DDC system—no matter whose brand it is—up to the current standard, and it needs to be accessible via the

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In spite of the many challenges to wireless technology and mobile applications that are emerging in the **building-automation space**, the trend still holds a great deal of promise in terms of helping owners and facility managers **optimize building performance** and **energy efficiency**.



web. So, whether using an Apple iOS or an Android or even just an Internet platform, that's the expectation."

Buhlig points out while the popularity of and demand for mobile applications for building automation are on the rise, he notes handheld technology is most commonly used for monitoring purposes and data collecting rather than for controls. Wireless solutions, he says, carry with them the added benefit of lower installation costs as opposed to hard-wiring. However, when it comes to controls, Buhlig says most customers still request browser-based hardwire systems that boast a higher degree of security (more on this later).

Among the reasons for the wireless trend in building automation is a strong push for data analytics as it relates to facilities management, according to Brian Oswald, executive vice president of Brookfield, Wis.-based Environmental Systems Inc. "I think that's going to be a growing trend—being able to see [building-automation] data on your mobile device, so that you can walk into a building or walk into a retail location and pull up the analysis of that store, and you can see how it's performing over a period of time. Or what possible faults occurred you would want to look at or start to investigate from a maintenance repair standpoint."

Integrating with IT

In the past, Building Automation Systems and IT infrastructure were housed on separate servers likely located in different rooms and controlled by their respective departments. This disconnect is now being bridged by increased integration between these previously independent networks.

"I believe you will see over the next five to 10 years that Building Automation Systems will reside on the building's primary IT

infrastructure rather than having their own subordinate network," says Scott Papay, sales manager at LONG Building Technologies, Littleton, Colo. "You will see each and every one of those controllers becoming WiFi-enabled, meaning LAN-based or wireless LAN-based IP-type controllers rather than being some old RS45 communications protocol, which is what we use today. I think that's where the industry is trending us toward."

Oswald agrees there is a greater convergence between IT and facilities and notes manufacturers of BAS programs are increasingly designing user interfaces that are HTML5-compliant and pushing for mesh network technology in wireless applications. "It's the ability for these wireless devices, instead of talking one-to-one or peer-to-peer, they can talk in a mesh-type network so you can bounce off of other wireless devices to extend their range. It's something that's very common in the IT infrastructure space," he explains. "It wasn't as common in the building-automation technologies, but it's definitely growing in that direction."

Six Obstacles to Upgrading

In spite of the promise that wireless and mobile applications hold for increasing building efficiencies, there are a number of challenges that hinder widespread adoption of these technologies, especially as they relate to retrofitting existing structures. Oftentimes, the most obstinate hurdle to overcome has nothing to do with technology:

1 OLD SCHOOL MENTALITY. "The biggest challenge on existing buildings is there's usually existing people in the facility that not only run and manage it, but also occupy the facility," Buhlig says. "To implement strategies, there's a whole different mindset on how the building

(continues on page 86)




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It's not impossible but you have to **adapt** as this technology grows, and you're talking about an industry where things wouldn't change for 10 years at a time and now **every six months something new** is coming out. —*Brian Oswald, executive vice president, Environmental Systems Inc.*

”



should operate, so the biggest challenge is to convey there's a better way. 'This is how we were taught and this is how it used to work, so why do we need to do it different now?' is the mentality, he explains.

Skepticism and resistance to change are understandable given these technologies aren't yet foolproof. There's also a lot to be said for reliability, particularly for critical systems. But as technology improves, so will people's comfort levels, according to Oswald. "I think you still have some clients out there who just want a traditional BAS application that is dependable and scalable and everything that goes along with what they've always been used to," he observes. "As people grow with technology, whether it's with their smartphones or with tablets, I think it becomes easier for them to accept these changes to the BAS base."

2 LEGACY EQUIPMENT WORKS. Adding to the hesitancy to adopt new technologies is the fact that many of the existing BAS products still work very well, so facility managers are reluctant to fix something that isn't broken, suggests Richard McCulley, IT manager at C&C Group, Kansas City, Kan. "You have legacy systems from all the major manufacturers and everybody makes really good systems out there. So we deal with facility people who are like, 'It's working fine. Why do I need to replace it?'"

Fortunately, McCulley notes there are a number of third-party manufacturers that offer products that can integrate with existing platforms to eliminate the need to dismantle infrastructure and enable facility managers to upgrade legacy equipment over time.

