electroindustry

BOOST *YOUR* PRODUCTIVITY

Tips on how to increase manufacturing output

2019
Hermes Award

2018 AM&P
EXCEL Award

2018 Hermes Award

2017 Azbee
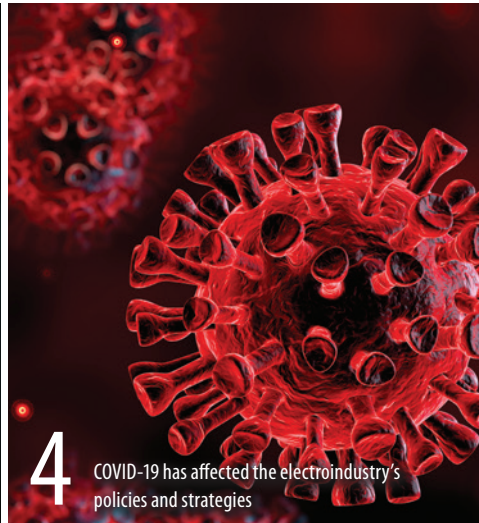Award

NEMA

CONTENTS

3

IDEA CEO David Oldfather on recommitting for Standards

4

COVID-19 has affected the electroindustry's policies and strategies

18

Mexican President Andrés Manuel López Obrador publishes new Law on Quality Infrastructure

electroindustry

Innovation Is Driving Productivity

2020 has been a year for the record books! The tragedy of COVID-19, the heightened social and political turmoil, and the genuine economic suffering for so many in our society are just a few examples of the challenges we have faced. In many ways, we are still painstakingly working through them.

Politics has also dominated our national dialogue in the United States in historic ways this year. As we go to press, the outcome of the general election is still unknown. Regardless of the outcome, we know that the electroindustry and manufacturing are strong and resilient. The men and women of the electroindustry have served our country in extraordinary ways this year. They kept plants running, even while supply chains were challenged, social unrest was flaring up in our streets, and consumer demand was plummeting and surging at whiplash speeds.

Achieving optimum productivity became a top priority for industries whose products were suddenly in short supply. Digitalization came to the rescue by allowing manufacturers to digitally configure new lines, test the retooling of existing lines, and virtually commission them from a remote location. More progress is underway by expanding 5G networks and smart electrical infrastructure, as the articles in this issue make clear.

As companies embrace smart infrastructure, 5G, digital skills, and the other technological advancements available as manufacturing enters the digital age, the result will be seen not only in terms of increased productivity but also better, more competitive performance overall. These are the key ingredients of growth and increasing quality of life for everyone involved in manufacturing and the many industries that grow alongside it.

There is great confidence in the ability of our industrial sector to deliver what the country needs. Investments in state-of-the-art factories, massive modernization programs, and groundbreaking product innovations are stories that have been overshadowed by political breaking news. What propels these investments is the fierce spirit of innovation at the heart of our industrial sector.

NEMA and its pioneering work embody that same spirit. It has been a great honor to serve as the NEMA Chair of the Board of Governors for the last 12 months. NEMA represents the best minds of the U.S. electroindustry and manufacturing. It is an organization that cares about standardization policies and productivity and maintains the world-class reputation and competitiveness of U.S. manufacturing.

The bench of talent at NEMA is deep and filled with great people who step up to serve not for the money or the power, but because they truly believe in its core mission. This is the spirit of NEMA and the people behind it. Having the opportunity to be at the helm of this outstanding organization is an experience that I will always cherish. ⊕

Sincerely,

Raj Batra, President, Digital Industries, Siemens USA

IDEA Recommits to Standards Leadership Role

With the unforeseen challenges we've faced this year, it's more important than ever to have consistent, transparent communication.

RECOMMITTING TO STANDARDS

At IDEA, our stated mission has historically been to be a single source of high quality, complete product data and as serve as the Standards body for the electrical industry. Yet, I recognize that for the past year the IDEA role with Standards has been unclear.

I want to provide an update on what we are doing at IDEA to help manufacturers, and where we are headed for the future.

