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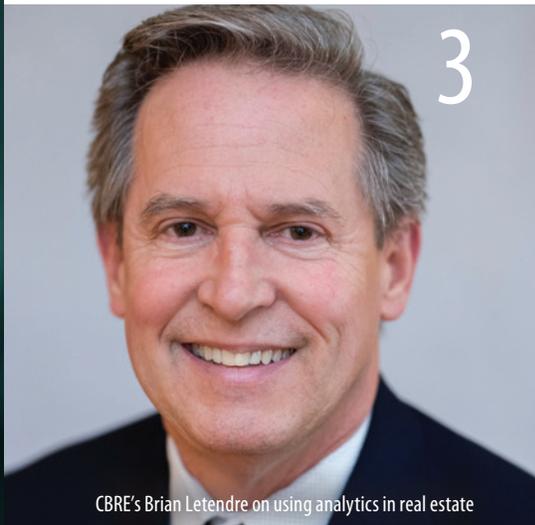


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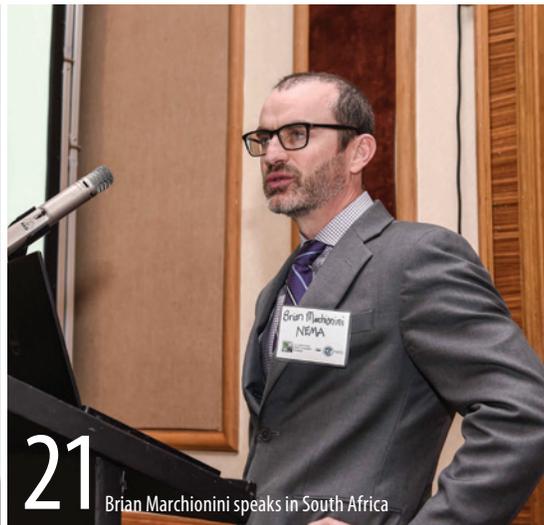
Jeffrey Weiss
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FROM THE CHAIRMAN

Buildings are like small cities. They are the infrastructure of our economy and include multiple and varied subsystems that serve to support the people who live, work, and visit them. These “communities within cities” are increasingly smart and connected.

According to Congress, “the term ‘high-performance building’ means a building that integrates and optimizes on a life cycle basis all major...attributes, including energy conservation, environment, safety, security, durability, accessibility, cost-benefit, productivity, sustainability, functionality, and operational considerations.”

To oversee the proper functioning of a building—regardless of its type—facility managers make use of connectivity to monitor and optimize occupant comfort and productivity through a range of integrated system controls. These controls employ a variety of smart sensors located throughout the building that capture data related to the climate within the building, the operation of the building equipment, and even the use of the building. This data is then analyzed, made available to the facility managers, and utilized to keep buildings humming for a more comfortable and industrious work environment. Everything from lighting controls to HVAC to fire safety data can be examined, and that data can be used to increase building functionality and occupant morale.

The upsides to all of this connectivity in building systems are many. System collaboration promotes efficiency, function, and security—to name a few. But over time, the collected data “teaches” us even more and it enables innovation in building design at virtually all levels—architectural, technical, and human. The most innovative buildings are touted as being “high performance,” meaning, in addition to being environmentally sound and sustainable, the owner/operators place a high priority on occupant output, safety, and more.

Facility managers are major players in defining the future of connected buildings since they have a systemic view from the very edge of function. For instance, by exploring newly enabled concepts in energy efficiency such as harvesting natural lighting via automated blinds and sensor technology in HVAC to decrease utility costs for owners. Over time, homeowners are expected to adopt the residential versions of smart building systems, which will deliver similar benefits related to safety, security, and comfort on a residential scale.

Taking care of these “little cities” and making sure they operate to their full potential will have far-reaching results for the people who live and work there. People spend more than 90 percent of their time indoors, and while they are inside, they want to be comfortable, productive, and efficient. The market will demand buildings that not only employ leading-edge designs and optimized system performance but also embrace a human-centric focus. Ultimately, that is what will make them smart. 🌐

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Business Analytics Serve Real Estate and Facilities Management



Analytics serve as a business tool in the management of real estate facilities by taking large amounts of data inputs and transferring this data into useful information that is used to drive business decisions and operational improvements.

The raw data is automatically processed and organized using predetermined algorithms that prepare mass amounts of data for human consumption. We gain knowledge and insight on historical trends, abnormalities, and excursions from normal operating parameters to drive improved work processes and data-driven decisions and outcomes.

Real estate and building operations use analytics largely to improve the operations, efficiency, and reliability of building assets and infrastructure. This benefits the owner and end users of the facility by providing a more comfortable and productive work environment. This results in improvements to reliability and uptime of production, operations, safety performance, and energy efficiency while preserving and extending the lifecycle of the assets and infrastructure.

Although some analytical processes can be technology agnostic, there are core technology platforms that are commonly used in the built environment that are routinely used to automate the transformation of this data into compelling information that drives positive outcomes.

A few examples of analytical tools used in the industry include:

- **Asset condition monitoring**

This technology samples and trends the condition and internal health of assets and equipment and is designed to identify early degradation in asset health and performance. This allows for planned intervention and corrective action before experiencing a catastrophic failure. It also helps to avoid a negative impact on the business, from production losses or damage to a company's brand or reputation.

- **Building Automation Systems (BAS)**

A BAS monitors and controls building assets and infrastructure such as HVAC systems, fire life safety, lighting, security systems, etc. A BAS can trend and automate the operation of building assets and infrastructure to provide occupant comfort, energy-efficient building operations, and support for other work processes, including production.

- **Computerized Maintenance Management System (CMMS)**

A CMMS serves as a platform and technology engine used for work execution management, which oversees all labor and daily work activities associated with operating and maintaining building infrastructure, assets, and equipment. The output transforms historical work and cost data into information that is analyzed and compared against known industry best practices to drive business process improvements.

This results in cost savings, efficiencies, and improvements to workforce productivity, work quality, safety, and asset reliability.

HYPOTHETICAL LABOR SAVINGS EXAMPLE

The productivity of maintenance technicians in a typical reactive or unscheduled work environment is generally in the 20 to 25 percent range. In a best-practice climate, the productivity is in the 50 to 60 percent range. While the percentages may not excite senior managers, this changes when they are converted to financial terms.

Applying this increase to a 20-person workforce using a rate of pay for maintenance technicians of \$30 per hour, the potential savings would be \$374,400.

Business analytics provide a powerful means to compartmentalize and understand what massive amounts of data are telling us about building operations. The logical use is to transfer this knowledge into actions that improve the workplace experience while providing safe, comfortable, and reliable facility operations. ☺



Try the 3-30-300 Rule as a Workplace Strategy

Mark Goh, CEO,
ChargeSpot

For building systems, especially those used as corporate workspaces, the Facility Manager (FM) is an indispensable role. The FM bridges conversations with executives and building management professionals while also helping to implement a corporate workplace strategy.

If an FM gets involved in a discussion at a strategic level, the C-suite may shift their view of the manager as someone who creates value and minimizes costs.

Tapping into C-suite dialogue requires FMs to approach their role differently. They can do so by using the 3-30-300 rule.¹

¹ A surprising way to cut real estate costs, JLL, September 2016, <https://www.us.jll.com/en/trends-and-insights/workplace/a-surprising-way-to-cut-real-estate-costs>

The 3-30-300 rule provides a breakdown of what an organization pays per square foot, in terms of total occupancy costs—\$3 for utilities, \$30 for rent, and \$300 for employee costs (salaries, benefits, etc.). These numbers aren't set in stone, but they do put into perspective how an organization typically distributes its occupancy costs.

The rule can serve as a valuable tool for FMs looking for a different approach or viewpoint and can be useful when making cost strategy decisions.

Many FMs typically focus on the 3 and 30 portion—utilities and rent—as the areas where they can make the most substantial impact. However, when engaging in conversations with executives, it's important to highlight how FMs can and do affect the 300.

Focus on Big Impact

Taking this approach focuses on big impacts—those that drive significant improvements concerning how employees work. This approach can change the way that FMs are viewed and can help create buy-in for a project.

For example, creating a “smart office” using the Internet of Things and sensor technology with a focus on improving utility costs can result in significant energy savings. A McKinsey report² found that people-related gains from IoT are five times higher than energy savings and make a much more substantial impact on the organization. Productivity gains from IoT technology accounted for 75 percent of the benefit, while energy savings accounted for only 14 percent. Changes that affect human capital have a greater impact than those that improve only physical capital.

The Rule in Practice

ENERGY

Energy-efficiency issues are a hot topic. Many FMs are looking at ways to upgrade lighting and introduce better features within offices. One example of energy-efficiency upgrades is daylight sensors, which present both energy savings and health benefits for workers.³ Implementing such sensors results in blinds being open to allow in natural daylight, which is better than relying on artificial lighting. The resulting increased natural light has been shown to have positive effects on the health of employees, improving mood and workplace satisfaction. The results translate into happier and more productive employees within the workplace.

WELLNESS

The focus on people is one of the reasons that the WELL Building Standard has been rolled out across the U.S. with early success. The Standard addresses seven core concepts that influence a worker’s performance and well-being: air, water, nourishment, light, fitness, comfort, and mind. It joins other certification programs like LEED, BREEAM, Green Star, and the Living Building Challenge in the green rating systems family.

While the costs for WELL certification can be significant, organizations that implement the Standard understand the human impacts that it has. Examples of these benefits include reduced absenteeism and strengthening employee culture, a crucial factor in workplace design.

