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# AMERICA'S **ELECTRIFIED** FUTURE

#### November 3-4, 2021 PGA National Resort and Spa Palm Beach Gardens, Florida

Whether providing electric transportation solutions, almost completely electric homes, buildings that increase comfort and productivity, or delivering the power to serve new loads reliably, NEMA Members are on the cusp of a major expansion of possibilities. Join us at the 2021 NEMA Annual Meeting, where guest speakers from government and industry will help attendees capitalize on **America's Electrified Future**. Attendees will be introduced to the new NEMA President and CEO at this event and will recognize outgoing President and CEO Kevin J. Cosgriff.



NEMA President and CEO Kevin J. Cosgriff



www.nema.org/annual-meeting

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# electroindustry

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# **Solving the Energy Equation for Net-Zero Buildings**

Our lives unfold in buildings—Americans spend nearly 90 percent of their time indoors. So it's fitting to focus this issue of *electroindustry* on buildings—how do we make them healthier and more people-centric? More resilient and efficient? More sustainable?

There's significant progress being made in these areas, and it's urgently needed. Buildings account for 39 percent of total global carbon emissions.<sup>1</sup> And yet 30 percent of energy in buildings is wasted.<sup>2</sup> It's not just wasted energy, it's wasted human potential: JLL found that improving ventilation and thermal comfort boosts productivity by 5 percent.<sup>3</sup> One way or another, the U.S. must get to net-zero emissions by 2050. It's hard to imagine reaching net-zero emissions without net-zero buildings. And there's no way to realize net-zero buildings without transforming how buildings use electricity. The simple formula for a net-zero energy building is to add the energy a building consumes and subtract the energy it generates on-site. If the building generates more energy than it consumes, it's net-zero.

Today, the equation for many buildings doesn't add up. There's too little on-site generation, and there's not enough passive or active energy management. It doesn't have to be this way—the technology exists to make the net-zero math work.

On the electricity *generation* side, microgrids make it possible for all kinds of buildings to generate enough clean electricity to power not just one but dozens of buildings. That alone can bring many buildings to net-zero energy—but we shouldn't stop there.

On the *consumption* side, there are many ways to shrink the total. Passive options, like high-efficiency lighting and HVAC systems, certainly improve the math. But another significant opportunity is to attack that 30 percent energy waste figure with active energy management. Internet of Things–enabled building management systems are instrumental to this objective. They detect and eliminate previously invisible energy waste: leaky valves, lights left on all night, heating and cooling systems fighting each other. But that's not the whole story. When our buildings are infused with digital intelligence, they can anticipate our needs. They empower us to control our environmental conditions while keeping us informed of indoor air quality and occupancy status in real time. Simply stated, digitalization enables healthier, safer buildings. Ultimately, these digital buildings meet more of our needs—for our health, our desire for connection (and connectivity), and our comfort. And they do so while meeting the needs of our planet.

This is why I'm bullish on the future of buildings. Technology exists today—all we need is a change of mentality. And this issue will drive the conversations to make that change happen.

Annette Kay Clayton Chair, NEMA Board of Governors

<sup>1</sup> U.S. Green Building Council, 2017

<sup>2</sup> U.S. Environmental Protection Agency

<sup>3</sup> JLL, 2016

#### Kevin Lippert

President, United States National Committee

# U.S. Industry Should Engage with the IEC

Most people don't know that the International Electrotechnical Commission (IEC) has some origins in the United States. At the World's Fair in St. Louis in 1904, the International Electrical Congress met, and several exhibits demonstrated the "new" phenomenon of electricity. However, many variations were already present within the displays: alternating current (AC), direct current (DC), single phase, two phase, and three phase.

Because of the different voltages and frequencies, this power was accessed through many different plugs and connection configurations. As a result, the Congress proposed a permanent international group to begin standardization in this area. The resulting IEC held its first meeting in 1906.

From its humble beginnings with 14 countries represented, the IEC has evolved into a large organization with 89 Member countries. The United States National Committee (USNC), with more than 4,000 participants contributing to IEC work, coordinates U.S. participation in the commission. These participants represent various communities, including government, consumer, academia, and industry. Their work focuses on the areas of Standards and conformity assessment.

Numerous NEMA Member companies support their employees' participation in IEC activities. You might ask yourself—"Why?"

Over the past 30 years, NEMA Product Groups have continued to grow their participation in the IEC and USNC. Many NEMA Members have a global presence and value the ability to ship the same product design for installation anywhere in the world. The goal of "one Standard, one test, accepted everywhere" can be achieved through IEC Standards, and U.S. industry should have an active role in the development of those Standards.

Several NEMA product groups have gone through Standards harmonization activities to align requirements between historical ANSI/NEMA/UL Standards and IEC. More and more products have become "Listed" by certification agencies to IEC Standards. Reducing region-specific requirements and embracing challenges and opportunities reflective of a global marketplace can make business sense. A prime example of this is cybersecurity. As we learned from recent headlines, there are no geographical boundaries to cyber threats. That is why it is vital to approach standardization globally and actively participate in IEC efforts.

I have been a Member of an IEC Governance Review Task Force over the past year. This select group meets regularly to review the Statutes and Rules of Procedure (SRoP), which specify how to govern the IEC. Through regular consultation with select experienced Members of the USNC, I have been able to identify critical U.S. positions to address in the proposed revisions to the SRoP. This is a "once-in-a-generation" opportunity, and the U.S. has been influential in setting up the governance of the IEC to promptly and properly address future challenges that await the Standards and conformity assessment communities. It has also made sure to include major U.S. positions.

Conformity assessment (CA) of electrical products continues to grow in importance, too. Perfect Standards, if they aren't followed, do no good. The IEC offers CA "schemes" to assist manufacturers in determining that their products conform to IEC Standards' requirements. Manufacturers that utilize certification bodies participating in these CA schemes can "test once" and benefit from having the other Members of the scheme accept those test results without requiring unnecessary redundant testing. The U.S. is an active participant in the IEC Conformity Assessment Board (CAB). Additionally, the U.S. presently serves as the vice chair of the International Electrotechnical Commission for Electrical Equipment, assuming the chair role in 2022.

