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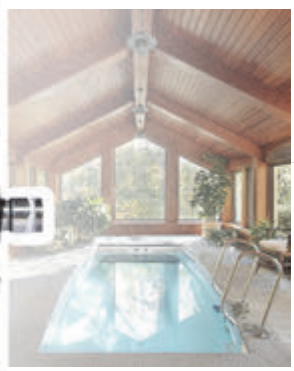

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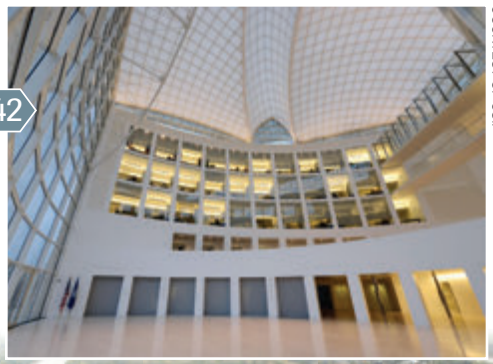

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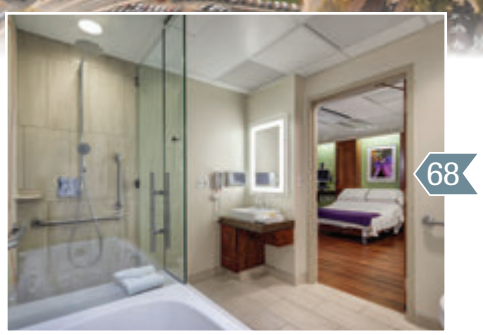

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EDITORIAL

IoT: A Door to Smarter Buildings

Is your home smarter than your building? Today, smart home thermostats can learn your occupancy patterns, and a doorbell with a camera can send video of the person at your door to your smartphone. Neither function may qualify as a gee-whiz application to a tech-savvy facility manager, but Internet of Things devices like those could help change the way occupants and top management think about your buildings.

The "Internet of Things," commonly shortened to IoT, refers to a network of devices that enables data-sharing and control; analytics are often used to make sense of the data. Smart buildings and smart homes are good examples of the IoT in action.

Of course, it's not fair to ask whether your home (or your CEO's home) is smarter than your building. A facility manager can't go out and buy a smart building system for a couple hundred bucks. What's more, the definition of "smart" is completely different for the two types of buildings. A smart building offers much more complex control, generates vastly more information, and takes advantage of far more sophisticated analytics than the smart home.

Still, there are plenty of buildings with dated controls, and the outside world is putting pressure on facilities to get smarter. The IoT and the big data it produces are seen as an enormous business opportunity. In the facilities arena, start-ups are gaining venture capital funding, new players are already well-established, technology giants have entered the smart building/home market, and familiar building product manufacturers are rolling out innovations based on the IoT.

The Building IoT is the latest stage in the development of building automation. As this issue shows, the Building IoT is still very much under construction. But the build-out is moving quickly, with new offerings appearing all the time. Now is the time to get familiar with the choices, cut through the inevitable hype, and look for Building IoT products that can help make your buildings smarter.

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BUILDING OPERATING MANAGEMENT® (USPS 070-460) (ISSN 0007-3490) is published monthly by Trade Press Media Group, Inc., Milwaukee, Wisconsin. Periodicals postage paid at Milwaukee, Wisconsin, and additional mailing offices. (Postmaster send change of address orders to: Building Operating Management, P.O. Box 47704, Plymouth, MN 55447.) All packages shipped via UPS, air express or common carrier, plus all general correspondence, should be addressed to: 2100 West Florist Avenue, Milwaukee, WI 53209-3799. Subscriptions: United States, $99 for one year; $186 for two years. Single copy, $8; Foreign subscriptions, $145 for one year, $254 for two years; USPS Priority Mail, $150 additional per year.

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DATA LOGGER supports up to 15 channels of smart sensors and eight analog inputs for additional sensors. The HOBO RX3000 Station is equipped with cellular communications, and transmits data to the company's software platform, which allows users to access current and historical data from the Web, manage and control stations remotely, and set alarm notifications. Automatic delivery of data files can be scheduled via email or FTP in CSV or XLSX format, and an API is available to organizations that want to integrate the environmental data into their applications. ONSET

More Info

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PRODUCT GALLERY

CIRCUIT BREAKER features solid-state switching, overcurrent, and short-circuit protection. The Atom Switch circuit breaker is software driven, allowing a switch to be a 20-amp circuit breaker one day, an 80-amp circuit the next. It also operates over 100 times faster than mechanical circuit breakers, according to the company. Has 100 to 600VAC output rating. **ATOM POWER**

WIRELESS THERMOSTAT for the hospitality industry features proximity sensing and auto dimming to minimize intrusive screen light and make the display easier to read. EcoTouch measures 15mm thick and is the size of a standard single-gang electrical box. The interface may be customized. **TELKONET**

FIXTURE-INTEGRATED CONTROLS have an individual fixture controller, a zone controller, and a power booster. The suite of Digital Lighting Management (DLM) controls combines with panels and room controllers in other spaces, and integrates with BAS. Allows up to 99 automation groups, each with the ability to respond uniquely to commands via sensor, photocell, switch, or other override. **WATTSTOPPER**

WATER MONITORING SYSTEM can measure free or total chlorine residuals, temperature, pressure, pH, conductivity, and more at customer-specified intervals. The Potable Water Analytics Base Monitoring System 2.0 includes a Modbus interface plus eight additional analog or pulse signals, and can receive data from up to 32 additional sensor systems that support Modbus. Data is made available in a Web-based platform. **PHIGENICS**

GATEWAY interfaces Modbus RTU and Modbus TCP devices to BACnet MS/TP or BACnet/IP systems. The FieldServer EZ Gateway Modbus to BACnet features mapping files that define a relationship between a Modbus register and a BACnet object, and allows the integrator or installer to configure the gateway quickly. Dual serial ports allow integrating twice the number of Modbus devices supported by traditional gateways, or doubling the performance of each connected device. **SIERRA MONITOR**

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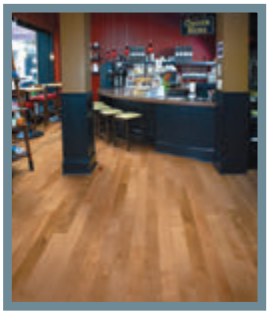
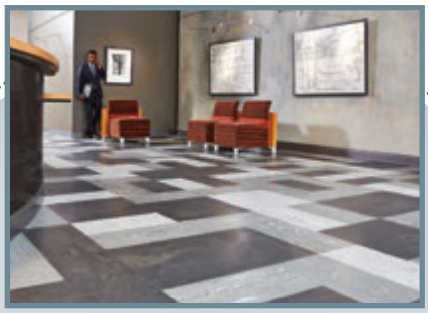


ARMSTRONG Midtown hardwood, with rich grain patterns in a low-gloss offering, and Performance Plus hardwood (shown), in low- and medium-gloss options, are recent additions to the company's hardwood product lineup. Midtown is designed for a variety of commercial spaces. Performance Plus offers liquid acrylic infusion for enhanced durability and an aluminum oxide finish for added surface protection, company says. Performance Plus offers the option of matching color schemes; Midtown offers a choice of nine species, multiple colors, textures, widths, thicknesses, and acoustical features. These hardwoods are manufactured in the U.S. with over 95 percent domestic content.

More Info

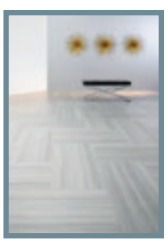
For more information on these products, visit www.facilitiesnet.com/16189BOM.

FORBO The Marmoleum Touch Duet is designed to have a sophisticated finish, combining the tactile nature of soft-surface flooring with the durable, sustainable properties of linoleum. The surface features a random pattern and a color spectrum that changes according to the direction from which the floor is viewed. Product is all-linoleum and homogeneous, from surface to backing. Product is suited to areas that see heavy use, including meeting rooms, offices, leisure areas, and lounges. Thickness is 2.5 mm.



TARKETT The Johnsonite Minerality Wood/Stone Rubber Tile and Plank uses the look of natural wood and stone to create linear and striated visuals. The looks are suited to areas like healthcare, retail, and corporate where the benefits of rubber flooring are desired but real stone and wood flooring is impractical and cost prohibitive, the company says. No two patterns are identical. Minerality Grains wood planks are 6 by 48 inches. Minerality Strata tiles look like real 12-by-24-inch stone inlays, according to the company. Custom sizes available. Product offers slip resistance, shock-absorbing qualities, and natural acoustic properties, the company says.

PROTECT-ALL FLOORING Black is a new color option added to the company's Rapid Weld System. The installation system, designed for Protect-All flooring products, uses a chemical welding process that dries fast and enables same-day installation and welding, the company says. The flooring and Rapid Weld system together can reduce downtime and flooring seams by up to 80 percent, versus 6-inch-square ceramic or quarry tile, according to the company. Other color options include dark gray, light gray, and brown.



SHAW HARD SURFACE Surface and Strand (shown) are two 18-by-36-inch resilient styles that offer concrete and linear stone visuals and can be mixed. The 20-mil wear layer and Exoguard Quartz Enhanced urethane finish are designed for heavy commercial traffic and minimal scuffing. Surface, a concrete visual, is available in 10 colors, while Strand, a linear stone visual, is available in six colors. Direct glue provides expanded installation possibilities. The styles, when installed with approved underlayments, reduce sound transfer and exceed common IIC rating requirements, the company says.

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J+J FLOORING Kinetex textile composite flooring offers its first modular plank in a sophisticated pattern of Umbra and Umbra Stripe, with lines of varying breadth and width. Size is 18 by 36 inches. Kinetex products are constructed of knitted polyester fabric and cushioned polyester felt backing. Company says Kinetex provides exceptional stain and crushing resistance through its ability to withstand more than 5 million foot traffics, as well as better acoustics, comfort, cleanliness, and slip-and-fall resistance than traditional hard- surface flooring. Kinetex products contain 55 percent recycled content, are fully closed-loop recyclable, and are certified to NSF 140 Platinum.

FREEAXEZ Latest versions of Gridd and Gridd Power provide easy underfloor access to a facility's cables and wiring. Gridd is a UL-listed, modular, all-steel, adaptive cabling distribution system that safely distributes cables beneath finished floors. Gridd Power is a 50-amp electrical bus track system that allows devices and furniture to easily connect to electricity in the Gridd system. Company says Gridd system allows commercial layouts to be reconfigured quickly and cheaply in comparison to raised flooring systems and other wiring methods. Gridd can be repositioned, redeployed, reused, or recycled in its original state in any building, company says. Product is Greenspec listed.

FLEXCO Delane Solid Vinyl Tile (shown) and Delane ESD Vinyl Tile are now available in 12 new colors. The solid vinyl tile is designed for applications where durability and easy maintenance are desired, such as healthcare, office, retail, and hospitality. The product has an antimicrobial barrier to control bacteria and fungi, buffs to a shine without waxing, and may be seamlessly installed by heat welding. The ESD Vinyl Tile is well-suited to areas like healthcare and server rooms. Low outgassing allows for clean room applications. No waxing is required to maintain static dissipative qualities, and the product may be seamlessly installed by heat welding. It performs under heavy rolling loads up to 2000 psi, according to the company.

CHILEWICH Woven Plynyl Plank Tiles use new manufacturing techniques to create new shapes and sizes of flooring products, the company says. The base shape, 6 by 36 inches, was chosen for ease of installation and to highlight the textiles' inherent bi-directional quality. The visual effect is one of strong linearity. The unique feature of Woven Plank is that its specific shape highlights the joints between planks and makes them a design feature, giving designers a new visual tool, according to the company. The tiles are available with a vinyl backing or BioFelt backing.

3M The next generation of Scotchgard Resilient Floor Protector is a zinc-free, low-odor formula that produces a hard surface that, according to the company, retains gloss while resisting black marks and hand sanitizer drips. The product works with the 3M Resilient Floor Protection System. When used as a two-coat protector, the system is significantly more resistant to abrasion than traditional floor finishes and minimizes the need for stripping, according to the company. Scotchgard is designed for floor maintenance in areas such as hospitals, schools, office, and retail spaces, and is formulated for a variety of surfaces, including sheet vinyl, linoleum, luxury vinyl, and vinyl composition tile (VCT).

EXPANKO Vallarex Cork floating floors, from a brand of The Stonhard Group, feature locking systems, finishes suitable for light to medium commercial use, plus stylish cork, stone, and wood visuals. Vallarex floors feature a multi-layer flooring system with a natural cork veneer, an HDF mid layer, and a cork insulation underlayer. For cork visuals, CTX ceramic technology finish is applied to the patterned cork. For the wood and stone visuals, high-resolution digital images are printed onto the cork veneer, and HTX finish is added. Product is GreenGuard and GreenGuard Gold certified for low chemical emissions.


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GREEN BUILDING REPORT

Building Internet of Things: Emerging Tools for Green Buildings

by robert knight

Presented by *Building Operating Management* **and the U.S. Green Building Council**

building OPERATING management

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IN THE COMMERCIAL BUILDING space, we have essentially been building our corner of the Internet of Things (IoT) since before it got that name. (IoT is a phrase commonly attributed to Kevin Ashton in 1999.) Our buildings already employ networks of sensors to gather data from the real world, in real time. We have controllers which directly use the data to control processes, and we prefer to do that "at the edge" in a distributed intelligence or distributed control architecture. Data from the sensors and controllers feeds back to software for human supervision, analysis, and intervention. Newer software products operate in the cloud, or offer lightweight mobile or browser apps for specific functions, but more commonly our software has been deployed as a locally installed "monolithic" instance. That is to say, as a single large piece of software from the device manufacturer which attempts to provide enough functionality to satisfy all potential users of the system. These systems are essential for the operation of today's green buildings.

An examination of a typical modern BAS/EMS or a modern networked lighting control system would indicate that our industry is well on its way up the adoption curve. After all, we've been deploying sensors since the first pneumatic thermostat, and we've been gathering data from the sensors since the first operator recorded the gauge readout onto a clipboard.

At this point, if the concept of the IoT is old news to us and we're already participating, should we care? Is IoT just a fancy new marketing word for the same old thing?

Yes, we should care, and no, it's not exactly as simple as a new spin on the same subject. The potential advantages are large, especially in the arena of sustainable, smart buildings, and the influence of the IoT on commercial buildings will help us run our buildings more efficiently and effectively in the future. In fact, Building IoT applications promise an array of new tools that will be useful in green buildings. That's why it's important for facility managers interested in sustainability to understand where the building IoT is today and where it's headed in the future.

Today, great strides are being made in tiny embedded processing and wireless radios from a number of different industries, and this technology will trickle down into sensors we will deploy in our buildings. Batteries will last longer, devices will become smaller, radios and mesh networks will become more robust, and costs will fall.

LIGHTING TAKES THE LEAD

A handful of lighting control system manufacturers already demonstrate this trend today, with an unexpectedly IoT angle. Their architectures consist of a sensor per light fixture, which creates a very dense array of measured light level, temperature, and occupancy, for the original purpose of superior lighting control. They discovered that the sensor density allowed us to derive an approximate measure of space utilization using algorithms tied to the multiple sensors in an area. Coupled with software to reveal the trends over time, this unanticipated application of lighting control sensors is enabling facility managers to make better space-planning decisions based on the measured use. This is both efficient and green. Manufacturers have recently begun selling sensor networks without any lighting controls for customers interested only in the space-planning application. This application was fundamentally enabled by a low cost per sensor, which for the first time allows such sensor density in practical installations.

For buildings, we must strive to adopt IoT solutions that permit interoperability with other products and manufacturers. Take two hypothetical environmental monitoring products as examples that show the difference between true interoperability and not. The first product creates a wireless mesh network between sensors and a gateway, but the sensors use a proprietary radio and messaging protocol, and the gateway pushes the sensor data to the manufacturer's cloud, where it gets cleaned, normalized, and displayed in browser-based dashboard graphics. The second product uses a published open protocol over a standards-based wireless network. The data is available locally from the gateway via common BAS open protocols such as BACnet/IP, and the manufacturer-created application program interfaces (APIs) permit more sophisticated interaction. (APIs are a set of functions other software developers can use to access data and functionality.) The second product is a better option because sensors from third-party manufacturers could be deployed within the mesh, other systems in the building could directly react to the measured data if desired, and the data could be incorporated into software solutions along with other systems in the building.

One hopeful promise of the Building IoT is to permit decoupling of software applications from the sensing hardware and networks. The decoupling is born from necessity, as highly specialized manufacturers with very narrow product offerings seek larger market share by permitting other novel use-cases of their prod-

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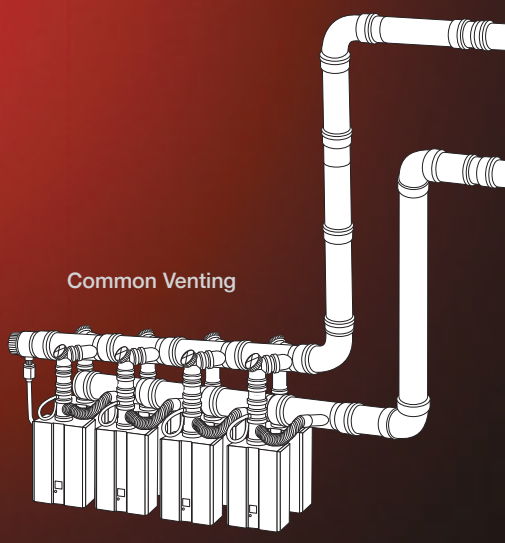

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ucts. To enable others to leverage their products, they include easy-to-use APIs.

For buildings, the last decade has been marked by a slow but steady shift toward a similar mindset. The Constructions Specification Institute, the authority on the organization of specs commonly used in commercial construction, created a dedicated spec division in 2004 to address integrated automation systems. This Integrated Automation Systems division (Division 25) is distinct from the customary Mechanical, Electrical, Plumbing, and related building services divisions.