IDEA has recommitted to being the Standards leader for the electrical industry. To this end, we've joined the board of European Technical Information Model (ETIM) North America and agreed to serve as the lead for the Electrical sector.

PROOF OF CONCEPT FOR NEW "SUPER" DATA MODEL

IDEA has also re-engaged with the Product Data Standards Task Force (PDSTF), which addresses the electrical industry's need for a rigorous, reliable set of data Standards. This group, initially sponsored by NEMA (and later by the IDEA Board of Directors), also focuses on product information needs both now and into the future.

Working closely with PDSTF Members, our team is working on a proof of concept for a new "super" data model. We're also collaborating with other Standards groups, like United Nations Standard Products and Services Code (UNSPSC) and Euro Technical Information Model (ETIM), to harmonize the data models.

The goal is to determine whether a unified data Standards model is viable and can be applied to IDEA Connector's dataset. At the same time, we will be working to develop a more nimble process to rigorously review Standards while still being able to anticipate and quickly respond to market needs.

We are targeting the end of this year to present the proof of concept for a "superset" data model with harmonized Standards. It will outline the effort involved, participation needed, objectives, and timelines, as well as what it will take to formalize and enforce the Standards going forward. The proof of concept will be released first to the IDEA Board, and then to the NEMA and National Association of Electrical Distributors (NAED) Boards.

SYNDICATE PRODUCT DATA MORE EFFICIENTLY

IDEA is also planning to enhance IDEA Connector's data model, which will be a big step forward in streamlining the process validation and implementation. This will remove friction in the supply chain and make the data easier to search on eCommerce websites.

We are focused on enabling manufacturers to syndicate their product data more efficiently and empowering distributors to sell more products from their digital shelves.

MANUFACTURER FEEDBACK WELCOME

I believe it's essential that we keep working together to solve industry challenges. We recognize that the requirements for high-quality data are accelerating and that the need for IDEA to fulfill its mission successfully is correspondingly even more critical.

The IDEA team has been proactively reaching out to industry organizations and leaders. Monthly, I'm meeting with the IDEA board, and these industry leaders share our vision. I've also begun attending NEMA board meetings and plan to attend NAED board meetings to gather feedback and consensus on our roadmap.

Moving forward, we plan to be as transparent as possible. We're setting milestones and will be accountable for what we say we'll do. It often takes a while to get alignment, so we'll be as realistic as possible.

Finally, please do not hesitate to share your observations and feedback with me at doldfather@idea4industry.com. We want and need to hear from you. ⊕

IDEA CEO David Oldfather

Natural Disaster Response in the Next Normal

The SARS-CoV-2 coronavirus pandemic has been the most prominent natural disaster in 2020.

The start of the new decade held the promise of continued electroindustry prosperity, economic well-being, and unlimited potential for emerging technologies. However, we have learned that Mother Nature can lay waste to "the best laid plans of mice and men" with a continued onslaught of natural disasters.

The most prominent natural disaster of 2020 is the SARS-CoV-2 coronavirus pandemic. The impacts to the electroindustry from the COVID-19 outbreak have not fully surfaced and may not be completely known for some time, but there is no doubt that policies, strategies, and a new way of doing business will have to be employed for the remainder of this decade as a result.

Other natural disasters that have plagued the nation this year do have known and measurable negative impacts on electrical products and therefore allow us to develop standard operating procedures to properly address these challenges and capitalize on the opportunities embedded within these events.

In response to guidance published by the U.S. Federal Emergency Management Agency on "COVID-19 Pandemic Operational Guidance for the 2020 Hurricane Season" and to fully utilize digital resources to enhance the NEMA response to natural disasters, the NEMA Natural Disaster Standard Operating Procedures (SOP) have been completely revised and updated.

The NEMA Natural Disaster Team, consisting of staff from the Field Representative Program, Communications and Brand Management, and Electrical Safety Foundation International (ESFI), activates the SOP to coordinate NEMA activities in our effort to provide the most current guidance information and other resources to assist electrical professionals, emergency management officials, and community decision-makers on policies and best practices on the selection and installation of electrical products that are resilient to natural disasters and guidance on how to restore electrical systems after a natural disaster has passed.