I encourage other NEMA Members to consider becoming engaged with—or increasing their present engagement with—the IEC and USNC. We can all work together to align global requirements to speed the digital transformation, ensure safe installation and use of our products, combat ever-growing threats from malicious actors, and address threats to our environment. ©

Kevin Lippert is the Manager of Codes & Standards at Eaton Corporation.

Kevin Lippert, President, United

Kevin Lippert, President, United States National Committee

### **Council Focuses on Supply Chain and Managing Materials**



Stacy Tatman, Senior Manager, Government Relations and Legal Analysis, NEMA NEMA has formed a new Materials Management Council to address the myriad issues related to materials management and associated supply chain issues.

For several months, NEMA Members have been sharing their concerns about supply chain disruptions and increasing regulatory pressure. Shipping delays, restrictive tariffs, chemical bans, and of course the global pandemic are just a few of the natural and manmade hindrances creating vulnerabilities in companies' ability to maintain access to parts, supplies, and materials.

These difficulties highlight the benefits of improved materials management. Today's businesses manage complex, global, nonlinear, multitiered supply chains. A transparent and diversified supply chain increases resiliency, robustness, and adaptability when disruption occurs.

The Materials Management Council's primary activities cover critical minerals sourcing and diversification, chemicals management, packaging, labeling, and extended producer responsibility. The Council provides a forum for discussion to foster collaborative solution-finding efforts. The Council will help Members manage these issues through awareness, support, and advocacy.

#### AWARENESS

The Council increases Member awareness of emerging issues by keeping current with breaking developments, staying ahead of trends, and interpreting policy impacts.

#### SUPPORT

The Council helps Members resist and recover from supply chain disruptions by providing support via practical tools and collaborative forums to increase supply chain transparency and sourcing diversity.

#### ADVOCACY

The Council will engage with legislators and regulators to implement both reasonable, science-based solutions and industry-led programs.

To join or get more information about the Council, contact Kirk Anderson (kirk.anderson@nema.org) and Stacy Tatman (stacy.tatman@nema.org). •

#### **Healthcare Facilities Council Update**

In other NEMA Council news, the Healthcare Facilities Council has worked diligently over the past six months to set the Council up for success. During its last meeting, the Council revised its scope to include home healthcare and reviewed and approved its strategic plan and marketing plan, also created the Healthcare Codes & Standards Review Committee, which is focused on healthcare codes and Standards such as NFPA 99, Health Care Facilities Code; NFPA 101, Life Safety Code; and the Facility Guidelines Institute (FGI) Guidelines for Design and Construction. The Committee will actively participate in codes and Standards proposal development, engagement, and monitoring. For more information, contact Building Systems Division Industry Director Marc Neufcourt at marc.neufcourt@nema.org. @

FUTURE OF BUILDINGS—FEATURE

# How Building Systems Will Shape New Office Space



Over the last year, the office has been redefined. And we have quickly learned to work remotely. Now we are returning to buildings, and our expectations have shifted. We are re-evaluating how space is used. Office space has changed over the years to adapt to different collaboration and management styles. The most recent shift has moved us from a mix of enclosed offices and cubicles to open space and large pods. With a need for rapid response and risk reduction, we now see a need for flexible space and a hybrid work environment. New technology enables building owners and occupants to meet these demands. Through systems integration it will be possible to ensure that conference rooms and workspaces are automatically set for the desired work environment upon reservation. For instance, if the meeting includes a presentation, the room can be set to a dimmer light with any audio-visual equipment powered on and ready to go. Building managers can also arrange for the temperature to be automatically adjusted based on occupancy.



Maria Marks, National Business Development Manager, Siemens

#### **New Customer Requirements**

There is an increased focus on sustainability and healthy buildings. We are seeing an increase in requirements for net-zero buildings. A net-zero building uses the same amount of energy that it produces each year. But this shift does not come easily. Owners, consultants, and contractors are using building systems and green energy sources to meet these demanding requirements. Wind, solar energy, and energy storage systems such as lithium-ion batteries are examples of common energy solutions.

Building systems are also increasingly designed with a focus on reducing energy consumption. For example, motion detectors automatically turn off lights if the space is unused. Building management systems can be programmed to reach the desired heating/cooling setpoints in an energy-efficient manner rather than having systems running continuously or occupants reacting to temperature extremes.

There is also a renewed focus on healthy environments, which are known to promote better work conditions. Although this is not a new concept, recent challenges have highlighted indoor air quality. It is well known that conditioning spaces reduces health risks. It's important to examine building air quality from a holistic standpoint and not only in isolation—this includes the air brought into the building, how it's conditioned, what temperature and humidity setpoints are programmed for each space, etc. By using dedicated approaches to indoor air quality, one can protect people's health and safety inside the building and increase productivity.



However, a careful balance needs to take place, as simply increasing the rate of air changes may increase building energy consumption. Today's building management systems can use sensors to set the appropriate air exchange rate while balancing energy concerns. These goals may be achieved through dedicated approaches to indoor air quality.

# New Technology in Building Systems that Will Help Meet New Demands

Building systems have advanced with the use of increased sensors and new technology. For instance, some lighting systems now utilize Power over Ethernet (PoE) technology. Ethernet has become a standard cabling method for diverse building systems. Even NFPA 72 has a section on a shared Class N (Ethernet) network.

By integrating building systems to create a smart building on a converged network, it's possible to leverage occupancy data from different sensors and systems to achieve energy efficiency and comfort for the occupants. This also eliminates redundancies of occupancy sensors and switches, and ultimately reduces the cost of ownership. With an integrated building management system, a building can now set the temperature in a space or call an elevator when an employee uses their access card to enter the lobby. Or in the event of an emergency, the operator may see the alarm shown on a graphical map, and the associated security cameras will be activated to show the live feed.