TD Bank completed a WELL Building Standard interiors certification at its Toronto HQ—the first in the world—and undertook the project for its employees.⁴

“When looking at reducing energy and rent costs we have to focus on people,” said Barbara Ciesla, VP of People+Place at JLL, a consultant on the project. “If we can put people in better buildings and improve productivity by 5 or even 10 percent, 10 percent of 300 is your total cost of rent.”

Benefits to the 300 can easily offset and outweigh costs to the 3 and 30. It is essential not to lose sight of employee benefits in the pursuit of cost reduction in utilities and rent.

Considerations in Projects

Consider motivations around implementing changes. Are you switching to a more flexible office arrangement for greater collaboration and improved employee morale? Or are you making changes to reduce the cost of rent? Avoid making changes solely to reduce rent, as the impacts on employee happiness and productivity can outweigh the benefits.

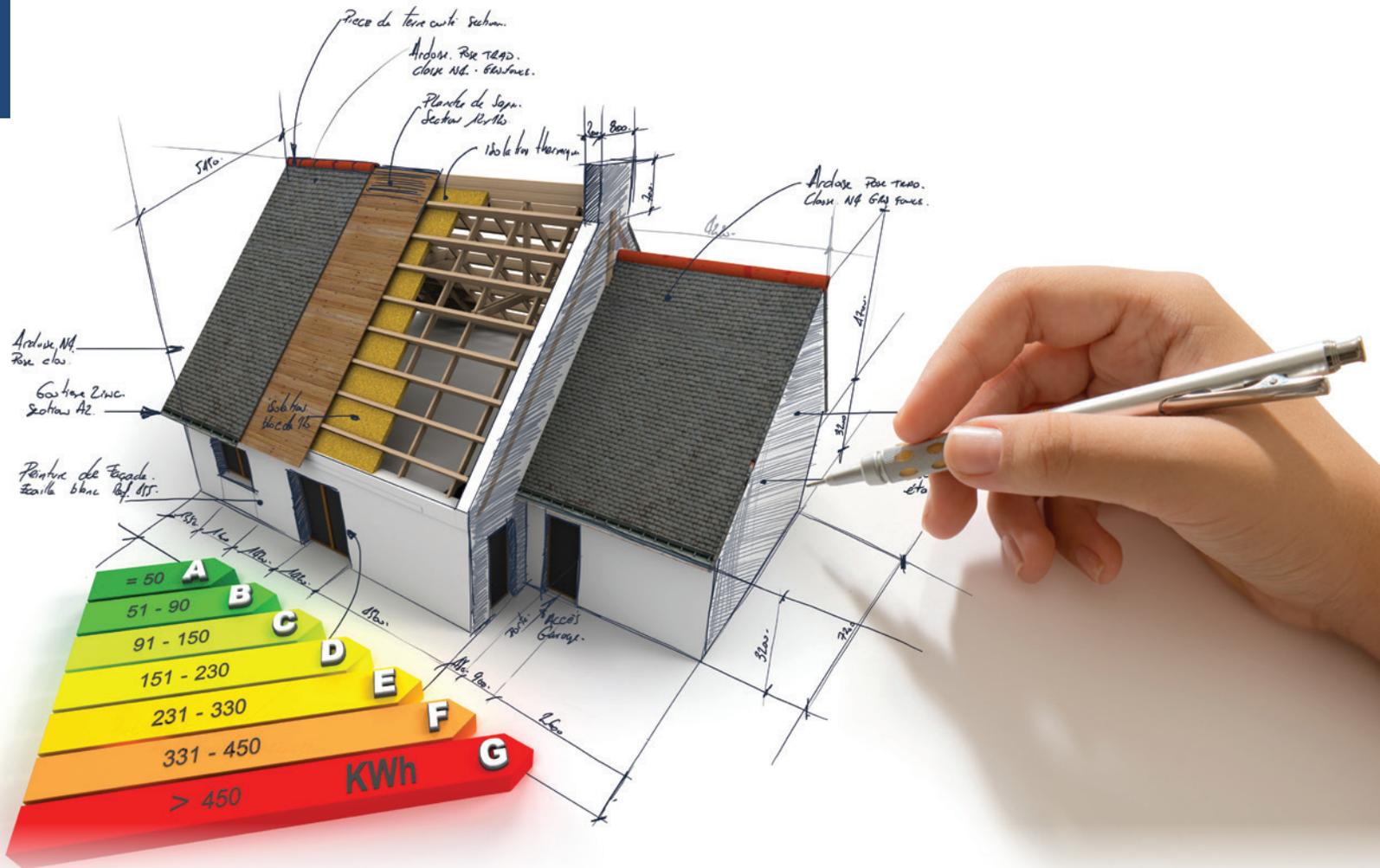
In cases when new projects focus only on the 3 or 30 aspects, take a second look. Are these savings achieved at the expense of employee well-being or productivity? If this is the case, it is crucial to push back. Know your limits based on the type of organization you work with, but a healthy amount of pushback can be right, especially on an issue that affects the people inside a space, your commitment to the organization, and its broader goals for success.

Taking the 3-30-300 approach allows FMs to take a holistic view of the space they manage. Once FMs begin to highlight how they impact the 300 aspects daily, the step to a strategy conversation with executives becomes inevitable. ©

² *Unlocking the Potential of The Internet of Things*, McKinsey Global Institute, June 2015, <https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/the-internet-of-things-the-value-of-digitizing-the-physical-world>

³ Sarah Garone, *The Health Benefits of Natural Light*, Healthline, October 2018, <https://www.healthline.com/health/natural-light-benefits>

⁴ Rebecca Melnyk, *How TD Bank HQ achieved WELL certification*, Canadian Property Management, June 2016, <https://www.reminetwork.com/articles/how-td-bank-hq-achieved-well-certification>



Building Energy Modeling Has Its Place

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Buildings are complex systems composed of numerous interacting components that are influenced by external factors such as weather and occupant behavior. Building energy modeling (BEM) tools use physics-based equations to calculate building energy use at hourly or sub-hourly timesteps. Typical applications of energy modeling include optimizing building designs, documenting compliance with energy codes, demonstrating above-code performance for programs such as LEED, and evaluating the cost-effectiveness of building retrofits. Millions of dollars in utility program incentives are awarded to projects based on their modeled performance. The American Institute of Architects (AIA) emphasizes the role of energy modeling for achieving carbon-neutral buildings: “Our numbers continue to demonstrate that energy modeling is an essential component of success” (AIA’s *2030 by the Numbers*—2016 summary).

Studies have shown that modeled energy use often deviates significantly from measured use, bringing into question the feasibility of relying on energy models for decision-making. For example, on projects that participated in a large-scale modeling-based incentive program, the projected savings were within 25 percent of the measured savings for only 39 percent of projects¹ (Figure 1). So, what makes the models non-predictive?

¹ Chris DeAlmagro and Maria Karpman, “Comparison of Projected to Realized Savings for Projects that Participated in a Modeling-Based Incentive Program” (presentation, 2017 ASHRAE Building Performance Analysis Conference, Atlanta, GA, September 27-29, 2017)

UNREALISTIC EXPECTATIONS

Modeling may be used to compare efficiency options, comply with code or above-code programs, or predict future building performance.² Depending on the modeling application, different levels of modeling resources are required with different areas of focus. When models are created to compare design alternatives, such as two competing HVAC system types, many aspects of the design may still be in flux. While it is imperative to get the system details and their differences characterized in the model, using standard operational and plug-load assumptions may give a reasonable result at a low cost to the building owner.

Modeling protocols used for code compliance and LEED certification include rules that can conflict with the actual anticipated operation. For example, California's energy code requires that default receptacle loads and schedules of services are used, regardless of the plan for the specific building. ASHRAE Standard 90.1 modeling rules for demonstrating code compliance and beyond-code performance require that cooling is modeled in all conditioned spaces whether or not it is specified and that fans run continuously while the building is occupied. These rules practically guarantee deviation from post-construction utility bills but serve a useful compliance purpose.

Sometimes modelers are specifically tasked with creating models that project future energy use. In those cases, the modeler needs to gather detailed information on how the building will be operated, interview future occupants regarding their room schedules and equipment, and visit similar structures. On retrofit projects, comprehensive site measurements are required. These tasks can be expensive and are not necessary for every modeling project.

MODELER EXPERTISE AND PROJECT KNOWLEDGE

Professionals with no specialized training often develop commercial energy models and learn the craft as they go. Modeling budgets and schedules are typically tight, and the work often goes to the lowest bidder. The Building Energy Modeling Innovation Summit³ cited the difference in the results obtained by different modelers simulating the same building in the same tool as one of the top issues affecting BEM credibility.

Modelers are often disconnected from the design team and are not fully aware of changes made to the building design. On retrofit projects, the impactful site conditions may not be communicated to the modeler and thus not captured. Errors can be reduced by requiring that modelers have specialized certifications (such as BEMP or BESA) and by rigorous quality control of modeling-based submittals. (Currently, the review time varies dramatically from program to program, from less than one hour to well over 40 hours per project.)

DIFFERENCE BETWEEN "IDEAL" AND ACTUAL OPERATION

Models often assume that building systems and controls operate as specified. However, this is rarely the case. Building controls are frequently not commissioned, and thus not configured to operate as intended by the code.⁴ Economizers were shown to save 6 percent to 32 percent of cooling energy use depending on climate, but they malfunction in more than 70 percent of the installations.⁵ Thus, models reflecting correct economizer operation substantially underestimate cooling energy use on many projects.