This division is being used to define a scope of work for a specialist system integrator and to provide software and special programming skills to link together the various control components of the other building systems into a unified intelligent building software platform. The system integrators are typically adept at bringing together various best-in-class software applications that meet the unique needs of a project or owner. For example, a project may desire a chiller plant optimization application, an in-depth energy analytics application for the owner's energy manager, and occupant-facing performance dashboards to provide feedback on occupant behavioral change.

It is quite likely that with the excitement and money behind IoT concepts, and with a wealth of new IoT hardware coming to market, the trend toward software decoupled from hardware will accelerate, and the more traditional building control system manufacturers will feel obligated to create more flexibility in their products to facilitate this trend.

AVOIDING SECURITY PITFALLS

When devices are connected to a network, new security risks are introduced. The data communicated across the network must be handled securely, because it may reveal sensitive or private facts, and others who may rely on the data must trust that it is accurate. Software applications must be safe from malicious actions, as well as accidental but non-malicious misuse. The new equipment and networks must not permit new "back doors" into other unrelated but interconnected devices and networks. These are but a few of the critical concerns around security.

Unfortunately, appropriate security is often woefully lacking in the IoT devices coming to market today, both in the commercial building space as well as from other industries and sectors. With the current "gold rush" to deliver products that are first to market, security often appears to be an afterthought. Whether the IoT devices are medical, industrial, consumer, or commercial building devices, security will be forced to the forefront in reaction to incidents. In our commercial buildings, we must remain aware about the need for security and avoid early adoption of products and solutions that are not yet properly secured.

Many of the things in our buildings today could rightly be called IoT, even if we tend to use less glamorous terminology such as BAS, EMS, or BMS. As other industries rush to adopt newer and better ways to gain efficiency by connecting more devices to networks, our buildings will naturally follow suit.

When the IoT has fully transformed our commercial buildings, we can expect to see

Understand the Basics of IoT

From Xerox commercials to the pages of trade magazines, the Internet of Things (IoT) is everywhere these days. But there is very little agreement on a simple definition of IoT. We are told, however, that it will usher in transformative change to industries from healthcare to heavy industry, and will deeply impact each of us on both a personal and professional level. Some predict the IoT market will grow into the trillions of dollars globally in under a decade, though with little clarity about what that market consists of. Research firms postulate about adoption curves and future quantities of connected things.

At the core of the IoT concept is connected devices. All of those "things" which surround you could be connected to a network (perhaps the Internet?). Obvious choices are the tablet, PC, and cell phone. Also obvious are electrical appliances such as your desk lamp, the light bulb inside the desk lamp, and the coffee maker. Less obvious are non-tech objects such as your chair, your trashcan, each article of your clothing, and your coffee mug. For every object in the physical world, there is probably already a Silicon Valley startup working tirelessly to connect it, and then to figure out why.

In regard to buildings, the IoT concept commonly involves sensors and data. Lots of sensors and even more data. Sensors will measure the environment, by detecting light levels, air temperature, air quality, noise levels, maybe even smell (see: air quality). When you stand from your connected chair, sensors will track your movements toward the coffee maker. Sensors in your clothing and on your watch may further verify that you have stood and are on the move.

All of these connected objects and sensors will spit out mountains of real-time data. But where does the data go? What is it used for?

In the beginning, the prevalent understanding of IoT stopped at the sensors and objects. IoT was a world full of sensors for their own sake, which would measure and report on all conceivable aspects of our world, and feed data to a network. The thinking goes that if we start with rich real-time data, transformative change will naturally follow. By presenting the data to humans, we will modify our behavior. We see successful examples of this in activity tracking bracelets, and in residential electrical meters which provide time-of-use data in near real time.

The Building IoT concept is evolving from its early beginnings, and now most conversations also include the requirement to do something more direct with all of the rich data. Sometimes IoT is described conceptually as feeding data into a cloud-based central software framework or platform, and other times the data is described as being directly available for countless single-purpose lightweight mobile or browser apps. In yet other cases, there is an emphasis on actually using the gathered data to directly control or optimize a process. The end goal for the Building IoT is autonomous control or distributed intelligence — that is, IoT machines using IoT sensor data to operate without a human.

— Robert Knight

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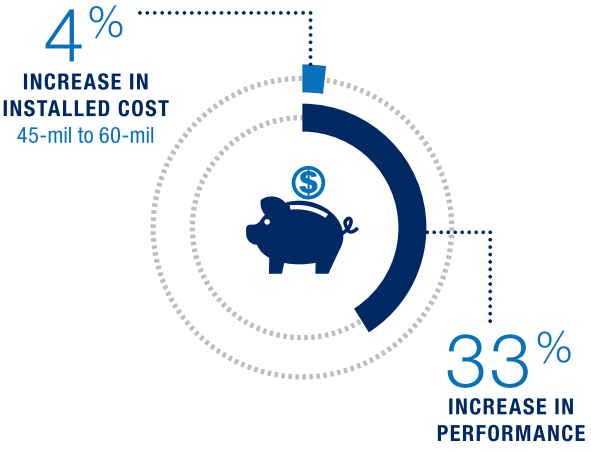

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Is There an App for That?

Developers of IoT applications strive to create plug-and-play software, so that a potential user can download the app and immediately begin using it. In the case of a Nest thermostat, or a Fitbit activity tracker, this is simple because the software only needs to know how to interact with a single device.

Compare this simplicity to the complexity found in a typical commercial building. A typical commercial building consists of a unique combination of mechanical and electrical systems, controlled by a random a la carte array of controllers, which in many cases have been uniquely configured by individual programmers. There is very little consistency, and as a result, it is impossible to create the world's next greatest energy reporting app and expect it to be deployed quickly and inexpensively into a huge number of sites. For the typical economics of an "app business model" to work, the app must cost $5 or $10 or $50 and be downloaded thousands or millions of times. If weeks of custom data mapping by a specialist is required for each deployment in a building, we will never see the explosive growth of apps in commercial buildings.

To solve this problem and permit IoT concepts to allow our commercial buildings to realize maximum advantage requires that the data itself have meaning and context. To software developers, meaning and context around data is known as metadata, or "data describing data." There are efforts underway today to formalize ways to encode metadata for our building systems. Project Haystack is one notable example of a community-based effort to devise a library of data tags and a method for consistently using those tags to describe the data. When Haystack tags have been properly applied to data, it becomes possible for a software application to gather data from a building and know what to do with the data. Applications could ask for a list of all air-handling units, or could ask for the reading of every space temperature sensor.

In the near future, we can expect commercial building systems to embrace better metadata. For example, the unique aspects of a chiller plant will be encoded in metadata at the time of installation, by specialists who understand the uniqueness of that particular chiller plant. Then the chiller plant operator can potentially select from a wide range of chiller plant optimization routines and analysis apps, which can be quickly downloaded and applied.

— Robert Knight

many times more environmental sensing devices, including devices that locate people, count people, and measure every aspect of how people interact with their commercial spaces. These devices will be relatively inexpensive to buy and install in bulk. And we can expect an explosion in the development of low-cost applications that can be installed and used directly by the building operators, owners, and occupants on a whim. The applications will leverage not just the building system data, but also a wealth of other systems and data from diverse sources, to solve problems we haven't imagined yet. These techniques will allow facility managers to run their buildings on less energy, operate and maintain them more effectively, provide adequate security, and enhance the occupant experience by creating a responsive environment targeted to the specific preferences of each occupant. ■

Robert Knight is senior associate, controls engineer, for Environmental Systems Design. He is a leading systems integration engineer, specializing in difficult integrations. Knight is proficient in writing sequences of operation for complex central plant and built-up systems.

Email comments and questions to greg.zimmerman@tradepress.com.

Greenbuild 2015: DC Green

Kate Hurst, vice president of community advancement, conference & events, USGBC

Last year, Washington, D.C., made history by becoming the fourth city in the world to certify over 100 million square feet of LEED space — a remarkable feat for a city with fewer than 700,000 people and encompassing less than 70 square miles. This year the city is poised to make green building history once again as it prepares to host what is expected to be the largest Greenbuild International Conference & Expo to date. The conference will take place from November 18th to 20th at the Washington Convention Center.

Washington, D.C., leads the nation every year in per capita square footage of newly LEED certified real estate, but Virginia and Maryland, anchored by their suburban-D.C. communities, have also ranked among the top 10 states for LEED each of the past four years. Given these trends and the highly developed market for sustainable design throughout metropolitan Washington, it's no surprise that the region also has the highest per capita concentration of LEED professionals in the country, including the most LEED APs in the nation.

The region's political and economic leaders have been highly supportive of green building and, especially within the District of Columbia, have turned to sustainable design as a hallmark of what is a very robust sustainability agenda. Since the passage of the District of Columbia's Green Building Act of 2006, all non-residential public buildings are required to certify as LEED Silver or higher, and all District owned or financed residential projects 10,000 square feet or larger are required to meet the Green Communities certification standard. Since 2012, all new private developments within the District of Columbia 50,000 square feet or larger have been required achieve LEED-certification.

The U.S. Green Building Council (USGBC), which has its international headquarters in Washington, expects 25,000 attendees at this year's Greenbuild, and over 600 exhibiting companies. There will be 26 different Greenbuild tours available this year for conference participants, including several that would be exciting for LEED professionals that deal extensively with LEED Operations and Maintenance (O+M). The Monitoring & Maintaining the LEED tour (Monday, Nov. 16), Government Green: Sustainability in the Nation's Capital (Nov. 20), and Pushing Toward Net Zero (Nov. 21) tours are just a small sample of the options available for this years' attendees.

Greenbuild attendees interested in learning more about the newest and best practices in O+M can also chose to follow the Building Performance and Energy Efficiency track over the course of the conference, which will include sessions that cover topics such as energy savings in tenant space, reducing plug loads, passive home building, carbon neutrality in the built environment, post-occupancy evaluation and green building/performance in the small commercial building space.

The staff at USGBC is ecstatic about inviting the national green building movement to USGBC's home city, and the local, national and international enthusiasm for this year's Greenbuild has overwhelmed us all. We hope that the broader LEED O+M professional community will come out in force for this year's Greenbuild as we look to show off what a truly transformative green industry looks like in our nation's capital. ■

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CLOSE-UP: UTILITIES

Ultimate Utility: How the Internet of Things Can Enable Demand Response

by rita tatum, contributing editor

Modern smart devices allow building systems to communicate and interact with each other, sometimes without much human intervention. This development — known as the Internet of Things (IoT) — is starting to have an impact on the way facilities communicate with electric utilities. In fact, the IoT is essential to automating demand response programs as the utilities industry tries to move closer to a national smart grid.

For years, savvy facility managers signed up when their local electric utilities offered demand response programs, which compensate customers who reduce electric use in response to requests from the utility during periods of high demand. Demand response programs allow utilities to meet high power demand spikes without building or buying alternative sources for that power. In return, utilities often reward facilities with lower electricity rates. More importantly, facility managers avoid peak electricity demand charges, which can be four or more times higher than regular charges.

Demand response programs are becoming a major resource base that utilities rely on to maintain electricity reliability on their individual grids.

Up to $400

Amount Pacific Gas and Electric pays per kilowatt of demand response load reduction. This is referred to as "dispatchable load," and can be controlled by automated DR technology.

Demand Response Benefits

For example, the Hudson Yards Redevelopment Project is a joint venture by the New York City Department of City Planning and Metropolitan Transportation Authority to encourage development on Manhattan's far West Side along the Hudson River. The 60-square-block campus is tapping smart building systems, using analytics, a microgrid, and managing energy use in real time. And, because of that energy conservation approach across the full development, New York's Consolidated Edison believes it will not need to add a new 40-megawatt power source.

> "IoT brings more information to the energy management table, plus IoT systems are interactive and interoperate."

Hudson Yard's South Tower is designed to achieve LEED Gold. As part of its plan to be the Big Apple's most energy efficient Class A office tower, South Tower will benefit from a DR program. The high-rise building also has an onsite cogeneration plant and the ability to transfer excess heat to surrounding buildings at Hudson Yards via a thermal microgrid.

Demand response can provide a revenue stream for facilities. Duke Energy cites Central Prison's use of its 2,500-kilowatt backup generator. In return, Duke Energy pays the prison $3.25 per kilowatt (kW) each month for its contracted amount of curtailable demand. That sounds small, but across 12 months, those 2,500 kWs add up to $97,500, just for being available. A one-time participant benefit of $50 per kilowatt for demonstrated demand reduction during their first

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two curtailment events added another $139,065. Central Prison also receives $15,000 during each actual curtailment.

Automated Demand Response

Automated demand response (ADR) is fully automated signaling from an electricity supplier that allows connectivity to the customer's control systems. However, these days, many existing ADR systems are not standardized or interoperable.

How ADR is applied varies from utility to utility. For example, Pacific Gas & Electric's ADR program offers both incentives and technical assistance for customers willing to expand their energy management capabilities with ADR controls and management strategies.

Facilities that sign up receive automated event signals from PG&E to a technical solution that initiates the preprogrammed DR strategies.

PG&E pays between $200 and $400 per kilowatt of DR load reduction, referred to as "dispatchable load," that is controlled by the ADR technology. Participants receive 60 percent of that amount after verification of equipment installation and testing. The other 40 percent is paid after performance during a full demand response season, which may be up to 12 months. In addition, the ADR program incentives can be coupled with applicable and approved energy efficiency rebates, but may not exceed 100 percent of total project cost.

Austin Energy uses special thermostats for ADR. When directed by the utility, the thermostats automatically reset temperatures by several degrees for several hours. In return, participants receive a preset price for each kilowatt saved.

Experts suggest buildings may be able to reduce energy consumption 10 to 20 percent with ADR, particularly when teamed with fault detection and measurement and verification. For example, a vent in the building may be stuck in one position, rather than opening and closing for optimum energy conservation. Fault detection could catch that.

"In practice, however, it's more difficult," points out David Holmberg, mechanical engineer with the energy and environmental division of the National Institute of Standards and Technology (NIST) Engineering Laboratory. "Automated systems for fault detection also can generate false negatives and false positives."

The result can be an overwhelming number of alarms that facilities managers must address. So NIST is investigating new approaches and higher intelligence to make fault detection measurement and verification more user friendly.

While the nation has yet to connect the dots for a smart grid, some utilities like Austin Energy already are establishing smart grids inside their territories. Using a communications network, reactive hardware, and interpretive software, Austin Energy is one of the utilities leading this technological revolution in the electric industry.

Under construction for more than a decade, Austin Energy's smart grid runs from power plants through transmission and distribution systems to the meter and then back to the utility.

Austin Energy's smart grid technology allows real-time meter readings online or by phone, remote service for power activations and deactivations, and time-of-use billing structures.

WHAT IS OPENADR?

In January 2015, the Electric Power Research Institute (EPRI) released open software that allows smart devices to respond automatically to changes in price, weather, and demand for power.

OpenADR is a standard attempting to remedy the problem of lack of standardization and interoperability. OpenADR meets the need for interoperability because it is an open and interoperable information exchange model and emerging smart grid standard. OpenADR standardizes ADR's message format so that real time price and reliability signals are delivered in a uniform and interoperable fashion to utilities, independent systems operators, and energy management and control systems.

EPRI's ADR software is certified by the OpenADR Alliance, an organization of stakeholders interested in facilities-utilities IoT communications.

"OpenADR is being applied all over and is moving toward being an international standard," says David Holmberg, mechanical engineer with the Energy and Environmental Division of the National Institute of Standards and Technology (NIST) Engineering Laboratory.

EPRI guided the software's development to accelerate adoption of OpenADR, which could provide another avenue for new building controls products and services using demand response programs. Utilities also benefit by increasing the electric grid's reliability and reducing the cost of operating it.

"Release of this software is a critical step in developing open, interoperable standards that will facilitate the emerging integrated grid," said Mark McGranaghan, vice president of power delivery and utilization at EPRI. "Making this software freely available to the industry will accelerate the adoption of standards-based demand response."

The EPRI integrated grid concept envisions a robust electricity grid that effectively integrates distributed energy resources — ranging from rooftop solar to DR.

The original OpenADR 1.0 specifications were published by Lawrence Berkeley National Laboratory after seven years of research into auto-demand response. Open ADR, sometimes referred to as OpenADR 2.0, is being developed by the OpenADR Alliance.

Others working on OpenADR developments and refinements include the NIST Smart Grid-standards effort, the Organization for the Advancement of Structured Information Standards (OASIS), the Utilities Communications Architecture International User's Group, and the North American Energy Standards Board.

— Rita Tatum

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Eliminating Human Error

Demand response programs may require considerable effort from facility managers to achieve successful results.

"Humans are part of the problem," explains Lindsay Audin, president of Energywiz, Inc.

He notes a case where the demand response concept failed. The organization's demand response plan included operating a number of emergency backup generators should the utility contact them to dial back power usage.

"When the call from the utility came in, every person who could do the switchover was on vacation," notes Audin. As a result, electricity demand was not reduced.

Now, thanks to the Internet of Things proliferation in building controls, it is becoming possible to automate demand response and eliminate the human error factor.

Jack McGowan, principal of The McGowan Group, sees IoT as "an enabler" to such concepts as analytics, energy management, automated demand response, utility rebates, and measurement and verification in real time. "IoT brings more information to the energy management table, plus IoT systems are interactive and interoperate," says McGowan, author of the book Energy and Analytics, Big Data and Building Technology Integration. "These are valuable assets to energy managers and building professionals."

— Rita Tatum

The concept of resilience also is impacting new developments, particularly along the Atlantic Coast following Hurricane Sandy in 2012. In the aftermath of that storm, electricity was off for many businesses for days.

Post-Superstorm Sandy, many facility managers realize the inherent value of a building that can remain functional during a long power outage. So they are looking at cogeneration, thermal storage, wind and solar power, microgrids, and other options to ensure that the lights stay on should the electric utility's power be compromised. That same infrastructure also gives them an opportunity to tap a potential revenue stream from utility demand response programs. ■

Rita Tatum, a contributing editor for Building Operating Management, has more than 25 years of experience covering facility design and technology.

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CLOSE-UP: SECURITY

Achilles' Heels in Security: 4 Lessons From the Frontlines

by sean a. ahrens

Most organizations want to have effective security, but achieving it involves such a multitude of factors that many security efforts ultimately fall short in one important way or another. Unfortunately, with security, a single Achilles heel can be catastrophic.

