

# electroindustry

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## BEYOND EFFICIENCY

Electrification for a Clean Energy Future in Buildings



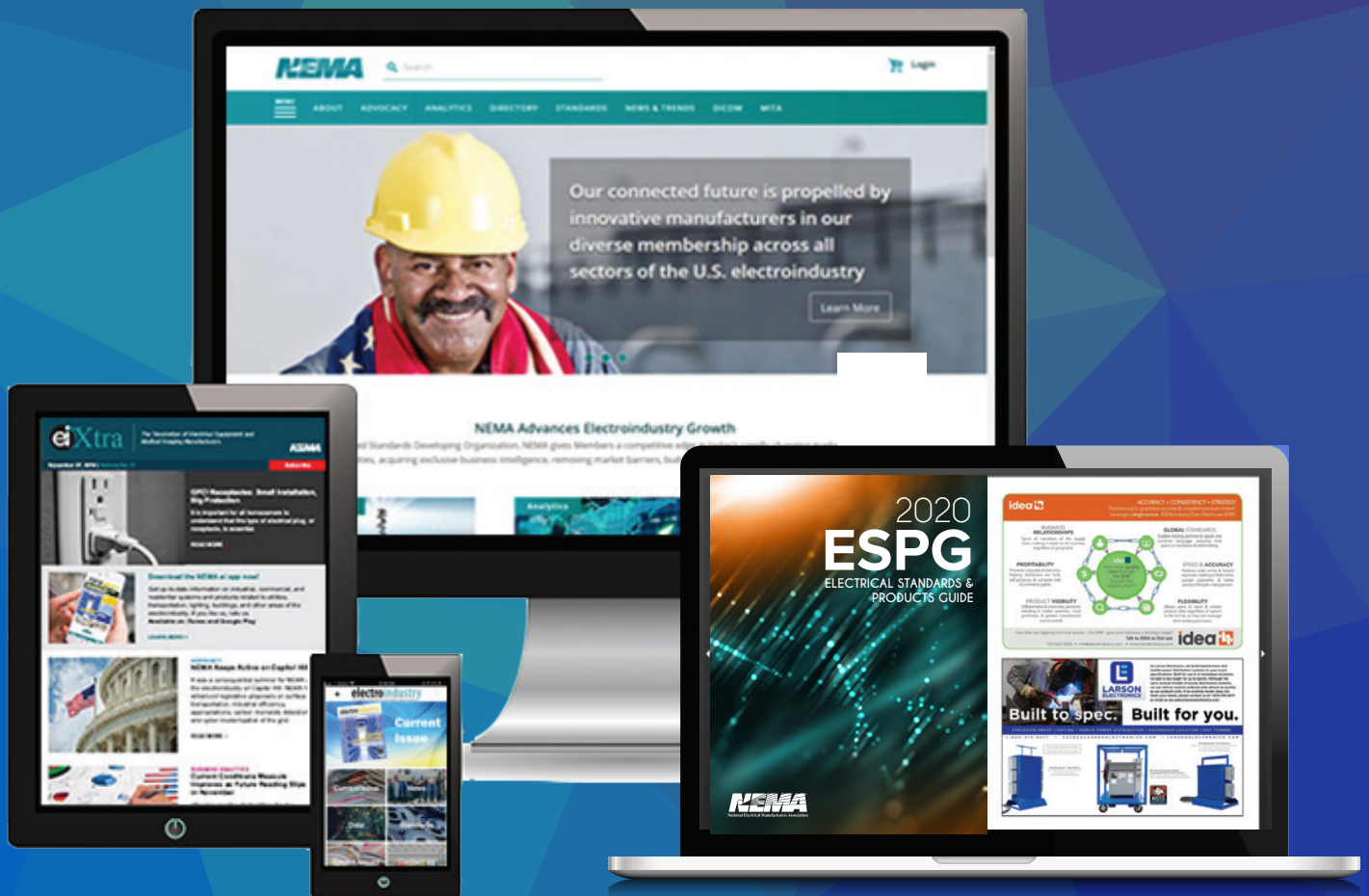
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**Publisher** | Tracy Cullen  
**Managing Editor** | Jena Passut  
**Contributing Editors** | Ann Brandstadter, Mariela Echeverria, Andrea Goodwin, William E. Green III  
**Art Director** | Jennifer Tillmann  
**Advertising Executive** | Travis Yaga  
The YGS Group  
717.430.2021  
Travis.Yaga@TheYGSgroup.com

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In the past few months, we have undergone massive changes as a country. The pandemic has moved many of us to an entirely remote work environment—one where we must still engage with our teams. But we cannot forget the millions of people across the country who have continued to show up every day on factory floors or at customer sites. These are the people dedicated to keeping our food supply chain up and running, the lights on, and our hospitals operating. Many of these essential personnel are our colleagues, our peers, our employees, or even ourselves. This puts the electroindustry's role in supporting the nation's infrastructure into a new perspective for me.

This *ei magazine* focus on energy management is especially timely. At its core, energy management is about providing safe, reliable, and efficient power—three factors that have been key in supporting and maintaining our nation's critical infrastructure during the past few months. Data centers have required reliable and efficient power to ensure people working and operating remotely across the country have stable bandwidth connections. Hospitals and temporary healthcare facilities have relied on quick-turn electrical solutions to expand their facilities to care for more patients. And consumer packaged goods manufacturers, facing higher customer demands, have counted on reliable and efficient power to keep their operations running at full speed.

In ways we all wish we did not have to experience, the pandemic spotlights the essential role played by our industry. Our contributions as NEMA Members have always been and will continue to be the backbone of America's economy. We provide this bulwark through products and systems that enable the end-to-end creation and ultimate use of electrical energy. This is shared responsibility that we shoulder on behalf of the country at large—a charge that I know none of us takes lightly.

As we learn from this crisis, we will likely see new challenges and opportunities for energy management solutions. Our customers will undoubtedly be looking for products and systems that can help them imbue their operations with capabilities for the future. That means a need for assured reliability, a more digital, connected, and secure virtual environment, additional remote services and operations, and the next generation of resilient energy management.

I hope you enjoy the perspectives on energy management in this issue. Stay healthy and safe. ☺

Raj Batra

Chair, NEMA Board of Governors

## A Distributor's Role in Technology

New technologies are pushing the boundaries of the electrical industry every day. Where once devices and equipment were meant to perform a simple function (e.g., transmit power or provide light), today, devices are collecting information about their operation, surroundings, and usage. And with a simple internet connection, they're communicating with the world. All of this is creating a major shift in the channel providing these components and systems to the end customer.

In many cases, a customer can no longer simply take a product out of the box and never think about it again. The end customer is going to need someone to provide support before, during, and after the sale to keep their project moving quickly and make sure it is done right. They are going to need help designing the solution that solves the challenges that arise, as they do not have the resources or technical experts on staff. They are going to need guidance and support during the purchasing and setup process to make sure they are choosing the right solution for the application.