The NEMA Natural Disaster Team is relying on digital resources such as social media updates, email blasts, live training webinars, remote video inspection and damage assessment assistance, and virtual team meetings. The days of hand-delivering printed copies of NEMA guidance documents and wading through floodwaters to assist a local code official in the evaluation of damaged electrical equipment are now behind us.

NEMA and our Member companies will continue to adapt and improve our own resilience to the challenges faced by the increasing number and severity of natural disasters and can assure the entire electroindustry that we remain vigilant and ready to respond to any and all future natural disasters. ⊕

Bryan P. Holland, MCP, CStd
Senior Field Representative, Southern Region,
NEMA

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Learning Strategies to ●●●●●●●●●●●●●●●●●● ● ● ● ●
Thrive in a Rapidly Changing Environment

**Gail Norris,
U.S. Lead,
Digital Industry
Academy, Siemens
Industry, Inc.**

Like the rest of the working world, manufacturers are operating during a global pandemic and under the gun. Running a plant at half capacity is a logistical nightmare and brings up many questions. How do we identify the right skills needed each day? How do we gauge an employee's current skill level? What happens when something breaks down, and there is only one maintenance tech who knows how to fix that problem? How do employers help their employees keep current with technology that is changing every two years?

These questions are essential to ask, even when the world isn't in a pandemic, but manufacturers today face new and unforeseen pressures. Just months ago, remote working, mask-wearing, social distancing, and contact tracing were seldom discussed, let alone understood. Now they have become the manufacturing norm.

Even with these new challenges, some companies are not only surviving in 2020 but also thriving. Their shared secret to success is quickly adapting to changes by following three simple yet effective learning

6

"Unfortunately, predicting and committing to a defined set of future skills leads organizations to focus on the wrong skills," Gartner found in its 2020 Shifting Skills Survey for HR Executives. "In fact, when HR leaders take a predictive approach to managing shifting skills, employees apply only 37 percent of the new skills they learn."

Understanding employee skills needs and status at the micro and macro levels are necessary to develop a successful workforce plan. The plan should consider where skill levels need to be in three to five years and where each employee's skill levels are today. This planning allows for successful upskilling in an environment of change and upheaval. Knowing where today's desired skills lie provides for efficient utilization of these employees in the near term.

Exhibit 1

To evaluate the competency gap key drivers are analyzed:

Source: Siemens AG HR
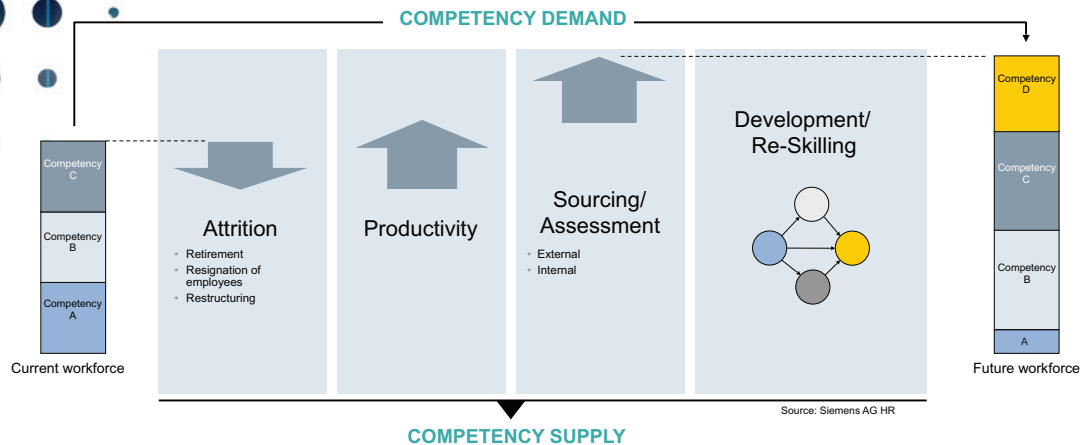
Source: Siemens HR 2012

strategies. First, they invest in workforce planning to optimize employee performance in the near term and beyond. Next, these forward-thinking companies focus on specific employee digital skillsets to enhance production efficiencies and output. Finally, they embrace a culture of lifelong learning that will prepare them for the next challenge waiting around the corner.