⁴ Michael Rosenberg et al., *Implementation of Energy Code Controls Requirements in New Commercial Buildings*, PNNL-26348, Pacific Northwest National Laboratory, March 2017

⁵ *HVAC Economizers 101*, Battelle, <https://buildingretuning.pnnl.gov/training/economizers/PNWD-SA-8511%20HVAC%20Economizers%20101-Section%203.pdf>

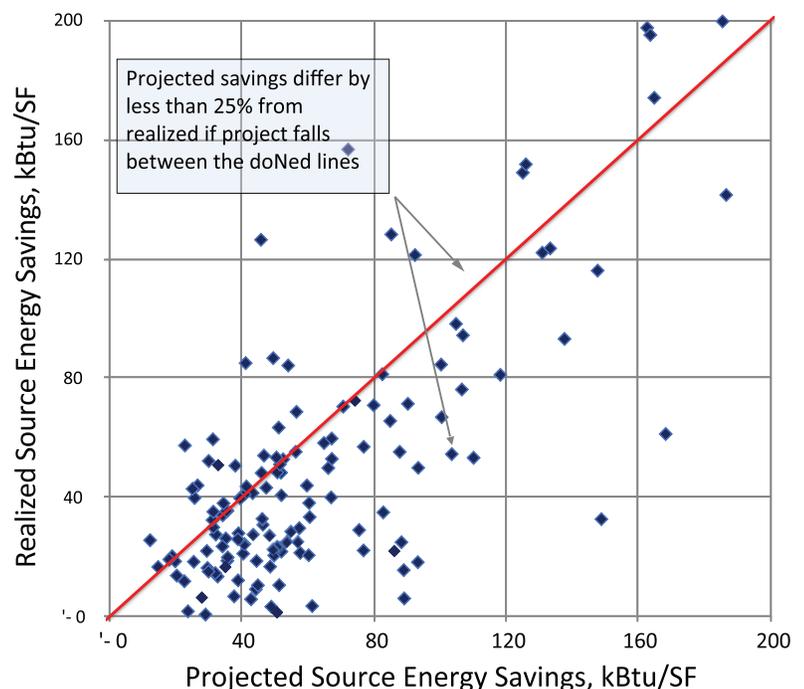


Figure 1: Modeled versus Realized Savings for Retrofit Projects

² *Building Energy Modeling for Owners and Managers*, Rocky Mountain Institute, August 30, 2013, <https://rmi.org/wp-content/uploads/2017/05/Building-Energy-Modeling-for-Owners-and-Managers-2013.pdf>

³ Building Energy Modeling Innovation Summit, Rocky Mountain Institute

Further, building operators may disable or override energy savings features. These problems are best solved not by the modeler or modeling software but by better building commissioning and training of building operators.

IMPACT OF OCCUPANT BEHAVIOR, DEMOGRAPHICS, WEATHER, AND OCCUPANT-INSTALLED EQUIPMENT

Building occupants can operate a building in a variety of ways; while estimating these parameters is possible, reliably predicting future behavior is not.

- Temperature setpoints, hours of occupancy, opening and closing windows, and shades all impact energy use.
- Service hot water usage differs by a factor of four or more depending on whether an apartment is occupied by seniors or a family with kids.
- Weather used in models represents a typical year and is different from actual post-occupancy or post-retrofit conditions.⁶
- Buildings have systems and equipment installed by occupants such as office computers, kitchen appliances, task lighting, and industrial equipment.

The energy use of these systems is difficult to predict. In one study, office equipment with a 3.5 W/SF load based on the nameplate rating consumed around 0.75 W/SF based on field measurements⁷; heat gains from desktop computers may differ by a factor of three depending on the manufacturer, processor speed, and RAM.⁸

For these reasons, incentive programs that rely on post-construction energy use to confirm modeled savings estimates recognize that accurate prediction is impossible, and often include a post-occupancy calibration step to verify operation and adjust for installed equipment and actual weather conditions.

LIMITATIONS OF BEM TOOLS

It is well documented that simulation results can vary significantly depending on the BEM tool used. Studies by Lawrence Berkeley National Laboratory and Texas A&M University showed heating energy differences of over 100 percent and 27 percent, respectively, for the same building modeled in commonly used simulation tools.^{9, 10} A study by Gard Analytics showed a 50 percent difference in annual cooling load between two tools when running a standardized test by ASHRAE Standard 140.

Furthermore, most BEM tools support multiple methods for calculating common conditions and technologies, such as infiltration or daylighting, and energy use projected by the same BEM tool for a given project may vary significantly depending on the method that modeler picks. There is little or no evidence of which results are correct because the peer-reviewed comparative testing of BEM tools is limited, and validation using the actual performance data is scarce. ASHRAE Standard 140¹¹ currently covers only a small subset of common building systems and provides no formal pass/fail criteria. The challenges are exacerbated by the diversity of commercial building designs, the rapid development of new systems and technologies, and the complexity of the underlying physics.



6 The amount of service hot water used in an apartment building varies from 12 to 44 gallons/day per person depending on the occupant demographics based on the ASHRAE Applications Handbook

7 2017 ASHRAE Handbook—Fundamentals (p.18.13, Figure 4)

8 2017 ASHRAE Handbook—Fundamentals (p.18.12, Table 8A)

9 Joe Huang et al., *Evaluating the Use of EnergyPlus for 2008 Nonresidential Standards Development*, LBNL-58841, Lawrence Berkeley National Laboratory

10 Simge Andolsun, Charles H. Culp, and Jeff Haberl, *EnergyPlus vs DOE-2: The Effect of Ground Coupling on Heating and Cooling Energy Consumption of a Slab-on-Grade Code House in a Cold Climate*, 2010, Fourth National IBPSA-USA Conference, New York, USA, <http://repository.tamu.edu/handle/1969.1/93374>

11 ANSI/ASHRAE Standard 140-2017 *Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs*

Implications

Building models rely on numerous assumptions, such as operating hours, occupant demographics, lighting and equipment use schedules, and weather. They often reflect the ideal operation of building systems and are affected by limitations of BEM tools, modeler expertise, etc. Even when the “right answer” (the actual energy use of the existing building) is known upfront, bringing a model within 5 percent of the utility bills, as required by ASHRAE Guideline 14, is a laborious process that does not guarantee that the model is representative of the actual building. Models are underdetermined systems, and multiple combinations of inputs may produce the same annual use.

Programs that set a fixed modeled target (e.g., target energy use intensity) to qualify projects for incentives or demonstrate compliance with code must prescribe unregulated loads and operating conditions and require that all projects use the same BEM tool, similar to the passive house (PHIUS and PHI) modeling protocols, or allow only the tools that pass rigorous sensitivity testing to ensure close alignment in results. These requirements will cause modeled energy use to vary even more compared to actual energy use than if anticipated unregulated loads and occupancy conditions are allowed.

Programs and approaches that are based on comparing two models (baseline and proposed) are less affected by the differences between BEM tools because most simulation inputs are the same between the models, and if one of the common inputs is wrong, it will likely not have a significant impact on the outcome.⁶ For example, savings from lighting fixture replacement largely depend on the change in fixture wattage and modeled runtime. Comparative approaches that are based on percent improvement between two models (ratio instead of delta) reduce the impact of operational uncertainty—e.g., lighting runtime hours are canceled out to a degree when savings from a lighting retrofit are expressed as a percentage reduction in building energy use.

Conclusions

Models don’t necessarily need to accurately predict future building energy use to be useful for comparisons and compliance. When it is the desired outcome, a more accurate prediction is possible, but it requires more resources and will always be confounded by the inability to accurately predict human behavior and weather. This is not unlike fuel efficiency and appliance ratings that are widely used in the marketplace (Figure 2) and are considered of great value. Expecting models to accurately predict the future is asking for the impossible. ☹

6 Michael Rosenberg et al., *Roadmap for the Future of Commercial Energy Codes* (Figure 2.6), PNNL-24009, Pacific Northwest National Laboratory, January 2015, https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-24009.pdf



Figure 2 Efficiency Ratings and Difference Between Rated and Actual Performance

Best Practices for Protecting Electrical Equipment in Natural Disasters



According to the National Oceanic and Atmospheric Administration, “weather, water, and climate-related events cause an average of approximately 650 deaths and \$15 billion in damage per year.”¹

¹ “Weather,” National Oceanic and Atmospheric Administration, <https://www.noaa.gov/weather>

Chad Kennedy,
Director of Industry
Standards for
Power Equipment,
Schneider Electric

In 2018 alone, there were 14 different billion-dollar disaster events in the United States. And over the past three years, the yearly frequency of billion-dollar disaster events has doubled the long-term average.² With storm data demonstrating a pattern of increasingly extreme weather, there’s a good chance this isn’t an aberration; we may be seeing the new “extreme” normal.

No matter what, hurricanes, wildfires, blizzards, and other extreme events will happen again. Following best practices for preparation is the best way to protect the electrical infrastructure of the buildings where we live, work, and play. This article explores some key best practices and industry guidance on how to protect your electrical equipment against natural disasters.