It is not as simple as looking at a specification sheet and determining what "works." Many of the items customers acquire throughout a project will need significant configuration during or after installation. They will need someone who understands the solution inside and out and can quickly implement it. In fact, after the project is completed, customers may require ongoing service, as many of these advances in technology have a much greater need for continued support and maintenance.

Electrical distributors have been an important part of the electrical product supply chain for over a century and have adapted to many changes. To remain a strong part of the channel, they are beginning to explore and offer a range of diverse services. They are a perfect fit for the role because they have a strong relationship with their customers and a unique knowledge of their needs. In addition, they are looking for a way to expand their businesses and constantly improve their customer experience.

Along with our distributor members, National Association of Electrical Distributors has recognized this much-needed adjustment in position and developing services gap within in the industry. We are adjusting our strategic priorities, since we feel this work is critically important to the future.

We are currently following up on the NAED Foundation's recently published action plan, **Building a Connected Business**, with a proposed study that will explore how NAED Members can best implement new and different ways to enhance value for their customers, suppliers, and other channel partners. With each new connected solution, electrical distribution is perfectly situated to help this emerging technology grow in the markets they serve. ☺



Mr. Naber possesses a strong background in both association management and the electrical industry, bringing more than 20 years' experience as an association executive.



# NEMA Publishes Guidance for Disinfecting Electrical Equipment

Since the onset of the coronavirus pandemic, many of us have incorporated extra precautions into our daily routines to stay safe. Now, as state and local governments begin lifting social distancing regulations and workplaces reopen, virus prevention methods are shifting from isolation to disinfection.



**Alan Manche,**  
Vice President,  
External Affairs,  
Schneider Electric

Mr. Manche is an active leader and contributor to the electrical industry, including participating in NEMA, ANSI, and NFPA activities.

One common question we hear from people working on and around electrical equipment, whether in critical facilities or on the plant floor, is: How do I properly disinfect my electrical equipment?

To provide guidance, the National Electrical Manufacturers Association (NEMA) published NEMA GD 4-2020 *COVID-19 Cleaning and Disinfecting Guidance for Electrical Equipment*. This white paper offers directions on how to clean and disinfect while preserving the functionality and integrity of most electrical equipment types.

Here are the main takeaways from the report:

## Safety First

The first consideration when cleaning and disinfecting electrical equipment is worker safety. As always, it's important to follow safety-related codes, Standards, and legislation, along with any documented safety procedures created specifically for your facility.

Electrical Safety Foundation International ([www.ESFI.org](http://www.ESFI.org)), a nonprofit that promotes

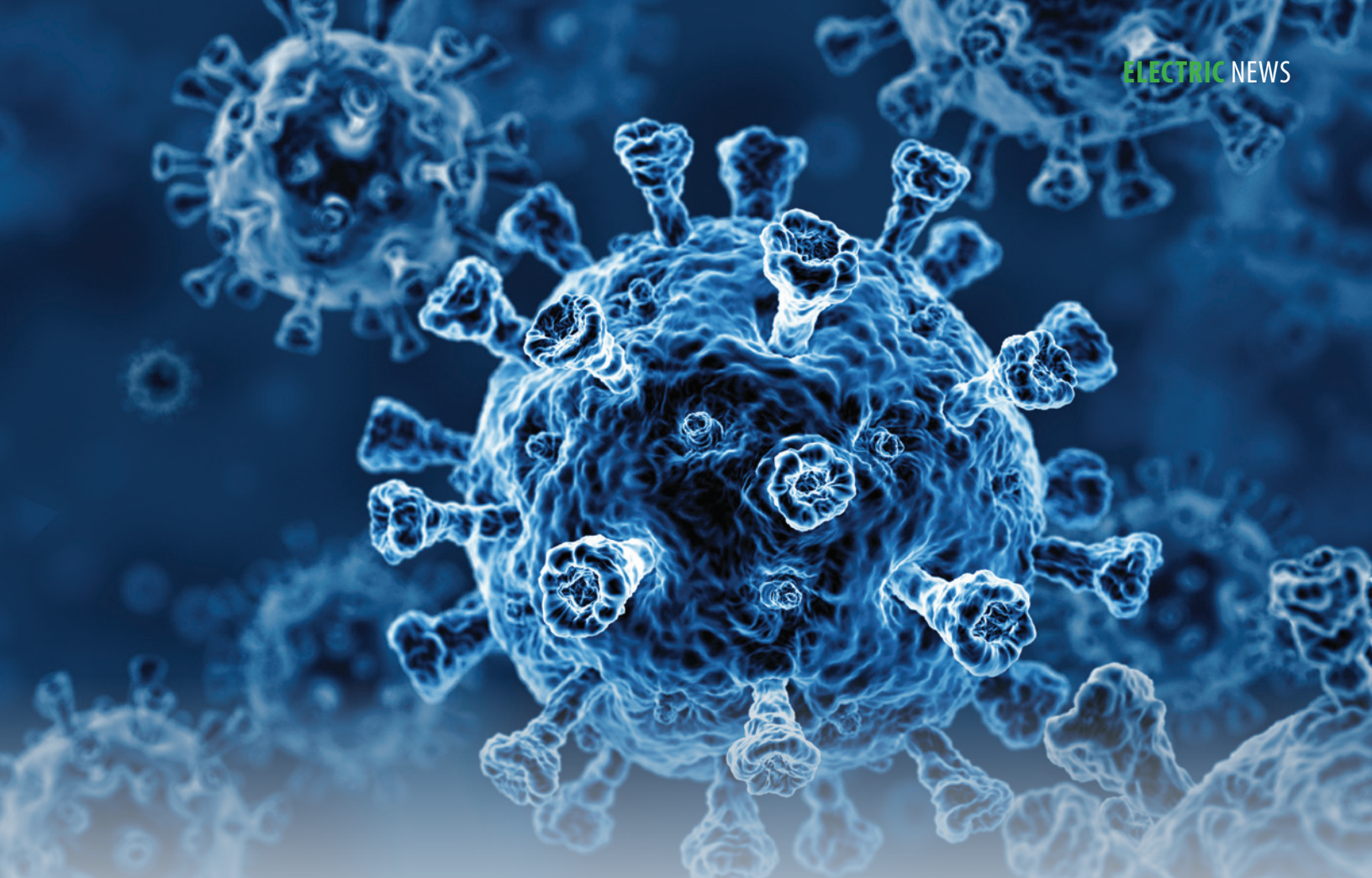
electrical safety in homes and workplaces, is a good source for information on common electrical hazards and general safety.

## Next, Protect Equipment and Personnel

At the time of this report, the Centers for Disease Control and Prevention (CDC) recommends using a U.S. Environmental Protection Agency (EPA) List-N disinfectant on surfaces to reduce virus contamination. However, these solutions and solvents may actually harm electrical products and components.