3 SECURITY AND RELIABILITY CONCERNS. Exposing building data and system controls via wireless networks poses obvious security concerns. Papay points out hardwired solutions have a much higher

degree of fidelity and less problems with interference—a pervasive problem with wireless technology in existing buildings.

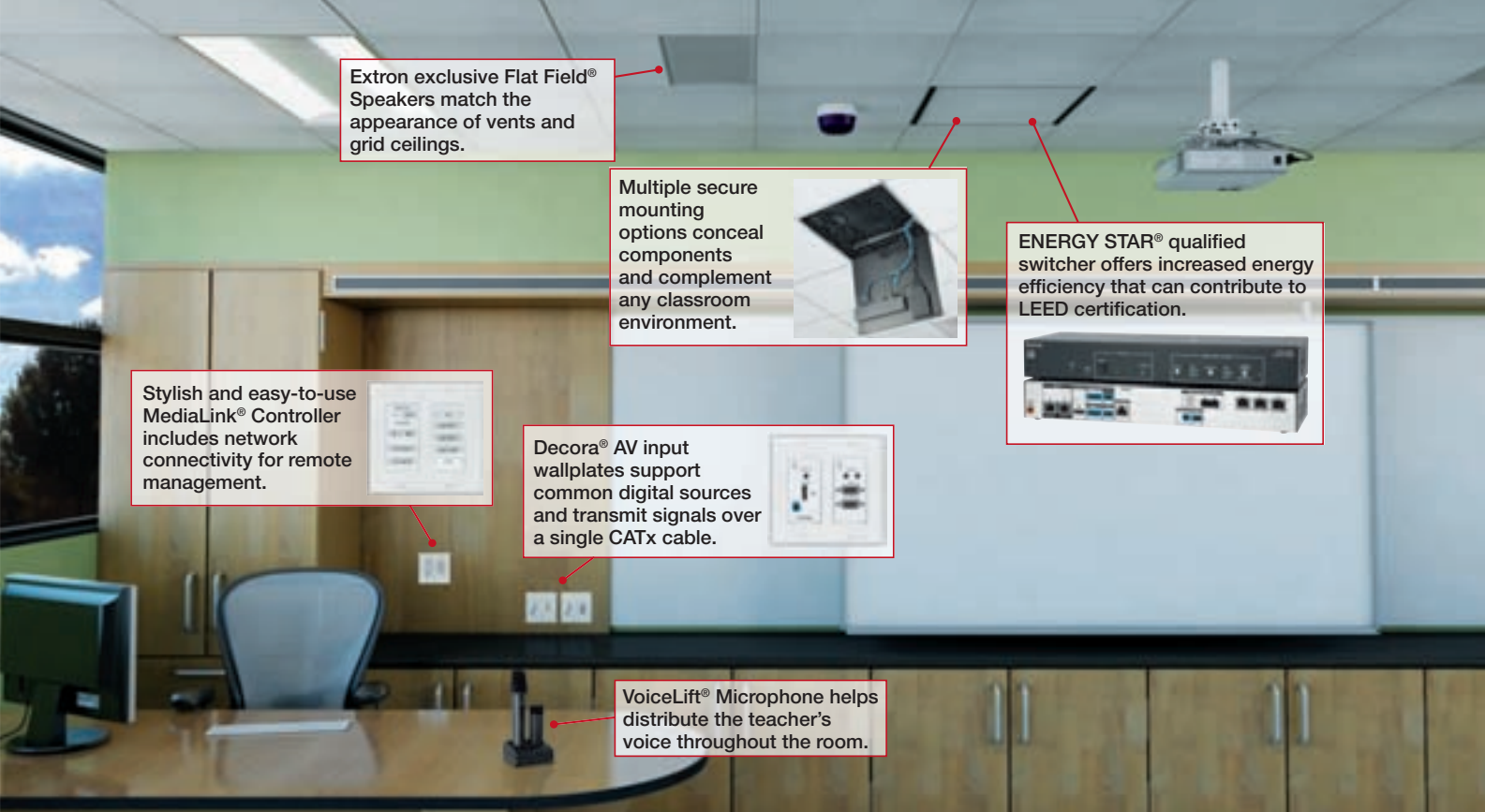
But it's important to note facility managers now have the choice of how much information is available via the web. "Reporting and alarm management—they don't necessarily have to be on an exposed server. Now we've got more options for outputting display data and not necessarily controls if they don't want it," McCulley says. He also highly recommends customers utilize VPNs for automation solutions, even if the security policies are somewhat cumbersome, rather than just dumping automation data onto the web.