Invest in Workforce Planning

Most of the workforce is digitally challenged, even though companies have been anticipating the digital skills gap for years. Despite that, manufacturers have deployed a host of digital solutions on the shop floor to meet the digital world's reality. To get the most out of digital technology now is the time to introduce workforce planning, or overall organization development, into the manufacturing environment.

At the same time, this approach takes a long view of employee development and skills acquisition and becomes a living process in the environment. Managers should also conduct annual reviews of projected skills, and strategic visioning must occur to anticipate emerging skill requirements accurately.

Focus on Specific Skills Needed

Only those manufacturing organizations that begin their digital transformation will survive over the next 10 to 20 years. In this rapidly changing world, digitalization delivers the operational efficiencies customization requested by customers. Only through the automation of processes and the ability to rapidly alter outputs will these outcomes be realized.

7

Manufacturers should reskill and upskill the personnel who run these automated lines as well. They must plan generational changeout and ensure that current employees are continually dialed into digital upskilling and reskilling options to enhance operational productivity and optimize the gains from hire to retire. Employees entering the workforce should understand the new skills required and learn the company culture, manufacturing logistics, and workflow.

The ability to digitally configure new lines, test retooling of existing lines, and virtually commission both of those lines are skillsets required of most manufacturing engineers. These skills are also evolving and developing on an ongoing basis. As a result, manufacturers must revisit them regularly to take advantage of emerging talents coming with the next digital evolution.

Understandably, workers won't achieve skills in a single class. Training success requires an ongoing effort over a multiyear period. Discussing the skillsets needed for the future by engaging a digitalization partner is key to getting this training right. This partner can assist in the digital change out as well as competently upskill employees.

Lifelong Learning Culture

A lifelong learning culture requires constant attention to emerging didactic content, new delivery methods, and practical teaching tools. Focusing on employee flexibility can ensure ongoing relevancy for both workers and the organization.

Concept introductions, in-depth, hands-on training, ongoing performance assist tools, and refreshers can give employees opportunities to learn at their own pace and in their environment. Most employees desire this type of customized approach to learning, and they want just-in-time tools that help them remember and utilize their skills at a specific point in time, such as on the machine side.

At the same time, it is up to management to instill a customized and intriguing learning environment on the digital shop floor to keep the operation at the leading edge. As Henry Ford said, "Anyone who stops learning is old, whether at 20 or 80. Anyone who keeps learning stays young."

The same is true for manufacturers. A company that ignores the importance of a learning culture during a time of change does so at its peril. Charles Darwin warned, "It is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is the most adaptable to change."

Learning Equals Productivity

By embracing these three employee educational strategies, manufacturers are making the most of a challenging global pandemic. Investing in workforce planning, focusing on the digital future, and prioritizing a culture of lifelong learning make companies better prepared for work absenteeism. They will know who has the digital skills to operate a particular process. When operational issues occur, multiple people can fix the problems, not just one maintenance tech.

Siemens addresses these productivity gaps with our customers through our Digital Industry Academy offerings. Our philosophy is to provide a holistic approach to gap closure, with multiple learning modalities and various position and experience levels. This approach allows the employee to choose the learning content and method most suitable for them.

Investing in an annually updated workforce planning model serves as a living framework from which companies can make all employment decisions. Commit to skills-based talent acquisition, onboarding, and orientation; a three- to five-year employee learning plan; and a continuous learning culture that prizes ongoing skills and knowledge acquisition. The result of proper didactical execution is reliable and profitable manufacturing productivity, even during the toughest times. ⊕

How 5G Will Change
the Game in Manufacturing

**Jake Saunders,
Vice President,
Asia-Pacific
& Advisory
Services, ABI
Research**

Fifth generation (5G) cellular connectivity is here: as of September 2020, we are counting more than 15,000 full commercial 5G deployments globally, with currently 137 communication service providers (CSPs) having launched 5G services in the consumer domain.