#### Emerging Technology Committee Activities

The NEMA SB Emerging Technology Committee is exploring the concept of a Life Safety Knowledge Portal to enhance lifesaving responses while reducing risks to first responders and building occupants. Conceptually, the portal will store building data and permit access to it to essential first responders during an emergency.

Building systems have access to a remarkable quantity of data, including smoke detector status, security cameras, in-building temperature gradients, emergency calls from occupants, and more. If presented clearly and accessed in real time, this information could enhance lifesaving responses while reducing risks to first responders and building occupants.



In April, key Members of the industry attended a workshop. These experts included first responders, representatives from the National Institute of Standards and Technology (NIST) and Institute of Electrical and Electronics Engineers (IEEE), and others. We posed questions including:

- What information would be of most use to first responders?
- How could this data be securely stored and easily accessed?
- Can it be connected to the Next Generation 911 technology?

It is important to start asking these questions now, as it may take a code cycle to formalize the concept and structure. Work has already begun through recent fire alarm code updates. The 2022 edition of NFPA 72 permits remote access within parameters and adds a framework to follow for cybersecurity protection. Cybersecurity will remain an ongoing project discussion for the design, installation, ongoing maintenance, and use of the systems. Additionally, it will be necessary to define the format for data management across all building systems. This includes capturing and storing the data from these diverse systems so that it is available when needed. One of the challenges we will face is deciphering the data, as the tags used for the metadata across different building systems may not match.

As we look to the future, technology will continue to play a role in creating an office space that is comfortable, accessible, and an extension of how we work and live. By sharing data across the diverse building systems, owners will be able to meet sustainability requirements and operating budgets. And in the event of an emergency, the building will be a resource to aid the first responders. A smart building is truly a safe building. •

Maria Marks has been active in the fire life safety and security industry for more than 25 years. With a focus on the building design and construction industry, she promotes intelligent infrastructure to create safe smart buildings and communities.

# **The Future of Buildings:** The Non-Medical Response to a Pandemic



Fred Ashton, Senior Economist, NEMA

Since the onset of the COVID-19 pandemic, the global medical community hurried to secure medical equipment, improve therapies, and develop vaccines to prevent the spread of the virus. However, part of the long-term strategy to mitigate virus transmission could come from outside the medical community. Discussions among architects, city planners, original equipment manufacturers, and the medical community are fluid. Still, themes surrounding building design, construction, and technology are an integral part of the solution in limiting the adverse impact of future pandemics.

As businesses began to reopen following the initial economic lockdowns, offices and factory floor spaces were reconfigured to satisfy social distancing requirements. These measures often reduced productivity and were both resource-intensive and expensive to implement. Moreover, building managers, architects, and designers understood that these quick fixes were only stopgap measures likely ineffective against future virus spread. The Centers for Disease Control and Prevention reported that COVID-19 is transmitted directly by inhaling airborne droplets and indirectly by touching infected surfaces, leaving densely populated areas such as New York City vulnerable to high rates of infection.

#### **Expand Horizontally**

To address the density problem, Professor of Architecture and Urban Planning Naglaa Megahed and Professor of Ophthalmology Ehab Ghoneim, both of Port Said University in Egypt, postulate that city planners and architects should consider expanding horizontally, rather than vertically, while emphasizing the need for more open spaces.



The authors believe that low-rise structures could become normalized to relieve density and "reduce contact with everything in multi-story buildings such as elevators, elevator buttons, door handles, and surfaces."

The idea of horizontal design may be something to consider for future construction, but what can be done to mitigate virus spread in the existing building stock? Ventilation has become a major focus for building managers in the effort to retrofit buildings to help alleviate the health risks of COVID-19.

Bob Tita of The Wall Street Journal wrote:

The pandemic is challenging long-held conventions for offices to be cool, dry, shaded from direct sunlight and mostly sealed off from outside air. Researchers say those conditions can help spread and sustain the virus, prompting manufacturers of heating, ventilation, and air-conditioning equipment to alter their products and strategies. Currently, most HVAC systems are not designed to filter out viruses and generally recirculate air within the building. The Chartered Institution of Building Services Engineers (CIBSE) suggests that "any ventilation or air conditioning system ... should now be set up to run on full outside air where this is possible."

#### **HVAC Systems for Retrofits**

Remotely connected HVAC control systems are receiving greater attention as building managers consider retrofitting existing systems. An article from *Contracting Businesses* explains how these systems give facility managers "operational visibility and control in order to adjust HVAC equipment performance based on occupancy or environmental conditions." They also enable "database configuration and troubleshooting or root-cause analysis as needed, and visibility into performance dashboards to assess energy consumption ... without the need to physically be on site."

Additionally, the article states, the systems use machine learning and artificial intelligence to apply predictive maintenance, allowing "contractors and service technicians [to] resolve issues and make adjustments before building owners are even aware there is a problem."

#### Lighting Systems to Fight Infection Spread

Lighting equipment manufacturers have also been quick to respond with lighting systems utilizing Ultraviolet C (UV-C) to combat the spread of COVID-19. According to a recent report published by consulting firm Guidehouse, lamps and drivers using UV-C "emit a wavelength within the 200-280 nm that has been proven to disinfect water, surfaces, and air by breaking down viruses."

An article published in *Environment International* proposed another lighting strategy that was adopted during the tuberculosis outbreak in the 1980s known as the "upper-room" system. This system is one in which "lamps are placed in the upper part of the room, either on the walls or mounted on the ceiling, directing the UV light into the upper zone with louvers and limiting UV exposure in the occupied space." This design helps alleviate the potential health risks associated with UV-C or germicidal ultraviolet (GUV) light while limiting the spread of viruses in poorly ventilated areas. The authors note that although no data are available on



the effectiveness of this strategy related to COVID-19, data for other coronaviruses suggest it is "highly likely that it is susceptible to UV-C."

The same article outlines the potential for the combination of GUV and HVAC systems called "induct" GUV. This strategy focuses on "disinfecting contaminated extracts or in cases where it is not possible to stop recirculation of ventilation flows." Both the "upper-room" and "in-duct" strategies have been approved by the U.S. Centers for Disease Control (CDC) for controlling tuberculosis transmission.