4 COSTS. Papay suggests the perception of wireless technology in the market is that it's still significantly limited from a cost-benefit analysis. "The technology has yet to get to a point where it is less costly to purchase the wireless [system] to avoid that initial installation cost along with ongoing maintenance and potential problems with a wireless solution so that it's feasible," he says. Not everyone agrees on this point, however.

According to Oswald, from a cost standpoint, wireless products have come down in price and are more competitive than ever. He also points out "instead of being limited to a complete retrofit or an overhaul that would cost 10 times what customers want to spend, some of these devices are more easily implemented. And being that they can now sit on an existing infrastructure, it will reduce some of the install costs."

5 LIMITED GRAPHICS. With BAS, graphic user interfaces typically feature a schematic for an air handler, a chilled-water plant or a heating plant, which are most often displayed on a large monitor in a building engineer's office. Graphics get compromised

(continues on page 88)



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and are far more difficult to view on mobile devices. "At one time, we were all excited about graphics on our phones, and then came to realize that doesn't work very well on the BAS side of it," McCulley says. "The graphics are cool but don't always translate well. They translate well on an iPad, they don't do too bad on a big iPhone 6 Plus, but there's a limit to how much real estate you can put on a screen."

6 KEEPING UP-TO-DATE. "It's challenging for an operations team to stay consistent with technology because it's ever-changing," Oswald says. "It's not impossible but you have to adapt as this technology grows, and you're talking about an industry where things wouldn't change for 10 years at a time and now every six months something new is coming out." He adds trying to adopt too much too quickly can create confusion for many building owners and, as a result, it can hinder the upgrade process.

Silver Linings

In spite of the many challenges to wireless technology and mobile applications that are emerging in the building-automation space, the trend still holds a great deal of promise in terms of helping owners and facility managers optimize building performance and energy efficiency.

"For what it's trying to solve, wireless technology gives building owners more options," Oswald explains. "The ability to pull up a VAV box or pull up an air-handling unit through a user interface that's now HTML5 compatible and then you have full controllability of that piece of equipment, I think that is something that if I'm a building owner and I now have that ability to walk around with my tablet or my smartphone and make changes to devices, it not only facilitates my troubleshooting but it also helps in my overall efficiency of my daily tasks."

Many manufacturers now offer integrated software and mobile apps (see "Trend Products", page 90) that can be downloaded (some of them free of charge) and will tie-in seamlessly with existing building-control systems, as well, making the transition a much more attractive and cost-effective proposition. 



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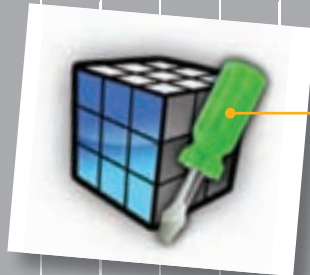


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LIGHTING DESIGN INC + TAKENAKA CORPORATION |
PHOTOGRAPHY © MASAKI KAWAGUCHI (2) BRANZ KOSHIE,
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UNIFY DATA SYSTEMS

DGLux5 enables the unification of all your data systems and multiple data providers into a singular interface with comprehensive functionalities, data visualization tools and workflows. You can now “App Yourself” without ever having to write a line of code. DGLux5 allows users to access their application with native “in-browser” loading on iOS, Android and Windows Mobile. Intelligent scaling with responsive layout ensures that every user interface is automatically optimized for any screen size to ensure the optimal viewer experience on any mobile device.

www.dglogik.com/products/new-dglux5 // Circle No. 48



COORDINATE SINGLE OR MULTIPLE SITES

Facility Explorer is an integrated, comprehensive building-control solution that features wireless or wired field controllers and devices to provide direct closed-loop control over mechanical and HVAC equipment. Supervisory controllers deliver network-wide coordination for single or multiple sites. With Facility Explorer, you get increased visibility into building operations so you can resolve problems faster and easier, onsite or remotely. You can modify equipment and system-control parameters to maximize efficiency and comfort from your mobile device.

on.jci.com/1FojXDq // Circle No. 49



INTERACT WITH THE BAS

The Facility Prime application is a building management iPad application for interaction with the APOGEE Building Automation System. Through customized screens, Facility Prime enables quick, mobile interaction to view only or view and command environmental conditions and HVAC control systems. Facility Prime goes beyond accessing data and provides two-way interaction between users and the Building Automation System. Users develop customized graphics for their facility using Facility Prime Editor or contracting their local Siemens office to create the graphics.

