

# electroindustry

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## Building Infrastructure:

## Backbone of Our Connected Future

2020  
MarCom Awards  
2020  
Hermes Award  
2018 AM&P  
EXCEL Award

**NEMA**



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## FROM THE CHAIR

### Together, Let's Take the Edge On

As we all look toward 2022, this final 2021 issue of *electroindustry* peers even further ahead. It explores how our industry will galvanize the connected future over the coming decade.

There's much attention on 5G, and most of it focuses on its broad-reaching opportunities to enhance industrial processes. We must also consider that the 5G revolution is going to require sweeping changes to our country's infrastructure. I'm talking about our cities, homes, buildings, industrial sites, data centers, and telecommunications—our street corners and rooftops. The fabric of our built environment will change.

For instance, the 5G speeds of tomorrow will require many more transmission points than previous technologies. No matter where they are placed, whether on a telephone pole, within a building, on a roof, or along transportation routes, 5G transmission points need to be protected and powered.

These transmission points—or nodes—will need to be closer to users and their equipment and require NEMA Building Infrastructure Division products, conduit, electric boxes and enclosures, and surge and overcurrent protection to operate as intended.

True low-latency, high-band 5G connectivity also depends on vastly distributed telecommunications and IT equipment networks—otherwise known as the network edge. But it's not just telecommunications and IT infrastructure that will transform. The way we use energy also needs to change. After all, when we're talking about more data, we're also talking about more electricity.

The arrival of true 5G will dramatically increase energy consumption. One recent report estimates that the total energy consumption for telecommunications networks will see a 10 percent compound annual growth rate until 2030. So, how do we support exponentially more 5G data with exponentially more electricity without creating exponentially more carbon emissions?

One area we should focus on is the network edge. An IDC report estimates seven million edge locations are already operating today—spread across hospitals, factories, and hotels—compared to 39,000 core data centers. That number will only grow.

A microdata center on every street corner is the key to 5G ultra-low latency. But let's face it: Street corners aren't ideal IT spaces. It takes extra care and NEMA building infrastructure products to keep them secure and supplied with reliable power and cooling.

Fortunately, it's now possible to achieve robust monitoring and optimization across IT networks, from the cloud to the edge. Advanced remote monitoring software tracks real-time conditions and sends text alerts when downtime threats arise. And cloud analytics can quickly distill petabytes of data into significant energy efficiency opportunities. With these advances, sustainability at the edge is possible.

And yet, our focus shouldn't end at the edge of the network; we must also transform the edge of the grid. Data centers will need clean energy microgrids in every neighborhood or home as our lives grow more digital.

The coming years promise major transitions for the electrical and telecommunications industries, and NEMA Members are at the forefront. Our technologies will make it happen and usher in an electrified, digital, resilient, sustainable future for all. Let's take this on together. ☺

Annette Kay Clayton  
Chair, NEMA Board of Governors

## Survey Reveals How and Why Surge Protective Devices Are Used

**Brianne Deerwester,**  
Communications  
Coordinator, Electrical  
Safety Foundation  
International

The NEMA Low Voltage Surge Protective Device Product Section (BI-VS) and ESFI recently surveyed commercial and industrial facility professionals, including building owners, managers, heads of maintenance, and engineers. The professionals provided information on the use of surge protective devices in their facilities and power surge incidents and effects. The results were highlighted in an infographic, Understanding Surge Protective Devices Survey (see on Page 5), and video, Surge Protective Devices Misconceptions, to better educate facility professionals on the devices and their functionality.


The overwhelming majority of survey respondents viewed surge protective devices as a success, as 79 percent reported that the devices reduced downtime and equipment failure significantly or completely in their facilities. When professionals were asked about the frequency of unexpected downtime, 49 percent reported that a power surge had caused an interruption within the last 12 months, while 72 percent experienced downtime more than a few times a year. Respondents reported that power surges and unexpected resetting or misoperation of equipment caused 34 percent of unplanned power outages. Equipment in service for five years or less bore the brunt of power surges, with 78 percent of the equipment failure. However, only 23 percent of facilities installed surge protective devices after experiencing a power surge event.

Respondents reported that the most common causes of power surges included switching of electrical loads, lightning, faulty wiring and/or connections, and damage to power lines. Regarding respondents that did not currently have surge protection installed, 62 percent said that it had been recommended for their facilities,

while 21 percent of those without surge protection said they plan on installing it in the future. Forty percent of survey respondents indicated that their facilities had surge protection technology for one to five years, while an additional 39 percent reported having surge protection for six or more years.

Regarding when respondents first purchased surge protection, 23 percent said they bought it after experiencing a surge event and because of other catalysts, including during a build and/or specification (27 percent) and renovation (23 percent). Most facility professionals reported having surge protective devices inspected or tested monthly (54 percent), and 94 percent of those who tested or inspected their devices did so as part of routine maintenance.

The survey also revealed mixed results on people's knowledge of surge protective capabilities. Only surge protective devices, also known as transient voltage surge suppressors, protect against power surges. Fuses and breakers, ground-fault circuit interrupters (GFCIs), wiring, low-cost uninterruptible power supplies, and typical power strips do not offer power surge protection. It's also imperative to note that surge protective devices protect only against voltage surge events created by motor starts and/or stops or load switching. They provide a degree of protection against direct lightning strikes but are not intended to protect against long-term, sustained overvoltage events.

Surge protective devices protect against damage, downtime, and lost revenue. Installing these devices in a facility helps prevent costly electrical failures and helps to maintain the system and data reliability of expensive electrical equipment. For more information on power surges or surge protective devices, visit [NEMAsurge.org](http://NEMAsurge.org) and [esfi.org](http://esfi.org). 



# UNDERSTANDING

## SURGE PROTECTIVE DEVICES SURVEY

In 2021, the **Electrical Safety Foundation International** surveyed industrial and commercial facility professionals, including managers, owners, building engineers, heads of maintenance, and related occupations. These professionals **provided insights** regarding power surge incidences and effects, as well as usage of **Surge Protective Devices** in the facilities they manage.

## COMMON VOLTAGE SURGE CAUSES



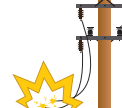
Switching of  
Electrical Loads



Lightning



Faulty Wiring and/or  
Connections



Damage to  
Power Lines

## INSTALL SURGE PROTECTIVE DEVICES TO PREVENT DOWNTIME & PROTECT EQUIPMENT

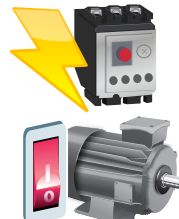
### SURGE PROTECTIVE DEVICES WORK

**79%** of facilities state that **Surge Protective Devices** have cut down on the amount of **downtime** and **equipment failure**.