The true potential of 5G, however, lies in its ability to facilitate a wide range of applications and services beyond the end-user market. 5G connectivity offers a wider latitude and versatility that can bring substantial value to a diverse range of enterprise verticals. This increased versatility allows for connectivity scenarios that provide meaningful business impact in varying industry verticals such as healthcare, energy, automotive, and smart cities.

Industrial manufacturing, in particular, stands to gain considerable value from 5G. The need for more adaptive, agile processes requires a shift to networks that can provide higher data rates, lower latencies, and reliable connectivity to more devices and machines. 5G connectivity is positioned to be a cornerstone in delivering highly deterministic networks for mission-critical processes on the factory floor.

5G Connectivity Scenarios for the Consumer and Enterprise

Contrary to previous cellular generations that focused solely on consumer use cases and mostly smartphones, 5G aims to introduce a plethora of enterprise applications and support from a diverse set of devices. While 4G aimed to increase data speeds and network capacity, 5G introduces three distinct areas of focus:

- **Enhanced mobile broadband (eMBB)** services are generally oriented toward data-intensive, consumer-driven use cases such as 4K/8K ultra-high-definition (UHD) videos, augmented reality (AR), virtual reality (VR), cloud gaming, and enhanced mobile media.
- The **massive machine type communication (mMTC)** aspect of 5G is based on providing cheap and stable connectivity to an exponentially larger number of low-power, low-data-consuming devices and nodes without overloading the network. This increased pervasiveness of connected equipment and devices in enterprise settings would create highly contextualized decision-making in processes like predictive maintenance and energy management in Smart Grids.
- 5G's **ultra-reliable low-latency communication (URLLC)** framework is designed to support highly deterministic networks for mission-critical processes through robust reliability (<1 packet loss in 10^5 packets; 99.999%) and latency rates as low as 1 ms.

Addressing Enterprise Use Cases in the Official 5G Standard

The 3rd Generation Partnership Project (3GPP), hosted by the European Telecommunications Standards Institute (ETSI), defines the Standards for 5G connectivity. 3GPP is an industry-led consortium, where delegates from hundreds of leading companies discuss and democratically agree on the best technology to put forward for standardization.

3GPP Release 15 is the first full set of 5G Standards with a main focus on eMBB and consumer use cases; it sets the basis for mMTC and URLLC requirements as well. However, it is **Releases 16** and **17** that are expected to provide critical updates and formalized Standards for the enterprise-oriented URLLC and mMTC scenarios.

Coalescing 5G Standards for the diverse set of industries is essential for accelerated digital transformation adoption. Having unified Standards and common communication protocols will facilitate tighter collaboration between network infrastructure vendors, CSPs, and original equipment manufacturers in delivering robust networks that implementors can confidently depend on.

Because of 5G's provision of multi-dimensional connectivity scenarios, it expands high-data applications from consumer-driven use cases to cater to a diverse set of industry verticals.

The extension of cellular connectivity to new use cases and verticals has important implications on existing networking technology as well as the sale of auxiliary