Available on the Apple App Store // Circle No. 50



CONFIGURE HVAC OPERATING PARAMETERS

The myDC Control app works with the ECB series BACnet and ECL series LONWORKS controllers operating under an EC-NetAX system. In addition, the myDC Control app allows you to connect directly to an ECLYPSE Connected System Controller for a complete standalone solution. Quickly view, edit and configure operating parameters of an HVAC system. Color-coded icons provide at-a-glance indication of alarms and override conditions.

www.distech-controls.com/en/us/products/mobile-apps // Circle No. 51

FIND AND DISPLAY CRITICAL INFORMATION

Niagara 4 allows end users to directly access, analyze and act on a wide range of operational data. A truly open framework, Niagara 4 delivers a variety of notable improvements to help businesses take full advantage of the Internet of Things, including advanced visualization and new search, security and navigation tools. Modern and easy to use, the platform utilizes HTML5 to provide an array of rich features. With a simple point-and-click or drag-and-drop, users can instantly find and display critical information from their desktop, tablet or mobile device.

www.tridium.com/niagara4 // Circle No. 52

ANALYZE DATA FROM ONE INTEGRATED SOLUTION

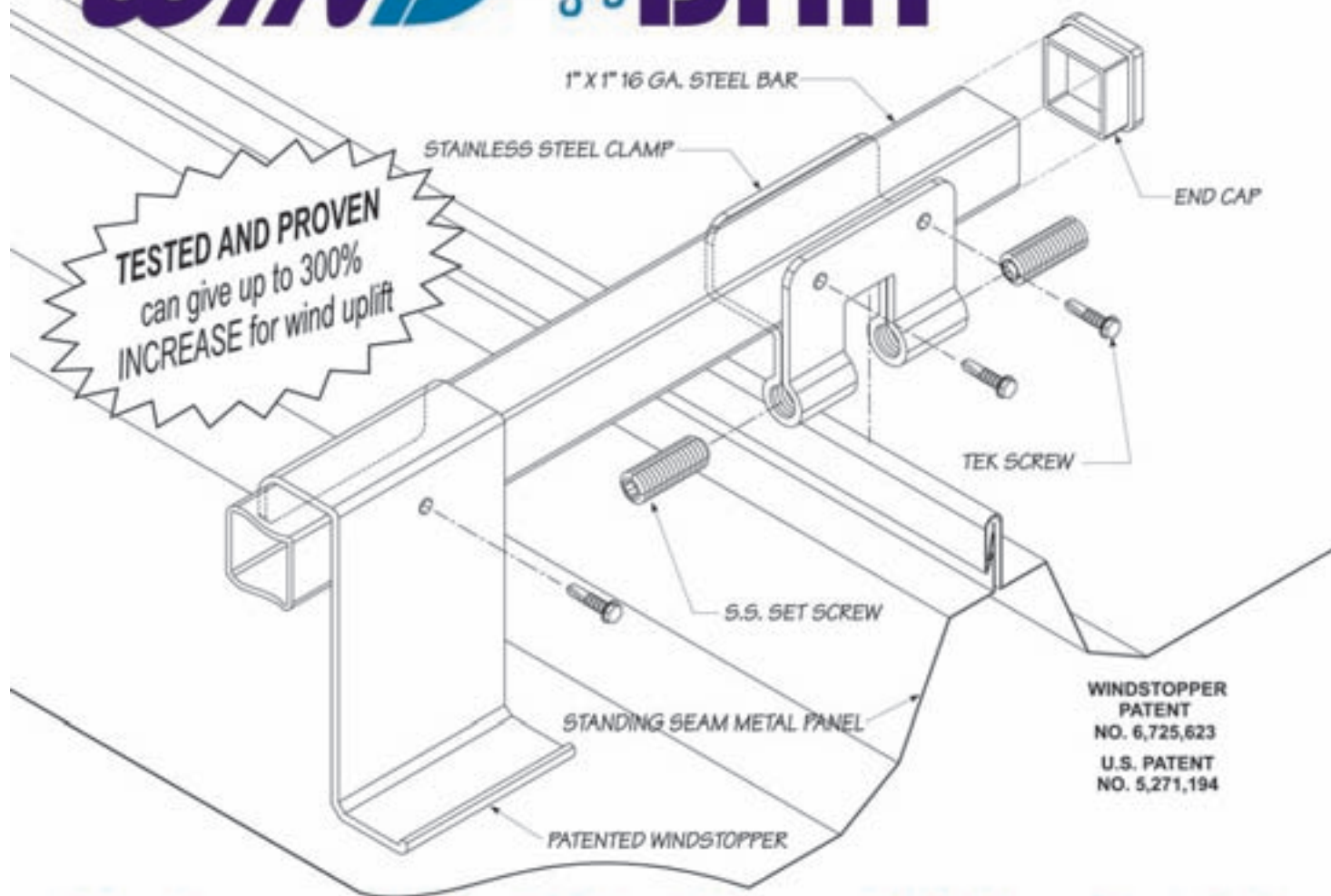
SmartStruxure is a fully integrated solution that selects from a menu of available software and hardware, combined with engineering, installation and services that ensures buildings are efficient and effectively managed. SmartStruxure solution facilitates the exchange and analysis of data from power, lighting, electrical distribution, fire safety and HVAC.