² Adam B. Smith, “2018’s Billion Dollar Disasters in Context,” National Oceanic and Atmospheric Administration, February 2019, <https://www.climate.gov/news-features/blogs/beyond-data/2018s-billion-dollar-disasters-context>

Standards Enhance Safety

Industry codes and Standards provide useful guidance on the proper installation, maintenance, servicing, and operation of electrical equipment. When it comes to disaster event planning, these Standards recommend starting with a risk assessment to understand the potential site exposure and system impact from disaster events. For example, Article 708 of the *National Electrical Code*³ (NEC) contains requirements for designated critical operations areas. These are mission-critical buildings or areas where disruption would impact national security, public health, or safety. A documented risk assessment and associated mitigation strategy is the starting point for providing the necessary safety and evaluation of code compliance. Although general businesses are not required to follow the rules in Article 708, the completion of a risk assessment will provide needed guidance when creating plans for disaster events and recovery.

To keep your facility safe and operable, the NEC includes the key items that a risk assessment should identify:

- Potential hazards (whether from a natural disaster or human error)
- The likelihood of their occurrence
- The vulnerability of the system to the identified hazards

An essential part of the risk assessment is evaluating where specific equipment is located or positioned. For example, when considering flood damage exposure, the assessment may lead to having backup generators and associated fuel pumps elevated to be kept safe. During Hurricane Katrina, for instance, flooding knocked out basement generators in a New Orleans hospital, leading to an emergency evacuation of all patients.³

Completion of a risk assessment should be followed by a mitigation strategy that addresses what equipment and actions should be included in an electrical emergency action plan and the events that would trigger these actions.

Crafting the Right Plan

Guidance on creating a natural disaster plan for your site can be found in NFPA 1600 *Standard on Continuity, Emergency, and Crisis Management*. NFPA 1600 provides a method on how to create an

electrical emergency action plan to save facilities from experiencing too much downtime. The action plan also:

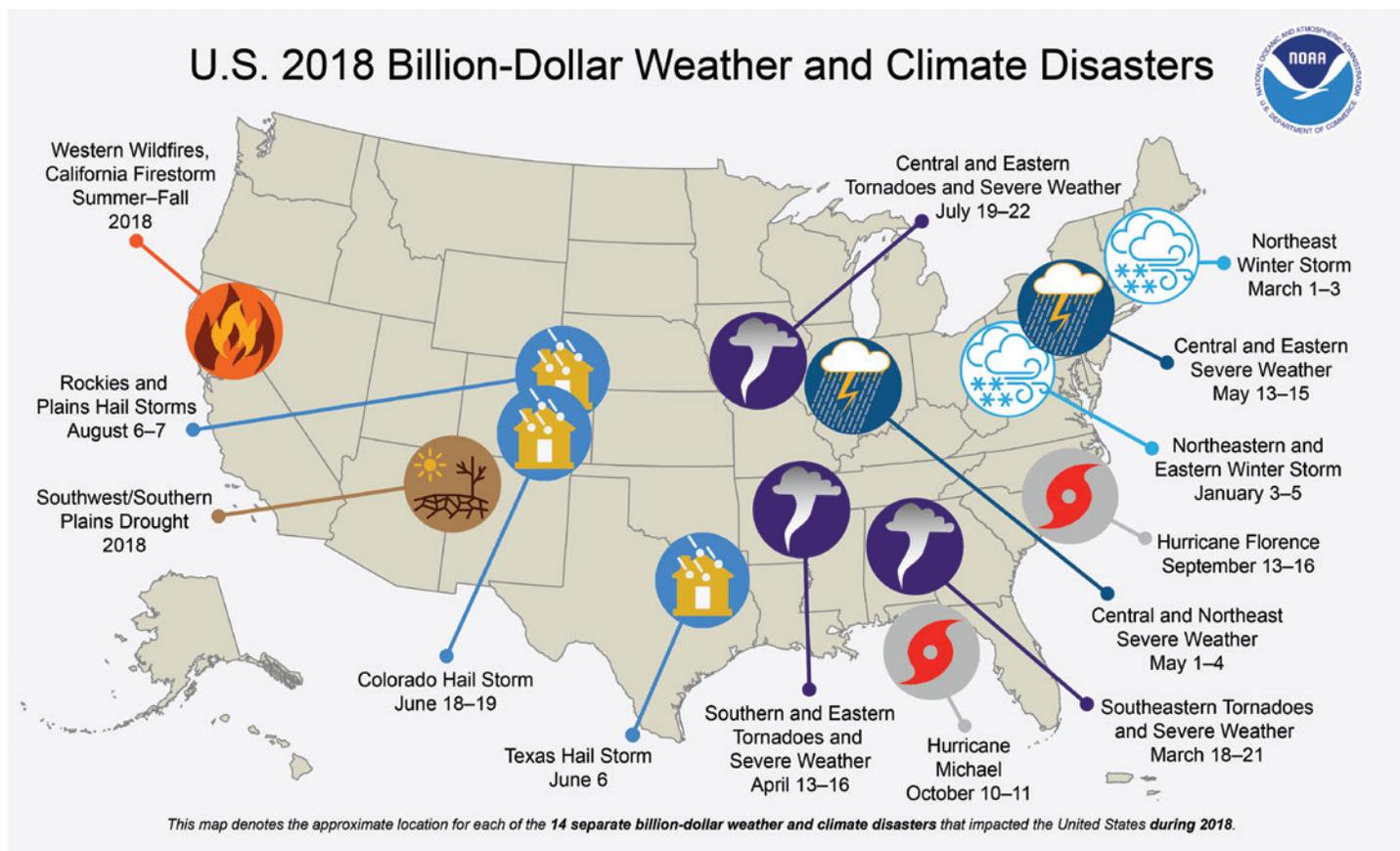
- Reduces time to restore short- and long-term power quickly and safely
- Minimizes uncertainty when a disaster occurs
- Increases understanding of electrical assets, available emergency services, and replacement market availability

While it takes a lot of time and thought to develop an action plan, doing so is fundamental to restoring power safely. To build a successful action plan, facility managers should approach its development by thinking about what they need both within a facility and outside of it.

- 1) **Internally:** Teams need to define the emergency criteria clearly, whether it's the damage from a natural disaster or even tripping circuit breakers that can affect productivity. They must also identify mission-critical electrical equipment and list these within the plan and associated documentation, such as the facility single-line diagram. Once the teams identify the mission-critical pieces of electrical equipment, they should perform analysis on each of these assets to assess availability in the market, lead times, and a plan of action when the equipment is no longer functional.
- 2) **With external partners:** It is important that facility managers maintain relationships with external partners and pre-negotiate emergency service contracts with outside vendors. This way, they do not fall victim to overpricing and insufficient support in the wake of a natural disaster. Facility managers should also clearly state internal and external responsibilities, such as providing electrical one-line diagrams, energization procedures, and coordination and communication activities between multiple vendors. Other factors that should be pre-determined include defining the equipment and service scope, the timeframe of the emergency contract (including expiration date), and contact information.

With an effective action plan in place, facility managers have the tools and strategies needed to get their facilities back to a functional state, but doing this safely needs to be a priority.

³ Bradford H. Gray and Kathy Hebert, *After Katrina: Hospitals in Hurricane Katrina*, The Urban Institute, July 2006. <https://www.urban.org/sites/default/files/publication/50896/411348-Hospitals-in-Hurricane-Katrina.PDF>



Source: “Billion-Dollar Weather and Climate Disasters: Overview,” National Oceanic and Atmospheric Administration, National Centers for Environmental Information, 2019, <https://www.ncdc.noaa.gov/billions>

Safety Takes a Front Seat

Once the disaster strikes, it’s all hands on deck to restore the facility and get business operations back to normal. But with flooding and other damage, safety, not the speed of recovery, should be the top priority for all employees.

- **Employees must be trained.** They should properly examine equipment that may have been affected by flooding, fire, blizzards, or other impacts, and determine if it needs repair or replacement. They should rely on the experience of qualified personnel and act by guidelines set by NFPA 70E *Standard for Electrical Safety in the Workplace*.
- **Employees should not clean and then reuse damaged equipment.** Damaged electrical equipment is dangerous to handle. Even applying cleaning agents or abrasives to electrical equipment to remove

debris or residue is likely to do more harm than good. Keep in mind that using damaged equipment can result in system failure and harm people and property.

- **Consult a professional.** Qualified personnel should be on-site to evaluate, replace, and repair damaged equipment. Electrical professionals can inspect the system for hidden damage and ensure proper system operation and safety.

Businesses that prepare properly for natural disasters are in the best position to quickly and safely return to normal operation. With the damage of natural disasters being largely unpredictable, it’s important for facility managers to have the proper plans in place to mitigate the risk, plan for an emergency, and restore electric power once the disaster has ended. ☺

BACnet Secure Connect: An IoT Twist on an Established Protocol

Even though it's not published yet, it's possible you've heard something about BACnet Secure Connect (BACnet/SC), which has sparked a significant amount of buzz in the building systems industry. The name itself triggers curiosity. Here are some questions you may be asking:

- How secure is it?
- How different is it from the BACnet we use today?
- Does it allow BACnet to work in the world of IoT?
- How IT “friendly” is it?
- What is the difference between the BACnet/IP and BACnet/SC?

Let's cover all of the above.

The original name, “Internet Transport Bindings,” was the brainchild of Bernhard Isler, a System Architect for Siemens and former Chair of the SSPC 135 BACnet Committee. The name was edited to convey the magnitude of this addition to the Standard, and the committee settled on BACnet Secure Connect. Described simply in a single sentence, BACnet Secure Connect implements the entire BACnet stack in the application space, as noted in Figure 1.