#### **IoT Technology Tracking**

In conjunction with lighting, upgraded HVAC systems, and building design, emerging technologies like the Internet of Things (IoT) are poised to be leaders in safeguarding workplaces and public spaces from the spread of COVID-19, according to a piece written by technology consulting firm Cognizant.

IoT technology can be used to track physical distance, human temperature, restroom hygiene, and even indoor air quality. The use of sensors, cameras, and data analytics can help to ensure the safety of the building and those occupying it and will likely become a common practice in building retrofits and new construction.

An example of such technology is the Nexos Intelligent Disinfection system, which received IoT World Today's COVID-19 IoT Innovation Award. The system uses "technology that can disinfect individual rooms or entire offices while protecting occupants" using UV-C lighting. It relies on "a smart lock on a given room [that] can display warnings to tenants not to enter. If a door manages to open mid-cycle, a triggered doorcontact sensor could deactivate the system."

#### **Utilizing Flexible Design**

Infrastructure that is movable, multipurpose, and adaptable to a changing environment, known as flexible design, could become an integral part of building design.

According to an article in *The Los Angeles Times*, "Flexible components like movable walls can help buildings adapt to needs. A hospital, for instance, could shift or enlarge its spaces for treatment and quarantine, or open up new spaces to accommodate ICU beds." Offices can make similar transformations by subdividing open office areas into individual workspaces.

Decades of urbanization and the free and rapid movement of people across the globe created conditions ideal for a pandemic. COVID-19 vaccines help lessen the virus's impact, but additional investment will be required to avert or mitigate the next highly contagious viral outbreak.

This brief review of early post-pandemic literature, while by no means exhaustive, suggests that building designs are likely to address the need for viral containment by incorporating IoT technology, touchless interfaces, reimagined spatial configurations, flexible design, antiviral lighting, and upgraded HVAC systems.

#### Speaking of IoT ...



NEMA initiated a Strategic Initiative in 2020 to provide NEMA Members with a repository of quantifiable, monetized value of IoT products/systems and perspectives from end users that can be used in product design and marketing. To read the resources that were developed from that initiative, please visit www.nema.org/si-reports.

# **Building Safety:**

# A Key to Safe Occupancy

As our country initiates a return to normal and workers return Ato the office, building owners and managers have shifted their focus to readying their building systems for life safety. Those systems need to be at their peak performance.

People have new safety concerns and questions. They wonder if building owners have maintained and cleaned the heating, ventilation, and air conditioning (HVAC) system and serviced the fire alarm and mass notification systems. Office workers are now more aware and curious about the systems in a building that will ensure their safety, health, productivity, and peace of mind.

Owners and facility managers also have new questions and concerns:

- How will service technicians coming into the building be protected?
- How will service providers ensure their staff does not contaminate the building and equipment they service?
- Are there new ways to perform maintenance or inspections remotely to limit risk exposure?

#### **Cleaning and Maintenance**

As owners and occupants become more aware of their surroundings within a building, it becomes more common to think about how systems and furnishings are cleaned and maintained. There are national codes and Standards on how to inspect, test, and maintain life safety systems. For example, the National Fire Protection Association (NFPA) has Standards on fire alarm, carbon monoxide, sprinkler, mass notification, and many other life safety systems. Those Standards specify how often systems should be visually inspected and functionally tested—and how often to replace specific components and equipment like batteries and smoke alarms.

When it comes to cleaning equipment, consideration has to be given to what types of chemicals may clean and disinfect without inadvertently causing harm to equipment, shortening the equipment's life expectancy, or in some cases, impeding the operation of the equipment. If you are using a chemical or process to clean and disinfect equipment, ask the manufacturer if it will harm the equipment or change its operation. NEMA GD 4-2020 *COVID-19 Cleaning* 



Rodger Reiswig, Vice President of Industry Relations, Johnson Controls and Disinfecting Guidance for Electrical Equipment is a good resource and provides specific guidance to answer common questions on maintaining cleanliness while preserving the functionality and integrity of electrical equipment.

#### **Start Fresh**

For facility managers and building owners, recurring questions include "What if I missed a periodic inspection or maintenance during the shutdown?" and "What if we missed multiple inspections and are now off our typical maintenance cycles?" Unfortunately, we cannot go back in time and inspect and maintain equipment that was not accessible during the shutdown. In these situations, the best thing to do is to start fresh and handle all of the required inspections and maintenance items that need to be completed now. Building owners and facility managers should document what systems they have, get them evaluated by the authorized service providers, and complete the maintenance and inspection reports.

There is demand for inspection and maintenance of building systems today, and the lead time for an authorized service provider may be lengthy. Building owners and facility managers can perform some of the work themselves. For example, NFPA has mandated visual inspections that are the "hands in the pockets" type and do not require you to touch anything. For instance, an inspector should visually observe the batteries' condition for a fire alarm system and evaluate if they are corroded, bulging, or leaking. Smoke detectors, manual pull stations, and audible and visual appliances need to be visually inspected to ensure they are still appropriately mounted and not painted over, blocked, or vandalized.

Building owners and facility managers should work with their service providers to create a plan to get the various systems back on track for servicing and inspection. A question to ask is, "Are there any items on the maintenance and inspection side that I can take care of to help get the inspections done quicker?"

#### **Remodel or Rearrange?**

Many building owners or facility managers find that they need to remodel or rearrange their floorplans to change cubicles and designated work areas. Walls might need to be moved, spacing partitions may need to be added, etc. A life safety expert should evaluate any modifications to walls, partitions, etc., to review if the modifications could impact the performance of a system. For example, if a wall or partition is added, will it change the airflow and affect the operation of a smoke detector?

If remodeling and renovation is going to occur, this would be a great time to consult with a service provider to see if changes to equipment can be incorporated into the renovation. There may be economical advantages to performing a system upgrade (full or partial) during the process. Many authorities having jurisdiction (AHJs) will allow for partial upgrade of life safety systems or allow for a long-term plan to upgrade these systems. As always, consult with the local AHJ in the jurisdiction of the building to glean their input.