### UNPLANNED OUTAGES CAUSES

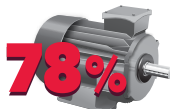
**34%** of unplanned outages are caused by **power surges** and **unexpected resetting** or **mis-operation** of equipment (Commonly caused by power surges).



Unexpected downtime is common with over **72%** of facilities surveyed experiencing downtime more than a few times a year.



**23%** of facilities installed Surge Protective Devices after **experiencing a surge event**



**78%** of equipment failure caused by power surges were in service for **five years or less**

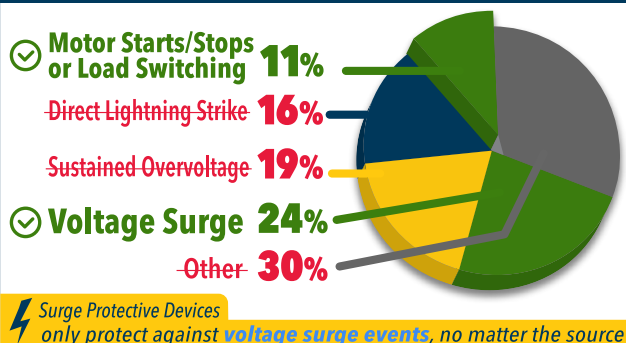


**49%** reported that a power surge had caused an interruption **within the last 12 months**

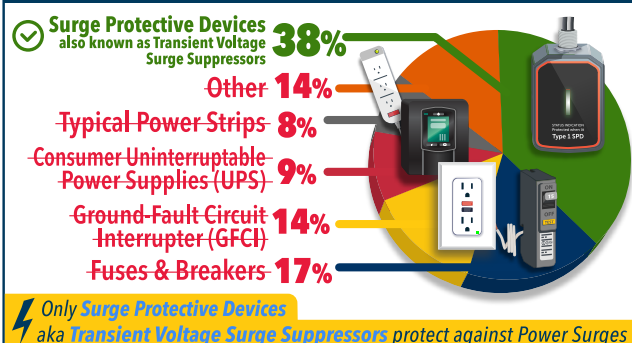
## SURGE PROTECTIVE DEVICE & POWER SURGE MISCONCEPTIONS

Respondent's knowledge of surge protective capabilities **revealed mixed results**.

### WHAT CAN A TYPICAL SURGE PROTECTIVE DEVICE PROTECT AGAINST?



### WHICH OF THE FOLLOWING DO YOU BELIEVE PROVIDE SURGE PROTECTION?



VISIT **ESFI.ORG** AND **NEMASURGE.ORG** TO SEE FULL SURVEY RESULTS & LEARN MORE ABOUT SURGE PROTECTIVE DEVICES



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[www.youtube.com/ESFI.org](https://www.youtube.com/ESFI.org)

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# NEMA Publishes Lessons-Learned and Best Practices for Workforce

The National Electrical Manufacturers Association (NEMA) published a new *COVID-19 Workforce Development Report*. This document highlights workforce management tactics and strategies NEMA Members and other manufacturers implemented out of necessity during the pandemic. It also identifies adaptations that are likely to persist, and how they can be applied to small, medium, or large businesses. The report addresses the full life cycle of workforce management: Workforce Strategy Planning, Talent Acquisition & Onboarding, and Talent Development.

“Our industry continues to face challenges in the area of workforce development. For many industries, including ours, those challenges were exacerbated by the COVID-19 pandemic. Our

Members stabilized their businesses and met demand through innovative responses that can and should be more broadly adopted,” said NEMA President and CEO Debra Philips. “The *COVID-19 Workforce Development Report* highlights how some of our Members have adapted to the pandemic and navigated uncertainty, including what has worked for them and how it could be replicated by other manufacturers, large or small. The report is also peppered with important “post-COVID keepers” which will benefit any manufacturer looking to improve their workforce development efforts.”

*NEMA COVID-19 Workforce Development Report* is available for download at no cost on the NEMA website. For more information, please contact Marc Neufcourt at [marc.neufcourt@nema.org](mailto:marc.neufcourt@nema.org) 

**Marc Neufcourt,**  
Industry Director,  
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Danny Abbate,  
Industry Director,  
Building  
Infrastructure,  
NEMA

## The Backbone of Our Connected Future

***NEMA Members depend on building infrastructure products to keep connections flowing efficiently***

**Q**uality building infrastructure products have a massive impact on modern commerce and society. Those products—manufactured by NEMA Members—power the world economy, protect the global population from shock and fire, and construct the electric backbone that makes contemporary life possible.

Today's electrical grid provides safe, ubiquitous power access to more places than ever before, including business, education, healthcare, hospitality, manufacturing, and many other industries. Behind the increase in connectivity and electrification are essential supporting technologies—steel conduit, surge protectors, industrial fuses, and cable trays, to name a few—that keep connections flowing efficiently.

Because people tend to think about electricity when there's a power outage the aforementioned electrical building infrastructure often is taken for granted. The products sit behind walls or in ceilings year after year, providing silent assurance, supporting data centers that offer connectivity, protecting people and sensitive electronics from being harmed, and serving to make

people's lives comfortable and safe.

For example, there are far fewer electrocutions in homes thanks to the increased adoption of ground-fault circuit interrupters (GFCIs). Many types of wiring devices have been standardized, encouraging companies to develop safer products. Surge protective devices are a cost-effective solution to prevent downtime, improve system and data reliability, and mitigate equipment damage due to transient overvoltage events, more commonly referred to as surges, for both power and signal lines.

NEMA helps advance these products by writing Standards, developing and advocating for strong building codes, and promoting safe electrical products through the work of its seven product Divisions. Building infrastructure is the backbone of the electric world. But how are the six other NEMA Divisions affected by Building Infrastructure products Division, and how do they interact with building infrastructure?





## Building Systems

Building Systems Division products help increase the comfort and productivity of people in commercial, government, and industrial facilities.

New and retrofit commercial, industrial, and residential buildings rely on integrated systems to provide shelter, safety, comfort, and convenience. Automated systems are possible because of controllers, sensors, and software that aggregate data, analyze system use, diagnose problems, predict maintenance needs, and improve performance. The shift from singular products to connected systems reflects and encourages innovation in design, technology, sustainability, and life safety. These building systems require electricity, delivered with products from the NEMA Building Infrastructure Division such as cable trays, steel conduit, cable buses, enclosures, GFCIs, surge protective devices, and electric receptacles.