NEMA GD 4-2020 specifically cautions against the use of fogging and spraying disinfectant solutions on and around electrical equipment because this can corrode conductive materials and degrade plastics, causing damage to equipment, outages, and even physical injuries.

Ensure your equipment and personnel remain safe by following the manufacturer's cleaning and disinfection instructions.



Keep in mind: the approved method for cleaning does not always disinfect the electrical equipment. For example, the manufacturer may recommend cleaning with a clean, dry cloth.

## Follow CDC Recommendations for Personal Safety

Personnel working with and around electrical equipment should follow CDC recommendations to reduce the risk of transmission. Precautions include thorough hand-washing and the use of face coverings and other personal protective equipment.

These protective measures are especially important when the approved cleaning method does not disinfect.

## When in Doubt, Reach Out

If you have a specific question about cleaning and disinfecting your electrical equipment, or you have equipment in a facility with an elevated risk of virus transmission, it's best to contact the manufacturer for guidance.

As the COVID-19 situation evolves, NEMA and its Members will continue to review all information related to best practices for cleaning and disinfecting, and will share updates to NEMA GD 4-2020 as they become available.

NEMA GD 4-2020 is available as an electronic download at no cost on the NEMA website.

Other NEMA COVID-19 resources are available at [www.nema.org/about/covid-19-response](http://www.nema.org/about/covid-19-response). @

## Key points

- Know and follow safety procedures
- Follow manufacturer's instructions for cleaning and disinfecting
- Avoid List-N chemicals unless allowed by manufacturer
- Follow CDC guidelines, including on hand-washing and use of personal protective equipment
- Consult the manufacturer with specific questions

## NEMA Strategic Initiatives Focus on Digitalization, Technology



**Daniel Abbate  
and Steve Griffith,  
Industry Directors,  
NEMA**

Each year the NEMA Strategic Initiatives program generates valuable market research, technical and policy reports, websites, educational toolkits, and more for the benefit of NEMA Members.


The 2020 Strategic Initiatives (SI) cover topics related to digitalization and the Internet of Things, market development, resilience, and workforce development. One example of a 2020 initiative is NEMA.Lab. This SI will establish a cross-domain, technology-based knowledge development, capture, and sharing forum on artificial intelligence (AI) and the future of wireless communication (5G). It will also research how these technologies will impact the next normal after COVID-19.

An AI research white paper is being developed for electrical equipment manufacturers. This document will discuss items such as:

- needed architecture for AI implementation and Standards gaps
- relevant current and future use cases/ applications
- technology adoption trends
- criteria manufacturers might wish to apply when making decisions to further automate processes
- challenges that apply across all markets that NEMA Member companies represent as well as those that are unique to a specific industry

Another part of NEMA.Lab is the development of a technical guidance document on 5G technology. This document will:

- provide relevant use cases/applications that apply across markets for electrical equipment and medical imaging manufacturers
- identify emerging Standards and regulations related to 5G as well as appropriate end users and the benefits they receive from implementing 5G technology
- map NEMA technical and policy priorities to help NEMA prioritize future 5G activities
- investigate how 5G can enable services across the full spectrum of healthcare from hospitals to urgent care clinics, long-term care facilities, and individual homes
- explore 5G as an enabler of smart manufacturing and industrial automation

More information about getting involved in NEMA Strategic Initiatives is available at [www.nema.org/si](http://www.nema.org/si). 



## NEMA Launches Healthcare Facilities Council

The healthcare industry is facing accelerating changes driven by a perfect storm of new technology adoption, consumer demographics, and regulation. To top it off, the industry is at the forefront of a global pandemic, with COVID-19 pushing to the limit its staff, infrastructures, and operations.

There is little doubt that the current crisis will only accentuate trends that are reshaping the industry such as telehealth adoption, the rise of robotics, and the growing use of data and artificial intelligence. As healthcare facilities evolve in the process, NEMA has an important role to play in driving change and assisting the healthcare industry in its transition.

However, to provide assistance that is both effective and impactful, we need to better understand the unmet needs of our customers, the details of the transformation they are going through, the problems they face in the field, and how we can best assist while limiting operational disruptions.

As a result, NEMA has launched the Healthcare Facilities Council to address the unique and specialized unmet needs in the U.S. healthcare facilities market. The Council will:

- establish a forum for professionals from different trades to share knowledge and best practices in the area of healthcare facilities
- create a better understanding of healthcare facility trends, codes and Standards gaps, government policies, and other opportunities to support Council Members' businesses
- provide an avenue for Council Members to initiate projects to bridge those gaps for the betterment of the healthcare, electrical, and medical imaging industries

As a result, the Healthcare Facilities Council will increase business opportunities for NEMA Members and help improve healthcare facilities by:



- attracting and retaining Council Members with expertise across industries and trades to identify issues encountered in the building, maintenance, and retrofit of healthcare facilities
- engaging Council Members to identify technological, technical, legislative, and regulatory solutions to address those issues
- leveraging NEMA staff and resources to initiate and execute projects that will help deliver such solutions

For more information about the Healthcare Facilities Council and its planned activities, email Marc Neufcourt, Industry Director, NEMA Building Systems Division, at [marc.neufcourt@nema.org](mailto:marc.neufcourt@nema.org). ☎

**Marc Neufcourt, Industry Director, NEMA**

# All-Electric Buildings: Electrification in the Code



Mike Stone,  
West Coast Field  
Representative,  
NEMA

Member companies have made possible the electrification of the country. What the term “electrification” has meant traditionally is to provide electricity to areas that previously did not have service. In the late 19<sup>th</sup> and first part of the 20<sup>th</sup> centuries, providing electricity to all parts of the country, including rural areas, was the challenge. The products and technology supplied by NEMA Members successfully met that challenge.

Recently, though, the term electrification has taken on a new meaning. Now it also refers to the use of electricity to power buildings, replacing natural gas, fuel oil, and other non-electrical sources of energy in

buildings. Appliances and other equipment used for heating, cooking, air conditioning, refrigeration, and vehicles are all candidates for electrification in homes and buildings.

Building energy codes have historically favored the onsite usage of natural gas over electricity. These codes have been primarily concerned with the efficiency of the energy source without regard to the environmental impact of its generation. Much modern natural gas-fired equipment is highly efficient when it comes to energy usage. As a result, equipment such as electric water heaters and electric resistance heating have

been less often used. Technologies such as electric heat pumps are changing that, but natural gas still is prevalent in buildings built under today's energy codes.