Upgrading or changing out older systems can have a positive financial impact. Newer equipment for almost all building life safety systems uses state-of-the-art technology, advances that have come about in recent years to help building owners and facility managers interface with their systems. Apps on tablets and phones allow users to interface with systems and gain information quickly and intuitively. Newer systems can inform building owners and facility managers of upcoming maintenance and provide reports of events that occurred, and in some cases, help prevent unwanted service issues such as midnight calls.

#### **Data Monitoring**

Newer systems can also transmit information off-site to building owners and facility managers to inform them of status changes and alert them when action is needed.

A supervising station typically monitors life safety systems to transmit information about security, fire, environmental, and other issues off-site to operators that are staffed continually. They, in turn, will inform police, firefighters, service providers, and users as to what has transpired. With the integration of these systems with the internet or dedicated networks, users can verify system performance and address some issues with staff on-site without having to travel to the facility.

Building owners and facility managers need to understand the potential of their systems and stay abreast of new building system technology. As systems become more interconnected, opportunities will arise to improve building safety while reducing operational costs—a win-win for building occupants and owners.

In his global role, Rodger Reiswig is instrumental in championing life safety for people worldwide through his efforts to improve fire protection codes and Standards and promote their adoption and enforcement.

# **Benefits of Stored Energy Performance Data**

The COVID-19 pandemic exacerbated a trend in the commercial buildings market that existed before but was not front and center. With office space under major reconfiguration pressure, building managers and owners will implement new technologies that would improve profitability and increase flexibility. Other types of commercial buildings have similar needs.

One such technology is electrical energy submetering. Submeters installed downstream from the master utility meter allow monitoring separately relevant components of the entire electrical building structure. Storing their energy consumption data is like having "the transcripts of a trial" says a recently published white paper by the NEMA Electrical Submeter Section. Titled *Demonstrated Benefits of Stored Energy Performance Data*, NEMA ESM3-2021 goes into more detail describing specific benefits building owners may derive by making informed decisions regarding building operations and energy management.

One of the first benefits of storing energy data is **benchmarking**, the ability to compare a set of energy consumption data to itself, peer buildings, established norms, or other data. To get the most benefits out of this effort, organizations should develop a benchmarking plan and stick to it. An EPA ENERGY STAR\* program developed a benchmarking fact sheet for 35,000 buildings in a three-year program, demonstrating significant energy savings.

**Forecasting and budgeting** are two linked benefits building owners could use to their advantage. Understanding the specific energy performance and history of any functional subsystem of the building electrical system's could be used to accurately model the entire system behavior and predict its related costs. The advent of **demand response (DR)** submetering allows the building manager to use historical data to decide what subsystems could be shed without affecting occupants' comfort and operational stability.



**Remote monitoring** is another option increasingly used by building managers to troubleshoot issues from afar. By monitoring the data trends, they can implement predictive maintenance, one of the most effective ways of keeping the building running without significant interruptions.

Billing tenants is, in most cases, done today by dividing the utility bill into tenant shares based on criteria such as unit occupancy or surface area. By replacing these methods with individual tenant submeter billing, building owners are effectively passing some of the energy-saving responsibility to tenants. Studies show that such savings are not trivial. One study showed electrical energy consumption reduced by 25 percent after switching to individual billing.

Finally, add this flow of relevant data about a building behavior to the new crop of building management systems (BMS) equipped with state-of-the-art artificial intelligence, and the results are expected to blossom in energy savings, tenant comfort, increased reliability, and sustainability.



Andrei Moldoveanu, Senior Program Manager, NEMA

# **Fixing the Leaky Energy Faucet**



Painting by Pekka Hakkarainen

Pekka Hakkarainen, Vice President, Lutron Electronics; Harold Jepsen, Vice President of Standards & Industry Relations, Legrand Lighting and Building Control Systems divisions; Andrew Kriegman, Executive Vice President, Leviton Manufacturing



Pekka Hakkarainen



Harold Jepse



Today's energy-efficient buildings rely on well-planned mechanical heating, cooling, and ventilation systems; tight and well-insulated building envelopes; and lighting with carefully controlled solid-state illumination technology. Each building system reduces energy loss and judiciously manages energy-consuming loads that support building operation and occupant comfort.

Yet buildings also come thoughtfully constructed with hundreds of energy spigots, ready to serve up energy at the whim and want of thirsty electrical devices and equipment. It's as if all work to carefully manage energy can be circumvented, with ready connections to a myriad of leaky energy faucets.

Each time an uncomfortable bend under a desk finds an electrical receptacle to "plug in," a potential leaky energy faucet is connected to a building's self-service fountain. How can buildings aim for efficiency or keep energy use targets while electrical energy siphons abound? One answer is the managed control of electrical receptacles or outlets. Known as "automatic receptacle control" in the energy-efficiency codes or commonly "plug load control" in the trade, it is the simple ability to shut off power to electrical receptacles when plug-in devices are not needed.

#### Adoption of Automatic Receptacle Controls

Automatic control of electrical receptacles is not a new concept, as controllable advanced power strips have been used to manage plug-in device energy waste for many years. Only within the past 10 years have automatic receptacle controls come mainstream to commercial buildings infrastructure, with the 2010 version of the ANSI/ASHRAE/IES 90.1 energyefficiency Standard. The adoption soon followed the 90.1 Standard in California's 2013 Title 24, Part 6 energy code. Since the codes do not permit plug-in controllable power strips, the electrical industry has many controlled receptacle products to match what the codes require. Some products control receptacles from the origination of the circuit feed in or close by the panel board. Some control receptacles are at the branch circuit level and are distributed out in the rooms and spaces they serve. Others are self-contained receptacles that can easily replace an existing noncontrolled receptacle and receive a control signal to shut off wirelessly, so no added wiring is necessary.