bit.ly/1jQU8pB // Circle No. 53



View videos of several of these apps and software programs in action.

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PROTECT CONFIDENTIAL CONVERSATIONS FROM BEING OVERHEARD

Cambridge Sound Management has announced the Qt Conference Room Edition, which allows companies to protect the speech privacy of confidential or sensitive conversations taking place in conference or board rooms. The all-in-one privacy solution consists of a control module, two lighted privacy status signs and a series of direct-field sound-masking emitters. When the control module inside the conference room is turned on, it powers the sound-masking emitters placed in the ceiling just outside the room. The system integrates with other conference room AV equipment and is installed by Cambridge Sound Management's certified sound-masking specialists.

cambridgesound.com/conferenceroom // (800) 219-8199 // Circle No. 55



LED OFFERS DIMMING OPTIONS

Hubbell Lighting's Prescolite now offers its MegaLum LED in lumen packages ranging up to more than 16,000 lumens.

Designed for ceiling applications from 20 to 60 feet, the product is available in a downlight (MD8LED) or cylinder (MC10LED) option. It is capable of delivering up to 100 LPW and offers a variety of dimming options, including DMX. With a rated minimum life of 50,000 hours, the MegaLum features Prescolite's Variable Intensity Technology, which allows customers to specify the exact amount of light and power, as well as beam distribution, to illuminate any environment.

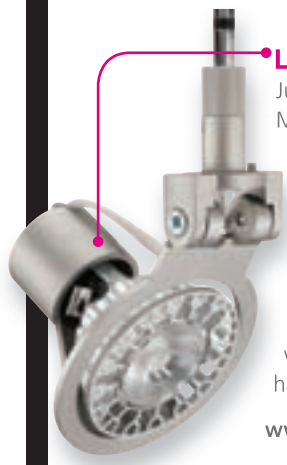
www.prescolite.com // (864) 678-1000 // Circle No. 57



LED LUMINAIRES SOLVE FLICKER ISSUES

Juno Lighting Group has released a family of Juno LED-Compatible MR16 Trac Fixtures, which optimize the performance of 12-volt LED MR16 lamps in track-lighting applications. The luminaires solve flicker issues, overheating and premature lamp failure. The fixtures are available for line voltage Trac-Master, Trac-Lites, Quick Jack systems, and low-voltage Trac 12 and Flex 12 systems. They are available in five designer-grade styles and feature durable, die-cast aluminum construction with black, white, silver or satin nickel finishes. The fixtures are compatible with most dimmable LED lamps and can accommodate MR16 halogen bi-pin cover glass lamps up to 50 watts maximum.

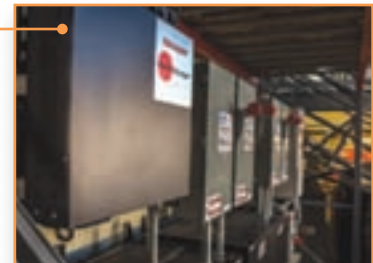
www.junolightinggroup.com // (800) 367-5866 // Circle No. 56



CUT UTILITY CHARGES WITH ENERGY STORAGE

Sharp Electronics Corp. has launched Sharp's SmartStorage energy solution, which can dramatically cut utility demand charges for commercial and industrial buildings. SmartStorage keeps a large amount of electric energy stored in reserve, which it selectively releases to limit a facility's electricity demand. The system employs sophisticated, predictive controls to manage the release of this energy, resulting in high-performance, high system efficiency and reliability. SmartStorage operates effectively as a standalone solution or when deployed with a solar-electric installation.