## Industrial Products and Systems

From mining operations to space exploration and everywhere in between, the NEMA Industrial Products and Systems Division supports a smart manufacturing approach to meet the needs of global markets. Member companies increase quality, decrease waste, maximize output, and minimize energy used through

artificial intelligence, automation, big data, industrial connectivity, optimized systems, sensors, and other technologies. The Division is also a force behind developments that include the Industrial Internet of Things (IIoT), Industry 4.0, systems efficiency, nanotechnology, augmented and virtual reality, predictive modeling, and 3D printing.

NEMA electrical enclosures are essential to ensure the safe and efficient operation of industrial machinery. The Building Infrastructure Division's various conduit and cable management products such as cable ties, cable trays, cable cleats, and cable buses route the wires and connections throughout industrial facilities. Manufacturers would not be able to implement Industry 4.0—the automation of manufacturing and industrial practices using smart technology—without infrastructure products serving as the backbone of electrical facilities.



## Lighting Systems

The NEMA Lighting Systems Division intersects every aspect of modern life and strives to achieve reasonable energy and environmental regulations and promote the benefits of lighting.

The lighting industry is evolving in the wake of disruptive changes caused by the widespread adoption of light-emitting diode (LED) technology. When sensors, networks, and software are connected or added to LED infrastructures, the resulting system enables services, benefits, and revenue streams that exceed the value of lighting alone. The LED revolution affects efficiency, cost, demand, production, and global competition. It also allows for more control of lighting, resulting in more consumer options and higher-quality lighting designs.

Lighting control devices, motion sensors, and timer switches have long been integral parts of a basic lighting system. Now, as lighting controls and

connected lighting systems become more popular and available, the compatibility of wiring devices with all lighting products becomes more relevant. The NEMA Building Infrastructure Division and Lighting Systems Division collaborate regularly on NEMA 410 *Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts*, to ensure this vital Standard accurately represents the industry criteria for quality products. Without Building Infrastructure Division products such as wiring devices, outlet and switchboxes, and wire management systems, buildings, streets, and walkways would go dark.



## Transportation Systems

The NEMA Transportation Systems Division promotes the tools and infrastructure associated with moving people and goods from Point A to Point B safely and efficiently while also ensuring systems are cyber secure. Division Members produce integrated information management and control systems that inform users and facilitate smarter utilization of transport networks. Products and assemblies deliver and manage electrical energy between an electric vehicle (EV) and an electrical source. They also enable energy stored in EVs to be fed back into the electrical grid and encompass outdoor and roadway lighting solutions ranging from traditional methods to intelligent ones that adapt to their surroundings.

As the transportation sector becomes increasingly electrified, the corresponding building infrastructure will need to accommodate the growing deployment of electric vehicle supply equipment (EVSE). An EV-ready home ensures that the conduit and service panel capacity are ready and available for an EVSE. An EV-ready parking space needs full 208/240-volt circuit installations for a commercial building, including

panel capacity, raceway wiring, and receptacle and circuit overprotection devices that can provide “Level 2” charging defined in the SAE J1772 Standard. Including these EV-ready infrastructure requirements in building codes will support the transition toward EV ownership throughout the country.



## Utility Products and Systems

The NEMA Utility Products and Systems Division drives the modern power grid with dynamic equipment that ranges from manually operated apparatus to advanced automation software. The Division contributes to the development of transformational trends like microgrids, energy storage, and distributed generation systems to ensure reliable and resilient delivery of electricity.

Division Members manufacture the devices that keep the electrical grid operating efficiently and enable grid operators to respond to the demand for reliable energy with trends like digitalization, self-healing grids, and reinforced infrastructure. These products and systems enable renewable generation, energy storage, and energy management by using building infrastructure products such as capacitors, connectors, and insulators as well as smart meters, switchgear, and transformers,

NEMA enclosures are ubiquitous in power distribution products, particularly those installed in outdoor areas with exposure to external elements like water or pollutants. In some cases, such as meters and meter sockets, the entire apparatus might be enclosed. In larger equipment such as medium- or high-voltage switchgear and circuit breakers, only the control box utilizes an enclosure. Enclosures are essential to preserving power grid equipment longevity and proper functionality.



Utility-scale switchgear and circuit breakers contain internal low-voltage circuits used to power lights and other sensors within the control box. Utility workers and repair personnel regularly need to access the control box, so manufacturers employ cable management products to run conduits away from controls and visual alarms to prevent access.



## Medical Imaging & Technology Alliance (MITA)

Medical imaging drives effective patient care through screening, diagnosis, and treatment. The Medical Imaging Division, known as the Medical Imaging & Technology Alliance (MITA), is the collective voice of medical imaging equipment manufacturers, radiopharmaceuticals, innovators, and product developers. The Division's Members strive to reduce regulatory barriers, establish Standards, and advocate for the medical imaging industry with technologies that include medical equipment employing noninvasive modalities.

MITA products help safely and quickly diagnose medical issues and are integral to peoples' health and wellbeing. Products from the NEMA Building Infrastructure Division help medical imaging equipment operate seamlessly and safely. NEMA enclosures house the electric components of the medical imaging equipment, GFCIs ensure the safety of those operating equipment, and surge protective devices protect equipment from internal and external surges.



## Building Infrastructure Enables Connected Life

As electrification continues to proliferate to all aspects of life, NEMA Building Infrastructure Division products quietly deliver electricity to businesses, schools, hospitals, houses, and nearly every building. The Internet of Things has led to the introduction of new products, sensors, and connected devices rapidly, amplifying the importance of these products. They will be there whether people think about them or not, day and night, without pause or complaint, enabling today's connected life. 📶

### NEMA Building Infrastructure Division Highlights

The NEMA **Surge Protective Devices Section** has two ongoing research projects. The first is investigating surge susceptibility, where common electrical products are being tested to determine the effect of surges on functionality. The second attempts to determine the efficacy of commonly available Power Quality Monitors to mitigate surge events. Both projects will help consumers understand the need for surge protective devices to protect valuable electrical equipment.

The **Cable Tray Section** is continuing a marketing campaign to promote correct and safe installation. That group is also working with a Korean consortium to propagate NEMA cable tray requirements.

The **Pin and Sleeve Plug and Receptacle Section** has begun work on two application guides: Non Hazardous Industrial and Hazardous Locations.

Both the NEMA **Ground Fault Personnel Protection and Wiring Device Sections** met in conjunction with the NEMA Annual Meeting. For more information, contact Industry Director Daniel.Abbate@nema.org. 