The following four stories, drawn from the writer's personal experience, offer a glimpse of the kinds of vulnerabilities that can exist in facilities. All of them are based on actual events — though for obvious reasons the entities, names, and locations are changed — and they teach useful lessons about principles that can minimize loss of life and information, and protect an organization's brand and image.

1 Pay attention to all aspects of security

Organizations sometimes hire a third-party security team to try to break into their facilities. It's a way of testing real, not hypothetical, vulnerabilities.

In one case, the assignment was to gain access to a riser/data closet, and if possible, the main Network Operation Center. The team's first step was to covertly conduct surveillance of the property, using satellite imagery and street views to stay inconspicuous. On first impression, the facility was immensely secure: A large fence encircled the property and the three primary entries appeared to be staffed. Security was 24/7. The security department, however, was housed in a guard house at the property's edge, and the guards' comings and goings could be seen at all times of the day and especially at night, when security was reduced from four guards to two.

> "Addressing security issues may require a very close look at the motivations of the people who pose risks."

The team, including remote support personnel, did its homework. It observed peak pedestrian and vehicle flows; gathered supplies to make fake ID cards, such as a portable, high-resolution ink-jet printer; and dug up names of individuals within the company such as facilities, security, and high-ranking individuals from various departments via the Internet and social media. The biggest find: architectural drawings of the facility which identified lunch rooms, break rooms, conference areas, and a large unnamed room which appeared to be the facility's data center.

A determined aggressor may be able to circumvent physical security measures. To be effective, a security program must address operational and technical factors as well as physical security elements.

Approaching the facility in their car, team members flashed IDs, as they had seen others do, and the security guard raised the vehicular barrier. Getting past an access-controlled exterior door was easy. One member of the team carried a series of empty cardboard boxes, while putting on some fake exertion, and asked a woman with whom he had started a conversation to please hold the door.

Inside was a surprise: a row of optical turnstiles. A security guard was watching. Once again, however, the cardboard boxes did the trick, and the security guard allowed the stranger to use the emergency stairwell. In the stairwell, it was just a question of finding the one door that did not close properly.

Most employees paid no attention to the stranger wearing a baseball cap and looking at a drawing. One woman asked if she could help, but her concerns were allayed by the mention of the facility director's name. She then pointed the stranger in the direction of the riser closet that she said was next to the men's restroom.

Although the riser closet was access controlled, it was equipped with an electric strike that had been cut into the frame, which made the door inherently unsecured. A credit card retracted the latch — and the riser closet had been breached. (For more details on

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how social engineering can be used to breach security, see the online sidebar, "How a Smooth-Talking Intruder Can Defeat Building Security," at facilitiesnet.com/16193BOM.)

The moral of the story? Just because a facility appears to be secure does not mean it is. More importantly, a security program needs to involve all aspects of security (operational, physical, and technical) to be successful.

2 Don't be penny-wise and pound-foolish

A large corporation wanted to identify hypothetical security threats and vulnerabilities for its corporate headquarters. A proper risk assessment involves gaining an understanding of the facility through a tour, an introspective examination of technical security (e.g., cameras and access control), physical security (e.g., building siting, locks, door hardware, and lighting), and operational security (e.g., security staffing, policies and procedures, and response plans), as well as a robust set of interviews.

This type of study should involve an assessment team that has at least two people, to support multiple views, and to allow a "divide and conquer" approach that limits the assessment's intrusiveness and impact on the organization.

This analysis uncovered a significant amount of opportunities for enhancing security. One of the key concerns was a lack of compartmentalization for the lobby that led to executive offices. The executives desired an open, inviting environment for the corporate facility without the obtrusiveness of security. Therefore, the only security between the lobby and executives was a 65-year-old woman, Grace, who had worked at the company for 25 years. Grace had no duress button and no training, and she indicated that the only step she could take to control an aggressor would be to say "Stop." What if the aggressor did not stop? "Well, I guess I would say 'Stop' again," she said.

The risk assessment also uncovered tensions with the union workforces, tensions that appeared to be escalating. The report suggested that Grace receive training, multiple methods of communicating a hostile situation(i.e., the duress button/phone), detection of aggressors, de-escalation, and personal safety training and a way to control access to the executive area (e.g., access-controlled door, barrier-type turnstile).

The assessment was very well received, and the document landed on someone's desk for implementation. But for cost reasons, the organization elected not to proceed with recommended improvements in the main lobby.

One day, multiple union representatives rolled up in buses, walked by Grace as she repeatedly yelled "Stop!" and entered two executives' offices while chanting on bullhorns.

The access-controlled doors, compartmentalization, training, and duress buttons were added the following week at 160 percent of the original price, due to the urgent need.

The moral of the story: Being proactive is less expensive than being reactive.

3 Technology is not a silver bullet

An organization wanted an evaluation of an aging access-control system and video system which had not been maintained.

Technology that is not properly maintained — or staff that is inadequately trained on the system — can be a significant liability for an organization. While technology can reduce staffing expenditures, it will fail if there is no preventive maintenance. The repairs needed if the system fails will likely cost more than the preventive maintenance would have cost. While the system this organization had was still functional, it was handicapped by a lack of documentation such as as-built documentation, administrator passwords, or firewall log-on information.

In this case, the electronics had a significant amount of dust on their exteriors — imagine what was on the inside. Additionally, all of the alarms were masked — the alarm was wired, but it was shut off in the software and did not produce an alert. The biggest concern, however, was the cardholder database, which had more than 6,000 active cards enrolled; at the time, the company only had 3,500 employees.

The evaluation report indicated many other concerns, such as unsupported operating systems and end-of-life equipment. What's more, the local area network (LAN) facing the Internet was unprotected because the firewall was inaccessible. The report concluded that it was not a matter of "if," but "when" the system would fail.

Within a month of the report, an ominous beeping was originating from the access-control server; one of the hard drives in the redundant array of independent disks (RAID) had failed. If a new drive was installed to repair the error, the system might not come back up afterwards. Instead, the security firm that prepared the report developed a comprehensive program to replace the existing system.

The moral of this example? Security technology is not "pay and forget." Security technology needs to be maintained, updated, and reviewed regularly. While technology does provide a reduction in staff costs , it does not entirely replace staffing. To be effective, technology and operations need to be harmonized and staff needed to know how to use and maintain the systems.

4 Make sure security measures address the problem

Under a partnership with the municipality, a corporation developed a park for community use near its corporate campus. The company enriched the park environment with cutting-edge architecture that used large wood beams, cabin-style restrooms, concession stands, and a significant amount of glass. Once the park was completed, however, the corporation had a slew of problems, involving issues with gangs, drugs, ATVs, damage, and vandalism.

The park was a significant distance from the corporate office building. The area had a far setback from the road, was unlighted, and was accessible to those with malicious intent. As it turned out, the problems were being caused by very different groups of people, and the solutions had to address each group.

Aggressors fell into three groups: urban explorers (ATVs), criminal intent (drugs and gang members), and mischievous kids (vandalism).

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A layered approach was used to change the environment through a crime prevention-through-environmental-design (CPTED) program, which was intended to reduce the aggressors' confidence that they could get away with these acts without being caught or suffering other ill effects.

To deter urban explorers, signs were posted regarding the property, enforcing ownership and defining the park's territory. To change their behavior, local motion detectors on light poles were linked to an existing industrial sprinkler system. It only took a few weeks and a handful of soakings before the urban explorers were displaced to another environment.

For those with criminal intent, a more direct approach was needed. Placing security at the park 24/7 was not a cost-effective option. What's more, the site needed to better control vehicular access. A two-lane divided road accessed the park, but it was uncontrolled. To enforce territoriality, the road that ran parallel to the park was lined with small hedges and "No Trespassing" signs. Access to the site was controlled with a sliding gate that was set on a schedule to remain open during the day and close during the evening hours. Only select community members and police were given a code or ID card to access the gate.

Conversations that the local sheriff's department personnel had with this group revealed the group had no place to store their new $80,000 to $90,000 Harley Davidson motorcycles. If the corporation built storage for the motorcycles, would the sheriff's department use it and monitor it? The answer was a resounding "yes." Now law enforcement had a reason to frequent the facility, making the area undesirable for criminal activity. In addition, the influx of police drew more legitimate witnesses to the park, while negative influences, such as gang activity, withdrew during weekend sporting games.

The park also had several semi-transparent shelters. The strength of the glass was enhanced by layering it with a film to prevent shattering. This increased the time necessary to vandalize the environment, which increased the opportunity for police detection.

The moral of the story is that effective security has to be tailored to address the specific problem — or problems — at hand. That may mean understanding the motivations of people who pose security risks. In some cases, with proper planning security can be very cost effective. ■

Sean A. Ahrens, CPP, BSCP, CSC, leads Aon's global security consulting and design practice. The stories in this article come from his personal diary of security vulnerabilities he has encountered. With more than 20 years of experience in the security industry, Ahrens is responsible for providing security organizational consultation, threat and risk analysis, contingency planning, loss prevention, and force-protection design and planning. Ahrens can be reached at sean.ahrens@aon.com.

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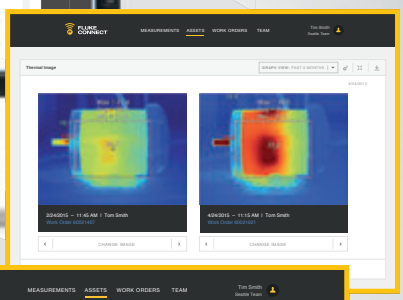

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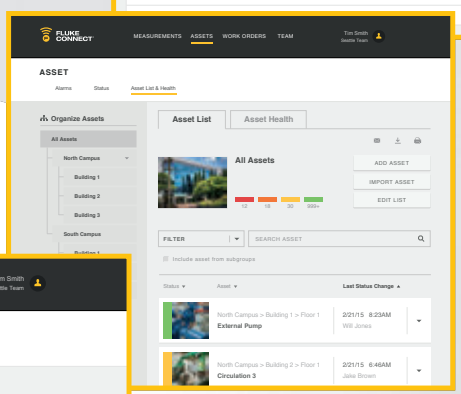

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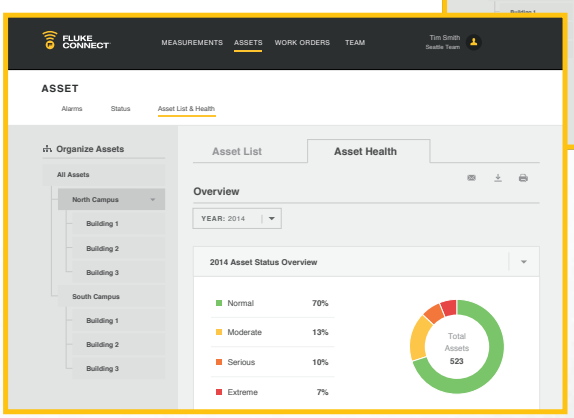

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Internet of Things

What it means for FMs

The Building Internet of Things promises technology that will make buildings more efficient and occupants happier

In an era when CEOs are talking about "digital strategies" for corporations, it might seem that bricks and mortar are not exactly relevant to the future of most organizations. But the dynamics that are producing Chief Digital Officers are also beginning to transform the way facilities are managed. Sensors in buildings are becoming cheaper, smarter, and more widely used. New connections are being forged, not just between devices in a system, but among systems in a building and buildings in a portfolio. And the unprecedented volume of data coming from buildings is being converted into useful information by sophisticated analytics.

For facility managers, there's nothing new about the idea of connecting devices to enable data sharing and control. But the Internet of Things, or IoT, changes the game in important ways. For one thing, there are more tools and standard offerings that enable use of newly available data. "The balance has shifted to the use of this data," says Glen Allmendinger, president of Harbor Research. He cites another big change: Widespread interoperability has enabled the move beyond simple applications like monitoring alerts to "compound" applications involving multiple systems.

The Building Internet of Things is producing a multitude of new choices. There are cloud-based analytics, lighting systems involved in temperature control, new options for managed services, and software that sits on top of legacy systems to offer new levels of monitoring and control. "Be prepared for lots of newness and lots of things you might not have expected," Allmendinger says.

The top priority for facility managers interested in the Building Internet of Things is to learn about the capabilities and limitations of new technologies. That's the first step on the road to deciding how, when, and where to put digital strategies into action.

— Edward Sullivan

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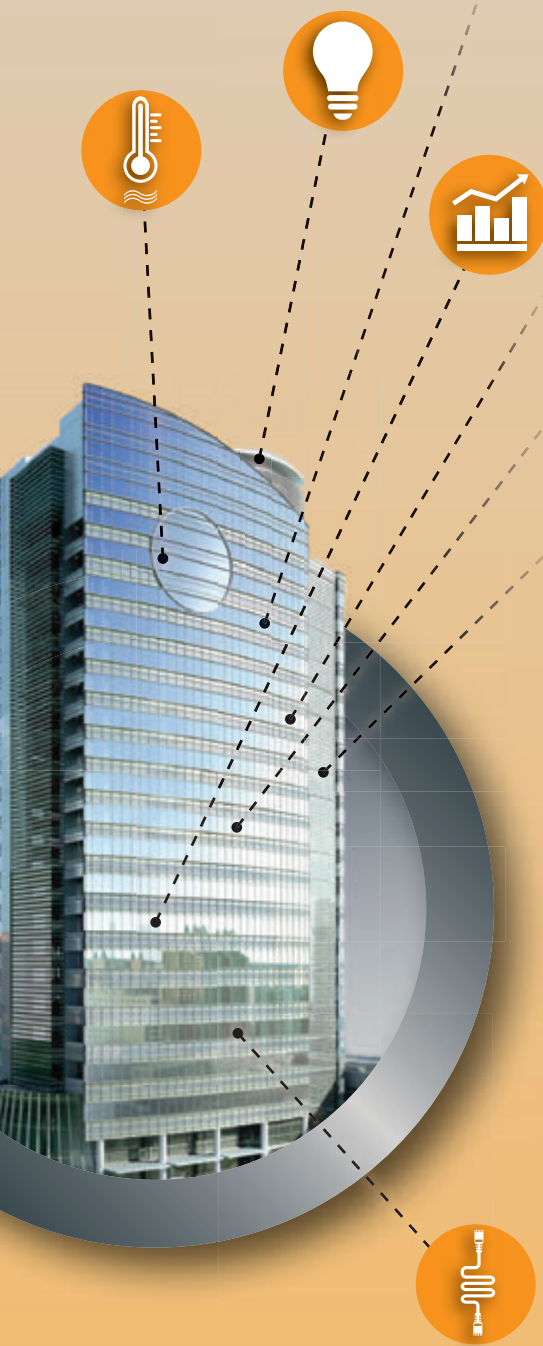
INTERNET OF THINGS

Myriad Sensors, Multiple Benefits

Building Internet of Things holds great promise for facility managers and occupants

by naomi millán, senior editor



It is widely considered a foregone conclusion that the Building Internet of Things (IoT) is the next step in facility management. Already, manufacturers have developed a plethora of ever more capable sensors, and solutions for control and interoperability, which not too long ago seemed part of a far-off Jetsonian future, are possibilities for today. But there is a disconnect in the industry between what is possible and what is being done, as facility managers are still working on understanding, and trusting, the Building IoT.

In a recent report, McKinsey & Company estimates that the Internet of Things offers a potential economic impact of at least $4 trillion by 2025. In facilities, this is based on anticipated impact to operations management, layout optimization, and equipment maintenance, among other factors. While there are many layers to consider, the Building IoT undeniably holds great promise for both facility managers and facility occupants.

Of course, a significant amount of building automation technology has already been deployed in commercial facilities, but what Building IoT represents is an acceleration of the integration of systems to create lower operating costs and improve the functionality of buildings, says Ronald Zimmer, president and CEO of the Continental Automated Buildings Association. Paraphrasing research from Harvard, he says, "The goal is to ultimately integrate intelligent devices with network systems that are self-sensing, self-controlling, and self-optimizing, all automatically, all without human intervention."

This does not mean that facility managers will be out of a job. Rather, it means that the tools for leaner, more efficient, and more predictive operations will soon be at their fingertips.

Benefits to Facility Managers

The Building IoT has one capability that all facility managers need and none has: the ability to be everywhere at once. Sensors can be placed throughout a facility and be tied in with each other so that not only is the HVAC system reporting back to the facility manager, but so are the lights, and even the toilet paper dispensers and trash cans. What's more, they're talking to each other.

The ability to activate this kind of intelligence across a facility's systems can lead to more efficient operations. Instead of physically going out to check the status of a filter, for example, the filter itself can indicate whether it's fine or needs maintenance. Building IoT leverages all the data from the universe of sensors and systems in a facility. "You have all this information," says Thomas Grimard, associate partner with Syska Hennessy Group. "In itself, it's useless. But if it's properly formatted and segmented, then it becomes very useful."

According to McKinsey & Company, most of the data from IoT devices is currently unused. "That's because this information is used mostly to detect and control anomalies — not for optimization and prediction, which provide the greatest value," they say.

To manage all the data coming from Building IoT and get more use out of it, Grimard sees a move to the cloud. Facility data will be pushed out to third-party service providers that will monitor and analyze the infor-

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mation. Relevant information, such as when maintenance is needed on a system or energy use information, will be sent back to the facility manager in a format that is useful and actionable. In fact, this functionality is already a reality with some systems.

"Most providers are thinking of their BMS systems and their low-voltage systems as a service," says Grimard. "Everybody's component is the same. A microprocessor is a microprocessor. It's how you plug it into the big picture. That's really where the industry is going to be driven."

In addition to transforming the flood of data from myriad sensors into actionable information, and also supporting continuous commissioning by third parties, using systems as a service will allow facility managers to have the latest and greatest software applied to their facilities as part of the service package. The day may soon come, Grimard says, when maintaining a stand-alone on-site system will be more expensive than a cloud service. For some facilities, the cost will make sense due to other factors, but for most the Building IoT approach will be most economical.

More efficient operations are the chief benefit of Building IoT to facility managers, but other aspects amplify the good it can do. The Building IoT can help facility managers understand how facility occupants use a facility. Information from occupancy and other sensors can help facility managers tune when to have the lights on or where to slow down fans to save energy, but it also helps to illuminate the facility as an asset.