Yet in some building design and construction circles, automatic receptacle control is not well understood, and there is skepticism regarding its benefits and effectiveness. Indeed, the skepticism has turned into objections to overreaching code mandates without benefits, and claims they result in safety hazards when people plug in extension cords to keep their devices or appliances powered. An energy research group recently conducted an informal survey of electrical building actors to understand automatic receptacle control perception. It confirmed the skepticism and misunderstanding in the industry of automatic receptacle control use in buildings.

New and existing commercial buildings continue a downward energy use trend with fewer heating and cooling losses, more efficient lighting systems, and improved operating efficiencies for heating and air conditioning systems. However, according to the U.S. Energy Information Administration, energy use by plug and process loads is expected to grow for the foreseeable future. This has prompted the Department of Energy's Better Buildings program to create a Plug and Process Load Technology Research team to create energy reduction strategies.

#### **Identifying Markings**

Automatically controlled receptacles are identified by clear markings on the electrical outlets as required by the *National Electrical Code*<sup>®</sup> section 406.3(E). Controlled plug-in receptacles will have the word "controlled" along with the universally recognized on/ off power symbol.

Outlets with these markings automatically turn off or remove power when no one is detected in the room or as scheduled by an automatic time switch or similar controlling system. Often, room occupancy detection cost-effectively piggybacks on controls already installed for lighting controls.



#### **FEATURE**—FUTURE OF BUILDINGS



This automatic shutoff stops power to electrical devices not needed when occupants are not in the room. These unneeded loads could be display monitors, printers, task lighting, space heaters, fans, audio/ video equipment, and many other devices we plug in at our desks. Automatically controlled receptacles are not the place to plug in computers, medical devices, refrigerators, shared network printers, or uninterruptible power supplies. Such devices requiring constant power must be plugged into uncontrolled receptacles.

Installation of automatic receptacle controls required by energy-efficiency codes is limited to commercial building rooms such as private offices, classrooms, breakrooms, copy rooms, conference rooms, guestrooms (California only), and individual workstations (like in open office furniture). The energy code provision requires at least 50 percent of the receptacles in these rooms to be automatically controlled, leaving the other 50 percent of the receptacles to remain under constant power.

When commercial building projects do not show modular furniture on the construction plans, at least 25 percent of the branch circuit feeders installed to power future modular furniture must also be automatically controlled. This ensures the modular furniture power system will have access to a controlled circuit for receptacle control when the furniture is installed.

Most energy-efficiency codes require that a controlled receptacle be next to or within a specific distance from an uncontrolled receptacle. This prevents a safety concern with the use of extension cords when either a controlled or uncontrolled receptacle is desired for use, as either receptacle would be within reach.

#### **Saving Energy**

Researchers have conducted studies illustrating the energy savings achieved by automatic receptacle controls. A study by the Minnesota Department of Commerce's Division of Energy Resources in October 2016 found that using occupancy sensor-based control of receptacles yielded a 21.7 percent average energy savings. An August 2016 report from San Diego Gas & Electric's emerging technology program indicated average energy savings of 19.9 percent from plug load control technology in office buildings. Other studies and reports have shown similar findings on energy savings achieved by automatic receptacle control strategies over the past 10 years. Another factor in a successful automatic receptacle control program is end-user education. Suppose a user is not familiar with the controlled receptacle markings or notices them on receptacles under the desk. In that case, they may not understand the energy-saving function the controlled receptacles provide. This can cause occupants frustration when they plug in a device, like a computer, that is not intended to be controlled.

However, suppose they understand the difference, the function, and the correct device to plug into the right receptacle. In that case, they will play a key part in automatic receptacle control success and in the energyefficient operation of the building. In a sense, they will participate in supporting the building's energyefficiency success.

#### **To Find Out More**

More information is available from NEMA Members that manufacture automatic receptacle control products and by visiting the U.S. Department of Energy's Better Buildings website. Additionally, good education materials for automatic receptacle controls (plug load controls) can be found through the Lighting Controls Association website with online training offered by the association's Education Express program at www.lightingcontrolsassociation.org.

So, before an energy faucet is plugged into a receptacle, take a closer look for the automatic controlled receptacle markings. Help play a part in saving energy, even just a leaky drip. •

### Section Is Energy Aware

The NEMA Residential and Commercial Controls Section (BS-RC) is working on a project to streamline and realign its Energy Aware program with the ENERGY STAR® program for smart thermostats. The objective of the project is to increase brand awareness while reducing redundant compliance and the cost of participation. The Section is also exploring an opportunity to integrate Climate Talk Alliance Standards into the NEMA Standards portfolio. For more information, contact Building Systems Division Industry Director Marc Neufcourt at marc.neufcourt@nema.org. Director of Regulatory Affairs, NEMA

### DOE Proposes to Revise the Process Improvement Rule (Again)

The Department of Energy (DOE) recently published proposed modifications to its Process Improvement Rule of February 2020. The proposal responds to a Memorandum from the White House Chief of Staff directing agencies to review several rulemaking outcomes from the previous Administration.

Before issuance of the February 2020 rule, the National Electrical Manufacturers Association (NEMA) and other trade associations argued the original Process Improvement Rule of 1996 was sorely out of date, and its guidance had been interpreted and reinterpreted so many times it was no longer relevant. A practice of "energysavings-at-all-costs" seemed to be in effect, ignorant of diminishing returns on mature product Standards. The February 2020 Rule made several important changes, including making the process rule's provisions mandatory, finalizing test procedures ahead of new proposed Standards, increasing transparency, and encouraging rapid assessment of previous rulemaking conclusions (aka "quick look").

New DOE leadership in the Biden Administration is seeking to overturn the provisions of the February 2020 rule without considering its benefits for the Agency itself.