# Power, Light, and Data Rely on Cable Management, Receptacles,

Steve Killius,  
Vice President,  
Contractor  
Industry Affairs  
and Programs,  
Electrical  
Wiring Systems,  
Legrand North and  
Central America

**T**he pace of change in our connected lives and recent global events have affected how people use built spaces. Construction is rapidly moving to digitize and standardize infrastructure to speed delivery, control waste and cost, and improve building quality.

The emergence of improved delivery systems and trends in off-site and modular construction means it has never been more critical that the electrical

infrastructure in our built environments be supported and ready to meet the needs of the technologies that bring our spaces to life. Our buildings need to be as intelligent and efficient as the people who occupy them.

A building's infrastructure will need to power its current systems for light, comfort, and entertainment and meet future technological needs. With the adoption of the Internet of Things at home and work, a building's electrical system might need to change continuously to meet these needs.





## and More

### Connections Everywhere

The rapid proliferation of connected devices has users looking for power and charging everywhere they go—at the workplace or anywhere they gather to relax, recreate, and rejuvenate. Whether commercial, residential, corporate office, hotel, casino, or even outdoor spaces, carefully selecting a building's electrical infrastructure can boost the ability of a building to meet its occupants' technology power requirements for years to come.

Users are also looking for ways to connect to 5G wireless speeds, which means building designers will need to consider where 5G transmission points will be located, either within the building, on the roof, or on nearby telephone poles or transmission routes. Those transmission points—or nodes—will need to be protected by NEMA Building Infrastructure Division products such as cable management, electric boxes and enclosures, and surge and overcurrent protection, to name a few.

Whether planning for a new space or rehabbing an older one, a building's electrical infrastructure should be well designed and include flexibility, adaptability, efficiency, safety, productivity, and a quality user experience.

### Managing Cable Systems

Open cable management systems like ladder trays and wire mesh management systems form the framework of power delivery. The open wire and cable distribution and management concept, common in Europe and code compliant, consists of a grid of ladder or wire mesh trays to provide a facility with better access to electrical infrastructure.

Once installed, these options offer lower installation and lifetime costs. Additionally, open cable management is highly flexible and installs easily. A reusable open wire and cable management system means that designers can quickly make additions, moves, and changes to repurpose the space, making changes to power infrastructure as required. A properly designed cable management system can yield benefits for the life of the facility.

### Powering Spaces

Receptacles placed to allow public access should include device charging. For example, solutions exist to surface mount and place receptacles in furniture for power and charging. In slab cable management systems like duct and frequently placed floor boxes placed during new construction put power and communications in accessible places. For both new and reconstruction/remodeling with access to space below, slab penetrating poke through devices allow the frequent and flexible placement of power, data, communications, and charging.

With the post COVID “return to work”, companies may need to keep a certain amount of space between people or reinvent spaces for multiple uses. Plug together desk/tabletop modular power systems can




reconfigure these new flex-spaces for different purposes or respond to future needs. These solutions allow you to use a conference room one day and convert the room to a training or classroom in minutes. Outdoor power solutions enhance the way people think about exterior space. We are encouraged to move around and work and a change of environment can be productive. With outdoor power and charging stations, including solar charging options and in-ground boxes, it's easy to provide outdoor power and device charging solutions to any space where people gather. In all of these spaces, adding today's high-power USB charging ports for charging our devices means people gather more and stay longer. These devices are available today with power levels high enough for larger and more power-hungry devices. Prepare for the demand by installing the highest power charging receptacles available.

## An Evolution in Infrastructure

Designing a space to meet energy codes and Standards while meeting owner and user needs can be difficult and complex. Be sure to select and specify infrastructure solutions that enable high-performance buildings, reduce the environmental impact of the space, and transform how people live and work—more efficiently, comfortably, and safely. In addition to convenient and flexible power, intelligent buildings integrate building and lighting controls,

fire alarm systems, security, surveillance, and access control systems to meet codes and Standards and deliver the safety, comfort, and convenience people seek. Make your facility future-ready.

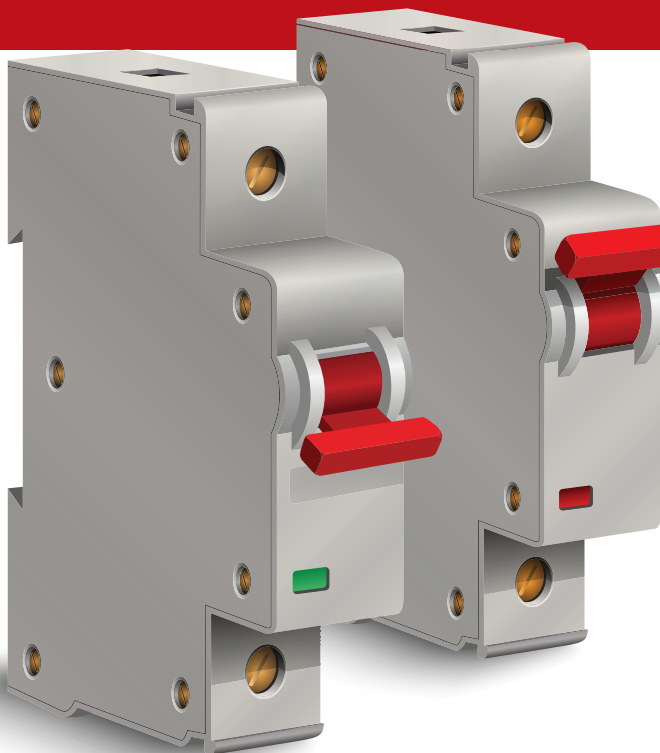
We are in the middle of an evolution with these disparate building services and applications converging onto a common infrastructure, enabling new services and experiences for the occupants, operators, and building owners. With further developments of the Power-over-Ethernet (PoE) Standards and emerging technologies around Digital Electricity/DC power, we are witnessing more devices coming onto a low-voltage cabling infrastructure. The common infrastructure is taking the shape of the IT infrastructure that is already the network backbone of buildings. Cabling needs for power, light, and data will change. Attention to trends will permit you to prepare your facilities to have an infrastructure ready to meet future needs.

Reliable, flexible power and electrical solutions are the backbone of future technology. Be ready for new technologies and rapidly changing user demand by designing and installing an electrical infrastructure that can adapt, grow, and change to meet future needs. 