Natural gas is one of the cleanest burning fossil fuels when compared to others such as coal or oil, and technology has helped improve its environmental impact. The U.S. Energy Information Administration (EIA) states that natural gas accounted for 39 percent of U.S. electricity generation in 2019, followed by coal at 23 percent. Also, in 2019, renewable energy sources accounted for 17 percent of generation and 11 percent of energy consumption. (1)

But regardless of how clean technology can make the burning of natural gas and other fossil fuels, emissions and other environmental impacts will never be reduced to zero. Renewables, on the other hand, produce no emissions in operation. Hydroelectric and geothermal are two types of renewables that have been used for generations ever since electricity was first harnessed for use. Their capacity for significant expansion, though, is limited. The greatest expansions of renewable energy have been solar photovoltaic (PV) and wind. Other technologies such as biomass and tidal energy are also promising, but wind and solar PV have been, and will likely continue to be, the primary sources of at-scale renewable electricity generation for the foreseeable future.

Various energy codes across the country are beginning to address the concept of electrification. These codes include the International Code Council's (ICC) International Energy Conservation Code (IECC), the ICC International Green Construction Code (IgCC), ASHRAE 90.1, and California's Title 24 Part 6 Energy Code and Part 11 Green Construction Code (CALGreen). At the 2021 IECC code development hearings last year, NEMA assisted one of our industry partners in drafting an electrification proposal which was ultimately successful. This new code language requires that any appliance location in a dwelling unit that has a natural gas supply must also be provided with an equivalent electrical circuit. As of this writing, several of the opponents to this code change have filed an appeal with ICC to have it removed. But if the appeal is denied, the new requirement will be in the 2021 IECC edition.

The State of California does not have electrification requirements in its current edition of the Title 24 Energy Code or CALGreen. However, the California Energy Commission (CEC) is currently discussing

electrification, and there will likely be electrification provisions in the next editions of both the Energy Code and CALGreen, which will be effective on January 1, 2023.

In other related activities, the newly formed NEMA Solar Photovoltaic Council is working with Members and other outside solar PV industry partners on areas of mutual interest. One of the projects underway is the creation of a new Standard for PV wire connectors. NEMA involvement in the solar PV industry will undoubtedly help advance the technologies that will enable the expansion of the use of solar PV renewables.

Energy codes in various forms have existed in this country since the 1970s and have been a significant factor in the decline of energy consumption in buildings. But electrification goes beyond efficiency to address the sources of the energy that we use. Less reliance on direct fossil fuel use in buildings in favor of electricity, and cleaner fossil fuel generation augmented by a growing amount of renewable generation, means fewer overall emissions and an executable incremental step toward a cleaner environment. Through technology and innovation, NEMA and its Members continue to lead the way. ☺

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"Electricity explained," Energy Information Administration, <https://www.eia.gov/energyexplained/electricity/electricity-in-the-us.php>

# Proactive Efforts by NEMA Shape the Future of Building Energy Performance

The NEMA High-Performance Buildings Council's (HPBC) Codes and Standards Review Committee has been deeply engaged in the past three years preparing for a successful 2021 *International Energy Conservation Code* (IECC) revision cycle. Many NEMA Member companies heavily invest in the future of high-performance buildings. The basis of building performance relies on strong energy codes and Standards being adopted by state and local jurisdictions.

**Andrei Moldoveanu,**  
Program  
Manager, NEMA

Through the coordinated efforts of NEMA staff and Members, the 2021 IECC cycle saw an unprecedented energy-efficiency gain estimated at over 10 percent above the most recent 2018 IECC version thanks to a focus on advanced controls and a systems- and controls-based approach to whole-building performance. Furthermore, many of these code changes promote not just energy efficiency but building electrification, grid stability, occupant health, comfort, productivity, reduced operation and maintenance costs, and other benefits of modern building technologies. This is a significant achievement for the code, NEMA Members, and the building of the future.

“With the energy code updating only every three years, and the opportunities it offers to increase building efficacy, NEMA Members had a lot at stake,” said Harold Jepsen P.E., Chair of the Codes and Standards Review Committee. “It was important we began our efforts early, stayed on top of the rigorous process, and

supported a strong NEMA presence, before, during, and following the two separate week-long hearings.”

Key successful building performance measures supported by NEMA included:

- Automatic lighting controls for interior and exterior lighting in residences
- Improved lighting efficacy metrics for lamps and luminaires
- Fault detection and diagnostic systems for HVAC systems of larger buildings
- Automatic receptacle controls in offices, workstations, conference rooms, classrooms, and other spaces most benefiting from receptacle control
- Energy monitoring by load types in larger buildings
- More efficient lighting power allowances for lighting designs



- Improved and expanded daylight response control areas
- Parking garage controls, further increasing operational efficiency
- Measures for home electrification readiness
- EV charging capability and readiness for both commercial and residential buildings

Although not thought of as a life safety code, the IECC targets the health and safety of the building's occupants. For example, energy codes mitigate the occurrence of rot, mold, and mildew by controlling airflow, temperature, and moisture. Access to daylight can aid productivity and improve general feelings of well-being. Electrified buildings have fewer concerns about carbon monoxide and other combustion by-products that can be harmful to human health.

NEMA worked with several organizations to develop consensus on its own proposals and also on other code proposals relevant for its Members. Organizations were engaged in amending proposals to increase their chances of success during the committee hearings and, ultimately, the governmental final ballot. Key industry partnerships were developed to assist in educating International Code Council voting Members on the benefits of the NEMA proposed requirements.

Wayne Stoppelmoor CEM, NEMA High-Performance Buildings Council Chair, remarked, “The NEMA partnership with organizations who share NEMA Member goals on energy efficiency and building codes was an important component in the success of NEMA-supported proposals.”

## Digging into the Process

The length and unpredictable pace of ICC hearings requires an immense amount of patience, team coverage coordination, and preparedness as well as a clear understanding of the code development process outlined in the Council Policy on Code Development. Understanding this process is also necessary to develop successful proposals, comments, and testimony during the hearings. Early and engaged involvement with the various ICC committees, key industry partners, and veterans of the code development process provided additional insight and guidance on how to be an effective contributor and trusted ally.

NEMA membership on a code development committee enhanced the position and status of NEMA as a relevant and credible thought-leader in the building performance space. The IECC development committees that vote on each proposal during the hearings had been missing, until now, a representative of the electroindustry that could serve not only as an advocate for those proposals of interest to our industry but also, more importantly, as a unique technical expert in this field.

“The ability to contribute to committee discussions, initiate motions, and vote on proposals was a real game changer, and another spoke in our wheel of success this code cycle,” noted Bryan Holland MCP, AStd, NEMA Senior Field Representative and member of the ICC Commercial Energy Code Development Committee.

The NEMA HPBC Codes and Standards Committee (CSRC) played a clearinghouse role for all proposals generated by individual Sections. The Council itself is a horizontal NEMA group supported by NEMA Sections with common interests in advancing technological progress in the building environment.