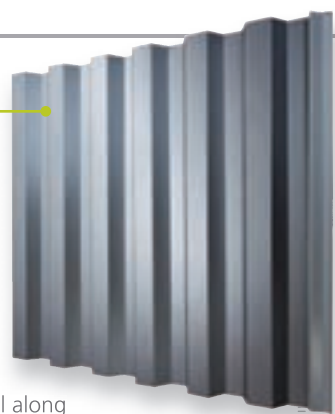
www.sharpsmartstorage.com // Circle No. 58



METAL WALL PANEL CONCEALS FASTENERS

AEP Span has launched TW-12, a concealed fastener architectural metal wall panel that features a trapezoid shape with unique shadow lines. TW-12 has a 12-inch net coverage offered in 24 and 22 gauge. Combining the natural shadow lines from the shape of the panel along with a wide range of colors, prints and textures provides the architectural community various design possibilities.

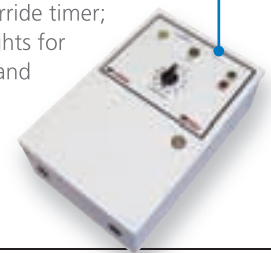
aepspan.com/roof/tw12.html // (800) 733-4955 // Circle No. 59



REMOTE CONTROL IMPROVES HEATER EFFICIENCY

Cambridge Engineering announces the addition of a remote-control station that increases energy savings of its SA-Series units from 40 to 70 percent compared to traditional systems. CE-Smart includes controls for heating and ventilation and can be interlocked with external signals, including CO detectors, to maintain IAQ. It includes a lockable NEMA 1 enclosure equipped with a three-position selector switch (Summer Ventilation, Off and Heating); combination seven-day programmable timer and setback thermostat; an override timer; intermittent/continuous control; and indicating lights for blower operation (green), burner operation (red) and reset (amber). Sensors for the thermostat and gas modulation system also are provided.

cambridge-eng.com // (800) 899-1989 // Circle No. 60



INSTALL LIGHTING CONTROL IN HARD-TO-REACH LOCATIONS

OSRAM SYLVANIA has launched the ENCELIUM Wireless Energy Management System (EMS), a portfolio of hardware solutions designed to expand lighting control to hard-to-reach locations and simplify and lower the overall cost of installation. ENCELIUM Wireless EMS is based on the ZigBee Pro network stack and includes wireless managers, sensors and control modules for attaching to light fixtures and wallstations. It integrates with wireless and wired ENCELIUM devices and the ENCELIUM Polaris 3D lighting management software, which facilitates the commissioning, usage and data analysis of the lighting installation.

www.sylvania.com // (800) 544-4828 // Circle No. 61



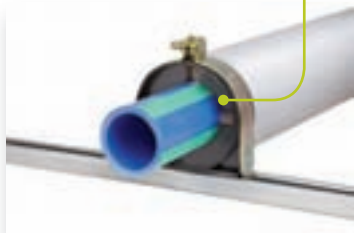
EDGE-LIT PANELS ARE AVAILABLE IN ROUND OR SQUARE

Super Bright LEDs has introduced its Decorative Edge-Lit LED Glass Flat Panel Lighting, which is available in round and square versions with glass bezel for a decorative glow. The thin panels, which can provide accent and task lighting, can be installed in tight spaces and feature an integral heat-sink for cooler running temperatures and a UL-recognized constant current driver for enhanced reliability. They are available in natural white or warm white color temperatures with white housing. The panels offer a 120-degree beam angle and come in 2- by 4-, 2- by 2- and 1- by 2-foot sizes.

www.superbrightleds.com // (866) 590-3533 // Circle No. 62



VAPOR BARRIER IS FOR POLYPROPYLENE PIPE



Hydra-Zorb announced the availability of its Klo-Shure Insulation Couplings for metric-sized polypropylene pipe systems, including Aquatherm Blue Pipe and Green Pipe. The Klo-Shure product creates a vapor barrier at the clamping points on insulated tube/pipe runs. It allows for sections of insulation to be secured without having to remove the clamp assembly while maintaining the integrity of the insulation. Klo-Shure is UL 25/50 flame- and smoke-rated and made in the USA.