Why is moving to the application space vital? From the beginning, BACnet has always been a network communications protocol with an architecture based on the IT model. However, BACnet is a protocol adapted to the unique communication needs of relatively lightweight controllers and other resource-limited devices. While using the basis of standard

IT protocols it will, at times, deviate on how they are implemented. This pushes IT departments to adapt to how BACnet is implemented on its IT infrastructure, rather than fitting into the current IT framework. Moving to the application space allows for easier IT adoption. Benefits include:

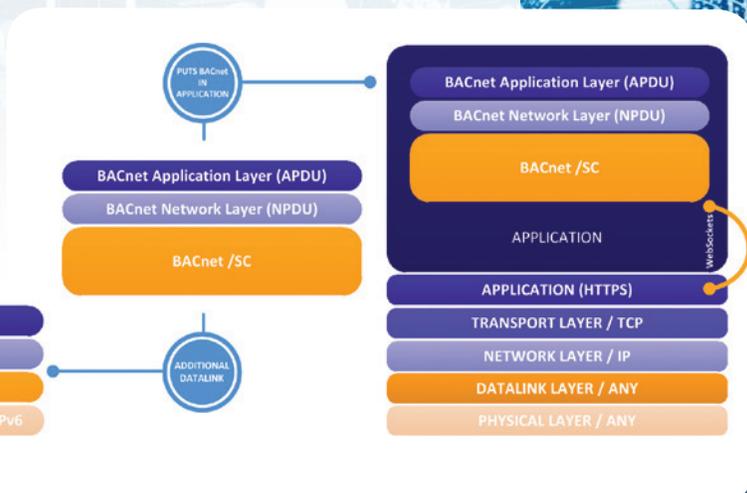
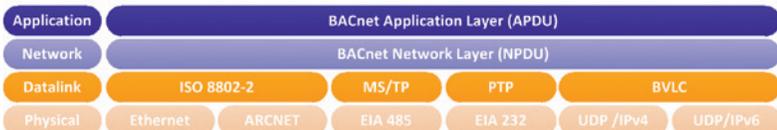
- Additional support of DNS and DHCP
- Elimination of IT structures unique to BACnet like BACnet Broadcast Management Devices (BBMDs)
- Takes away the requirement for User Datagram Protocol (UDP) broadcast messages
- No special requirements for firewalls and Network Address Translation (NAT)
- Moves to the use of Transmission Control Protocol (TCP) instead of requiring UDP

These are all things that make it a “business-as-usual” proposition with IT.

BACnet/SC is essentially another datalink in the Standard just like Master/Slave Token Passing (MSTP) or Ethernet supporting the BACnet Network Layer (NPDU) and BACnet Application Layer (APDU). However, it is meant to live entirely in the application space. This allows BACnet/SC to live on top of the standard information flow layers of the TCP/IP model common to network IT infrastructures, as noted in Figure 1.

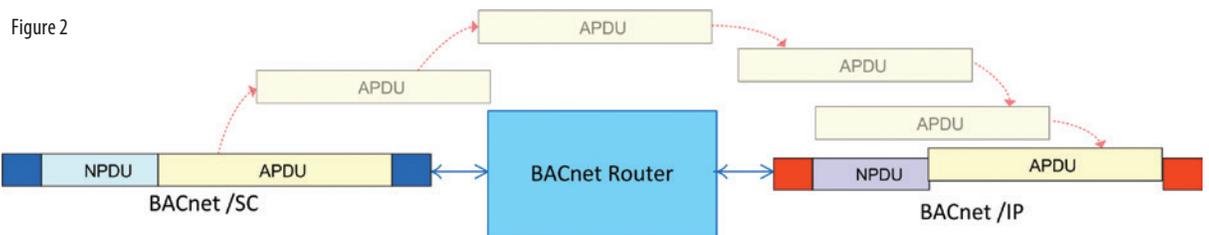
Scott Ziegenfus,
Systems Architect,
Hubbell Lighting

Figure 1



The BACnet/SC datalink connects from the application space to the IT world using the TCP-based WebSocket protocol (RFC 6255) developed for browser-based applications as extensions to HTTP. The WebSocket protocol allows the use of port 80 for regular WebSocket connection or port 443 for secure WebSocket connections over Transport Layer Security (TLS). However, BACnet/SC mandates that only the use of secure WebSocket connection over TLS is allowed, as noted in Figure 1.

Because BACnet/SC is a datalink, conversion from SC to any other datalink can be accomplished by a BACnet router. As in all BACnet routers, the BACnet message or command within the APDU remains unchanged as the message wrapper gets stripped and reapplied for the new datalink. This will allow an existing network of BACnet devices using a datalink of IP or MSTP to be converted to BACnet SC for network adaptations, as noted in Figure 2.



The logical topology of BACnet/SC communication is hub and spoke. BACnet devices will be considered as nodes. Nodes are any BACnet device, from an Advanced Workstation (AWS) to a Smart Actuator (SA). A hub will monitor and assess the communications and provide the switch function from a device node and to its destination node. If required it will also send it to all of its connected nodes.

For redundancy, a second hub may be added to the network as a failover hub. All BACnet/SC nodes are required to support connecting to the main or primary hub. In the event of a failure it will connect to a failover hub. Nodes also can talk directly to other nodes, as noted in Figure 3.

This additional datalink allows for multiple configurations when the logical topology of hub and spoke combined with BACnet/SC in the application space. Configurations can be across a campus or the world, in the cloud or on a corporate intranet, as noted in Figure 4.

To recap, let's answer the original questions noted at the beginning of this article.

Is it different than the BACnet we use today?

The BACnet message is still the same, but the datalink is different. Today, plenty of off-the-shelf BACnet IP to MSTP routers are available to route between a BACnet/IP network and BACnet MSTP network. While the medium changes, the BACnet message stays the same. There will be no difference routing between a BACnet/SC network and a BACnet/IP or MSTP network.

How "IT friendly" is it?

It allows IT to use the conventional methods, procedures, and protocols Standard in the IT world, making it extremely friendly. BACnet/SC eliminates aspects of BACnet/IP that are sometimes

problematic because it deviates from conventional IT policies and practices such as BBMDs and UDP broadcasting. BACnet is not dictating how the physical, datalink, network, or transport layers of the TCP/IP model are to be used or tweaked for BACnet. The methodology for information flow is left to the local IT policies and procedures.

How secure is BACnet/SC?

BACnet Secure Connect does not use Clause 24 in the BACnet Standard (the security clause). Although Clause 24 is a sophisticated network security solution of authentication, authorization, and encryption, it uses a vastly different approach to security that doesn't follow the current thinking and Standards widely used by the IT world. Instead, BACnet/SC requires the latest version of Transport Layer Security (TLS). Where Clause 24 was optional and not widely used for BACnet/SC, TLS is not an option and will always be implemented—thus the name BACnet Secure Connect.

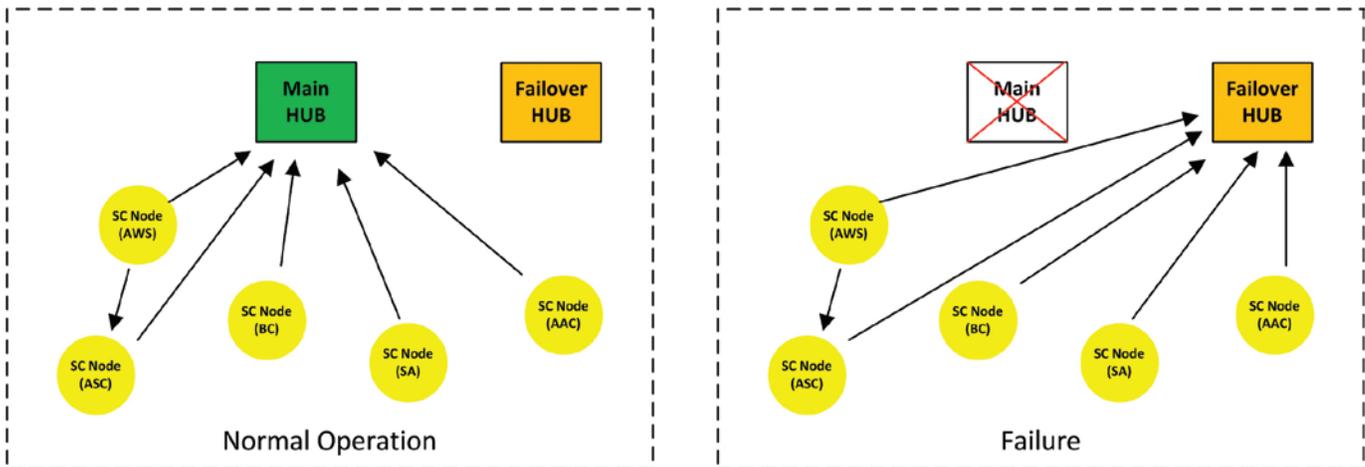


Figure 3

What is the difference between BACnet/IP and BACnet/SC?

BACnet/IP allowed BACnet to be adopted on an IP-based network. It also mandated installation criteria such as the need for message broadcasts and the use of UDP for the transport layer. Additionally, security methodology used would be from the BACnet own Standard under Clause 24, or expensive Virtual Private Network (VPN) solutions. This adoption required IT departments to adapt their network to BACnet requirements instead of having BACnet adapt to the IT department protocols and procedures.

BACnet/SC moves the BACnet stack into the application space and allows BACnet to effectively fit any IT department’s procedures using common IT practices. The only requirement is to use “secure” WebSockets employing the common TLS security Standard.