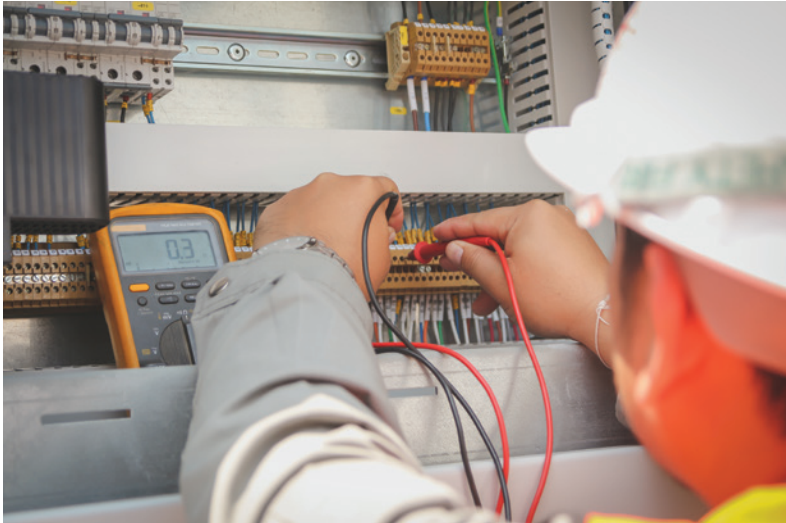
# Fusing a Path Toward Compliance



Those who design and construct commercial buildings live by a code. It's the *National Electrical Code*®, or *NEC*.

Many thousands of products help builders and designers stay compliant. Overcurrent circuit protection items, such as modern current-limiting fuses, help enhance safety and reliability and ensure conformity with code requirements.

Dan Neeser,  
Senior Field  
Application  
Engineer, Eaton



The main *NEC* requirements include Interrupting Rating (IR), Short-Circuit Current Rating (SCCR) and Selective Coordination.

## Interrupting Rating

Interrupting Rating (IR) is the maximum fault current at a specified voltage that a circuit breaker or fuse can safely interrupt under standard test conditions. An Overcurrent Protection for Equipment and Conductors (OCPD) must interrupt destructive fault current energy safely. A fault current could rupture, causing damage and posing a safety hazard if it exceeds a level beyond OCPD capacity.

An interrupting rating defines the OCPD ability to maintain its integrity when reacting to fault currents. When applying a fuse or circuit breaker, it's essential to use one that can safely interrupt the largest potential fault currents. Most modern, current-limiting fuses have a 200 kiloampere (kA) or 300 kA interrupting rating. Misapplication is rare; thus builders may use them in nearly any system. *NEC* 110.9 requires equipment intended to break current at fault levels to have an interrupting rating sufficient for the available fault current at the point of application.

The fuse interrupting rating is not dependent on a particular voltage when applied within its rating. For example, a 600 Vac rated fuse can have a UL Listed 300 kA interrupting rating for any voltage up to 600 Vac. Whether for the initial installation or system updates, a fusible system can maintain a sufficient interrupting rating throughout its life. There is little need for additional fault current calculation, and builders need not worry that an improper interrupting rating will cause a fuse misapplication. A short-circuit

study isn't needed, either, when applying fuses for selective coordination. In this case, meeting *NEC* 110.9 requirements is simple.

Additionally, high interrupting ratings help equipment achieve a high short-circuit current rating that may be limited by the installed OCPD's low interrupting rating.

Fuses provide peace of mind as the interrupting rating is always at least equal to or, in many cases, greater than the available fault current at the line terminals.

## Equipment Short-Circuit Current Rating

Short-circuit current rating (SCCR) is the ability of the equipment to withstand a certain magnitude of short-circuit current at a specific voltage in conjunction with an OCPD without causing a shock, fire, or projectile hazard external to its enclosure. SCCR may be an attribute of a single electrical device, such as a contactor, or of an electrical apparatus with multiple devices in an enclosure, such as a panelboard, switchboard, motor control center, or industrial control panel.

*NEC* 110.10 requires equipment to have an SCCR adequate for the available fault current. Compliance with equipment short-circuit current protection (*NEC* 110.10) is an analysis much different than compliance with overcurrent protective device interrupting ratings (*NEC* 110.9). *NEC* 110.10 requires all electrical equipment to have adequate short-circuit current protection. The intent of *NEC* 110.10 is that the equipment and OCPDs must be "selected and coordinated" so that equipment will not sustain extensive damage under fault conditions up to the available fault current value.

To assure proper application, the designer, installer, and inspector must guarantee that the marked SCCR of a component or equipment is greater than the calculated available fault current. To ensure compliance, it's necessary to:

1. Determine the available fault current at the point of installation of the component or equipment
2. Ensure the component or equipment marked SCCR is equal to or greater than the available fault current

Equipment manufacturers may use current-limiting fuses to increase the equipment SCCR by using



methods under product Standards such as UL 508A for industrial control panels. Specification and installation of equipment with higher SCCRs, such as 200,000 amps, make it easy to meet the requirements of the NEC. In addition, equipment with the highest ratings can be moved from plant to plant without worrying about unsafe situations that might arise from placing the equipment in a new location where the available fault current is higher than the old location and now above the rating of the equipment.

## Selective Coordination

Selective coordination is critical for electrical distribution system reliability. A dependable system is not only important for life safety. It's vital from a business perspective as nothing will stop all activity, paralyze production, inconvenience, and disconcert people more than a major power failure.

Selectively coordinated overcurrent protective devices address localizing faulted conditions on the power distribution system and often have a reliability design goal. In addition, the NEC mandates selectively coordinated OCPDs for circuits that supply power to vital loads in specific building system applications (such as multiple elevators, emergency, legally required, and critical operation power systems). A properly

selectively coordinated engineered and installed system will allow only the nearest upstream OCPD to open for the full range of overcurrents (both overloads and all fault types), leaving the remainder of the system undisturbed and preserving continual service.

Correctly selected and applied fuses alleviate the design hassle of trying to achieve selectively coordinated OCPDs. Fuses must maintain a minimum 2:1 amp rating ratio for upstream and downstream and be properly chosen to achieve selective coordination. This eliminates the possibility of cascading multiple OCPD levels under fault conditions.

NEMA Members offer solutions that can help builders and designers meet code requirements, such as selective coordination. The manufacturers' comprehensive overcurrent circuit protection products portfolio provides solutions that enhance safety and reliability and ensure compliance with code requirements.

For proper selection and sizing of an application, contact a NEMA Member: <https://www.nema.org/directory/products>

*NEMA Members from Eaton, Littelfuse, and Mersen contributed to this report. 📧*



## NEMA Has Its Eyes on Washington: Roundup



### HOUSE PASSES BIPARTISAN INFRASTRUCTURE BILL, SENDS TO PRESIDENT BIDEN FOR SIGNATURE

The House of Representatives passed the *Infrastructure Investment and Jobs Act* by a bipartisan vote of 228-206. This comprehensive infrastructure bill covers surface transportation, grid infrastructure, and resiliency, cybersecurity, clean technology supply chains, energy efficiency, building infrastructure, smart manufacturing, transformer/motor drive system rebates, and more. It will modernize American electrical infrastructure and other sectors as well. NEMA calculates that the bill will direct approximately \$24 billion in direct funding for NEMA products, with an additional \$391 billion in broader spending of which NEMA products are a portion. Passage of this bill is the starting line to a complex, multi-dimensional, 5+ year implementation timetable.