As required by the Energy Policy and Conservation Act, Standards must be "economically feasible" and "technologically justified." DOE rulemakings entail the investment of significant staff time and financial resources to determine the positive and negative impacts of a range of potential Standards levels. The resulting analytical reviews then assess the best point at which to strike the balance of positive energy savings versus negative national impacts. Critics of the February 2020 Process Rule imply that any energy saved or any energy consumption reduced is sufficient to justify tighter regulations for that sector. However, it is worth remembering that most proponents of energy-savings-atall-costs bear little to no stake or burden in the development or implementation of those Standards. A central purpose of the Process Rule is to reduce inefficient use of government resources and prevent the undue burden of its regulations. Like all agencies, DOE must prioritize its resources and is obliged to apply them where they can provide the most benefit. The simple "quick look" is an excellent tool to allow DOE to assess whether factors such as technological breakthroughs, market transformation, or other changes to market dynamics have occurred that might warrant deeper investigation by DOE analysts. In contrast, where little or no change in the factors that determined previous conclusions have taken place there would be little benefit from a more thorough investigation.

NEMA supports DOE efforts to implement congressional intent to improve the energy efficiency of appliances, products, and systems. Further, NEMA believes DOE can and should responsibly utilize as many tools as possible to accurately and reasonably justify where public resources should be applied. The Process Improvement Rule of February 2020 provides many such tools and should not be nullified, so DOE can effectively review and revise regulations promptly and wisely.

#### **CODES & STANDARDS**

#### **Big Changes Are Coming for International Energy Conservation Code Development**

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fter the National Electrical Code®, the International Energy Conservation Code (IECC), published by the International Code Council (ICC), is one of the most important codes to NEMA Members. First published in 1998, it is used widely throughout the United States, California being a notable exception since it has its own Title 24 Energy Code. The IECC has been updated every three years through the "governmental consensus" process that other codes such as the Building, Fire, and Residential codes published by ICC also use. In this process, the draft code language is developed through two public hearings in which all interested parties participate. Still, the final code language is voted on only by governmental Members from jurisdictions.

After the 2021 IECC was finalized, some parties objected to the outcome based on irregularities in the governmental voting process before publication. Most of the voting was online within the two weeks after the second hearing, and some of the outcomes were different from the in-person voting at the hearings. The same parties also disagreed with some new requirements in the 2021 IECC for electric-vehicle ready spaces and building electrification. They contended that these two items were not related to energy conservation and thus were outside the scope of the IECC.

After much consideration and several public appeal meetings, the ICC Board of Directors voted to develop the IECC through an ANSI Standards process instead of governmental consensus. They

#### **Mike Stone**

West Coast Field Representative, NEMA

also overturned the requirements for EV-ready and building electrification because they were not under the scope of the IECC.

The International Code Council will need to form new commercial and residential committees and appoint Members to serve on these committees for the new IECC/ANSI Standard. There was considerable interest in committee membership, with more than 300 applications submitted to the ICC. Following the ANSI process, no more than 30 percent of any group, including governmental Members, can serve on a committee. Several NEMA Member representatives whose companies are Members of the NEMA High Performance Buildings Council (HPBC) and two of the NEMA Field Representatives have applied to serve on both committees. NEMA staff and Members have played an active role in developing the IECC for a number of code cycles. We are hopeful that our previous participation in and dedication to the process will be taken into account when the Board of Directors chooses committee Members.

The 2021 IECC saw significant improvements in energy conservation in automatic receptacle control, energy monitoring, additional energyefficiency credits, and a new voluntary appendix for zero net energy buildings. The ICC has ensured that the new IECC/ANSI Standard will continue to advance energy conservation. The NEMA HPBC and staff look forward to participating in this new process.

#### **NEMA Section Revises Guides**

The Fire, Life Safety, Security, and Emergency Communications Section (BS-SB) recently published revisions to several of their guides, including: SB 13 *Guide for Proper Use of Smoke Detectors in Duct Applications*, SBP 2 *Multi-Criteria Detectors (MCD)*, and SB 50 *Emergency Communications Audio Intelligibility Applications Guide*. For more information, contact Building Systems Division Industry Director Marc Neufcourt at marc.neufcourt@nema.org.

Manager, Standards Publications and Marketing, NEMA

# New Lighting Systems Standard Covering Wire Insulation Colors Now Available

Wire Insulation Colors for Lighting Systems (NEMA 100-2021) is a new Standard that specifies a visual reference for the violet, pink, and red colors of the wire insulation supplied with luminaires, controls, ballasts, drivers, and other devices that are part of a lighting system. This Standard can be utilized for related components such as wire terminals, wire connectors, and terminal blocks for field connection of wires.

NEMA 100 was developed to address the changes to the National Fire Protection Association *National Electrical Code*<sup>\*</sup> 2020 version (NEC-20), specifically section 410.69 on "Identification of Control Conductor Insulation."

Those that benefit from this Standard are lighting controls manufacturers, contractors, and installers.

It is available on the NEMA Standards Store at no cost for a digital copy.



Other recently published Standards:

American National Standard for Roadway and Area Lighting Equipment—Vandal Shields for Roadway and Area Lighting Luminaires ANSI C136.34-2020 is available for \$70.

American National Standard for Roadway and Area Lighting Equipment—Metal Brackets for Wood Poles ANSI C136.13-2020 is available for \$70.

# **SPOTLIGHT**

#### I Am NEMA | Khaled Masri



Khaled Masri Program Manager for the Building Systems and Industrial Divisions at NEMA

M y destiny was to be a mechanical engineer and to work in the electrotechnical industry.

As a teenager, I spent summers play-working with Caterpillar bulldozers at my father's diesel engines service shop. While there, I developed a passion for vehicles and gained insights into combustion engines. Shortly after I graduated with a degree in mechanical engineering from the University of Toledo, I went to work at the family electrical supply shop in the "electrical souk" of Riyadh, Saudi Arabia. There, I sold all kinds of electrical equipment—breakers, panels, receptacles, switches, light bulbs, wires, cables, and everything in between. I met NEMA early in my career through legacy products such as enclosures, pins and sleeves, and plugs and receptacles named after NEMA.

Our customers had amazing confidence in the quality and safety of NEMA products over the competition. This affinity to the NEMA brand became evident when my fortune led me to work at NEMA for the first time in 1998. I had a dozen years of experience in building codes and Standards development and implementation by that time. Three years later, I began work with the National Institute of Standards and Technology (NIST) as a U.S. Standards Representative based in Riyadh with responsibility in the six countries of the Gulf Cooperation Council (GCC) region. Endorsed by my supervisor and several Member companies, I worked closely with trade groups in several industries on market access, conformity assessment, and Standards harmonization. When I came back to work at NEMA in 2015, I had 25 years of experience in 12 countries.