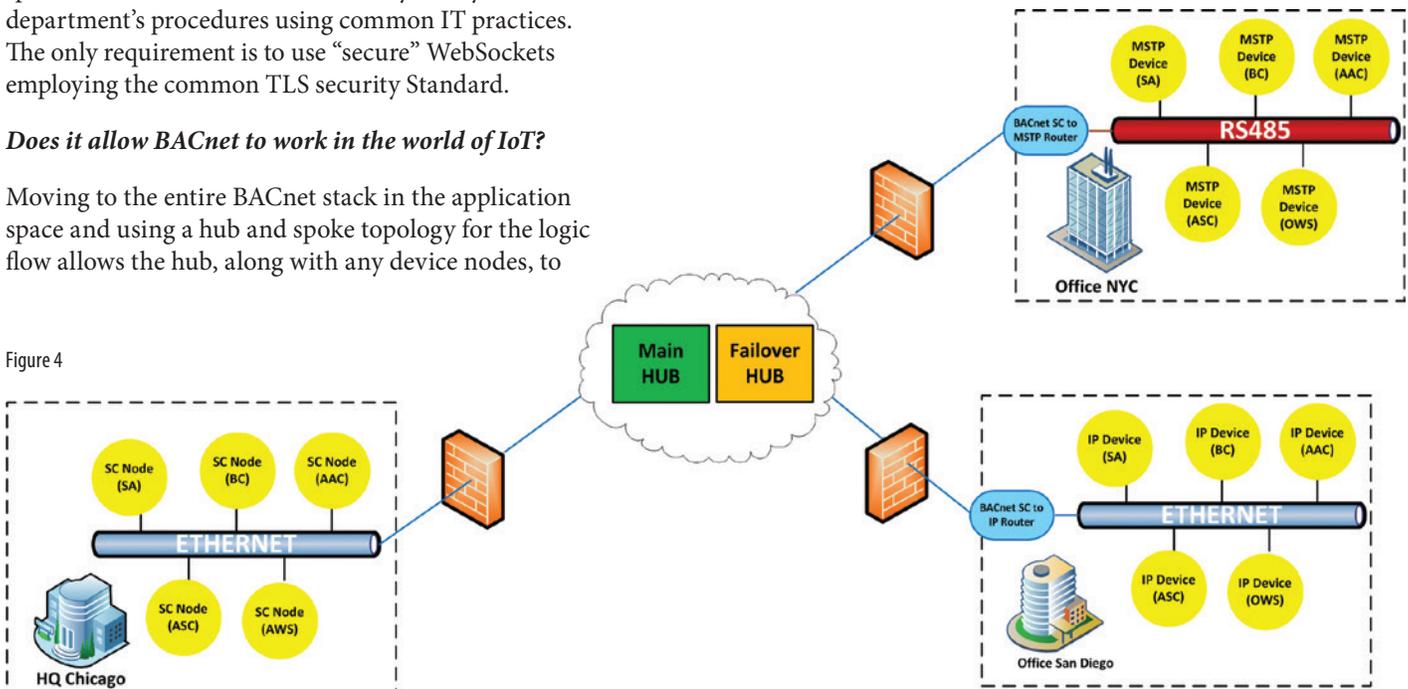
Does it allow BACnet to work in the world of IoT?

Moving to the entire BACnet stack in the application space and using a hub and spoke topology for the logic flow allows the hub, along with any device nodes, to

live on premises, at the Edge, or in the cloud, or any combination controlling BACnet data flow. The flow of data is the basis for IoT.

The addendum for BACnet/SC is Addendum *bj* and is expected to be out for third public review by the time of this publication. All SSPC 135 BACnet Committee addendums out for public review can be found on the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) website at <https://www.ashrae.org/technical-resources/standards-and-guidelines/public-review-drafts>. ©

Figure 4



It's Time to Repair and Modernize America's Infrastructure.



The National Electrical Manufacturers Association strongly believes that the U.S. needs a **comprehensive, modern, and realistic** plan to overhaul and update its infrastructure. In its policy paper, "Electrifying Our Future: Building America's 21st Century Infrastructure," NEMA outlines ways in which resources and technology play a crucial role.

For more information, or to download your copy, visit www.nema.org/infrastructure.



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Thermostats Know When and How to Keep You Comfortable

Zijun Tong, Program
Manager, NEMA



When it comes to modern consumer digital technologies, the first few things that come to mind might be Apple's Siri, Amazon's Alexa, and Google Home. People rarely think of thermostats, although they are quietly serving everyone in the background. The technology related to thermostats has evolved from manually setting a cooling or heating point with a mechanical lever to a computerized thermostat that improves the user experience.

Two types of thermostats are connected thermostats and smart thermostats, though those terms are often used interchangeably. A smart thermostat is a connected thermostat that can learn an occupant's behavior over time, while a connected thermostat may not be a smart one. The term "connected" generally means a device is hooked up to the internet and can transmit data or be controlled remotely.

A thermostat is a control system that regulates the air temperature in a room. Since about 48 percent of all energy consumption in American homes is a result of cooling and heating, thermostats play an important role in helping homes become more energy efficient.

A thermostat that is smart and connected can monitor and learn from your daily routine and thus help reduce energy consumption. It is like

having a personal assistant that understands your needs and adjusts to your comfort. Although actual energy savings depend on many factors, studies have found that a connected thermostat that is smart can help save 10 to 12 percent on heating and 15 percent on cooling.

Since it is connected, it gives you the ability to remotely control the temperature in your room. For instance, you may be with a friend at a party and with the remote access feature, you are able to adjust the thermostat down. If you adjust the temperature on a particular weekday repeatedly, the thermostat will learn the behavior and adjust accordingly when that weekday comes.

Smart thermostats that learn occupants' behavior make use of algorithms to optimize HVAC settings for occupants and adapt to their lifestyle. They also have features such as geofencing to improve energy efficiency. Geofencing uses a GPS system to know if an occupant is within the vicinity of his or her home. Once notified that the user is close to home, the thermostat activates the HVAC system.

As thermostats become more connected and intelligent, they will become an integral part of a home automation ecosystem. ☺

Electric Companies Demonstrate Innovative Infrastructure



Mariela Echeverria,
Communications
Services Manager,
NEMA

The Edison Electric Institute, GridWise Alliance, and National Electrical Manufacturers Association (NEMA) hosted the Grid Innovation and Infrastructure Expo on Capitol Hill recently in conjunction with the U.S. Congressional Grid Innovation Caucus, co-chaired by Rep. Jerry McNerney (D-CA) and Rep. Bob Latta (R-OH).

“Innovation will be central to the long-term resilience of our nation’s energy infrastructure,” said Congressman Jerry McNerney. “Today’s expo brings together leading industry companies to highlight new technologies and innovative partnerships that are forging the path for a modern, cleaner power grid. As co-chair of the Congressional Grid Innovation Caucus, I look forward to working with my colleagues on how we can invest in a stronger, more resilient grid that can withstand our current and future challenges.”

“Now and in the years ahead, technological advancements of a different kind will change the grid system in a variety of new and exciting ways,” said NEMA President and CEO Kevin Cosgriff. “Our increasingly digital 21st-century infrastructure is laden with sensors, produces nearly unimaginable amounts of important data, and communicates via wired and wireless networks in fractions of seconds. This convergence of electricity and information technology is ushering in a more reliable, resilient, and aware

power system. Policymakers and grid regulators are key to enabling these modern, innovative grid technologies, and the sooner they act the better for citizens and society.”

Companies at the Expo showcased a wide range of modern energy technologies, including electric vehicles, distributed energy management, cybersecurity, advanced metering, and storm hardening. The Expo included exhibits from ABB, CenterPoint Energy, Duke Energy, Eaton, Hitachi, Itron, Landis+Gyr, Qubitekk, National Grid, Pepco, Rappahannock Electric Cooperative, Siemens, and Southern California Edison. ©



NEMA, ISA Announce New Building Systems Cybersecurity Program



During a recent Industrial Control Systems Joint Working Group meeting, representatives from the Department of Defense (DOD), International Society of Automation (ISA), and National Electrical Manufacturers Association (NEMA) outlined a new program to address the growing risk of unprotected and underprotected building control systems in the U.S. and abroad.

Building owners, users, and manufacturers of control systems continuously work to find practical ways to create safe and more secure environments. Combining the expertise from ISA, NEMA, and DOD advisors, the working group has spent several months developing a proposed program in preparation for a rollout to a wider audience of industry peers.

“While cyber risks are well documented, implementing solutions that address different risk levels within a single building is no simple task,” said NEMA Industrial Products and Systems Industry Director Kirk Anderson. “Coming up with a path forward required the efforts from multiple groups, including manufacturers, installers, and end users; however, we weren’t sure if this would appeal to the entire supply chain. When the program received near-unanimous support, we knew we were on the right track.”

“The International Society of Automation has an internationally recognized certification program for automation and control systems that started in 2007,” stated ISA Managing Director Andre Ristaino. “Under the ISASecure® brand, the scope of the ISA/IEC 62443 Standards-based certification includes building

management technology. The proposed facility certification would be a natural extension of the ISASecure® program.”

The national program will incentivize the use of existing Standards for cybersecurity in building control systems. It will create easy-to-understand tiers for end users to apply industry-accepted Standards to products, processes, and technology to allow end users to market cyber protections and consumers to understand the level of security present. The program would also help building owners protect building automation systems, and provide a means for insurers and other stakeholders to offer incentives for buildings to incorporate safer and more secure systems and processes. The working group plans to open the frame document to additional stakeholders’ input, with a potential launch date later this year. For more information, contact NEMA Industry Director Kirk Anderson at Kirk.Anderson@nema.org. ☎

Kirk Anderson,
Industry Director, NEMA

As part of a 2019 Strategic Initiative, NEMA is working to provide Members with guidance on additive manufacturing use cases, safety concerns, and standardization gaps.