Take a transit facility, for example, says Herbert Els, national leader of building technology systems with WSP. The data from the Building IoT can be used to look at where people intermingle and how traffic flows around the building. "What kind of retail spots can I charge more for because they generate more foot traffic, or where can I send my janitor using beacon technology because I know there was a spill?" says Els. Data coming back from the facility users, through data streams such as Bluetooth signals picked up by beacon technology in the facility, offers X-ray vision into the facility as a system of systems.

Another benefit may come in the form of decreased insurance premiums, says Zimmer. Insurance companies are starting to partner with manufacturers as the benefit of granular insight into systems to catch problems while they're small becomes more apparent, as well as easier to achieve with developments like wireless technology.

Benefits to Occupants

Accountability to facility occupants continues to grow in importance for facility managers, and here the Building IoT can be useful as well. First among the several significant benefits to a facility's occupants is a potential for improved life safety. In a security or life safety emergency, a whole host of things need to happen quickly in a moment of crisis, and Building IoT technology can facilitate that speed of response.

In a more day-to-day fashion, Building IoT can also deliver a more comfortable work environment to facility occupants. The predictive and continuous maintenance aspects of a Building IoT solution mean systems will be performing within established parameters, and any issues will be discovered and resolved much more quickly, perhaps before occupants can even sense them. "The immediate benefit for occupants is that they get a better environment," says Els.

In addition, Building IoT supports another aspect of personal comfort: controllability. It has been proven time and again that having some degree of control over the immediate work environment is a highly desired attribute in the workplace. From the lighting set-up for individual spaces, to the amount of cooling that is done, to control of the blinds, the Building IoT supports a much more personalized feeling, Els says. "And occupant comfort, which is hard to quantify, does have a direct impact to productivity," he says. "That direct control, which is personalized, makes a big difference."

The personalization of the workplace experience can be carried throughout the facility with Building IoT. For example, when an occupant swipes in at the lobby with her access control card, the security system can send that information back to the BMS, which can relay the signal to turn the lights on and adjust the HVAC setpoint in the workspace. The same can be done in reverse sequence when the person is done working for the day. This is possible today with access cards, says Els.

The next step, he says, is to move to beacon technology, so the building recognizes a person and grants access by picking up a Bluetooth signal from a smartphone, no swipe required. These location-aware applications are currently being applied in facilities like sports stadiums and airports, facilitating food delivery or just-in-time promotional messaging. "You can sit in the stands in a stadium, and we can know exactly where you are so we can deliver (your food order) exactly where you are," says Els.

Beacon technology can also be particularly helpful in a healthcare setting, where patient satisfaction scores are so crucial and the patient experience often begins at the parking lot. "One of the biggest stresses is find-

Giving Occupants the Power

The Building Internet of Things can enable occupants to provide real-time feedback about building conditions, which can provide greater levels of comfort and control.

Several software packages on the market today allow occupants to use their smartphones to report whether they're hot, cold, or just right, as well as other building requests, like trash pickup or something not working properly.

"You'll have direct occupant interaction with building systems," says Dev DuRuz, senior consultant with Paladino and Company. "They may not have direct control, but can input immediate feedback. This more fluid, continuous feedback loop will result in richer data sets for faster control."

These packages also often include cloud-based analytics or trend modules to plot and analyze systems, for example HVAC or lighting energy. "The number one reason tenants don't renew leases is environmental controls," says DuRuz. So the Building IoT can be a major tool for tenant relations, he says.

— Greg Zimmerman

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ing parking at a hospital and getting to the right place where you need to be," says Els. "With beacon technology, you can get to the parking garage and have parking systems that lead you to the open parking spot." Then using the Bluetooth in a smartphone and a wayfinding application, patients can navigate exactly to where they need to be for their appointment, he says.

Benefits to Tenants

Having a facility up to date and ready to accommodate Building IoT solutions is also becoming an expected deliverable, especially in facilities with tenants, says Justin Lee, chief operating officer of TheSquareFoot, a commercial real estate brokerage and listings aggregator. Even when a tenant might not know exactly what Building IoT solution they might want to use, they want to know that the facility can support it. There's been a shift within the last two years, Lee says, where part of the criteria that prospective tenants are looking for is the quality of the fibering and the connectivity in the building. "They want to know that the building they choose has been optimized," Lee says. "We've seen facility managers and building owners responding by upgrading what they have in place."

Building IoT also supports employee recruiting and retention, says Lee. Especially in the case of younger companies, or those in medium-sized spaces, Building IoT helps provide functionality previously only available through enterprise systems. Lee has seen a rise in the use of systems such as virtual concierge services, which use dedicated tablets in a space to take over many duties of a receptionist and office manager, such as paging someone when a guest arrives, booking a conference room, or tracking a work order request. Another application he has seen uses WiFi speakers for ambient music and also zoned paging, which is particularly attractive to tech startups, which often lack a sophisticated phone system with an intercom in place.

Facility occupants can also benefit from the Building IoT in helping them feel more integrated with a facility's sustainability initiatives, says Grimard. With converged technology, data can automatically be pushed out to occupant devices to alert them to participate in a load-shedding event or give them a window into real-time operations. "Once people know that their building is operating efficiently and they can become part of that, that takes it to a whole different level," Grimard says.

The Building IoT faces several challenges before widespread deployment can take place. Qualms about privacy issues will need to be addressed, and facility managers will need to gain confidence that high levels of data security can be maintained. Both of these are surmountable challenges, especially with proper technology protocols in place. ■

Email comments and questions to naomi.millan@tradepress.com.

Ken Groh (right)
Supermarkets Director and Facilities Manager
Rosauers Supermarkets, Inc.

Ann Carey (left)
Commercial Account Executive
Avista Utilities

Energy savings? Grocery Aisle 6.

Selling bread and bananas may not seem complicated. But in the grocery industry, the profit margin is just pennies on the dollar and often there are competitors on every corner. Success requires insight into consumer trends as well as tight controls over store costs—one of the biggest being energy use. It's why Rosauers Supermarkets partners with Avista on energy efficiency.

Considered one of the most innovative grocery chains in the Northwest, Rosauers first opened in 1934 during the Great Depression, when Mert Rosauer purchased a small grocery store in Spokane. Despite the economy at the time, his store quickly became a success.

Eventually, the company added superstores with full-service pharmacies. It also established Huckleberry's Natural Market, Spokane's first grocer to offer a full array of natural and organic foods. Today, Rosauers operates 22 stores in Washington, Oregon, Idaho and Montana. Successful growth, however, has only increased its need to save energy.

"Energy for heating, cooling and lighting is one of a store's highest operating costs," says Rosauers Supermarkets Director and Facilities Manager Ken Groh. "But it's also one we can more easily control, especially with energy-saving rebates and incentives from Avista."

Rosauers has been committed to energy efficiency for over 20 years and, through Avista, takes advantage of the Energy Smart Grocer Program. Avista helps all types of large energy users but adopted a specific grocer program because most stores have similar efficiency opportunities. In the program, Avista provides a facility assessment as well as rebates and incentives to offset the costs of making energy-efficient upgrades.

Rosauers recently received $106,000 in Avista rebates and incentives to complete energy upgrades for one project alone (a recent remodel of one of the company's stores). Because the changes were extensive and completed all at once, they also saw the immediate, total effect on their energy bill.

"The store reduced its electrical use by 14 percent," says Groh. "Over the last two years alone, it's saved us over $50,000 in energy costs."

Rosauers' store strategy began with switching its lighting from 4-lamp fluorescents, high-bay HIDs and neon to higher efficiency, high-output 3-lamp fluorescents and low-watt LED track lighting. Now only a third of the floor lights stay on after hours, and all case lighting is turned off, leaving just enough light for night workers. The directional LED track lighting also requires less light to make products look appealing and generates less heat which preserves shelf life.

Rosauers upgraded refrigerated cases throughout the store, too, by installing fans with electronically commutated motors (ECMs). Unlike shaded-pole-motor fans which have heavy metal blades, ECM fans are lightweight plastic so use less energy and create less unwanted heat.

"They're more expensive, but Avista rebates help offset that," says Groh, "and the money you save in energy consumption offsets the cost."

EMC fans were also installed in the freezer cases, as were more energy-efficient doors. Unlike the older doors which were fully heated to keep from freezing shut, the new doors save electricity by using only a bit of heat along the frame.

To maximize energy efficiency store-wide, Rosauers also uses an automated energy management system to control everything from lighting schedules and comfort levels to refrigerated case temperatures. The computerized system even sounds an alarm if a refrigeration-case isn't running properly to help prevent product loss.

Along with the greater energy savings, Groh is very happy with the store upgrades, especially the lighting: "Everything looks a million times better," he says. "It was well worth the money."

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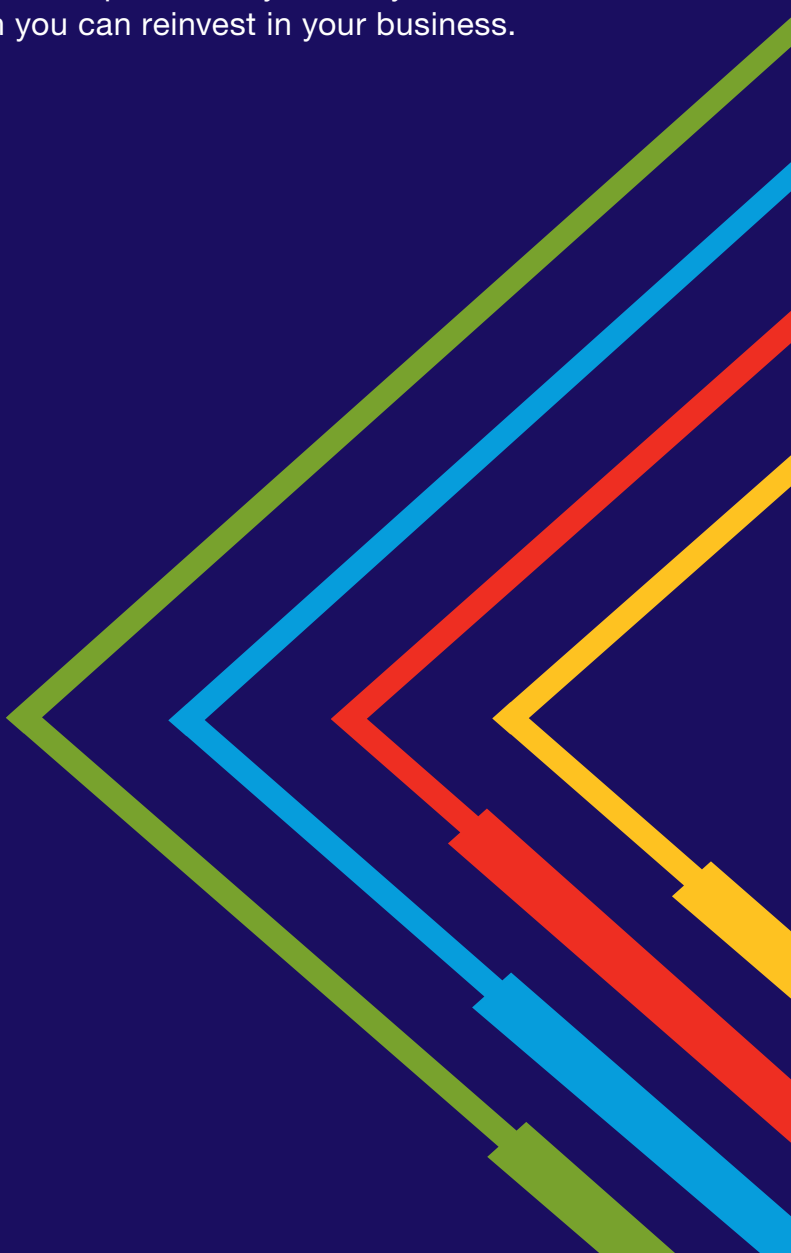

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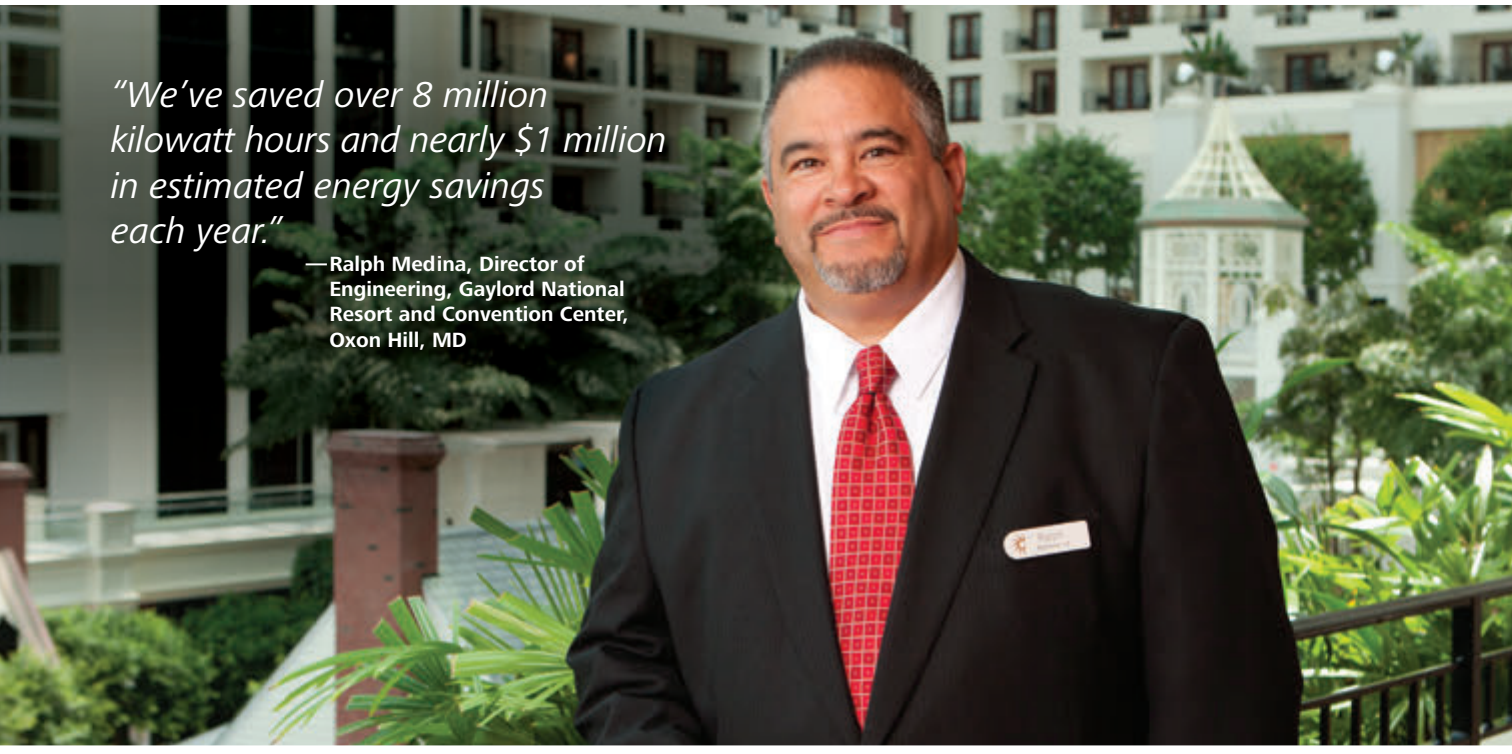

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INTERNET OF THINGS

Existing Infrastructure Sets the Stage

Most facilities already have elements in place for the Building Internet of Things

by greg zimmerman, executive editor

The term "Building Internet of Things" can be daunting, suggesting a vague yet overwhelming set of new technologies. In fact, the Building Internet of Things (IoT) builds on systems and tools that are already widely understood and often commonly used in buildings today.

Indeed, the goal of the Building IoT is simplification. "In our mobile world, people are used to simplicity," says Chris Purcell, chief technology officer, McKinstry. "Similar to any major system project, the success of a Building IoT initiative is tied to your ability to quickly use the tools and maintain them as requirements change."

To describe how Building IoT can simplify a building's technology, Dev DuRuz, a senior consultant with Paladino and Company, offers the analogy of the On-Board Diagnostics (specifically the OBD-II standard, introduced in 1996) systems used on automobiles, and how its advent simplified maintenance and repair for automobile owners and technicians. "You can plug into a common interface port of any manufacturer, and it allows anybody to see what the engine is doing," he says. "IoT represents that possibility for buildings. You can unlock building data anywhere for independent reporting and action."

DuRuz's analogy assumes a car at least has an engine to be diagnosed. Similarly, buildings must have in place a minimum of technology to best reap the rewards from the Building IoT. Broadband Internet access, for one, says DuRuz. As well, well-established network security and a good working relationship with IT are obvious prerequisites.

But beyond the basics, a building automation system, meters, sensors, analytics software, and a common communications protocol allowing for some degree of interoperability are all the load-bearing I-beams of a building IoT system.

"If you have a BAS, you're halfway there," says DuRuz. "You're already acting on data from existing systems."

Deploying Building IoT, like any building system, requires you to "begin with the end in mind," says Purcell. You need to determine what you hope to gain from an IoT system — energy efficiency? Simplify how people in the building interact with the building? Improve the experience for visitors or customers? Streamline an industrial process?

Whatever the goal, or combination of goals, it's critical to analyze your current system to understand limitations and possibilities of the future system, says Purcell. "Your technology choices for your future environment

OVERCOMING TECHNOLOGY CHALLENGES TO BUILDING IoT

Mike Grush, a technology solutions engineer with McKinstry, says that overcoming challenges in deploying the Building Internet of Things (IoT) means understanding how devices can be connected (including knowledge of protocols), the capabilities and quirks of various products and technologies, and network implications and requirements to facilitate various integration schemes. Here are some to-dos for facility mangers who want to be successful deploying Building IoT applications.