www.hydra-zorb.com // (248) 373-5151 // Circle No. 64

LED ENGINE'S LUMEN OUTPUT IS IMPROVED

Amerlux has improved its Hornet HP A14 LED Engine to provide better-maintained lumens and consistent color rendering, as well as enhanced control, dimmability and longer life span. The lumen output increased to 1369 and the lumens per watt increased to 75 lumens per watt, resulting in 18 percent gains in output and efficacy. The center beam candle power (CBCP) revealed an increase of 20 percent, delivering more than 12,200 CBCP. The Hornet HP focuses LED lumens, delivering crisp beams of light with consistent benchmark color. Life at 70 percent of initial lumen output is rated at 50,000 hours, providing lower operating and maintenance costs.

www.amerlux.com // (973) 882-5010 // Circle No. 63



ADD INSULATION TO METAL AND POST-FRAME BUILDINGS

Innovative Energy has announced its ASTROBOARD Insulation System for retrofitting ceilings and walls in metal and post-frame buildings. ASTROBOARD improves thermal performance to meet building codes and provides condensation protection. It consists of a 2.2-pound-density nominal layer of polystyrene foam, sandwiched between a 95 percent reflective film surface on one side and a white polyethylene UV-protected film on the other side. All ASTROBOARD products are classified as Class 1/Class A in accordance with the UL 723 and NFPA-286 fire test standard; UV inhibitors help provide a durable white finish.

Insul.net // (800) 776-3645 // Circle No. 65



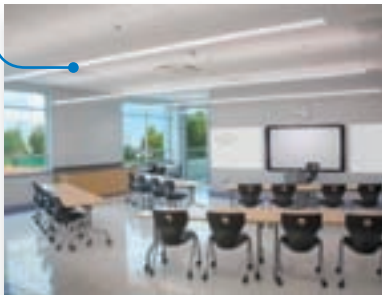
DRIVERS PROVIDE TUNABLE CONSTANT POWER OUTPUT

Universal Lighting Technologies has launched Class 2 UNV and 347V EVERLINE LED Driver Families with tunable constant power output—Compact Drivers and Linear Drivers. The driver families are available with a variety of output current and power options that provide more design flexibility for LED lighting. The tunable constant power output allows a driver's current to be tuned down while increasing output voltage up to a maximum of 56 volts, enabling output power capacity to remain constant over a wide range. This permits the driver to offer load regulation with low total harmonic distortion and a high power factor.

www.unvlt.com // (615) 316-5100 // Circle No. 66



LINEAR LIGHTING HAS NO VISIBLE FRAME



Hubbell Lighting's Litecontrol Liteweave Linear features a profile smaller in width and height than a typical smartphone to provide an unobtrusive solution for commercial, educational and civic applications. With no visible frame or border, the product uses a precision-formed light diffuser to weave light across the visual plane, delivering a 30/70 indirect/direct distribution. Featuring seamless connections, clear row joints translate the "weaved" appearance for continuous, un-

interrupted rows of light. Installation is done with gossamer thin aircraft cable, which is adjustable vertically for height and horizontally to avoid small obstacles. Liteweave ships with the cord and end treatments pre-installed.

www.litecontrol.com // (781) 294-0100 // Circle No. 67

DOOR HANDLES ARE CONTEMPORARY

Doug Mockett & Co. Inc. has made available round or square door handles that can be specified single sided or with back-to-back mounting hardware. The handles are based on Mockett's two most popular drawer-pull designs, which were reimagined on a larger scale for doors. All are 12 inches on center and available in the following finishes: satin nickel, polished chrome and satin chrome.



www.mockett.com // (800) 523-1269 // Circle No. 68

CONTROL HEAT WITH VOC-FREE SHADE FABRIC



Mermet USA has introduced GreenScreen Reflect, which is 100 percent PVC-free and made from naturally abundant resources. The shade fabric reflects

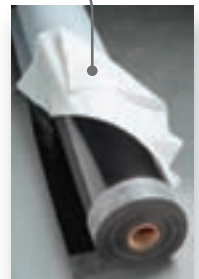
up to 72 percent of solar radiation for heat control. The fiberglass yarn provides mechanical resistance and dimensional stability while its aluminum backing offers enhanced solar protection for heat management. The fireproof, VOC-free fabric's lightweight construction allows the overall dimension of the finished roller shade (tube and fabric) to fit discreetly in small or large windows and enhance the aesthetics of a space. GreenScreen Reflect, which is available in seven colors, offers a 5 percent openness and basket-weave construction for views to the outside.