Take a short survey to help us understand how 3D printing and additive manufacturing affects your industry.

www.nema.org/3DPrinting

For more information contact NEMA Senior Manager, Regulatory Affairs, Alex Boesenber at alex.boesenber@nema.org.



NEMA Seeks Expanded Carbon Monoxide Protection in Oregon

Mark Kohorst

Senior Manager, Environment, Health, and Safety, NEMA



On one afternoon in February 2019, three aviation mechanics working in a hangar in Moberly, MO, were overcome with carbon monoxide (CO) poisoning resulting from a malfunctioning heater inside the structure and rushed to the hospital. The previous month, emergency workers treated 14 people and hospitalized one from a nail salon in Fort Worth, TX, less than a week after three employees of the South Dakota Department of Transportation received medical treatment after exposure to CO in their office. As in Missouri, authorities traced the problem in these latter incidents to a fuel-burning heating appliance.

The victims in these events were fortunate; authorities recognized the CO poisoning and took appropriate actions before any permanent injuries—or worse—could occur. Sadly, this is not always the case with CO exposure. According to the Centers for Disease Control, at least 430 people die in the U.S. every year from accidental CO poisoning, while approximately 10 times that number are hospitalized.¹

Carbon monoxide is an especially pernicious hazard because it is a colorless, odorless, tasteless, and poisonous gas produced by the incomplete burning of fuels such as coal, wood, charcoal, and natural gas. Undetectable by human senses, CO exposure can incapacitate people before they realize they are in danger, which is why it has been labeled the “stealth killer.”

¹ *Carbon Monoxide (CO) Poisoning Prevention*, Centers for Disease Control and Prevention, January 2019, <https://www.cdc.gov/features/copoisoning/index.html>

Minimizing the risk of CO exposure in private and public areas is a priority for NEMA’s Fire, Life Safety, Security and Emergency Communication Section. Member companies in this Section produce the reliable CO alarm and detection systems needed to protect residential, commercial, and institutional spaces, as well as the technical Standards that ensure the systems are installed and operated correctly.

The industry also strives to make CO detection more widespread through legislation and state building code amendments. While states have taken significant strides in recent years to ensure that homes and lodging establishments are protected, other areas where people gather in large numbers have received less attention. Unless and until authorities take steps to address this issue, incidents like those described above will not be uncommon.

NEMA is sponsoring one such measure in Oregon. The effort began in 2017 with proposed legislation but moved to the state’s Building Codes Structures Board when the industry was advised that the appropriate mechanism for this type of initiative was a building code change.

In February 2018, therefore, NEMA submitted a formal proposal to the Structures Board to amend the Oregon Structural Specialty Code (OSSC) to require CO detection equipment in *new* Group A, Group B, and Group M “occupancies.” These groups essentially embody most commercial, retail, and mercantile facilities. If adopted, this would make Oregon the first state with a building code that requires CO detection systems in restaurants, bars, theaters, churches, libraries, retail stores, and many other highly populated environments.

If Oregon adopts this code requirement, it can serve as a model for action by other states and local jurisdictions. Protecting more people, in more places, against the “stealth killer” is a worthwhile goal, and NEMA Members can provide the means needed to achieve it.

To find out more, contact Mark Kohorst of NEMA Government Relations at 703.841.3249 or mar_kohorst@nema.org.

Regional Energy Initiatives Multiply



Brian Marchionini, NEMA Senior Program Manager, speaks at the Power Africa Clean Energy Standards Program workshop on energy storage in South Africa in February.

For the Western Hemisphere, the Administration launched the America Crece energy initiative in 2018 (“crece” is Spanish for “it grows”). Led by the Treasury Department but involving six additional agencies, the initiative promotes economic prosperity through energy growth, integration, and security. It encourages energy trade, private sector investment, and financing for transactional growth through bilateral frameworks with individual countries. Targets include power generation, transmission, and distribution; renewables and energy storage; mini-grids; and energy efficiency.

In its first year, the U.S. signed Crece framework agreements with Argentina, Chile, Jamaica, and Panama. In the case of Panama, the initiative has identified 1) high potential for micro-grids with renewables and energy storage in remote communities that are home to 450,000 people and 2) significant regulatory and legal reforms that would be needed. This year it is working to reach framework agreements with Brazil, Peru, and Colombia and advance closer to its potential of \$100 billion in new public-private energy sector investments.

For the broad Indo-Pacific region, the Asia EDGE initiative seeks to grow sustainable and secure energy markets. Led by the State Department but involving seven additional agencies, Asia EDGE aims to strengthen the energy security of allies and

partners; create open and efficient energy markets; increase energy diversification and trading relationships; and expand energy access across the region.

“We’re helping Asian partner countries leapfrog over decades-old infrastructure and modernize their energy sectors by investing in smart grids, efficient technologies, and mobile apps for electricity payments,” said Mark Green, Administrator of the U.S. Agency for International Development (USAID). “These projects will require high-tech solutions, the kind that U.S. companies are uniquely placed to provide.”

Power Africa, meanwhile, was launched in 2013 to “add more than 30,000 megawatts (MW) of cleaner, more efficient electricity generation capacity and 60 million new home and business connections” in the sub-Saharan region. NEMA has participated in Power Africa’s Standards program to promote awareness and adoption of electrical safety practices and technical Standards for energy storage systems. Over the last six years, Power Africa “has helped facilitate the financial close of 121 private-sector power transactions that are generating (or expected to generate) 10,169 MW, of which 2,652 MW have been commissioned and are producing power.” Since 2017, the initiative has reallocated resources toward natural gas project development in addition to renewable generation and energy storage. ☯

NFPA to Develop Remote Inspection Standard



I have been appointed to a new National Fire Protection Association Technical Committee that will develop a new Standard for Remote Inspections (REI-AAA). This Standard will assist jurisdictions in adopting procedures of inspections that use current technologies, increase department efficiencies, and address security for data that is gathered in the process.

The idea was presented at the 2017 NFPA Annual Meeting by Jim Muir, Chief Building Official in Washington's Clark County. The NFPA Building Code Development Committee followed up with a white paper, *Conducting Remote Video Inspections*,¹ in 2018. The paper highlighted the need to use technology to efficiently manage time for the permit holders and the inspectors during the inspection. The paper identifies what criteria would be used in developing the rules, procedures, and policies for the data collected during the permitting, inspection, and construction process.

The proposal to the NFPA Standards Council was submitted and approved to establish requirements for the performance and use of remote methodologies to conduct inspections. The new Standard will address practices, technologies, and components that will make up these systems.

The applications of remote inspections will cover many aspects of the building process (building, electrical, fire, and other systems). Whether the inspection is a rough, framing, or re-inspect, the technology used should be recognized as appropriate and have standardized rules and guidelines for jurisdictions to accept as an appropriate method of inspection. The technical committee will develop rules that address the data as it is collected, managed, and archived, as cybersecurity will be necessary. Current applications involve live video feeds from the job site to the inspector's office. The contractor may use Skype or any other live platform that can store the images and also give the inspector the ability to direct the camera in the areas he or she would like to view. Drones have been used for aerial photography and viewing that eliminates the hazards of getting an inspector "up in the air" to view systems like PV, towers, and other rooftop systems.

The first meeting of the Technical Committee will be held in Seattle from August 20 to 22. Jim Muir will chair the committee, and Kevin Carr will be its NFPA staff liaison. ☎

¹ *Conducting Remote Video Inspections*, NFPA, August 2018, <https://www.nfpa.org/-/media/Files/White-papers/WhitePaperRVI.pdf>

New Guide Available for Evaluating Surge Protective Devices

Ann Brandstadter

Manager, Standards Publications and
Marketing, NEMA

NEMA SPD 1.1-2019 Part 1—Surge Protective Device Specification Guide for Low Voltage Power Distribution Systems is the first in a new series intended to guide the evaluation, specification, and use of surge protective devices (SPD) deployed in low-voltage power distribution system applications. It includes SPD ratings, a specification checklist, and information on surge current ratings, modes of protection, and general grounding practices.

NEMA SPD 1.1-2019 is available for \$64 in hard copy and electronic download.

New Standards and white papers:

NEMA UV P2-2018 Application Environments Exposure to Ultraviolet Light is available as an electronic download at no cost.

ANSI/NEMA SC 1-2019 American National Standard for Supplier Credentialing in Healthcare is available for \$84 in hard copy and electronic download.

NEMA C29.14a-2019 Composite Insulators Guy (Strain) Insulator Type is available for \$50 in hard copy and as an electronic download at no cost.

NEMA UTN P1-2019 Electric Utility Communications Networks is available as an electronic download at no cost. ☎

Book-a-Speaker



Steve Griffith, Industry Director, NEMA Transportation Systems Division, will participate on a panel titled “Using Technology and Product to Advance Safety: How Can Transportation Providers Use Hardware and Software Innovations to Make Micromobility and Our Streets Safer” on July 11 at the Lime Education and Safety Summit in San Francisco.



Patrick Hope, Executive Director of MITA, will give the keynote address, “Ensuring the Cybersecurity of Medical Imaging Equipment,” at the Association for Medical Imaging Management annual meeting July 24 in Denver. For more information, check out www.ahra.org.



NEMA Field Representative **Bryan Holland** will deliver the keynote address at the International Association of Electrical Inspectors Suncoast Division Seminar on July 27 in Tampa. To learn more, log on to www.iaei.org.