1. **Everyone wants the benefits** of modern building systems. To get them, facility managers, and the organizations they work for, have to be willing to invest the time and money to design, specify, purchase, operate, and maintain these systems properly.
2. **Cyber-security concerns** have to be balanced against legitimate needs for accessibility to the system.
3. **Facility managers have to look closely** at vendor offerings to avoid being painted into a corner or trapped under a false claim of "openness." At this point, because of limitations on what is available in the marketplace or installed in buildings, facility managers often have to use integration drivers and gateways to provide interoperability rather than using a single open protocol.

— Greg Zimmerman

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Understanding what is currently in place is essential, says Mike Grush, a technology solutions engineer with McKinstry. "Documenting the existing systems is a good place to start on that task, since detailed documentation of the existing situation will be needed to develop upgrade plans and to prioritize projects," he says.

This may not be as easy at it sounds. "BAS deployment has left us with a jigsaw puzzle of legacy and new systems that aren't always backwards compatible," says DuRuz. "If you manage 10 buildings in 10 states with 10 different control brands, and 10 different service vendors, you have a muddy picture of what's going on." But even in the same building, if systems like irrigation, fire/life safety, security, vertical transportation, HVAC, and lighting are siloed or not connected to a central system, much less speaking the same language, you might have trouble, he says.

A first-step solution, says Grush, is BACnet. "If you specify BACnet controls, they can talk to each other without requiring an integration system, intermediate gateway, or driver," he says. "This enables devices from a huge variety of manufacturers to belong to the same internetwork and interoperate together."

But true Building IoT will require IP addressable components, which, Grush says, will be the true key to unlocking data extraction from any system. "If you have a well-planned, well-administered IP network, it can be leveraged to support various Building IoT technologies, devices, and systems in a secure, high-performance environment," he says. "This makes all system information readily accessible to any or all applications being used to manage the facility."

Automated Integration

This begins to get at what DuRuz calls the process of "automated integration" and what Grush calls "unfettered device interoperability" — that is, similar to his OBD analogy, you'll be able to plug in any web appliance and extract data. "Communication protocol or the kind of data wouldn't matter," he says. "Then you can get homogenous data and be presented it in your browser, and structure reports for finance."

DuRuz says one of the challenges with Building IoT today, though, is that each IoT solution is practically custom. But in the future, he sees web appliances being able to unlock any type of digital data in a building. "This unlocked data is continuously pushed to cloud storage for automated analytics, and users receive email alerts for fault detection, air quality, energy use, etc.," he says. Not relying on internal hardware resources is one way you can maintain your Building IoT system's flexibility, he says. "The rapidly dropping cost of cloud storage and wider availability of automated analytics tools can make your system future proof." ■

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INTERNET OF THINGS

PNC Tower Uses Integration in Effort To Be 'Greenest Skyscraper'

by ronald kovach, managing editor

When The PNC Financial Services Group began planning The Tower at PNC Plaza, it envisioned a headquarters building as hardworking as Pittsburgh's reputation. That meant incorporating hardworking building systems, some of them cutting edge, and designing a structure that is complex, but still runs on the basics. Gary Saulson, director of corporate real estate, thinks it may be the most complicated building anywhere. Still, as Jeremy Snyder, associate principal, BuroHappold Engineering, puts it, "The bits and pieces are pretty typical; we're still talking typical-sized motors, and valves and actuators and dampers — that's pretty much how our building is controlled. We're just doing it in a unique and energy-efficient way."

The 33-story, $400 million structure, scheduled to open Oct. 1, is being billed as the greenest skyscraper in the world and is expected to exceed LEED Platinum certification. (PNC, one of the leading financial organizations in the country, has 258 LEED-certified projects.)

The building's systems reflect much of the Building Internet of Thing's emphasis on connectivity, data-sharing, sensors, and control. Among the elements tied into its BAS are energy recovery wheels to recover heat energy from the ventilation system, chilled beams to help cool the building, a system that treats and re-uses water for flushing toilets, and a lighting system that reads the sun to determine how much electric light to provide to each floor. The tower is transparent, with the ability to daylight more than 90 percent of its office floors.

"We have a window system that during certain portions of the year will open and close to naturally ventilate the building. The BMS controls these motorized windows based on sensors that read temperature, humidity, and pollution levels," Snyder says. Additionally, these windows open in the summer to remove heat and close in the winter to retain heat.

"The curtain wall is a double-skin façade, and within that double skin we have automated blinds that block out the direct solar gain and reduce glare," says Snyder. "This reduces our energy consumption and makes for a healthy working environment."

The star of the show, arguably, is the natural ventilation system, which is designed to operate without the aid of fans for up to 42 percent of working hours. The tower, Snyder says, is currently the tallest naturally ventilated building in the United States. At its top is a solar chimney 90 feet high and tilted at about 25 degrees. "Basically it's dark corrugated concrete to maximize surface area, with a glass top that collects heat," Snyder says. "When we have enough heat at the top of the building we open up the windows on each of the office floors. The height and heat of the chimney create a stack (effect) and we're able to draw air through each of our office floors naturally without the use of fans."

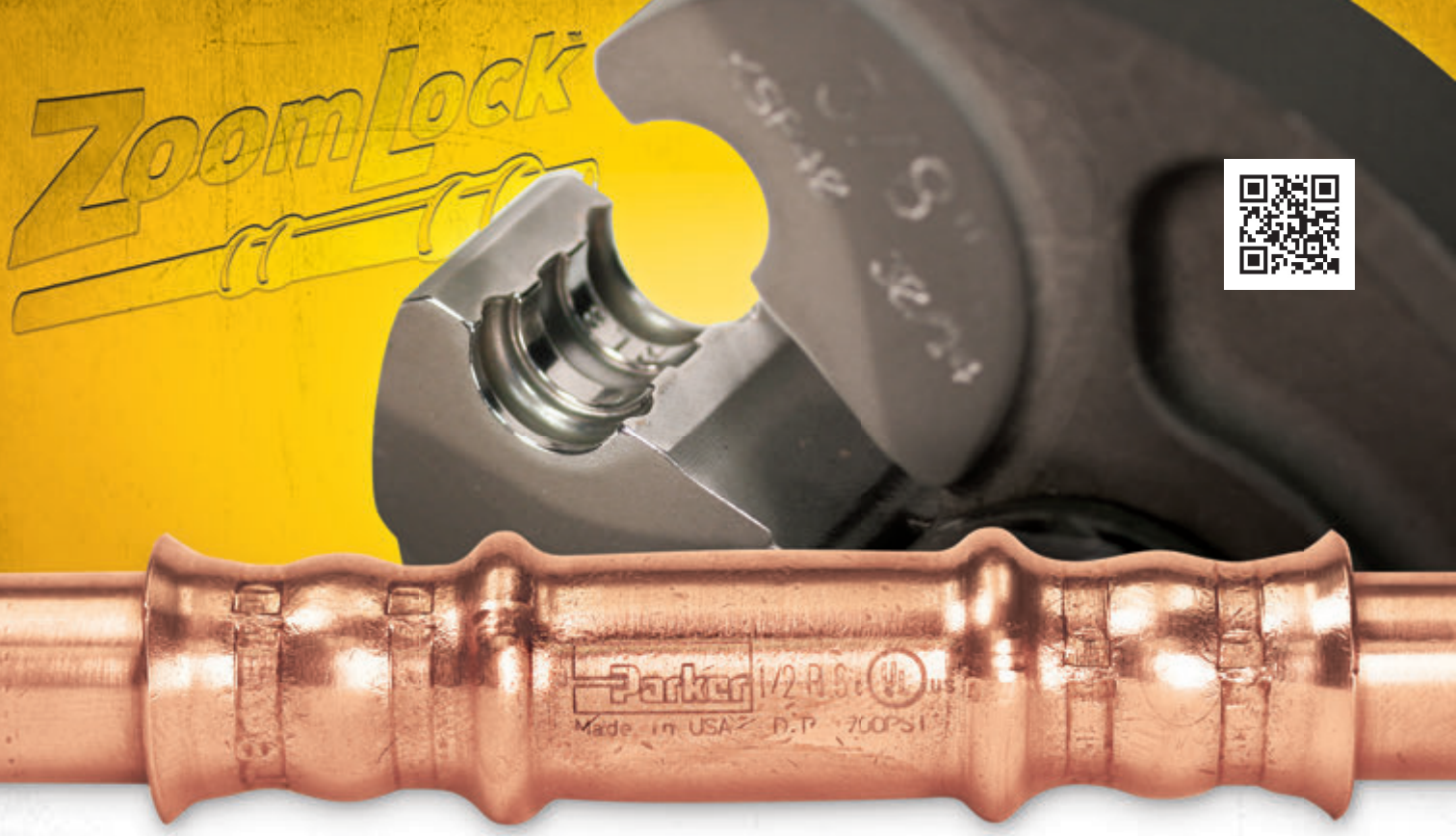
Saulson says it's like standing next to a stopped elevator when you can hear the sound of warm air rising. "So the warm air goes out of the solar chimney by itself in the hot months, and in the cold months we actually are heating up air in the solar chimney and using fans to bring the warm air back into the building," he says.

The BAS touches virtually every independent system network in the building, gathers information, and passes that information to all other system networks to ensure coordinated operation of the entire facility, says Paul Fusan, PNC's critical systems expert. For example, the fire alarm network is tied into the BAS network, which in turn is connected to the water treatment system, lighting, solar, security, and trouble-alarm notification networks.

As the building's sophisticated design evolved, a great deal of meticulous testing was done to identify the potential tweaks that would be needed before all 33 stories went up. Integrated components were tested in a 1,200-square-foot mock-up. Planners regularly crunched data and sequences in long, intense sessions called, appropriately enough, "root canal meetings." ■

An artist's rendering of The Tower at PNC Plaza, whose features include sensor-based motorized windows and automated blinds.

GENSLER



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IOT Projects

INTERNET OF THINGS

Connectivity To the Max At Cleveland Clinic

by ronald kovach, managing editor

The vast, internationally famous Cleveland Clinic system takes an important part of the Building Internet of Things — connectivity — to extremes, and happily so. It has 25 million square feet of buildings, including regional hospitals and family health centers, throughout the United States, and also reaches out to Canada and Abu Dhabi. And its integrated building management system allows the clinic to connect to nearly all of those buildings over the Intranet and monitor comfort levels and systems, including HVAC, elevators, and pneumatic tube systems, which are used for transporting specimens and drugs.

All of that information flows into a central command center on the main campus in Cleveland that features 22 television screens. A software system lets the clinic bring all of the different legacy and proprietary controls into one platform.

"Basically, we could control everything if we wanted from Cleveland," says George Thomas, a lead HVAC technician. "We do like our facilities to control their own buildings, but we're able to do analytics and diagnostics ourselves here and kind of reach out as their partner and show them things that we see wrong." The system also allows convenient alarm monitoring of facilities on nights and weekends and quick response, adds Larry Rubin, senior director, facilities management.

The main hub of all the connectivity is the HVAC controls, as well as lighting controls and elevators. "As far as what we're doing with the information, we're presenting dashboards, whether it's at the executive level or the mechanical view level, to whichever audience needs to see this information," Thomas says. The analytics software "allows us to analyze buildings at just the click of a mouse and send reports to the appropriate people, so it's pretty intense."

The clinic's system has so many sensors — checking everything from humidity and motor amperage to discharge and return air temperatures — that they cover more than 500,000 data points, Thomas says. "We're able to watch energy use live."

And because of the critical nature of health facilities, Rubin says, it is important to see the entire electrical system. "We're able to trace electricity from the utility power system all the way into the buildings to the panels, so if there's an outage we can trace it pretty fast," he says.

"Our goal," he adds, "is to save energy, and this system has really done a phenomenal job of that because now we can read it and become more proactive."

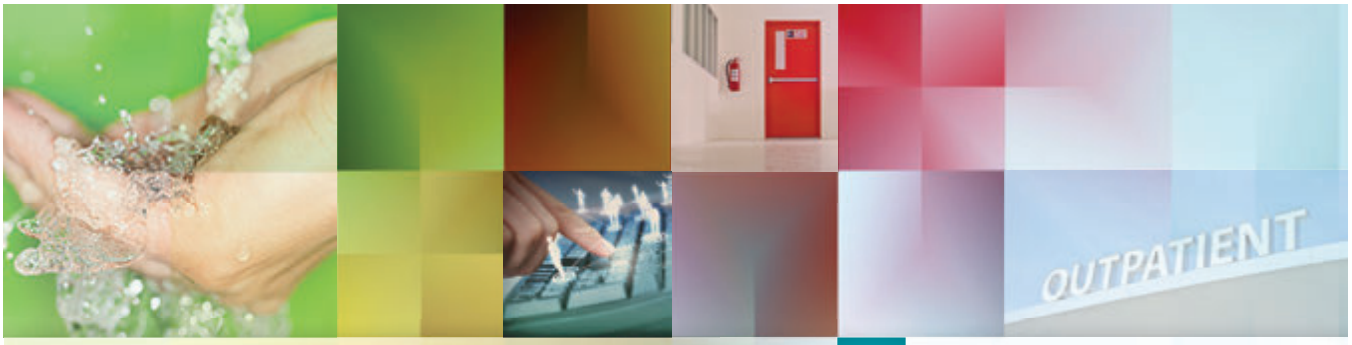
The challenges of running such a sophisticated system are many, Thomas says. Among them: "trying to integrate older legacy controls or proprietary controls that are in an open system and bringing them to one platform; improper installation of building controls that we have to fight; people understanding how the IT world works, how it talks, and how it does integrate into our building; and making sure that we're naming things correctly and not bottlenecking our information going across our network."

The clinic's command center monitors a huge healthcare-facility network on 22 TV screens.

Rubin's goal is to have all the software systems talk to each other, so that if an air handler, for example, sends out an alarm, it automatically generates an electronic work order. The technician getting the work order through a mobile phone or tablet sees that 12 filters are needed. When the technician removes those filters from the stockroom, the inventory system would determine whether more filters are needed, and if so notify the purchasing system to order more. That way, Rubin says, "everything is paperless." ■

The sophisticated building management system at Cleveland Clinic's main campus covers more than 500,000 data points.

PHOTOS: CLEVELAND CLINIC



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INTERNET OF THINGS

Building Systems Deliver Data, Control at U.S. Institute of Peace

by ronald kovach, managing editor

Data is central to the Building Internet of Things, and at the striking four-year-old headquarters of the U.S. Institute of Peace (USIP) in Washington, D.C., data plays a very important role, says William F. Rothenbecker, associate vice president for operations.

A group of systems and monitors throughout the building lets engineers check real-time data on electrical, water, and gas consumption, alerting them to a problem or giving them time to react before a problem arrives. Such monitoring, Rothenbecker says, can be especially helpful if the building is holding a large event — it has hosted more than 20 heads of state — or if the day is unusually hot or cold. The energy data benefits budget preparations as well. As an example of one of the systems, the facility team uses Web-based software to access real-time energy data to provide historical comparisons and assist with energy conservation measures.

State-of-the-art technology lets engineers control BAS, lighting, and other systems from anywhere in the building, Rothenbecker says. On one occasion, an individual using the building for a big event requested a major change in the lighting sequence, and Chief Engineer Eddy Alvarado was able to do that from home.

Acquiring a lot of data can be a double-edged sword, Alvarado observes. All of that information can be helpful, but one small change in a sensor can cause a headache — affecting the sequencing of a lot of systems — if not carefully analyzed, he says. An occupant, for example, might complain that the USIP's main atrium is too hot. "If you don't know exactly what you're doing and put it too cold, it will affect the dew point, which will make the limestone floor (which has radiant heating and cooling underneath) sweat and could damage the floor."

On a normal day, without a big event, the building's automated systems control themselves and can basically run on "auto pilot," Alvarado says. Its connectivity occurs across two systems. One, which controls the lighting, is linked through a processor to a computer that can be accessed remotely. The energy management system, which monitors 13,000 points, runs within a different, wireless system that communicates to a server in the engineers' office. ■

Integrated systems help meet the climate-control challenges of an enormous atrium.

Send questions and comments to ronald.kovach@tradepress.com.

Systems and monitors at the U.S. Institute of Peace in Washington, D.C., provide early alerts, allow proactive responses, and aid budget preparations, as well.

PHOTOS: USIP

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INTERNET OF THINGS

Today & Tomorrow

Building IoT applications exist now, and many new options are on the way

by edward sullivan, editor

The Internet of Things is reshaping the operation of HVAC systems. Today, cloud-based analytics can monitor operations, capture trends, and manage settings, while a connection to the utility enables demand response, says Dan McJacobson, McGuire Engineers. As IoT infrastructure expands, "we will start to see an ecosystem of tools and services develop that will make the HVAC system more efficient and easier to operate," he says. For example, continuous commissioning tools, like automatic notification of performance problems, will become cost effective. Other IoT tools will automate daily tasks and help distill mounds of data into actionable tasks.

Remember when Web-based remote monitoring and control was the latest in building automation? Today, says Steve Brown, Environmental Systems Design, "IoT devices such as elevators, HVAC systems, and lighting controls are being integrated with intelligent building platforms." Communication across the systems fosters efficiency, for example, with common scheduling and occupancy programming. The new generation of technology can also give occupants more say about their environment — for example, apps that give individuals some control of lighting or temperature.

Managed services offer one way to take advantage of IoT energy data, says Glen Allmendinger, Harbor Research. The service provider's subject matter experts analyze IoT data for signs of problems, which can then be corrected either remotely or by a technician.

Embedded sensors and networking capability are giving LEDs IoT capabilities for gathering data. If every lighting fixture is a connected sensor, building automation could become "lighting-centric and information-rich," says Andy McMillan, BACnet International. That's only part of the story. With an LED, it isn't hard to change characteristics like intensity and color temperature. Manipulating such characteristics could bring benefits like increased sales or shorter patient stays. If "dynamic lighting" applications take off, McMillan says, they could transform building automation by making lighting improvements, not HVAC energy savings, the key reason for automation projects.

Analytics, whether cloud-based or embedded in building systems, are crunching the Big Data available from IoT sensors to identify problems that are increasing energy use, guide equipment maintenance, and provide user-friendly data to facility managers and building occupants.