www.mermetusa.com // (866) 902-9647 // Circle No. 70

INSTALL EPDM IN TEMPERATURES FROM 20 TO 120 F

Firestone Building Products Co. LLC has launched its Secure Bond Technology, which ensures adhesion coverage across the entire roof membrane. The company will offer UltraPly TPO SA and RubberGard EPDM SA with Secure Bond Technology, allowing them to be installed in temperatures between 20 and 120 F. The technology has no VOCs and does not emit odor during or after installation. It also is FM tested and approved, meets or exceeds all ASTM requirements and is covered by the Firestone Building Products Red Shield Warranty.

www.firestonebpc.com // (800) 428-4442 // Circle No. 69



LED DRIVERS OFFER EMBEDDED WIRELESS COMMUNICATION

Daintree Networks and LG Innotek have created a line of LED lighting drivers with embedded wireless communication capability. Designed to be integrated into LED troffers and retrofit kits, the lighting drivers eliminate the cost and installation challenges associated with multi-box wireless implementations that require a separate wireless adapter plus an LED driver for advanced wireless control. The LG Innotek driver can be used by lighting fixture manufacturers for 2- by 2- and 2- by 4-foot LED troffers and retrofit kits. The combination is expected to result in upfront cost savings up to 85 percent and energy efficiency following installation up to 90 percent.

ledlighting.lginnotek.com // www.daintree.net // Circle No. 71



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Springs Window Fashions
www.swfcontract.com // (800) 327-9798
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Boon Edam
www.boonedam.us // 800-334-5552 // Circle No. 77

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(800) 219-8199



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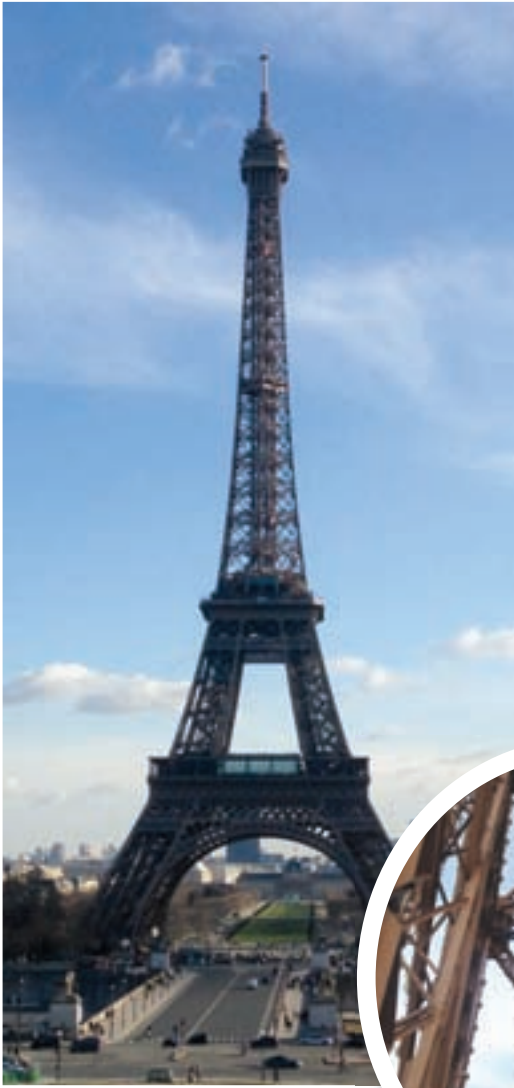
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WIND POWER OFFSETS EIFFEL TOWER'S ELECTRICAL CONSUMPTION

In partnership with the Paris-based Société d'Exploitation de la Tour Eiffel, UGE International, New York, has installed two VisionAIR5 vertical axis wind turbines on the Eiffel Tower as part of a high-profile renovation and upgrade to the monument. Located above the second level, the turbines will produce more than 10,000-kilowatt hours of electricity per year, offsetting the annual consumption of all commercial activity on the Eiffel Tower's first floor.

The two UGE VisionAIR5 vertical axis wind turbines were specially painted to match the iconic tower and are located 400-feet above ground level to maximize energy production. Mounting the turbines at this location was in itself a technical challenge, requiring each component to be hoisted individually and suspended with rope above the tower's second level. [f](#)



Learn more about UGE International at www.urbangreenenergy.com.



PHOTOS: UGE INTERNATIONAL