— *Phil Squair, Vice President of Government Relations, NEMA*

### COMMERCE DEPARTMENT ANNOUNCES EARLY ALERT SYSTEM TO IMPROVE SEMICONDUCTOR SUPPLY CHAINS

The U.S. Department of Commerce has established a system whereby companies can submit information via email “regarding new or ongoing COVID-related shutdown or disruption to microelectronics and semiconductor manufacturing facilities and their related supply chains around the world.” According to the announcement, “the information gathered will be used to assess potential disruptions, enhance engagement with foreign governments as appropriate, and work to safely reopen these critical microelectronics and semiconductor facilities.”

— *Phil Squair, Vice President of Government Relations, NEMA*

### SYSTEMICALLY IMPORTANT CRITICAL INFRASTRUCTURE BILL INTRODUCED

Bipartisan draft legislation by Reps. John Katko (R-NY) and Abigail Spanberger (D-VA) has been introduced which would direct the Cybersecurity & Infrastructure Security Agency (CISA) to designate certain entities “systemically important critical infrastructure (SICI),” a classification which would allow qualified sector owners and operators to additional resources to modernize and maintain their cybersecurity operations. As currently written, the legislation would mandate a participant-driven process in developing SICI criteria, including input from Sector Risk Management Agencies and their “stakeholders,” read critical infrastructure sectors of which NEMA and its Members belong.

In a way, a SICI is a form of cybersecurity labeling. It would highlight and distinguish certain industry sectors as being more deserving of resources and protections due to their critical role in society. Some incentives being to approved entities include front line access to cybersecurity programs and technical support, security clearance application prioritization, and greater liability protection for shared information. In exchange for these added benefits, companies would be subject to an information sharing arrangement. This legislation is not expected to move through NDAA or other must-pass bills this year, signifying that Congress will continue receiving feedback from interest groups on SICI.

— *Peter Ferrell, Government Relations Manager on Cybersecurity and Data Policy, NEMA*

### FCC SEEKS COMMENTS ON POSSIBLE FEES FOR CONNECTED DEVICES

NEMA is developing individual and joint comment documents for a notice of proposed rulemaking from the Federal Communications Commission (FCC). The proposed rulemaking inquires about ways to charge fees for currently unlicensed devices using the industrial, scientific, and medical (ISM) bands (example: WiFi) on a not-to-interfere basis with fee-paying licensees. All Members are welcome to join the working group or provide feedback to the draft comments.

— *Alex Boesenberg, Director of Regulatory Affairs, NEMA*



## The Changing Electrical Industry Landscape

Technology continues to shape the electrical industry and the built environment to drive innovation in a world that has become more digitized and dependent on electricity. Electrical power in homes, businesses, institutions, industry, and other locations is vital, and advancements in technology further support society's reliance on electrical power.

As we continue to use electricity to perform day-to-day tasks at home or work, electrical systems have become more complex with the advent of building energy management and smart grid technologies. Electronic appliances and other sensitive electronic equipment have a growing need for dependable protection due to increased exposure to surges, transients, and other power threats. Those threats are inherent to today's distributed power systems, both internal and external to the building or manufacturing environment. A survey conducted by the Electrical Safety Foundation International (ESFi) revealed that power surges cause 34 percent of unplanned outages, and 79 percent of the survey responses stated that surge-protective devices (SPDs) cut down on the amount of downtime and equipment failure. Surge protection is a well-understood and cost-effective technology utilized to protect electrical devices.

Requirements for surge protection in earlier editions of the *National Electrical Code*<sup>®</sup> primarily focused on installing SPDs and not necessarily mandating their installation. Over past code cycles, new requirements have been added to the NEC specifying SPDs for specific applications and equipment. Those include elevators, escalators, moving walks, chairlifts, critical operations data systems, industrial machinery with safety interlock circuits, wind electric systems, fire pump controllers, emergency systems, and power systems requiring continuous operation for the reasons of public safety, emergency management, national security, or business continuity.

As the electrical industry landscape continues to advance by leaps and bounds, the 2020 NEC has kept in stride with the inclusion of surge protection requirements for dwelling units. As electronic controlled product use continues to increase in the home, introducing this requirement couldn't be

any timelier. It addresses the need for surge protection to protect the sensitive electronics found in most modern appliances, life safety devices, and equipment used in dwellings. This new requirement will necessitate surge protection for new installations and when service equipment is replaced.

The 2023 NEC revision cycle is well underway, and we anticipate further expansion of requirements for the use of surge protective devices. Electrical power continues to be a catalyst for better lifestyles, driving economic development and enabling a more efficient operational environment for local businesses to succeed. Surge protection will help maintain the reliability and operation of sensitive electrical equipment where citizens live, work, and play.

Additional information from NEMA on surge protection can be found by visiting [www.nemasurge.org](http://www.nemasurge.org) and Electrical Safety Foundation International at [www.ESFi.org](http://www.ESFi.org). @



# The Importance of Phenolic Resins in Conduit

For more than a century, phenolic resin products have been mainly used in the production of circuit boards but are better known for producing molded products such as billiard balls, laboratory countertops, coatings, and adhesives.

Phenolic resins are versatile polymers. They are a synthetic thermosetting resin invented by Dr. Leo Baekeland in 1907 and the first plastic sold commercially.

Phenolic resins are divided into two types, novolacs and resoles. Both have high-temperature stability up to 572°F – 662°F, high water stability, and chemical stability.

## PHENOLIC PRODUCTS IN THE ELECTRICAL INDUSTRY

For the electrical industry, flame-resistant electrical conduit can be manufactured from phenolic resins. Electrical manufacturers have been able to modify phenolic resins in the manufacturing of phenolic fiberglass conduit. NEMA Members have offered phenolic conduit for many years, primarily for tunnel installations. Phenolic conduit protects electrical wires that provide lighting in the event of an emergency. Phenolic electrical conduit is available in various trade sizes and wall thicknesses.

NFPA 502 *Standard for Road Tunnels, Bridges, and Other Limited Access Highways* (National Fire Protection Association) is the governing Standard for automotive tunnels. It provides fire protection and life safety requirements for limited access highways, road tunnels, bridges, elevated highways, depressed highways, and roadways beneath air-right structures. For transit tunnels, NFPA 130 *Standard for Fixed Guideway Transit and Passenger Rail Systems* is the Standard that dictates similar safety requirements.