IoT is widely used for remote monitoring of alarm, trouble, and supervisory signals for fire/life safety systems. Some manufacturers are using IoT to provide real-time remote access to systems in remote locations, making it possible to diagnose errors remotely and ensure that, if a service call is needed, the tech comes with the right parts, says Brian McLaughlin, Arup. In the future, he says, smoke or heat detectors could feed real-time data to a BAS, reducing the need for overlapping sensors.

IoT could bring changes to the way occupants use elevators, says Jay Popp, Lerch Bates. Smartphones could be used as the security credential at turnstiles and automatically signal elevators to take a person to a specific floor. If elevators are configured for emergency evacuation, smartphones could be used to track which occupants have reached the elevator lobby or area of refuge.

IoT is enabling a growing connection between demand response and resilience, notes Jack McGowan, author of *Energy and Analytics: Big Data and Building Technology Integration.* He says Christian Healthcare kept a hospital operating for seven days with no utility power after Hurricane Sandy by using on-site generation, demand limit control (DLC), metering, and the BAS to provide power to only the most critical loads. Tools like those enable smart facility managers to optimize use and be ready when resiliency issues like outages occur.

With new IoT technology being installed, will a new sort of facility staff be required? The answer is yes and no. "We need the same skills — plus," says Ken Sinclair, automatedbuildings.com. Knowledge of building operations will remain crucial, but staff will also have to use IoT technology as a tool. IoT skills won't be a problem for the next generation of facility staff, says Sinclair. The challenge: getting current facility managers to embrace IoT while educating new staff about building operations.

"Magic carpet" uses a fiber-optic network to sense movement. Ultimately, the carpet, now under development at the University of Manchester in England, could detect falls and recognize changes in gaits, leading to applications in health care. The technology could also find a place in security systems of the future.

Just because a device is connected to the Internet doesn't mean it can work with other IoT devices. "Interoperability in the IoT still requires standards that are application-oriented (like BACnet) to provide the object models and data definitions that underpin useful interoperability," says Andy McMillan, BACnet International.

A multitude of new capabilities are reshaping security options. Infant and child protection systems can now use Wi-Fi access points and Internet GPS data to locate security tags anywhere in a hospital, says William Sako, Jensen Hughes. Instead of scrapping older systems, facility managers can link them to a Web-based platform that operates above the legacy systems for viewing and control. And that's only the beginning. Sako expects a proliferation of intelligent security devices, like IP cameras with built-in analytics, while integrating public and private information will make it possible to ramp security up and down in response to real-time developments.

For ongoing coverage of the Building Internet of Things, visit www.FacilitiesNet.com/IoT

SHOWCASE: IoT

Building Internet of Things Offers FMs Many Options

»a. LIGHTHOUSE The Lighthouse.io software platform uses beacons — small, wireless devices that emit tiny radio signals using Bluetooth Smart technology — installed around a facility. Smartphones and other Bluetooth-enabled devices listen for the signals and record data or trigger content. Lighthouse.io can let a facility know which zones its employees are in at all times; compose and schedule content such as work tasks and safety warnings, based on time and location; monitor compliance with service levels; and access heat maps that show historical customer or employee movements across locations and zones.

»b. SCHLAGE NDE Wireless Locks with ENGAGE technology combine the lock, credential reader, door position sensor, and request-to-exit switch together into one unit. The locks use standard cylindrical door prep and can be installed in minutes with only a Phillips screwdriver. They have been developed specifically for facilities that wish to upgrade to electronic credentials. ENGAGE is a connectivity platform that leverages industry-leading security practices, including AES 256 bit and TLS 1.0 encryption. For added protection, encryption keys between the cloud-based apps and locks are updated daily. Product is compatible with proximity as well as aptiQ and aptiQmobile smart credentials. Free cloud-based ENGAGE mobile and web apps are used to configure lock settings, add users, and view audits and alerts from anywhere.

TRIDIUM Niagara 4, the next generation of the Niagara Framework, includes dozens of new features and enhancements. Improved visualization tools, including dashboards and charting, leverage industry-standard HTML5 and other open Web technologies. Standardized data models provide faster build and install through templating. Enhanced security features include role-based access control, encryption of both data in motion and sensitive data at rest, and authentication that requires strong credentials. Because devices, systems, and data points can be tagged in Niagara 4, users can easily conduct a station-wide search of elements in their operation. The company also released the JACE 8000-controller, optimized for Niagara 4.

More Info

For more on these products, visit www.facilitiesnet.com/16189BOM.

»c. ENLIGHTED The four-component Enlighted System automates, analyzes, controls, and reports environmental data. Smart Sensors adjust energy consumption by responding to light, motion, heat, and other stimuli near each sensor. Data is collected and transmitted wirelessly for use in the company's dashboards and applications. Room Control lets individuals change lighting levels and configurations with the touch of a button. Gateways wirelessly gather data from sensors and send updates and commands to sensors. Energy Manager stores, analyzes, and provides visual reporting of sensor data through a browser-based dashboard.

»d. SIEMENS Advantage Navigator is a software platform which can track the long-term performance of a single building, entire campus, or virtual network of up to thousands of sites. The cloud-based software platform lets users monitor and analyze energy consumption, energy procurement, and key sustainability performance indicators. The technology provides an enterprise-wide view of energy and operational performance and six distinct groups of applications: dashboards, environment, efficiency, performance, supply, and projects.

»e. HUBBELL LIGHTING AND TOTUS SOLUTIONS Spaulding Lighting's Cimarron LED fixture is available with integrated surveillance, communication, and control, enabling a variety of surveillance and analytic functions. The outdoor lighting luminaire is integrated with an Ethernet-controlled LED fixture, 360-degree hemispheric camera, and communications platform. Active Deterrence offers the ability to flash lights and broadcast audible messages or alerts when occupancy is detected. Available in 3000K, 4000K, or 5000K with lumen outputs ranging from 8,844 to 13,675.

DAIKIN The Intelligent Equipment control solution provides real-time data streams for benchmarking performance and monitoring system operation. This provides remote diagnostics and control, offering an alternative to a BAS. Automated analysis summarizes and communicates alarms, makes recommendations, recognizes HVAC equipment maintenance issues, and validates occupant comfort. For packaged rooftop units, tools like remote access, trend information, energy monitoring and management, diagnostics, and alarm management are now a feature of the unit itself with Intelligent Equipment.

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»a. PARKER HANNIFIN The Parker Facility Maintenance Dashboard (Facility M.D.) system is a Web-based control system for small-store formats in the food retail market. The product focuses on the management of energy consumption, equipment management and health, and perishable product integrity and safety. Modular hardware allows a right-sized solution for each application and store, the company says. The user interface and analytics are on a Web-based software application, which provides dashboard summaries and detailed device-level data. System uses central server to perform real-time analytics; management can take place from any Internet-connected phone, tablet, or computer.

»b. RUSSELECTRIC The DTWG Web Server Communications Gateway, an accessory to the company's RPTCS Automatic Transfer Switch Control, provides access to automatic transfer switch (ATS) data from any Web-enabled device. It also serves as a pass-through gateway, allowing access to the ATS through SCADA or BAS. The product lets users view stored information from anywhere at any time. This information, displayed on a dashboard, includes real-time and historical ATS, engine, and exerciser status and performance data for a host of things, including switch configuration, trends, event logs, and metered voltage.

»c. TYCO SIMPLEXGRINNELL TrueInsight Remote Service gives company's remote service technicians an electronic window into advanced Simplex fire alarm systems 24/7. Remote diagnostics offer proactive notification of the appropriate facility contact when the system shows trouble; increased success solving problems on first site visit; and an ability to predict problems, such as a dirty smoke detector, in advance.

SKYFOUNDRY SkySpark analytics software combines an extensive library of standard analytic functions with full programmability to allow owners to implement analytic programs that fit a facility's unique requirements. Applications include energy management, systems optimization, monitoring-based commissioning, and fault detection. The product's analytics engine automatically analyzes data from equipment systems and smart devices to identify areas for improved performance and reduced operating costs. SkySpark is not tied to any one manufacturer's products or devices and works with data of all types, including live links to automation systems and smart meters, connections to SQL databases, static CSV files, or Web service feeds.

»d. SCA TORK EasyCube offers real-time restroom traffic and use data with 24/7 visibility, the company says. The product uses connected restroom equipment such as dispensers for toilet paper, towels, and soap. The "intelligent" technology enables a facility to move from static cleaning schedules to cleaning when and where needed. Facility managers can use generated data to plan restroom servicing and make purchase and inventory management decisions.

»e. RELIABLE CONTROLS The MACH-ProWeb is a fully programmable BACnet Building Controller (B-BC) with a built-in Web server and operator interface. The three-in-one product combines the field controller, configurable Web server, and browser-driven workstation into a single device which is simple to use, flexible to engineer, and economical, according to the company. Navigate through the system to access and print point values, alarms, schedules, trend logs, runtime logs, and audit trails.

»f. PLANON Accelerator 6.0, a new version of the company's Integrated Workplace Management System (IWMS) solution, offers new features like Capital Project Management, KPI reporting, and benchmarking; a restyled, fully Web-based user experience; and integration of sensor technology. The latter lets organizations equip rooms with sensors that register the status of individual desks and spaces. Interface mechanisms have been made simpler and intuitive, as well as more consistent for any type of user, according to the company.

ACUITY Lighting-based ByteLight Services for indoor positioning take advantage of LED lighting as a vehicle for embedded technology that can help deliver digital content to shoppers at a retail location who opt into a retailer's loyalty app. ByteLight Services helps retailers to get offers, product information, and assistance to shoppers based upon their location. Retailers can also obtain information that allows them to optimize staffing, efficiently replenish out-of-stock locations, and assess the impact of marketing and merchandising strategies.

BUILDPULSE BuildPulse is a plug-and-play reporting and information-management system, acting as the smart layer between BAS and modern IoT solutions. The system automatically identifies and standardizes data across platforms, the company says. Facilities staff can plug it in and get standard reports across legacy and new equipment.

»g. ICONICS Facility AnalytiX is a complete, continuous-commissioning software solution that uses company's Fault Detection and Diagnostics (FDD) technology. Product significantly incorporates user-customizable fault rules to weigh probability of equipment failure and advises personnel of preventative actions they can take. In the event of equipment failures, the software analyzes current and historical information and symptom/cause relationships, executes probability algorithms, and provides a list of probable causes sorted by probability. Web-based Workbench offers the product's users an easy setup process, integrating with the most Popular BAS, SCADA, PLC, DAQ, and other systems used to monitor equipment conditions, the company says.

»h. TERRALUX LEDSENSE is an intelligent LED lighting system with the ability to monitor occupancy, temperature, and odors in its environment while controlling building energy use through the cloud. If it detects people entering a room, it will brighten the lighting, and darken it when they leave. It can respond to utility demand response signals by automatically adjusting light levels in a building. It can detect potentially toxic chemicals in the air including smoke, carbon monoxide, and harmful VOCs. If a dangerous gas is detected in the air, the light can switch on an exhaust fan or trigger an alarm. Facility staff can remotely monitor energy use, occupancy, air quality and other environmental factors remotely by logging into the product portal.

»i. EMERSON Transient Detection System allows users to monitor and track system anomalies such as transients, surges, swells, and voltage total harmonic distortion. The system offers multiple alarm thresholds, including nine preset triggered alarm conditions and the capability for user-modified thresholds. The product's monitor measures and records the magnitude and duration of transient events, then dates and time-stamps the data for detailed event logging. A multi-port serial and Ethernet connection and an embedded Web page enable remote or on-site access of all information at any time.

»j. DISTECH CONTROLS The ECLYPSE Connected System Controller and the ENVYSION responsive, Web-based design and visualization interface are an IP-based building automation control and monitoring solution. ECLYPSE is an HVAC controller providing BACnet/IP, wired and wireless IP connectivity without the use of gateways/middle-ware. Combined, ECLYPSE and ENVYSION are designed to help facility managers achieve reduced costs, enhanced monitoring and control, and improved responsiveness to occupants. The solution uses Internet and Web-based services for data communication, allowing facility managers to leverage existing IT infrastructure, exchange data, and migrate multiple communication services into a single application, the company says. ENVYSION simplifies complex information into graphical, actionable elements, including floor layouts with heat/cool mapping and playback functions to visualize and replay data for improved alarm diagnostics.

BLUE PILLAR Aurora is a digital platform that connects, controls, and collects data from building meters, electrical and mechanical equipment, and on-site generation and renewables regardless of age, vendor, or vintage. The system collects energy, equipment status, critical alarms, and operational health and readiness data into a scalable, open database platform. It offers control of the entire facility equipment portfolio, executes critical power system compliance/readiness testing, and automates energy efficiency programs such as demand response.

OPTERGY Aurora is a software-based system that combines energy and building management features, using a Web interface accessible via a browser. The software, which is brand agnostic, can track schedules, trends, alarms, energy analytics, building performance, and work order requests, among other things. The scalable software installs on simple hardware or a virtual machine and requires no operating system or other software dependencies.

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How do FMs benefit from IoT technology?

Automating issue- and outlier-detection saves time. With more sensors coming online, teams are using them to determine the best time to complete work. Some teams were finding that their building was starting and staying on all day because they had cleaning staff coming in the morning. With smart sensors, they identified occupancy times in shared spaces and shifted their cleaning schedule to be during the day when the rooms were not occupied. While there are many benefits from IoT, the main benefit is productivity. By spending less time trying to troubleshoot issues on the ground, and more time using smart sensors to look for discrepancies, teams are spending less time moving between physical locations just to identify issues.

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How do building owners benefit from IoT technology?

With an IoT strategy, building owners can future-proof their commercial HVAC systems.

Given long life spans of equipment like rooftop units, enabling HVAC systems with IoT is critical to achieving top performance for the duration of the equipment's life. Daikin's Intelligent Equipment harnesses IoT by moving data from the building to the cloud, analyzing it, and optimizing opportunities to manage total building performance. It allows building owners to move from reactive to proactive management, creating greater productivity, minimized response times, and better asset utilization.

Leveraging IoT, Intelligent Equipment will deliver preventive diagnostics and fault detection, and gives owners complete control from any Internet-enabled device, 24/7, anywhere in the world.

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How are restrooms improved with IoT technology?

While the Building Internet of Things (B IoT) landscape is still taking shape, there are a number of new technologies bringing new and actionable insights into building managers' hands. Beyond smart thermostats, there's one often-overlooked area where B IoT can have a sizeable impact on a business' bottom line: the restroom. Smart solutions like the Tork EasyCube Intelligent Restroom System offer building managers real-time restroom traffic and usage data with 24/7 visibility — helping reduce the number of restroom complaints and increase overall customer satisfaction. Managers can move from static cleaning schedules to cleaning when and where needed. By harnessing the power of big data, building managers can keep up in an increasingly tech-driven world, while ensuring a pleasant restroom experience for guests.

TORK

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What benefits of IoT technology are being realized today?

Building owners can use the power of the Internet of Things (IoT) to connect existing equipment to Fault Detection & Diagnostics (FDD) technology solutions to greatly improve tenant comfort levels and save on energy costs, without requiring costly retrofits. ICONICS Facility AnalytiX addresses equipment issues in any size application; from large, expansive campuses down to a single building. Examples include the largest industry case study, Microsoft's corporate campus in Redmond, Wash., with over 100 buildings and millions of dollars in energy savings per year. This IoT technology has also helped Peirce Elementary School in Arlington, Mass., to save 10 percent on energy costs in one of the harshest winters on record, when all other schools in the town went over budget.

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How do building occupants benefit from IoT technology?

For building occupants, benefits of the IoT may largely be unseen, as future problems can be solved before they are even noticed. An example would be a heating/air conditioning system that is drifting out of tolerance. The system will send data to the maintenance team, who can then decide on what repairs are needed and schedule the work after office hours. To the occupants, the problem never occurred. For the maintenance team, wireless test tools enable them to be better prepared with the right tools and parts, as well as the ability to schedule the work when the fewest occupants are affected.

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What benefits of IoT technology are being realized today?

Building IoT technology brings a connection between the user and building operations. IoT can be used to customize comfort for occupants from remote locations, thereby increasing service levels. As the building owner increases service levels for occupants, buildings adopting IoT technology will gain a competitive advantage. IoT allows monitoring and automatic adjustments for the basic functions of comfort so the building owner can focus more attention on providing features that make life easy for the building occupant. Being able to provide the perfect temperature and environment for a bride on that special day, for example, is priceless; it provides ROI through a delighted customer.

For more insight, visit
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How can food retailers benefit from IoT technology?

Managers of supermarkets and similar retail facilities are always looking to improve margins as well as control operating costs and increase energy efficiency. The Internet of Things and cloud computing enable seamless Web-based control systems for small store formats that can focus on the management of energy consumption, equipment management and health, and perishable product integrity and safety. All management can take place from any Internet-connected phone, tablet, or computer. The Facility M.D. system, for example, is a combination of hardware and software that uses Web-based software to provide both dashboard summaries and detailed, device-level data related to maintaining temperature, HVAC, lighting zones, refrigeration, and more.

ENERGY EFFICIENCY

Energy Upgrades: Delivering Results

A successful project begins with careful analysis and concludes with good performance data

by desiree j. hanford, contributing editor

The growing emphasis on energy efficiency in general, and high-performance green buildings in particular, means that facility managers are more likely to be faced with large, complex upgrades, sometimes involving multiple systems within a building. The payoffs of those projects can be significant reductions in energy costs and greenhouse gas emissions, along with significant gains in occupant satisfaction. But ensuring that extensive upgrades hit their targets takes careful planning from the start of the project.

"With the rise of LEED and Energy Star, our buildings are getting smarter, more sophisticated, and more complex, and this means the role of the facilities manager is important because they are responsible for driving energy efficiency continually," says Jason Hartke, program manager, commercial buildings integration, Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy. "They are very important stakeholders in high-performance buildings."

Measurement and verification is often the first item that comes to mind when determining whether an upgrade is meeting expectations. But planning for a successful upgrade starts long before energy savings are measured. Experts say that facility managers need to start an energy upgrade project by knowing what equipment they have, what the equipment is designed to do, and whether any changes have been made to it since it was installed.