## The Revision Cycle

As expected, the IECC is a prime target for the HPBC given that many electrical products are involved in energy distribution, its control, and consumption. In the first phase of the three-year revision cycle, the CSRC collects proposals from Sections and its own Members. It vets them first internally and then through all NEMA before submitting them for the NEMA Codes and Standards Committee's approval as NEMA proposals.



NEMA team at the 2019 Committee Action Hearing. L to R: Wayne Stoppelmoor, Schneider Electric; Bryan Holland, NEMA Field Representative; Mike Stone, NEMA Field Representative; Michael Jouaneh, Lutron Electronics; and Harold Jepsen, Legrand. The entire team contributed to this article.

After the IECC publishes all proposed changes, the CSRC reads them all and determines which could be of interest to NEMA Members. For this IECC cycle, Members reviewed 267 proposals for the Commercial Code and another 229 for the Residential one. For each, with the help of the Sections involved, they prepared an implementation plan for the public Committee Action Hearing.

The proposals, as submitted or as modified, are approved or rejected during this hearing, and the rationales for those actions are then published by ICC. A second, very intense stage of the CSRC preparation starts as Members review each decision and decide to support or oppose the committee decisions. Comments are drafted, and another round of internal NEMA vetting follows, ending with NEMA C&S approval and submittal of the comments.

All the comments received are published by ICC staff. Preparations for another round of hearings follow. Many comments are again individually reviewed: 289 for the Commercial Code and 232 for the Residential one. Preparations for the Public Committee Hearings take place. Those are quite special since participants' positions are not always firm until the hearing. "The CSRC Members are getting better at anticipating those possibilities and adjusting on the fly," remarked NEMA Senior Program Manager Andrei Moldoveanu.

## NEMA as a Resource

Besides NEMA, there were several organizations at the IECC hearings that submitted proposals involving electrical equipment. Examples include proposals for electric vehicle charging equipment, residential lighting controls, and electrification (i.e., installing electrical circuits and outlets for optional use at gas appliance locations). NEMA Members and staff were able to share their electrical expertise with these organizations and helped them craft their proposals using industry-common language. The resulting proposals were technically correct and aligned with the *National Electrical Code*® (NEC) requirements. Nearly all were ultimately approved and will be in the 2021 IECC.

During the hearings, questions often arose regarding aspects of electrical equipment and electricity in general. The questions came from those giving testimony as well as from committee members asking for further information. NEMA was able to be a resource for the hearing attendees and committee members and address their concerns.

"Load calculations, voltage drop, types of lighting controls, electric vehicle supply equipment details, and NEC requirements were examples of topics that participating NEMA Members and staff helped clarify," said Mike Stone, NEMA Field Representative, about the electrical industry expertise contribution NEMA made to the process.

This is just the beginning. A new revision cycle is around the corner. Many others will follow. Learning from successes and failures, improving the NEMA process will give Sections the possibility to maximize opportunities to grow markets and promote the electrification of buildings while helping states and municipalities achieve their energy performance goals. ☺

# Avoid Integration Issues with BMS Specifications

Proper specification of a building management system (BMS) with other data-integrated building systems is important to ensure that the end user gets the building performance and user experience they expect. Specification errors happen far too often, causing added project costs, project delays, commissioning nightmares, and disappointed end users. Fortunately, by answering some key questions and following a few guiding principles, many of these integration issues can be avoided.

## BMS Specification Using MasterFormat

MasterFormat is a common layout or index for design requirements or specifications of all aspects of building components to be used in the construction of a building. The common layout is composed of divisions. Each division has a set number system that is focused on a construction subgroup, such as the Facilities Services Subgroup, which includes the divisions shown in Table 1.

**Table 1 Facility Services Subgroup**

Fire Suppression (21)
Plumbing (22)
HVAC (23)
Integrated Automation (25)
Electrical (26)
Communications (27)
Electronic Safety and Security (28)

Scott Ziegenfus,  
Hubbell Lighting,  
Inc.; Clay Nesler,  
Johnson Controls;  
and Wayne  
Stoppelmoor,  
Schneider Electric

The American Institute of Architects (AIA) MasterFormat is basically the Dewey Decimal System for locating and indexing the design specification for buildings. However, a complete design specification for a large building can be thousands of pages and includes multiple subsystems whose specifications reside in different divisions. The specifier's challenge is to make sure the information is clear, complete, and, most of all, easy to find so that it will meet the design team's Basis of Design (BOD) and fulfill the end users' expectations.



In 2004, there was a major expansion in divisions for the MasterFormat and HVAC was placed in its own Division 23; Division 25 was established specifically for building subsystem integration. It was expected that BMS specifications would migrate to that division but instead most BMS specifications are still listed in HVAC (23) along with HVAC specifications and requirements. Using Division 23 can provide challenges since building management, which includes lighting, elevators, access management, and life safety, is technically not HVAC and many contractors, installers, and manufacturers do not look in Division 23 if their scope is included in other divisions. It can also be difficult for contractors and installers to access Division 23 specifications if their scope of work is included within another division.

## Specifying Integration in Divisions 25 and 27

Division 25 provides a specification framework for a BMS that integrates multiple systems from separate divisions:

- Section 25 30 01 covers the items to be monitored or the data to be exchanged from each subsystem
- Section 25 05 01 defines the control functionality of each system
- Section 25 90 01, one of the most important sections, provides for the sequence of operations between the systems and the BMS

Division 27 is where the details of the building's communication infrastructure are listed. Division 27 equally applies to a common IT infrastructure that can be shared by building technology systems and information technology systems or a dedicated network for the BMS.

Using Division 23 can provide challenges since building management, which includes lighting, elevators, access management, and life safety, is technically not HVAC and many contractors, installers, and manufacturers do not look in Division 23 if their scope is included in other divisions.

Each building system is listed in its own division. For example, the specification for lighting system integration would normally fall under Lighting Controls sections within Electrical Division 26 09 23. If the system consists of a simple panel it would probably be listed under section 26 09 43 Network Lighting

Controls or a subsection such as Digital-Network Lighting Controls.

Each division is where the installer will access the information for system requirements and where the requirements for integrating the systems with a BMS should be listed. Even if listed in earlier divisions, the integrated system functionality should also be listed in the traditional division of that system or it may never be known by the system installer.

## Specifying Integrated System Functionality

Data flow between systems is a basic function of an integrated BMS. Many parameters need to be specified, including the mechanics of the data flow, what data is stored and/or displayed, what data can be sent, and what data can be received; the format of the data; and who is responsible for configuring and managing the data flow.

One of the most important items in a specification for system integration is the sequence of operations. The sequence of operations is important for a stand-alone system but even more important for data-integrated systems from different manufacturers. The sequence of operations is where the specifier defines “what” each system should do. This part of the specification is often documented as a narrative, flowchart, table, use case, or similar format. The system installers are often unfamiliar with the capabilities and characteristics of the other systems, so both the details of the overall system operation and system implementation need to be clearly specified. Additionally, listed in both Division 25 and within its own division each system would list the sequence of operations or interaction between the system and the BMS such as detailing each system's responsibility in implementing command or monitoring actions.