As a Program Manager in the Industrial and Building Systems Divisions at NEMA, I now help develop Standards for wire and cable, dry battery, arc welding, and insulating material. I have come full circle to realize that Standards are the main ingredient for customers' confidence in any product. The excellent reputation NEMA has built over the years is a vital component of the success and dominance of American electrical equipment in the global markets. I am excited to be part of NEMA history as we embark on celebrating our 100th anniversary.

### Warehouses a Bright Spot in COVID-Era Private Nonresidential Construction Market

Private nonresidential construction continued to lag the broader economic recovery through the first quarter of 2021. While gross domestic product, the broadest measure of economic activity, is expected to surpass its prepandemic high in the second quarter of 2022, private nonresidential construction has seen no such rebound.

In the final quarter of 2019, the last measure of GDP unaffected by the COVID-19 pandemic, real private nonresidential construction in structures, totaled \$545.1 billion at an annualized rate. By the first quarter of 2021, that number plummeted to just over \$450 billion, with nearly every major category experiencing declines exceeding 10 percent. Sectors most affected by the pandemic, such as food and beverage establishments, saw construction fall nearly 35 percent from Q4 2019 to Q1 2020. Over that same period, commercial and health care facilities construction sank 8.3 percent, and the building of mines and wells also collapsed more than 30 percent. However, warehouse construction, shown in the graph nearby, managed to gain more than 10 percent to an annual rate of \$30.5 billion in Q1 2021.

The economic lockdowns at the onset of the pandemic ushered in a surge in e-commerce sales. As quoted in an article in Logistics Management, James Breeze, a Senior Director at CBRE, commented, "Most consumers are not only buying more product online; they are expecting it to be delivered in a timely manner." The article also noted that "Consequently, developers are seeing upwards of five years of e-commerce growth in one year—a trend, they say, that's not going away."



To fulfill the promise of timely deliveries, building warehouses and fulfillment centers closer to customers is paramount. With this trend in mind, NBC News reported that Amazon is "buying up disused malls across the country and turning them into distribution centers." In March 2021, Amazon purchased three malls in various parts of the country totaling over 3.6 million square feet to transform them into distribution centers. Even before the COVID-related surge in e-commerce sales, Amazon converted approximately 25 shopping malls into fulfillment centers between 2016 and 2019.

A surge in demand for manufactured goods has also contributed to the construction of warehouses. From the same Logistics Management article, Carter Andrus of Prologis said, "Beyond carrying higher inventory levels to favor resiliency over efficiency in their supply chains, companies are also considering more diversified manufacturing locations." More manufacturing locations will likely result in the need for more warehousing space.

These trends coupled together "have the potential to generate more than 500 million square feet of additional warehouse and DC space in the next two to three years," according to Andrus. While most of the private nonresidential construction sector remains in the doldrums, warehouse construction is poised to stay at the forefront. COVID-19 accelerated the pace of e-commerce, forcing firms to adapt and open distribution centers closer to their customers. At the same time, vulnerabilities in the supply chain were exposed, which could lead to higher inventory levels for manufacturers and a premium on warehouses.

Fred Ashton

Senior Economist, NEMA



#### **Coming Next**

#### September/October

Industrial Products & Systems What Will the Global Economy Look Like in 2025?

**November/December** 

Building Infrastructure Backbone of Our Connected Future

#### STOCKART

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# ENDNOTES FROM THE **PRESIDENT**

# **Eyes Toward the Future**

Einstein once said, "In the middle of difficulty lies opportunity." While Einstein was obviously wrestling with cosmic matters, we can apply his aphorism to success in business.

Building owners and system integrators face many challenges—maintaining their existing physical plants, addressing health and wellness concerns, and reconfiguring building structures to respond to ever-changing end-user needs. In the last instance, building owners will face a host of issues arising from an expected increase in hybrid workplace models. In this issue, we explored how NEMA Members' products and systems create new opportunities and enable businesses to become more agile in responding to those needs.

NEMA Members are also creating opportunities in the manufacturing sector.

Over the past 20 years, many manufacturers adopted just-in-time supply chain principles to maximize business results and remain competitive. Such systems prioritize eliminating waste and redundancy while striving for consistent, predictable inputs, leading to dependable outcomes. Unfortunately, this structure can be fragile, where a delay from a single component supplier can stop an entire line.

This fragility has increased as products incorporate electronics and sensors heavily reliant on integrated circuits (aka "chips") for a range of purposes. Supply chains have evolved into networks of intertwined companies, where supplier and end user often switch roles multiple times to build a final product. A recent McKinsey report noted that the typical supply chain (or, more accurately, non-linear supply "web") consists of thousands of companies. For technology companies making the sensors and electronics enabling innovation, as many as 7,000 businesses may be involved in building certain products.

As businesses become more interconnected, the fragility, incidence of interruption, and severity of disruption are magnified. Recent events like the semiconductor shortage, the Suez Canal blockage, and new regulations highlight how events can ripple across adjacent manufacturing sectors—impacting, and in some cases completely shuttering for a period—entire industries. These disruptive events underscore the imperative for manufacturers to review their business models and consider a shift. This will not simply entail moving from a "just-in-time" to "just-incase" approach. Rather, businesses should assess risks and benefits through lenses focused on sourcing robustness, process agility, and improving overall resiliency.

Members of the NEMA Industrial Products and Systems Division make technologies that help other manufacturers create more adaptable businesses. In our next issue, we turn our eyes to 2025 and explore how NEMA and its Members will enable the next generation of manufacturing. The goal is to not simply get by, but to find the opportunities and means to thrive. Success in the future will likely belong to businesses that balance robustness, agility, and resilience by applying the technologies and processes that harness the potential of these attributes. ©

Kevin J. Cosgriff NEMA President and CEO

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