Facility managers also have to know how the overall building was designed, says Nate Mitten, senior manager, property standards and improvements, Kimco Realty Corp. Without that understanding, the facility manager won't have any framework to work from.

Gundersen Health System's La Crosse, Wis., campus includes a biomass boiler that uses locally sourced wood byproducts.

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"I think this is certainly true of HVAC and lighting, which are two of the largest energy users," he says. "The foundation of the plan is to understand the original design intent of the building. So what were the initial thermal loads? What type of lighting system is it? What is the ventilation system?"

Mitten says it's important to compare the actual use of a building against its current design configuration. A mismatch can lead to wasted energy, which he describes as akin to driving with your foot on the gas and the brake simultaneously. For instance, he says, if a building was designed to be densely occupied but now is lightly occupied, the building may be conditioning more outside air than needed. Demand-controlled ventilation and rebalancing of the flow are the remedies. Mitten adds that thermal loads may change due to lighting retrofits or density changes, while space reconfigurations may cause zones to fight against each other — heating and cooling simultaneously.

Documentation is key because it's easy to miss a change or not realize something was changed.

— COREY ZARECKI, GUNDERSEN

"You need to take a snapshot of how the building is operating currently," he says. "It's interesting what you find. It may not always be what you expect. It's easy to make assumptions and take on a project before you have a good baseline of flow points, schedules for on/off, and set points. You need to be honest with yourself about how the building is designed because only then can you prioritize and assess your opportunities."

A facility manager has to have a good baseline of current equipment so that the right decisions can be made about replacement equipment, says David Borchardt, vice president of development for Lerner Enterprises. "You can't improve what you don't measure," he says. "Understanding how your building operates is important to then taking those new systems and optimizing their function."

Measurement and Verification

After a facility manager has the building and equipment information, a decision can be made about what is needed for an energy upgrade project. Once the work is completed, measurement and verification should begin immediately, experts say. In fact, the measurement and verification process should begin as upgrade work is being completed, says Corey Zarecki, director of Envision engineering and operations at Gundersen Health System. If new equipment isn't meeting goals and expectations, work should be halted, and the equipment removed and promptly replaced, he says.

The General Services Administration is beginning to build a measurement and verification period into its base contracts. That approach has been piloted by the Northwest/Arctic region. The idea is to structure the contract to retain a small percentage of the payment pending completion of measurement and verification. If the upgrade meets the targets, the contractor will be paid the balance of the amount owed, says Laura Stagner, assistant commissioner in the Office of Project Delivery at the General Services Administration. "We want solid evidence."

It's essential for all parties to agree as to how results will be measured.

"I will listen to my service providers but at the end of the day, they need to meet my needs," says John D'Angelo Jr., vice president for facilities management at Northwestern University. "If the service provider isn't meeting your needs, you can always walk away."

Metering plays a central role in measurement and verification. Paul Torcellini, principal engineer with the National Renewable Energy Laboratory, equates metering to finance, noting that people who deposit money into an account want to know where the money is going when it leaves the account. That can be accomplished by keeping track of the money over time and gaining perspective on where it's being spent. The same can be said for metering, which allows a facility manager to see how energy is being used.

By submetering the lighting system, for example, a facility manager can see that the lighting load is higher than expected at night, when occupants are gone. The facility manager may then discover the reason for the higher lighting load is because the custodial staff is turning on all the lights upon arrival and then turning them off as each area is cleaned. "But if you're not collecting the data, you don't know this," Torcellini says.

"If you think your building is an energy hog and you don't have a meter," Torcellini says, "how do you know it's an energy hog?"

Metering can help a facility manager identify where a tenant might be using too much energy and where changes can be made, Lerner's Borchardt says. That's the case no matter who is paying the energy bill, including the tenant.

Submeters can also give a facility manager an immediate heads-up on energy performance, not one that comes 60 days later when the bill is due, Northwestern's D'Angelo says, adding that meters and submeters are among many different data points that can be used for monitoring the performance of a building's systems.

You need to take a snapshot of how the building is operating currently.

— NATE MITTEN, KIMCO REALTY

If a building is undergoing a large scale energy efficiency project and the goal is to reduce energy use by 10 percent, a facility manager "absolutely needs" to see that percentage on the utility bill or the upgrade isn't a success, says Gundersen's Zarecki. Submetering can help a facility manager see in near real-time whether the upgrade is successful, he says.

The value of metering doesn't stop once the savings from the project have been verified. "Then you use the meters for ongoing continuous commissioning," Kimco's Mitten adds.

The challenge with submetering is that it's expensive and there hasn't been much incentive to do it, says DOE's Hartke. There are some pockets of the country where submetering is used extensively and done well,

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but there is much work to be done in other areas, he says. "(Submetering) is definitely an area where we need to accelerate action," Hartke says.

Communication Is Crucial

Numbers are necessary when it comes to making sure energy upgrades are delivering as expected, but words are just as important. Communication between the facility manager and the contractor doing the work is key. Each party needs to explain in detail what is needed and expected and what can realistically be delivered.

"You need to be specific and state exactly what you want," says Gundersen's Zarecki. "I tell (contractors) that I can get the approval, but I need the information from them in order to do that."

Communication is critical for many reasons, including that if a facility manager can't tell contractors and others what expectations are, those expectations will go unmet, says D'Angelo.

"You also have to be open to there not being one right answer. And if you're only interested in one single answer and you don't communicate that, everyone will be frustrated," D'Angelo says.

"You need a clear, measurable goal," says National Renewable Energy Lab's Torcellini. "Just saying 'I want to be green' doesn't do you any good. You need to say 'We need to measure our energy (use) and cut it 10 percent a year.'"

I will listen to my service providers but at the end of the day, they need to meet my needs.

— JOHN D'ANGELO JR., NORTHWESTERN UNIVERSITY

When seeking competitive bids, particularly for large, capital projects, the facility manager should clearly specify information such as what the equipment needs to do, how long the equipment is expected to last, and what type of warranties are needed, Torcellini says. In addition, a facility manager should keep in mind that every time a decision is made, that decision will affect other energy and environmental systems. That's the case whether the decision is being made about a chiller, lighting system, or windows.

The sooner the lines of communication are open, the better, says Kevin Kampschroer, chief sustainability officer, director of the Office of High-Performance Green Buildings at the General Services Administration. "You can have six experts but if they can't work together, you have a problem," he says. "From our point of view, the more people you get in the room earlier, the better."

Communication shouldn't only occur during the energy upgrade. It needs to happen when the original system is installed and as changes are made to it during the course of its life. It means not just making sure all parties are talking but also that changes and decisions are being documented, says Kimco's Mitten. Without documentation of what exists and what changes have been made, chaos can quickly ensue, he says.

"You do a little change here and two weeks later, someone else comes along and puts a Band-Aid on something else and pretty soon the system is fighting itself and you move away from the optimization you had," Mitten says. "Documentation is key because it's easy to miss a change or not realize that something was changed. You have to have it so that you bring everything along to where it should be, which is essentially continuous commissioning." ■

Desiree J. Hanford, a contributing editor for Building Operating Management, is a freelance writer who spent 10 years as a reporter for Dow Jones. She is a former assistant editor of Building Operating Management.

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OFFICE BUILDINGS

Employee-Friendly Spaces

The right temperature, lighting, and acoustics can make it easier for office workers to be productive

by david lewellen

It seems intuitive that comfortable office workers would be productive workers. While proving that point has been notoriously difficult, evidence continues to emerge that temperature, lighting, furniture, and layout can be used to help a company improve employee performance.

"If employees are more comfortable, they're able to focus more on work" and not on cold hands or glare, says Judith Heerwagen, a research psychologist with the Office of High-Performance Green Buildings in the federal General Services Administration. She cited research by the National Institutes of Health that measured workers' heart rates and cortisol levels in pre- and post-renovation spaces and found correlations to levels of noise, light, and views. In better spaces, both heart rates and cortisol levels were lower. (Cortisol is sometimes known as "the stress hormone." Ongoing elevated levels of cortisol are linked to health problems.)

David Lehrer of the Center for the Built Environment points out that productivity can be measured in different ways. Depending on the situation, it might be easier or more relevant to look at individual workers, or a team, or the company. Lehrer's organization surveys workers by asking them whether various factors in an office setting enhance productivity, hurt it, or are neutral. A further refinement is to ask workers via email or text message how they feel at that moment.

Controllability and Comfort

In addition to subjective surveys about how workers feel, environments can be measured through parameters such as typing speed, or by collecting biometric data. Recent studies, for instance, have shown weight loss and improved blood cholesterol in workers who use adjustable-height desks.

"The majority of our clients are now buying adjustable-height desks for every work station," says Janet Morra, a principal at Margulies Peruzzi Architects in Boston. The cost difference with conventional desks is dropping, and in any case is "quickly made up in comfort and productivity," she says. Instead of walking around, "people can take breaks by standing up or sitting down."

An often-repeated phrase is "sitting is the new smoking," but standing for eight hours in the same position would be just as bad. Variability and control of the work environment are important components of comfort. The most important thing managers can do, Heerwagen says, is to let workers control their workspace in whatever ways possible.

This has already been adopted in the lighting world, which has seen an explosion of innovation in recent years and is one of the easiest changes to make in an existing building. Alan Hedge, director of the human factors and ergonomics laboratory at Cornell University says indirect, glare-free lighting can combine with task lights

Deloitte statistics showed that only 30 percent of employees come into the office on any given day. With that in mind, Deloitte's global corporate headquarters in New York City was designed for better space utilization.

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at desks that workers control; generally, people in their 40s and older will need more concentrated light than their younger counterparts.

Good communication is critical to executing solutions focused on improving the office environment since so many factors interplay. To create a comfortable, productive environment, the most important factor is "the way the organization itself is organized and run," says Heerwagen. Executives who manage space and who manage people need to communicate well, "and it's often not done." She cites a case in which architects and lighting designers worked together to maximize daylight in an office, but the effort was undone because the furniture blocked the light; the supplier had not been in on the discussions.

Similarly, "nothing frustrates tenants more than lack of information," says Kevin Kampschroer, GSA's chief sustainability officer.

Achieving Thermal Comfort

One area that really benefits from clear organizational goals, transparent communication, and personal control is thermal comfort. The Center for the Built Environment asks workers to rate their surroundings in seven categories, Lehrer says, such as cleanliness, maintenance, lighting, and layout. But on a seven-point scale, thermal comfort comes in a full point lower than all other categories.

Lehrer says his organization has made extensive studies of office temperature, and finds that many workplaces are kept colder in summer than in winter. "There's a high cost to that, and it's making people uncomfortable," he says. "Why are people wearing a sweater in Atlanta in summer?"

ASHRAE's official goal, Lehrer says, is for 80 percent of occupants to feel comfortable — a goal that is seldom met. One solution is to raise the set point for air conditioning. Talking to tenants, and adjusting summer set points upward, "is not a no-cost solution; it's a saves-you-money solution. You use less AC, your tenants will be more happy," Kampschroer says.

Hedge agrees that facilities managers could raise the air-conditioning set point to 76 degrees, if human resource managers would "allow men to throw the tie and jacket away. Just do that and you'll save 20 percent on energy bills."

Another aspect of thermal comfort is air movement. Air movement costs less than cooling, and it can allow set points three to four degrees higher. With the savings, "you can buy some really nice fans for that," Kampschroer says. One option could be to give workers small desk fans that run on 6 watts of electricity. Another new solution is smart ceiling fans, which speed up or slow down in response to temperature, humidity, or occupancy sensors.

VAV systems represent another opportunity to maintain or improve comfort while reducing energy use, according to a study by the Center for the Built Environment. VAV airflow minimum setpoints "are typically set at 20 to 50 percent of maximum airflow." The study found that lowering minimum airflow to 10 to 20 percent reduced occupant dissatisfaction with comfort and indoor air quality in summer by half and also lowered HVAC energy use significantly. "It appears that today's widespread overcooling of buildings can be corrected without risk of discomfort by lowering conventional VAV minimum flow setpoints," the study says.

The Role of Furniture

Of course, the work environment is created by more than the mechani-

The Future of Comfort

The developing Internet of Things may offer comfort to office workers and savings to building owners.

"Buildings already have tons of sensors that don't communicate very well," says David Lehrer of the Center for the Built Environment, and major players in the building systems industry build proprietary software that doesn't communicate with other systems. But he suggests there is room for disruption of that model. If those barriers could be removed, perhaps occupancy sensors could tell the energy-intensive ventilation systems in a lab to power down when the space was empty.

Lehrer cites one app on the market that allows workers to use their phones to report their locations and whether they feel hot or cold. If enough people in a participating building request it, the thermostat adjusts accordingly.

Adam Stoltz, regional leader of consulting for HOK New York, suggests that a building system could be tied to the entry badge a worker swipes to get in, sending automatic reminders to coworkers of upcoming meetings, or perhaps even turning on the coffee machine. In the mobile workplace, desk phones could sense a worker's presence by his or her badge and automatically route calls to a particular desk for the day.

Also, occupancy sensors could talk to the HVAC system to adjust heating and cooling levels. For example, mobile workers who choose their desks on a daily basis may decide to sit in an area that is warmer or cooler, whether by chance or design. When perhaps only 60 percent of workers are in the office on any given day, "systems to heat and cool often don't account for that," Stoltz says. He adds, "there are real sustainability implications, not just occupants' comfort."

Alan Hedge, director of the human factors and ergonomics laboratory at Cornell University, envisions a system that could anticipate a worker's arrival and prepare a work station for him or her, including desks and chairs custom-adjusted to their preferences. "If people are allowed to talk to and control the Internet of Things, it will be advantageous," he says. "If they're shut out, it will be no help at all."

— David Lewellen

cal systems in the space. Furniture, such as the development of sit/stand desks, also plays a significant role.

Although cubicles are no longer fashionable, they do allow workers to customize heating and cooling more effectively. In workplaces with individual temperature and airflow controls, Kampschroer says, fabric-covered cubicle panels can hold temperature differences of 4 to 6 degrees.

Partitions between workspaces can also provide speech privacy, but Larsen says the new popularity of standing desks is a complication: At standing height there is more chance for sound to spill out of the cubicle space.

And what about noise in those innovative open spaces with high, exposed ceilings? That is a tradeoff to be negotiated, often with the help of acoustical consultants. Alicia Larsen of Acentech says one solution is to set a uniform level of background noise. Sound masking systems are tuned to match speech frequencies. "It sounds like the HVAC system, but it's constant," she says.

Another solution gaining acceptance, Hedge says, is for employees who want to tune out others to listen to their own music through headphones.

Speech privacy, meaning that overhearing takes a conscious effort, is the standard for open offices, Larsen says. But since that will never suffice for confidential conversations, huddle rooms are part of modern office design. Some departments or fields — law, finance, medicine, and academia come to mind — will need more privacy and hence more offices or conference rooms. "You need a mix of open and closed, formal and informal, loud and quiet," says Adam Stoltz, regional leader of consulting for HOK New York. Of course, those areas should be far apart from each other, and the loud area should be near public space such as the kitchen.

Even there, Larsen says, the trend for lots of glass presents challenges for acousticians; a door will need gaskets if the conversations inside are not to be overheard.

The WELL Standard

A new building standard that actively considers all these factors is the WELL standard, which looks beyond environmental factors to include things like food, fitness, comfort, and mental health. Hedge says the first results from certified buildings suggest the standard is producing happier workers — which cannot be taken for granted in a LEED building. WELL, he says, measures "how well the building is working in reality, because what is designed usually isn't exactly what gets built."

"People in general are pretty good at compensating for their situation in terms of productivity, but why make it hard for them?" says Larsen. ■

David Lewellen is a freelance writer who covers facility issues.

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Healthcare restrooms should be attractive while incorporating safety elements like grab bars and shower seats, including seats for bariatric patients.

Old Problems, New Thinking

Healthcare restrooms reflect current issues, from patient mix to aesthetics to cleanliness

by karen m. kroll, contributing editor

Although restrooms are some of the smallest spaces in a facility, the constraints that come into play on most construction projects — budget, time, safety concerns — often are magnified on restroom projects. That's especially true for patient restrooms in a healthcare facility. Space is at a premium and cost is always a factor, yet the materials need to be durable, cleanable, and slip-resistant, and also create a welcoming environment. The rooms need to work for patients who have trouble hearing or seeing, or who need assistance from a wheelchair or healthcare providers.

It's a daunting assignment, yet facility managers are experimenting with new designs, approaches, and materials to create restrooms that work for patients, their caregivers, and visitors.

One example is the growing use of prefabricated toilet rooms. Advocate Health of Illinois is installing these in all new patient rooms, says Scott Nelson, director of design and planning. Because the units are made in a controlled environment, their quality is more consistent, while the cost is about the same as toilet rooms built onsite, he says. Moreover, prefabrication shaves eight to 10 weeks from the construction schedule, he says. "It's a better-quality product and we save on the general condition and schedule."

Stacey Hooper, a senior healthcare designer with NBBJ, also reports greater interest in pre-fabricated toilet

modules. She expects their popularity to grow, given ever-tightening construction schedules. "You can get up and running faster."

While the units offer compelling benefits, their use typically is limited to new construction, rather than renovations, due to the access through a building required to install them, says Jason Costello, associate principal, Margulies Perruzzi Architects. Another concern is the risk of damage while the units are being transported, he adds. Even so, he says, "the amount of time you're saving typically outweighs any risk."

Tackling Challenges With Floors and Walls

In an effort to reduce crevices that can trap dirt or bacteria, many facility managers are turning to materials that require minimal seaming, such as epoxy floors, says Kelly Brainerd, a healthcare interior designer with HGA. To minimize the institutional look, these can be dyed to blend with the wall color, she adds.

Crouse Hospital in Syracuse, N.Y., is using a "post-formed" sink and backsplash created from solid material that's welded on a CNC (computer numerically controlled) machine, says Jeff Tetrault, director of facilities and construction. "It's all continuous," minimizing the risk of dirt and bacteria getting trapped between the two pieces.