Data exchange is core to systems integration, and its specification answers such questions as:

- Do the systems need to pull the data or will each system push the data?
- How fast does the data need to be transferred?
- What data needs to be transferred and where is it stored?
- Where is the data analyzed?
- What capability does each system have to control devices in other systems?



- Can schedules in multiple systems impact devices and parameters outside their system?
- Can schedules be modified from more than one system?
- What devices or functions can be controlled or overridden from which systems?

## Specifying Communication Protocols

Each division including networked systems needs to clearly specify the communication protocol or protocols for integration. Many BMS and subsystems can accommodate multiple protocols. BMS protocols have two basic components:

- The message, such as what data needs to be transferred, how fast it needs to be transferred, and where it is analyzed
- The structure to transport the message, which dictates the wiring and physical connections used

Many of the most popular BMS protocols have multiple structures for message transport such as Modbus ASCII and Modbus TCP/IP or BACnet/MSTP vs. BACnet IP. Wired media like RS-232, RS-485, and Ethernet have different connectors, different communication speeds, and different wire types. Wireless media have different frequencies, speeds, and modulation types. Many BMS protocols offer a certification process for devices to ensure a base level of compliance. Some offer only third-party certification while others offer self-certification or both.

Media converters and protocol routers are used to change the transport structure while maintaining the same message. For instance, a BACnet IP to MSTP router communicates the same BACnet command but changes the wrapper with source and destination information to work between an IP-based message and an RS-485-based message.

Gateways are a translator between protocols. The advantage is that a gateway allows a system that does not support a specific protocol to communicate with a system with another protocol. Because gateways support multiple protocols, both open and proprietary, they often have to be updated when either protocols change or the configuration of the connected systems changes. Some highly integrated BMS employ middleware software running on a separate server that can support multiple standard and proprietary



system protocols and convert building system data to a common format for data storage, analysis, reporting, and compatibility with third-party applications.

## Specifying Responsible Parties

A common mistake in specifications of an integrated BMS is to not include who is responsible for making the system ultimately work. The specific responsibilities of installers of the individual systems and the integrating BMS need to be specified. If there is an issue and additional equipment is needed to address the integration between systems, who is responsible for purchasing that equipment? Systems on the same project can individually be tested using third-party BMS testing software all showing that each work adequately but when connected they don't work together. Each installer needs to stay on the project until the specified functionality is achieved. Sometimes a consultant or master system integrator is hired with the responsibility to sign off that each system has met the integration requirements and that the overall system works and meets user expectations. These responsible parties can also address aspects of network access, cybersecurity, operator training, and life-cycle management, which are critical with integrated systems.

In conclusion, experience has shown that specifiers do not have to be BMS protocol or systems integration experts to achieve project goals. Successful integration involves answering some key questions and following some guiding principles related to system functionality, technical implementation, and the location of integration information in specification documents. 🏠

## NEMA, DOD Cooperate on Critical Materials

NEMA is exploring cooperation with the Department of Defense (DOD) as agency procurement officials face mandates for supply chains of products containing critical materials.

As rare earth minerals have become increasingly important for advanced manufacturing and other high-performance and strategic applications, manufacturers and the federal government have concerns about reliability of supply into the future. DOD is facing a prohibition on procurement of certain alloys and magnets containing rare earth elements as well as some forms of tungsten from certain countries. DOD has also found overreliance on sole foreign sources for unique and proprietary advanced materials and overreliance on China for strategic and critical materials.

NEMA staff and DOD procurement officials are discussing how NEMA and its Member companies could achieve compliance and help mitigate supply chain risk. NEMA is exploring ways to help the electroindustry understand the government requirements, help provide a path to identify products meeting the requirements, and encourage development of alternative sources for these critical and strategic materials.

If your company uses rare earth or other critical minerals or you are interested in learning more about this initiative, please contact Kirk Anderson, Director, NEMA Industrial Products and Systems Division, at [Kirk.Anderson@nema.org](mailto:Kirk.Anderson@nema.org).

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## Building Resiliency and Sustainability Through Technology

Building construction materials have evolved extensively since electricity was first introduced into buildings in the late 1800s. Today's buildings are extremely resilient to fire, wind, and flood and have also become remarkably energy efficient. However, even the most hardened buildings remain susceptible to damage from fire and other natural disasters and tend to become inefficient in the use of energy over time as building materials degrade and equipment begins to age.

Building, fire, and energy codes are starting to recognize this trend and have begun to shift away from improvements to static building materials and components to dynamic smart systems that can evolve over time and can be adapted to meet the specific needs of the building occupants during normal operation or an emergency event. The bulk of these systems will be electrical products incorporated into a building as stand-alone systems, embedded components, or complete building management systems. These fully integrated and intuitive systems will be operated by artificial intelligence, respond in real time, and be capable of functioning in several concurrent modes of operations based on closely monitored inputs and outputs.

A prime case study would be the twin towers of the World Trade Center in Manhattan. While these buildings were considered to be technological marvels of their time when first constructed in the 1970s, the events of September 11, 2001, exposed many of the inadequacies in occupant safety, fire resiliency, and emergency response capabilities. Many lessons were learned from this tragic event and have now been incorporated into current building codes and Standards.

Today's buildings incorporate technologically advanced fire alarm systems that include multi-channel voice evacuation communication systems, mass notification systems, occupant emergency evacuation elevators, and building management systems that can control environmental air distribution systems, means of egress lighting, and other emergency systems. Today's buildings also include dynamic lighting controls, automatic receptacle controls, and energy monitoring systems that make them extremely efficient in the use of energy.

Tomorrow's buildings not only will be technological marvels at the time of original construction but also will sustain high-performance features over their entire lives. Building materials and components will incorporate hundreds of sensors and relays that are connected to the internet and will constantly change the conditions inside the building to suit the needs of the occupants to ensure safety, health, and productivity. Under emergency conditions, these sensors will be able to immediately count the number of occupants and their locations within a building to begin an orderly evacuation long before first responders even arrive on-site. These sensors, relays, and other smart devices will also be able to monitor the premises wiring system to redirect energy where it is most needed, reduce energy where it is not, and detect faults within the system before the component fails and becomes inoperable. With on-site renewable energy sources incorporating a full-load energy storage system, these buildings will be essentially energy and carbon neutral.

The electroindustry is at the dawn of a new era in electrical production, distribution, and use within a building. The 2020s are destined to be known as the decade of building and community resiliency and sustainability. This vision of the future use and occupancy of buildings can be achieved only with intelligent electrical, fire, life safety, emergency communications, and high-performance products and systems. NEMA and its Member companies are at the forefront of this movement and will rise to meet the challenges and opportunities that the future holds. ☺



## Section to Incorporate 2020 NEC Changes Into Four Standards



Ms. Vassallo represents NEMA on CMP-06 of the *National Electrical Code*®.