In addition to the requirements imposed by the *National Electrical Code*\* (NEC) Article 355, “Reinforced Thermosetting Resin Conduit: Type RTRC,” organizations such as UL, NEMA, and CSA have also defined the applicable Standards for the safety requirements and performance of RTRC products. Such NEMA Standards include the following:

- NEMA PRP 3, *Expansion Epoxy-Based Fittings for RTRC Rigid Nonmetallic Conduit*,

- NEMA TC 14.AG, *Aboveground Reinforced Thermosetting Resin Conduit and Fittings*,
- NEMA TC 14.BG, *Belowground Reinforced Thermosetting Resin Conduit and Fittings*,
- NEMA TC 14.XW, *Extra Heavy Wall Aboveground Reinforced Thermosetting Resin Conduit and Fittings*

## PROPERTIES OF PHENOLIC CONDUIT FOR TRANSIT AND ROADWAY TUNNELS

Phenolic conduit is fire-resistant and can be exposed to temperatures of up to 1,850°F for two hours. This property allows it to meet the elevated temperature requirements for exposed conduits according to NFPA and UL 2196.

Other attributes that contribute to NFPA Standards and U.S. Occupational Safety and Health Administration (OSHA) compliance are a low coefficient of thermal expansion, low-smoke characteristics, and no toxicity since halogen is not released when burning.

## PHENOLIC CONDUIT PROJECT BENEFITS

Phenolic conduit is a reliable conduit product for tunnels and other projects and offers the following benefits:

- Fire resistant — can withstand exposure to temperatures up to 1,850°F for two hours.
- Conforms to NFPA requirements
- Does not emit toxic halogens when burning
- Low coefficient of thermal expansion
- Wide resistance to industrial chemicals
- Streamlined installation due to light weight
- Corrosion resistance
- Fire-rated flexible conduit is able to retain its shape after impact or compression

Low coefficient of friction

- Will not melt or weld the wire to the inside of the conduit under fault conditions

Phenolic conduit offers durability, strength, and safety in roadways, trains, transit tunnels, and other critically demanding installations.

*The entire BI-TC Technical Committee contributed to this report. 🙏*



## World's Premier Magnet Wire Standard Now Available

**M**agnet Wire (ANSI/NEMA MW 1000-2020) is now available for purchase. It replaces ANSI/NEMA MW 1000-2018. MW 1000 is the world's premier Standard for general requirements, product specifications, and test procedures for manufacturing and packaging magnet wire. It contains all existing NEMA Standards for round, rectangular, and square film-insulated and/or fibrous-covered copper and aluminum magnet wire generally used to wind coils for electrical apparatus.

The 2020 edition contains new specification sheets for magnet wire constructions.

The audience of MW 1000 includes manufacturers of magnet wire, motors, generators, transformers, and electric and conventional vehicles.


It is available on the NEMA Standards Store for \$324.

Other recently published Standards:



*Electrical Submeter—General Requirements (ANSI/NEMA SM 31000-1-2021, formerly ESM 1-1* is available for \$74.

*National Transportation Communications for ITS Protocol Infrastructure Standards Security Assessment (ISSA) (NTCIP 9014 v01.20)* is available for \$300.

*Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing (NEMA TC 3-2021)* is available for \$100. 

## SPOTLIGHT

### Spotlight: I Am ESFI


Safety is at the forefront of the electrical industry. From codes and Standards to electrical safety devices, the industry does its part in keeping users of electricity safe. But there is still work to be done. Complacency in the workplace and lack of training amount to 5.8 workers being injured or killed in electrical accidents every day.

The Electrical Safety Foundation International (ESFI) was established in 1994, and its mission is to reduce the number of workplace and residential electrical injuries happening yearly down to zero. As a small organization, ESFI is agile enough to quickly shift focus to emerging safety issues while also having a far-reaching impact, including over 2.11 million web impressions in 2020. A Board of Directors made up of leaders in the electrical industry dedicated to electrical safety supports ESFI.

In Daniel's role as Program Manager, he develops and manages programs dedicated to advancing electrical safety in both workplace and residential settings. Daniel has led the ESFI effort to compile electrical safety data to guide ESFI awareness materials.

As Communications Coordinator, Brianne handles all traditional and social media, helping to promote ESFI's programs and initiatives.

Brianne partners with like-minded organizations to spread the importance of electrical safety to consumers, communities, businesses, and the media.

ESFI bases its programs on data and statistics. Every year, ESFI compiles workplace and residential electrical safety data to understand the current safety trends. Core programs at ESFI include National Electrical Safety Month in May, Disaster Safety, Fire Prevention, Holiday Safety, and Workplace Safety. 



Brianne Deerwester



Daniel Majano

**Brianne Deerwester and Daniel Majano, Electrical Safety Foundation International**

## Manufacturing to Drive Economic Growth

Quickly following the Covid-19 lockdowns that began in early 2020, manufacturers were overwhelmed with a surge in demand for goods as the service sector was primarily closed to consumers. This shift in spending habits has ebbed somewhat in recent months as the economy reopened, but manufacturers still face heightened demand. Backlogs in production, estimated to last well into 2022, could prolong the continued recovery as wholesalers and retailers struggle to restock inventories.

Growth in the manufacturing sector should exceed overall economic growth through 2023. This bodes well for several products within the NEMA scope, specifically products included in the Industrial Products and Systems Division. The manufacturing sector is estimated to account for nearly 70 percent of the end market.