Also at Crouse Hospital, "all patient restrooms are solid-surface walls, floor to ceiling," Tetrault says. While the increase in cost over traditional drywall is significant, the longevity, enhanced cleanability, and reduction in work orders required to maintain the walls should offset the additional cost, he says. With drywall, just a bump from a garbage can or wheelchair can necessitate a repair. With the solid-surface walls, "you don't get the damage, it's more aesthetically pleasing, and there's less maintenance," he says.

Another way healthcare facilities are trying to minimize bacteria-trapping areas is by using larger-scale tiles within shower areas. Larger tiles mean fewer grout lines. Because grout is porous, it can hold moisture and dirt.

To create a more welcoming look, decorative tiles can be interspersed among the other ones, Brainerd says. That added touch can be especially helpful when the restroom is directly within the patient's line of sight, she adds.

As with most materials, there's a trade-off inherent in larger tiles. "Because they're so big, you get a lot of wet, slippery surfaces," says David Williams, partner with Davis Brody Bond LLP. One solution is tile that is lightly textured but still sealed so it will resist water, he adds.

Universal Design Restrooms

Many facility managers point to the lip along the bottom of a traditional shower stall as a prominent tripping hazard, as well as another seam where moisture and bacteria can hide. To remedy this, a growing number of healthcare facilities are designing toilet/shower rooms that are one and the same — what's sometimes called universal design.

Rather than using a shower stall to contain the water, part of the restroom is designated "the shower zone." The entire floor slopes to a drain within the shower zone; some floors also have a second drain to catch any water that splashes outside the shower. "The floor slopes so anything within the shower stays within the shower zone," Advocate's Nelson says. A shower curtain can both delineate this zone and contain much of the spray from the shower.

Of course, this means the entire floor needs to be slip resistant. "Don't exchange a tripping hazard (the shower lip) for a slipping hazard," Williams cautions.

To further reduce the risk of falls, universal restrooms should incorporate a shower seat, Williams says. He points out that many hospital patients are mostly sedentary, and simply standing up can cause a drop in blood pressure. Installing a seat within the shower area may help someone who feels faint avoid a fall.

Fixtures Can Support Cleanliness

Because infection control is such a priority in healthcare settings, touch- or hands-free faucets, toilets, and urinals have become standard. The goal is to minimize the number of people touching any of the fixtures with dirty hands, potentially spreading infections.

There's a difference between hands-free and touch-free, Tetrault notes. Hands-free fixtures typically are activated by levers that are bigger and can be moved, for example, with one's elbow. Touch-free fixtures are activated by motion sensors. Crouse Hospital has moved to touch-free fixtures, he says. Along with the fixtures' infection-control benefits, they won't run continuously.

> Although a variety of materials with anti-microbial properties are available, some facility managers remain unconvinced of their effectiveness.

One key to durable touch-free fixtures is going with those that are hard-wired, versus those that require batteries, Williams says. Many maintenance staffs, already stretched thin, may struggle to replace the batteries on a timely basis.

Any healthcare setting needs to withstand frequent, thorough cleanings. Although some facility managers have looked into materials with anti-microbial properties, many remain unconvinced of their effectiveness. Crouse Hospital, for instance, has installed anti-microbial door hardware and run UV cleanliness tests on them. "We're not seeing them working positive or negative," Tetrault says.

Another concern is the fact that antimicrobial finishes may use products that incorporate some sort of pesticide or insecticide, Brainerd says.

Williams says he's seen some interest in using copper, which has been shown to have antimicrobial qualities, on fixtures like grab bars. These need to be textured so patients can maintain a grip on them, but the texturing also makes them difficult to keep clean. "You can't just take a wipe and go over them," he says. What's more, copper can be expensive, Williams says. "The dollars get in the way."

Another factor that can contribute to the cleanliness of patient bathrooms is the level of ventilation. It often needs to exceed code requirements, Williams says. "I find them

under-exhausted. You never feel the air moving." If moisture builds up in the room and isn't ventilated out, it can breed mold and bacteria.

Restroom Size and Location

In most healthcare facilities, patient restrooms can be located either along the interior wall (inboard) or the exterior wall (outboard.) Each choice has pros and cons.

A location along the interior wall typically leaves the exterior wall free for visitors, and possibly windows. That can bring light and views of the outside into the room. "The connection to views of nature has really been proven to be very advantageous to patient well-being," Hooper says. The access to daylight also can cut the need for electric lighting, thus saving energy, she adds. Finally, an inboard location allows a bit more patient privacy.

The downside? It reduces nurses' ability to see patients who need assistance, Costello says. For this reason, outboard locations are almost always used in intensive care units, he adds.

In some facilities, there's also the question of whether the restroom should be located nearer the head or the foot of the patient bed. When it's at the head, the patient typically can better visualize where he or she needs to go, and often has less distance to travel. Both of these factors can reduce the risk of falls, Tetrault says. Crouse uses this location when possible.

The size of patient restrooms is another area being rethought. While the typical door opening is 36 inches, this can be tight for patients who need assistance or are in wheelchairs, Williams notes.

In addition, as the American population grows larger, hospital restrooms have to accommodate their increasing girth. Some hospitals are dedicating full bariatric units, while others are placing bariatric rooms on otherwise standard medical/surgical floors, Costello says.

In addition to their larger sizes — the floor area tends to be about 20 percent bigger, Costello says — restrooms designed for bariatric patients include some other differences. The grab bars and sinks may need steel reinforcements, he says. And they'll often use floor, rather than wall-mounted toilets, since floor units can handle greater weights.

Moreover, some newer floor-mounted designs eliminate the hard-to-clean space behind traditional floor-mounted toilets by extending the fixture to the wall. "You clean the floor in a U-shape," Costello says.

A Hospitable Environment

Along with balancing cost, safety, and durability, many facility managers are striving to create aesthetically pleasing, welcoming environments within patient restrooms. Not only can this help patients feel better about themselves, but it may also help a healthcare facility attract other patients. "There's so much choice for consumers," says Carol Downey Fuller, senior project manager, construction, facilities, engineering and maintenance, with the University of

A patient bathroom at St. Elizabeth Hospital's Women and Families BirthPlace Unit in Appleton, Wis., includes a lighted mirror, creating a spa-like feel, and warm illumination in a postpartum suite of soothing colors.

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The choice of light fixtures and mirrors can play a key role here. Tetrault says Crouse Hospital is using warmer lighting — up to about 2700 Kelvin — versus the 4100 Kelvin from a "cool white" fluorescent light.

Because overhead lighting can create unflattering shadows on patients' faces, Brainerd is looking into mirrors that incorporate lighting along their sides.

Improvements in LED lighting allow for more control, Hooper notes. For instance, the lights can be set to cooler temperatures during the day and warmer ones at night.

Brainerd also tries to use slightly higher-grade finishes on some of the fixtures, like the faucets. "You want the things one touches to be a little nicer," she says.

Collaborative Design

The color used in patient restrooms also needs to do more than look nice, although a welcoming environment in itself can help patients feel better. Incorporating contrasting colors, rather than limiting the palette to shades of gray or white, can help patients better navigate the space, Williams says. "When it's one color, it's hard for people who are visually impaired. They don't get the depth of field and contrast." That can lead to bumps and injuries.

A natural color palette, such as paint in earth tones or resilient flooring designed to look like wood, also provides "a psychological connection to warmth and comfort," Hooper says.

Building patient restrooms that balance multiple objectives requires a collaborative approach. Tetrault, for instance, oversees facilities, construction, and environmental services at Crouse Hospital. Just the fact these areas report to him engenders collaboration, he says.

It's critical that any design team works with facilities, Williams says. Designers need to understand the cleaning products and methods the maintenance workers use, and also provide education on the proper cleaning for any new finishes and materials in new patient restrooms.

Talking with healthcare professionals and operations staff also helps in developing designs that enhance workflow, Hooper says. Those conversations, for example, may lead to designs that reduce the number of steps the nurses have to take, or that allow maintenance employees to do their jobs efficiently. "It's being smart about how all the pieces work together to optimize the patient experience," she says. ■

Karen M. Kroll, a contributing editor for Building Operating Management, is a freelance writer who has written extensively about real estate and facility issues.

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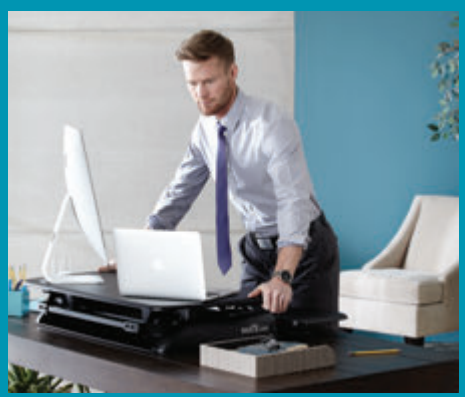

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Finding the Right Fit: Roof Coating Considerations

USED PROPERLY, ROOF COATINGS can be a cost-effective way to extend the life of a roof for up to a decade or longer. And they can provide additional efficiencies, such as lowering buildings' cooling costs and helping mitigate leaks. But roof coatings aren't one-size-fits-all propositions, so facility managers should consider several factors to make sure they select the product best suited to their facility.

Facility managers are trying to perform their jobs in the most fiscally responsible way without sacrificing safety and quality. Extending the life of an aging roof by applying a coating is one way for them to achieve these goals. According to the Roof Coatings Manufacturers Association (RCMA), "Coatings will extend the life of the roof, by reducing heat transfer into the building, decreasing thermal shock (thermal expansion and contraction of the roof membrane), and helping to mitigate leaks. Reflective coatings also can reduce cooling energy costs and improve the aesthetics of the roof." But how do you know if a roof coating is the best option for your building?

"The first determination needs to be whether or not the current system is suitable for restoration or coating," says Joe Mellott, vice president of Innovative Metals Company. "Not all roofs can benefit from the application of a coating. Roofs that are well beyond their service life, roofs with significant damage and leaks, or roofs with wet insulation are not immediately 'coat-able.' Any serious issues need to be addressed prior to restoration or coating."

Lee Martucci, senior product manager at GAF, agrees that the roof's condition should be the first consideration. "As a general rule, if 20 percent or more of the roof needs to be repaired, you are better off replacing it than applying a coating. If you have a ponding water issue, a coating may not be your best choice."

Another problem can be caused when coatings will be "exposed to specific families of chemicals," Mellott says. For these reasons, "it's important to have a 'use discussion' with a qualified manufacturer or roof professional prior to selecting a coating."

"Coatings are not 'miracles in a bucket,' " says George Daisey, a research scientist on elastomeric roof coatings for The Dow Chemical Company. "If the roof is damaged or leaking, then these issues need to be addressed first. It is irresponsible to think that all the flaws and damage in a roof assembly will be fixed by applying a couple coats of roof coating, regardless of the type of product. Always, always fix the problems with the roof first. Once properly repaired, then roof coatings can be considered for the job."

"The second thing to consider is the type of roof," says Martucci. For example, he says that, "coatings may be applied to most substrates, but some will require the extra step of applying a primer. For TPO roofs, most coating systems require a primer. For an asphaltic roof, a bleed blocker is recommended to prevent the asphalt from 'yellowing' the surface."

Different Coatings

In addition to making sure the coating is appropriate for the roof itself, facility managers should keep in mind that different coatings will have varying characteristics that also should help narrow down the best kind for a property. For example, says Martucci, "silicones are soft and tend to pick up dirt more than other coatings. That makes them lose reflectivity. They also have a lower abrasion resistance and a slicker surface, so they are not recommended for high-traffic areas."

He also says urethanes can be susceptible to ponding water, aromatic urethanes can chalk, yellow, or fail due to UV exposure, and aliphatic urethanes are more expensive. Acrylic coatings chalk and therefore lose mil thickness over time. Because they are water-based, acrylics are more susceptible to damage from ponding water.

A contractor or consultant can offer recommendations on what type of roof coating would be the best fit for a roof. Important properties to keep in mind are "percent solids by volume, adhesion, elongation, tensile (strength), and weatherability," Martucci says. Make sure to ask about the expected life of the coating and if it comes with a manufacturer's warranty. "Extended warranties are available from many manufacturers," he explains.

Daisey points out that manufacturers have recommendations for the best use of various coatings, so be sure to check product labels and tech data sheets. "There is a roof coating option for virtually every roof," he says. "I think the biggest mistake a facility manager — or any decision maker — can make is making a generalization about roof coatings based on one bad experience or hearsay. Roof coating manufacturers want to sell product, of course, but they really, truly want to see their product installed properly on

the proper roof to deliver the best long-term performance. So take time to understand your roof assembly and understand the roof coatings to learn which products match your unique situation."

For example, according to Martucci, a common use of coatings is to make a dark roof light. "A dark roof absorbs heat that can pass into the building, causing extra strain on the interior cooling system. Most roof coatings are white, highly reflective and can reduce the surface temperature of the roof 50 degrees Fahrenheit or more. This, in turn, reduces the heat transfer into the building and could save energy costs during hot summer days."

In a situation like that, "acrylic coatings are highly reflective and thermally emissive, so [they] are ideal choices when looking for the 'coolest roof,' " Daisey says. "There are different types of acrylic elastomeric roof coatings on the market, so always read the manufacturer label and tech data sheet to verify that that particular product is designed for the particular roof being considered."

Other kinds of roof coatings have their own benefits, he explains. "Aluminized asphalt roof coatings provide moderate reflectivity, excellent water resistance, and are often considered when the roofing surfaces are asphaltic in nature. A prime example would be an existing BUR, or built-up roof. More complex roof coatings like polyurethanes, silicones, and polyureas can be considered as well, but these installations are usually in highly specialized, unique situations. Those latter systems require specialized equipment and highly skilled contractors to install properly and are not the easy installation and application like an acrylic elastomeric coating or aluminized asphalt coating."

Budget should be another consideration. Because coatings are usually considered maintenance items, "the cost can be deducted immediately instead of depreciating over time," explains Daisey, who points out that facility managers should "always check with [their] accountant or tax preparer to verify this." Another financial advantage, he says, is "they are often less expensive to install versus a tear-off or applying a membrane."

And there should be a broader consideration as well: "Thinking environmentally, choosing a roof coating will extend the life of

Key Questions Before Coating

George Daisey, a research scientist on elastomeric roof coatings for The Dow Chemical Company suggests the following critical questions FMs should ask before undertaking a coating project:

- Is this the first roof?
- What kind of roof is up there now?
- How long should the current roof be expected to last, and how long does it need to last, if there are budget constraints?
- Does the entire roof need to be replaced or just certain sections?
- What kinds of roof coatings are recommended for this type of roof? Will the coating product be easy to use?
- Will cleanup be easy?
- Does it have low VOC?
- Is the roof in good shape, or does it need repairs prior to coating?
- Will the choice of repair method determine the type of roof coating I can use?
- Will building codes require a tear-off if a membrane or system is installed?
- Are there any warranties on the existing roof that could be voided if a coating is applied?

> Take time to understand your roof assembly and roof coatings options to learn which products match your specific situation.

that existing roof, preventing or delaying the need to tear off that roof and put the waste materials into a landfill," Daisey says. "Less building products going to landfills, extending the life of the existing roof, waterproofing and/or improving the energy efficiency of that roof — these are always good reasons to choose a roof coating."

But don't skimp on the coating itself, as this actually could make the product more costly over time. Martucci points out that if a facility manager uses a cheap coating or one not appropriate for the roof, this could cause the coating "to delaminate due to either poor adhesion or ponding water." When this happens, "you will need to spend additional time and money fixing the problem." It is important to keep in mind that a coating "will be exposed to the elements, such as direct sunlight, rain, hail, snow and ice," he says. "The roof may also be exposed to foot traffic and chemicals. Acrylic coatings are very popular in many situations due to their ease of use and cost-effectiveness. Solvent-based coatings, silicones, and urethanes cost more, but can provide more resistance to weathering, abrasion, and ponding water."

Check the Weather

Lastly, take into account the time of year, says Martucci. "Most coatings are applied at 42 to 50 degrees (F) and rising, and there should be no rain in the forecast for 24 hours after each coat. For this reason, a coating may not be practical in the late fall to early spring in many parts of the country."

Weather is an important consideration, agrees Daisey. "Coatings need to be applied under good weather conditions. If the conditions are good and the roof is in good condition or recently repaired properly, roof coatings are almost always a great choice."

The bottom line, says Mellott, is that there are many situations during the life of a roofing system when a roof coating is appropriate. "A review of the investment and calculating the ROI is a helpful way to determine the financial benefit of coating a roof. Roofs can be coated early in their life to protect systems or late in their life to extend the service life of the system. Roof coatings are nearly always a good investment." ■

RCMA: Advocating For the Roof Coating Industry

The Roof Coatings Manufacturers Association (RCMA) is the trade group that represents both manufacturers of asphaltic and solar reflective roof coatings, as well as suppliers to the industry. Headquartered in Washington, D.C., the group was established in 1982 and now has more than 70 members.

RCMA is focused on promoting roof coatings and educating its members on the most recent building codes and standards, and industry trends and developments. The association provides technical and educational resources, including case studies and white papers, as well as annual meetings. RCMA creates task forces and working groups as needed to focus on current issues, including volatile organic compounds and sustainability.

The organization has four standing committees: Government Affairs; Communications, Education and Membership; Technical Affairs; and Reflective Roof Coatings Institute. The last committee was formed following the early 2015 merger of RCMA and the Reflective Roof Coatings Institute. In addition to boosting RCMA membership and recognition, the arrangement produced a stronger advocacy approach for both state and federal initiatives.

RCMA's website has links to several entities — including the Lawrence Berkeley National Laboratory, Oak Ridge National Laboratory, National Roofing Contractors Association, and various roofing manufacturers — that have programs for estimating potential savings by coating a roof. And the group has a database that provides up-to-date information on rebates and tax credits available to facilities that install reflective roofs.

For more information, visit the RCMA website at www.roofcoatings.org.

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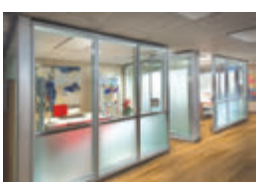

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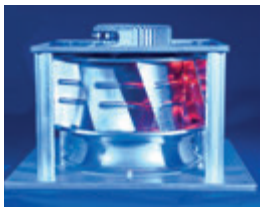

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