The NEMA Building Wire and Cable Group has four Standards that focus on application and installation guidelines for products that fall within the Section's scope. The Standards offer practical information on the correct use and industry-recommended practices for the installation of those products following the *National Electrical Code*® (NEC), and they are under revision to incorporate changes from the 2020 edition of the NEC, with anticipated publication later this year.

The information provided in these Standards is useful to designers, specifiers, contractors, electricians, and anyone who wants to be sure the proper cable product is used and installed correctly. They are helpful reference guides with necessary information all in one place.

### BUILDING WIRE AND CABLE APPLICATION AND INSTALLATION GUIDELINES

- **NEMA RV 1-2016** *Application and Installation Guidelines for Armored Cable and Metal-Clad Cable* applies to Type AC and Type MC cables

and covers topics such as grounding, marking, harmonics, voltage drop, and ampacity.

- **NEMA RV 2-2016** *Application and Installation Guidelines for Nonmetallic-Sheathed (NM-B) Cable and Underground Feeder and Branch Circuit (UF-B) Cable* applies to Type NM-B and Type UF-B cables and covers topics on permitted and not permitted uses, cable preparation, supports, and cable damage.
- **NEMA RV 3-2014** *Application and Installation Guidelines for Flexible and Liquidtight Flexible Metal and Nonmetallic Conduits* applies to flexible metal conduit, liquidtight flexible nonmetallic conduit, and liquidtight flexible steel conduit and covers fitting selection, environmental considerations, conduit prep, assembly torque, and attachment to boxes or enclosures and support systems.
- **NEMA RV 4-2016** *Application and Installation Guidelines for Service-Entrance Cable* applies to Type SE and Type USE cables and covers topics such as construction, securing and supporting cables, and installation location.

Other publications by the NEMA Building Wire and Cable Group include:

**NEMA BWCP 1-2017** *Aluminum Conductors for Building Wire and Cable*

*User Guide to Product Specifications for Electrical Building Wire and Cable*

These documents, along with multiple Engineering Bulletins covering building wire and cable, are available for electronic download on the NEMA website at no cost. 📄



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## New Standards for Lighting Equipment Now Available

Five new documents from the ANSI C82.77-X family of Standards for Lighting Equipment are now available; these Standards address electromagnetic compatibility (EMC) from various angles.

**ANSI C82.77-2-2020** *American National Standard for Lighting Equipment—Electrostatic Discharges* is available for \$50.

**ANSI C82.77-3-2020** *American National Standard for Lighting Equipment—Electromagnetic Compatibility (EMC) Testing and Measurement Techniques—Radiated, Radio-Frequency Electromagnetic Field Immunity Test* is available for \$50.

**ANSI C82.77-4-2020** *American National Standard for Lighting Equipment—Power Line Frequency Magnetic Field Immunity Test* is available for \$50.

**ANSI C82.77-7-2020** *American National Standard for Lighting Equipment—Testing and Measurement Techniques—Voltage Dips, Short Interruptions, and Voltage Variations Immunity Tests* is available for \$50.

**ANSI C82.77-8-2020** *American National Standard for Lighting Equipment—Fast Transients* is available for \$50.

### OTHER RECENTLY PUBLISHED STANDARDS INCLUDE:

**ANSI C18.2M, Part 1-2019** *American National Standard for Portable Rechargeable Cells and Batteries—General and Specifications* is available for \$124.

**ANSI C136.24-2020** *American National Standard for Roadway and Area Lighting Equipment—Nonlocking (Button)—Type Photocontrols* is available for \$67.

**ANSI/NEMA WC 53/ICEA T-27-581-2020** *Standard Test Methods for Extruded Dielectric Power, Control, Instrumentation, and Portable Cables for Test* is available for \$170.

**ANSI C136.3-2020** *American National Standard for Roadway and Area Lighting Equipment—Luminaire Attachments* is available for \$45. 📄

## SPOTLIGHT

### I am NEMA

I joined NEMA a few months ago. Before that, I ran my own consultancy, helping organizations plan and execute complex projects and process improvement initiatives. I also specialized in trade association work and spent almost 10 years at the Air-Conditioning, Heating, and Refrigeration Institute.

Throughout my career, I have had the opportunity to serve both as staff and manufacturer representative on various Sections and Committees. As a result, I got familiar with and have enjoyed the unique dynamics at play when competitors come together to tackle complex problems their industry faces. There is indeed a unique sense of

accomplishment when you finally publish that Standard or guideline, or when you reach an agreement on a specific industry position. It's a feeling that your work is valuable and you have made the world a better place.

However, as with any processes, inefficiencies stand in the way of reaching that feeling. There is always room for improvements, specifically in operations. There are ways to develop Standards that are faster and cheaper, and with agreements that will last longer. My excitement resides in our unique position as NEMA staff to unlock these improvements. I look forward to doing just that in my new capacity as Industry Director for the Building Systems Division at NEMA. 📄



Marc Neufcort

# Human-centric Building Design Enhances Employee Health and Productivity

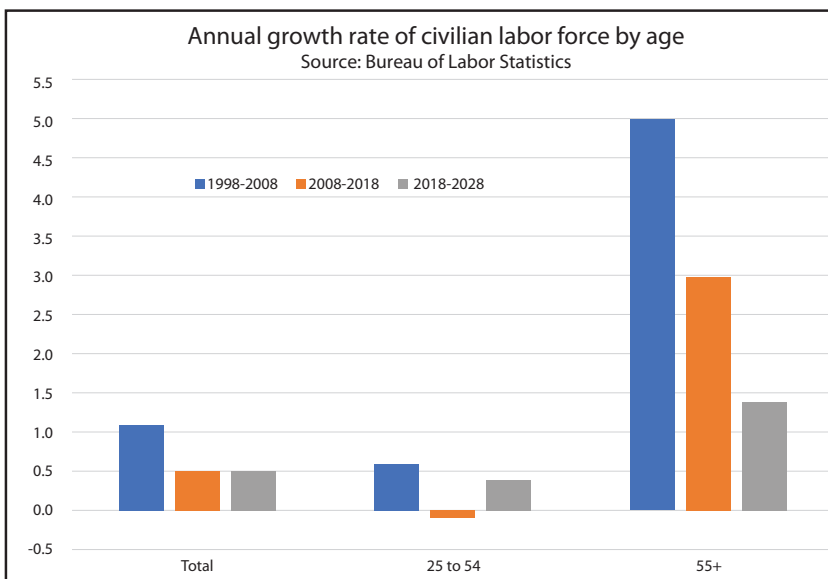
Workplaces designed for individual needs that boost productivity and enhance employee wellbeing can have a material impact on business outcomes. Advanced technologies in workplace lighting, ventilation and air quality, and temperature control are increasingly considered by some as “must-have” building design features that can create a more dynamic and productive work environment in addition to contributing to reducing a building’s carbon footprint. These new technologies blend digitalization, artificial intelligence, and advanced control systems to deliver connected systems that monitor, adjust, and improve key elements of the workplace environment.