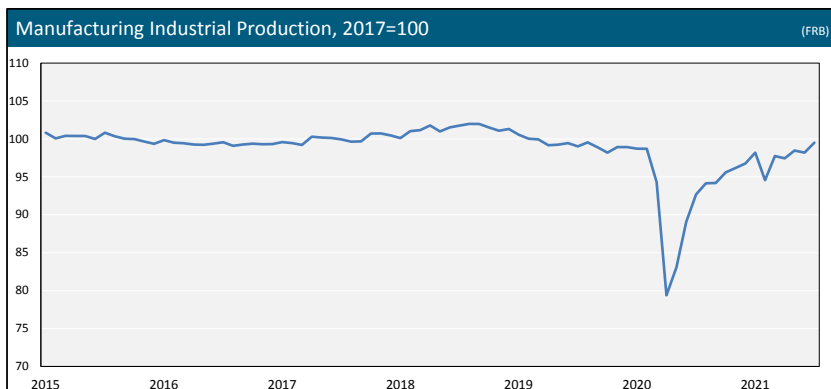
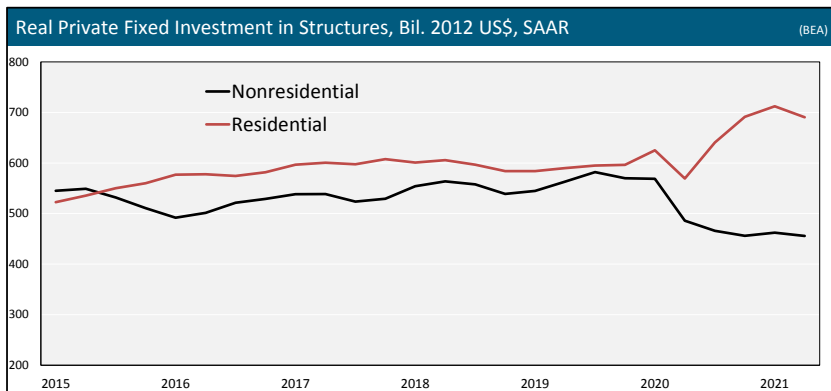
Meanwhile, the construction sector is more of a mixed story. Shortly after the initial Covid-19 lockdowns, residential construction emerged as a leader in the economic recovery. Low mortgage rates and a change in consumer preferences away

from cities toward suburbs boosted demand for new construction. Real fixed investment in single-family homes swelled from \$211 billion at a seasonally adjusted annual rate in the final quarter of 2019 to more than \$260 billion in the second quarter of 2021. Overall spending on residential construction, which includes improvements and multi-family housing, increased from \$596 billion to \$690 billion over the same period. While a near-term peak for housing may have been reached as construction costs and input materials have soared, home improvement projects such as upgrading heating, ventilation, air conditioning (HVAC) systems, and other home appliances will support ongoing spending.

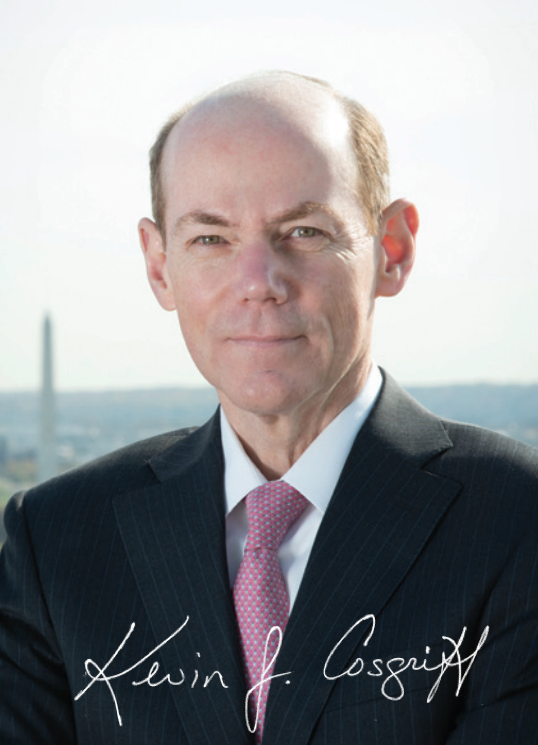
Conversely, real fixed investment in nonresidential structures continued to struggle. In the fourth quarter of 2019, investment measured \$570 billion. There has been a lack of clarity on how the economy will operate in the future. Consequently, nonresidential investment has steadily declined to just over \$450 billion at an annualized rate in the second quarter of 2021.

Recent infrastructure legislation includes planned spending on updates to the electrical grid, water treatment facilities, and other large infrastructure projects, which could alleviate some of the recent declines in the nonresidential construction end market. However, spending on these projects is unlikely to begin before 2023 at the soonest.

Both the manufacturing and construction end markets face mounting headwinds in the near term. The overall economic outlook for the second half of 2021 has deteriorated as the impact of the Delta strain of Covid-19 has compounded problems hiring and sourcing supplies. Additionally, recent elevated inflation could force the Federal Reserve to act sooner than expected to slow its support of the economy. While continued economic growth is likely, much depends on a smooth transition in Federal policy and avoiding. ☹







Recently someone made me aware of a quote from Bill Gates, “We always overestimate the change that will occur in the next two years and underestimate the change that will occur in the next 10.” While I might haggle over the timeframes, I do agree with the general idea. When I started at NEMA in 2014, I was mindful of the changes already underway in the electroindustry, and I knew NEMA had a challenge to meet if we were going to deliver on our contract with Members. NEMA staff did step up and, with strong Member support, we are well-positioned for what is shaping up to be a decade of change ready-made for our industry.

As I depart, some thoughts to underline that last point. Buildings, both residential and commercial, use almost a third of the energy consumed in the United States. Granted, homes and buildings do not exist to be efficient, but neither do their functions require them to be inefficient. And rather than some *deus ex machina* solution, we have seen consistent evolutionary efficiency improvement delivered by astonishing technological innovation in many cases led by NEMA Member companies. In just my time at NEMA, LEDs have gone from one percent of lamp shipments to more than 75 percent, according to NEMA Business Information Services. Beyond lighting, I see vast opportunities for NEMA Members in broader electrification of building systems.

On my first day at NEMA in 2014, the electricity generation mix in the United States was 39 percent coal, 28 percent natural gas, and 13 percent renewables. Today, coal use has more than halved, natural gas has increased to 40 percent, and renewables have increased to 20 percent. NEMA Members’ innovative technologies will herald further change such as will be needed to accommodate variable renewable energy generation capable of meeting base-load reliable criteria. As the grid continues its transformation, a more decarbonized system presents a real opportunity for our industry.

Finally, I want to mention the transportation sector. NEMA launched its Transportation Division in 2018, acknowledging that electric and connected transportation systems are the future of mobility. Transportation accounts for 35 percent of U.S. energy consumption, nearly all derived from petroleum. But that’s changing. On my first day at NEMA, electric vehicles (EVs) accounted for less than 0.5 percent of new car sales. Today, 55 different EV models account for five percent of new car sales, doubling in just a year. While still a small percentage of overall sales, automakers are making significant investments in EV production that signal that the future of transportation is electric. This EV adoption will require NEMA Members’ charging equipment and a grid capable of supplying electricity to meet these new loads without compromising safety or electricity reliability.

This innovation and change would not be possible without the hard work of NEMA Members and staff. I am proud of all that NEMA has accomplished over my time on this team. The organization is healthy and relevant as it passes into the very capable hands of NEMA President and CEO Debra Phillips. I wish you all continued success as you close in on NEMA at 100. 🎉

Kevin J. Cosgriff  
Outgoing NEMA President and CEO

## STOCKART

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