NEMA electroindustry experts are available to speak at your event. Need a speaker? Book a speaker at www.nema.org/book-a-speaker. 



Carolyn Hull, Manager, MITA’s Global Regulatory Standards, has been selected as one of three winners of the USNC’s 2019 IEC Young Professionals program. She will be a representative of the United States at the IEC 2019 General Meeting in October, in Shanghai, China.

Carolyn has been with MITA for just over a year. During that time, she has excelled in her grasp of the Standards development process and the role Standards play internationally. Congratulations, Carolyn! 



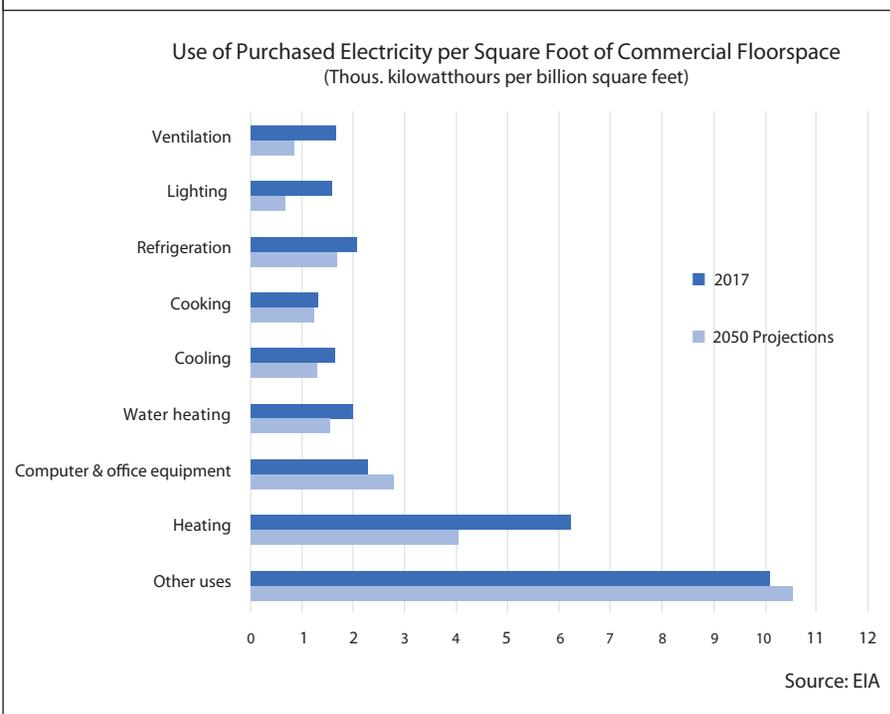
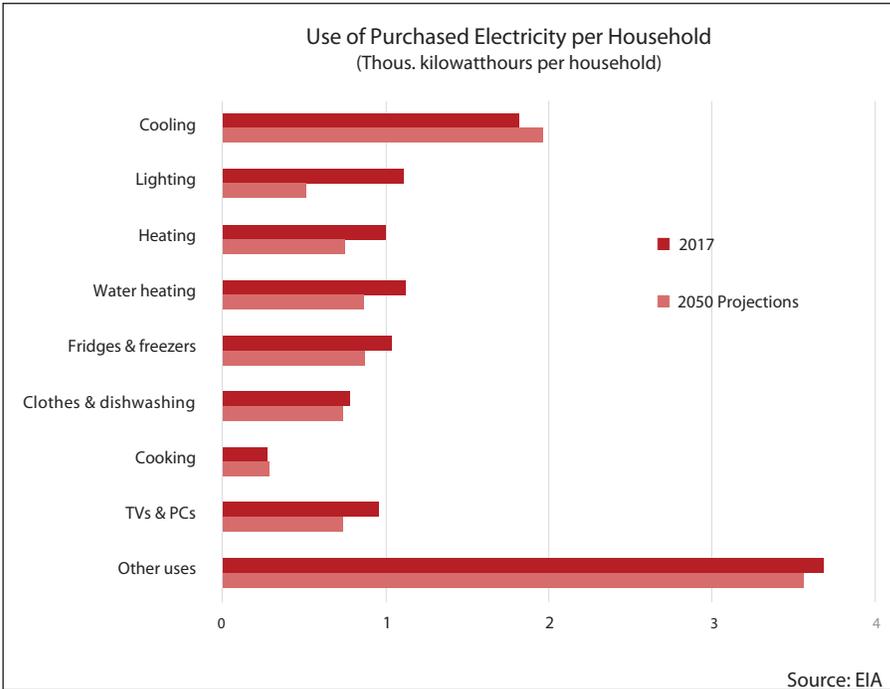
Megan A. Hayes

I AM NEMA

As Technical Director for Operations at NEMA, I’m responsible for managing and overseeing all NEMA codes and Standards activities, and there are many of them! When I started in Standards in 2000, I could not have predicted the career that I was beginning, and I’m so thankful to have had the opportunities that I’ve had through the years. I’ve come to realize that Standards are essential, from keeping us safe to ensuring that our products can communicate to providing consistency in measurement—without Standards, the world would be a much different place!

I’m one of the few boomerang employees at NEMA. I worked for the association from 2011 to 2017. I wanted to come back to NEMA because its mission is so essential, and the technical work that we do is critical. Standards development is currently at a crossroads between how we’ve always done things (based on paper) and how we can do things in the future. I’m excited to help lead NEMA through this transition and hopefully make our processes more logical and efficient along the way. 

Electrical Manufacturers Deliver Major Energy-Efficiency Solutions



Policymakers have established energy-efficiency Standards and building energy codes to reduce electricity consumption and the adverse externalities associated with electricity generation.

Over the next 30 years, the government projects a substantial reduction in electricity consumption by the residential and commercial building sectors.

The energy delivered to residential and commercial buildings, including electricity, natural gas, petroleum, and other fuels, is expected to grow 0.3 percent per year from 2017 to 2050 according to the U.S. Energy Information Administration’s *Annual Energy Outlook 2018*. That accounts for more than a quarter of total energy delivered in the United States.

As of the end of 2017, electricity consumption accounts for nearly 45 percent of energy use in residential buildings and 52 percent in commercial buildings. Over the next three decades, electricity consumption by the residential and commercial sectors is expected to increase nearly 16 percent to just shy of 11 quadrillion British thermal units (BTU). However, the amount of electricity consumption per household and per billion square feet of commercial space will decrease in most end-use categories. Why? Tighter energy-efficiency Standards and building energy codes.

According to EIA data, electricity consumption per household used by lighting is expected to fall by more than half. A similar trend is taking place in the commercial space. The adoption of high-efficiency light-emitting diodes (LED) is projected to result in a 56 percent decrease in electricity usage by lighting systems.

EIA forecasts electricity used for commercial HVAC equipment to drop by more than one-third between 2017 and 2050 because of increases in efficiency.

Building systems that help manage electricity use and an increase in energy-efficient products are helping to drive the trend. ☁

STOCKART

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ENDNOTES FROM THE **PRESIDENT**

Chances are you are reading this indoors. We spend almost our entire lives in buildings. Whether at home at work, learning in school, or recuperating at a hospital, buildings are integral to our lives. Consequently, NEMA and electrical manufacturers are working to make sure we are safe, healthy, and productive in those buildings. Here is a snapshot of some of the important work at NEMA to improve building performance:

Improving Code Enforcement with Augmented Reality

Building codes like the *National Electrical Code*® and the International Energy Conservation Code are updated every three years, and building inspectors are often asked to enforce 10 or more different codes. Because new information enters every three years, unsurprisingly, code violations are sometimes not discovered. A NEMA Strategic Initiative is exploring how to use augmented reality to give building inspectors heads-up information about specific code provisions, making their jobs easier and improving code compliance.

Creating Markets Through Building Performance Transparency

I would not buy a car without knowing its efficiency rating, but I cannot say I have been this vigilant in understanding my home's energy performance. (Largely thanks to my NEMA experience, I surely am more attentive now.) NEMA has successfully advocated for local energy benchmarking and labeling policies—now enacted in more than two dozen cities—that require buildings to measure and disclose their energy performance. These policies have resulted in hundreds of millions of dollars of energy-efficiency upgrades. Also, the High Performance Buildings Council promotes the adoption of technologies and systems that increase energy efficiency, safety, resilience, sustainability, productivity, and security in buildings. A companion Strategic Initiative is identifying gaps in existing building labels of different types, and we believe the use of measurable attributes of modern electrical technologies would mitigate these.

Electrifying Building Systems

In the 1950s and 1960s, the NEMA Living Better Electrically campaign issued approximately one million homeowners a Total Electric Award gold medallion for converting their homes from coal, gas, and oil to electric heating and appliances. The campaign focused on how much cleaner and less expensive electric heating and cooking is, in addition to the increased property value from electrifying one's home. Fast-forward 60 years and homeowners and building owners are once again pursuing electrification as a means to reduce emissions and save money. NEMA is leading the way by developing and promoting electric vehicle-ready building codes, advocating for electric heating adoption, and facilitating building-sited distributed energy resources communication and integration with the grid to improve reliability and reduce the cost of electricity.

I urge you to join NEMA in promoting the safe, efficient, and reliable buildings of the future. For more information about any of these activities, please contact Suzanne Alfano, NEMA Industry Director for Building Systems (suzanne.alfano@nema.org). To find out how to join NEMA, contact Vi Lilly, Membership Director (vi.lilly@nema.org). 📧

Kevin J. Cosgriff
NEMA President and CEO

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