Human-centric lighting (HCL) is at the forefront of this frontier and presents a new global market for lighting systems and products. Studies have shown that poor lighting can have negative health effects on our circadian rhythm, causing difficulty sleeping. HCL technology in the office allows for the user to “adjust the intensity and color temperature of the light to mimic natural light,” according to BUILDINGS.com.<sup>1</sup> An HCL system can be paired with advanced window shading systems to optimize performance. According to *High Performing Buildings Magazine*, shades can be “automated with software that ensures the shades are open at the right level, at the right time, to optimize their benefits.”<sup>2</sup> These products can be operated by smart, wireless controls or can be fully automated to improve performance.

According to the U.S. Environmental Protection Agency, airborne pollutants, chemicals, and even excess moisture can have short-term health and productivity consequences such as drowsiness and more long-term complications, including some respiratory diseases, heart disease, and cancer.<sup>3</sup> Devices that measure indoor air quality can communicate with HVAC sensors using Internet of Things (IoT) platforms to create systems that go beyond just heating and cooling. Improved ventilation will undoubtedly become a focus area in the next normal following the outbreak of COVID-19.

While some of the human-centric design is about individual products, a main feature is the ability to integrate these components into one management system. Sensors, artificial intelligence, IoT, and data have unlocked the ability of predictive analytics, according to *The IoT Magazine*.<sup>4</sup> We are empowered with the ability to intervene in order to prevent machine failure, predict condition-aware maintenance schedules, and optimize workflows.

In a post-coronavirus world, health and safety will remain a leading workplace challenge. This puts manufacturers in a unique position to promote those human-centric designs that can be credited as part of the solution to risks such as COVID-19. Despite a surge in pandemic related unemployment, a tight labor market remains for skilled workers of all types. Moreover, the size of the prime working-age labor force is projected to grow just 0.5 percent per year through 2028, intensifying the skilled labor-force gap, according to forecasts from the Bureau of Labor Statistics<sup>5</sup>, as shown in the accompanying chart. Human-centric building design offers companies a competitive hiring edge and greater expected productivity which will be important demand signals for products and systems that deliver these benefits. ©



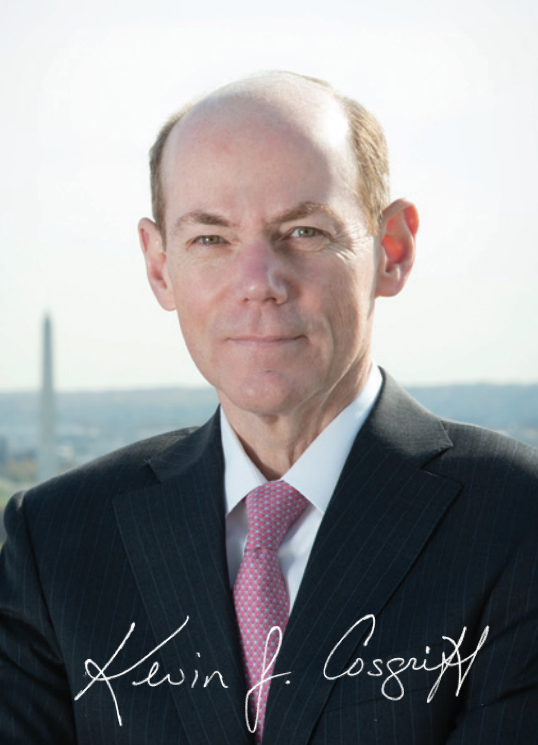
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## ENDNOTES FROM THE **PRESIDENT**

**E**lectrical manufacturers have consistently improved the efficiency of their products over time—in some cases dramatically. For example, annual electricity use from lighting fell 57 percent from 2001 to 2018 and has been the single largest contributor to energy efficiency gains this century. Motors, transformers, and many other electrical products are reaching their technologically and economically justifiable efficiency limits. Energy efficiency is no longer a differentiator for many products; it is a standard feature. Therefore, electrical manufacturers are thinking “beyond efficiency” when developing new products and systems.

The range of the possible is broad: Decarbonization, safety, health, productivity, comfort, data collection, machine learning and analysis all are viable considerations when contemplating providing value to consumers that extends beyond efficiency. For a place to start, however, NEMA might consider two broad attributes that are of the same nature and scale as our still-valid focus on safe, reliable, and efficient products and systems: resilience and sustainability.

Since many NEMA products are ultimately used in larger systems, we usefully might explore how a product contributes to system-level resilience. This broad category would take different forms in the six electrical Divisions of NEMA. And the Medical Imaging and Technology Alliance (MITA) Division of NEMA could consider how the use of the right type medical imaging contributes to the resilience of healthcare across that value chain.

Resilient systems can predict, absorb, and quickly recover from disruptions. For example, microgrids and energy storage systems can be used not only for backup power, but can also jump-start the grid by offering so-called “black start” capability needed to re-power generation facilities after an outage. Another example of system resilience is stockpiling traffic management system replacement parts in geographically strategic locations to ensure streetlights and traffic control systems can be restored quickly to maintain an orderly flow of traffic in the event of a natural disaster. Yet another example is the use of advanced industrial sensing and artificial intelligence to monitor manufacturing equipment for anomalies and defects, to predict problems before they arise, and to facilitate restoration of equipment quickly if they do fail.

A second broad consideration is sustainability. If resilience typically relates to a system, sustainability touches on both product manufacturing processes and potential downstream contributions. This can mean maintaining a given activity at a certain level, but also avoiding the overuse of natural resources or using them in environmentally injurious ways.

For example, volt/VAR optimization (VVO) devices can measure and automatically control voltage levels delivered to electricity customers. In turn generation facilities only have to deliver the minimum required voltage, reducing wasted electricity, fuel consumption, and emissions in the process. Another instantiation of sustainability is in the idea of the circular economy and end-of-life recyclability, as enabled by electrical products made from more easily recycled components.

In 2021, NEMA will launch a new Strategic Initiative called “Beyond Efficiency” to promote and advocate for technologies and policies that contribute to resiliency and sustainability while delivering positive business outcomes for Members.

Electrical manufacturers have always been innovators, beginning with Thomas Edison, Nikola Tesla, and George Westinghouse. Today is no different. It is time to move beyond efficiency to our next big challenge. 🌐

Kevin J. Cosgriff  
NEMA President and CEO

### 2020 Editorial Calendar

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Improving the manufacturing process

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