9

5G ENABLED ENHANCEMENTS ON THE FACTORY FLOOR

SMART WAREHOUSING
- Up to 12% Profit Over 5 Years
- Up to 14% Reduction in OPEX

CLOUD QUALITY CONTROL
- 25% Testing Capacity
- 92% Material Savings

AGV AND FLEXIBLE FACTORY
- Faster Time to Market
- US $100,000s Cabling Costs

ENHANCED ROBOTICS
- Efficiency in Production Process
- Manufacturing Inaccuracies
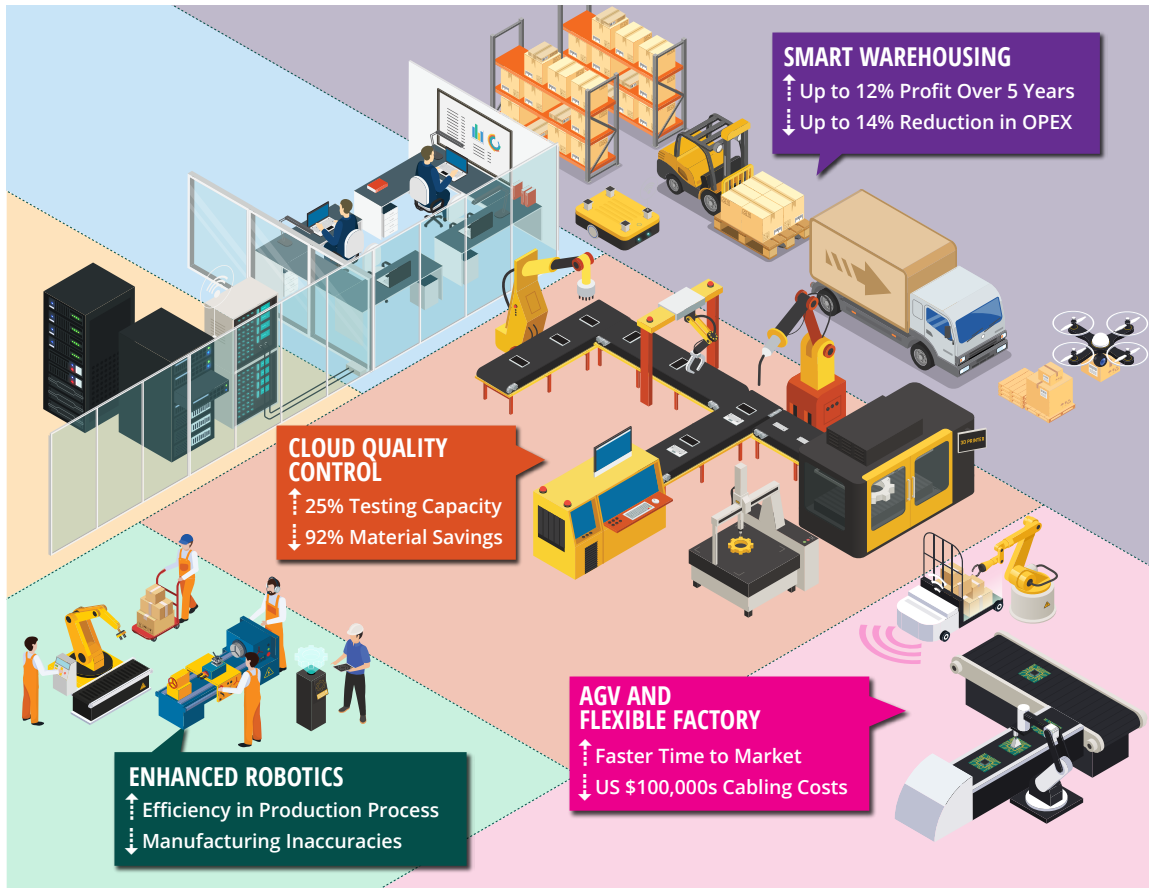
A LOOK INTO RELEVANT 5G STANDARDIZATION WORK

RELEASE 15
ENHANCED MOBILE BROADBAND (EMBB)
- Up to 10 Gb/s in the Uplink
- Up to 20 Gb/s in the Downlink

APPLICATION SCENARIOS
- Transmission of data-intensive video footage (for cloud based testing, remote operation or maintenance)

RELEASE 16
ULTRA RELIABLE LOW-LATENCY COMMUNICATION (URLLC)
- Latency: <5 ms
- Network Reliability: 99.999%
- Network Availability: 99.999%

APPLICATION SCENARIOS
- Mission-critical applications (Remote machine control)
- Production line automation

RELEASE 17
ENHANCED MASSIVE MACHINE TYPE COMMUNICATION (EMTC)
- 1 mio. devices / km2

APPLICATION SCENARIOS
- Massive wireless sensor networks

ENHANCED POSITIONING
- cm-level positioning for indoor deployments

RELEASE 17

RELEASE 16

RELEASE 15

STANDARDS

Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
2018				2019				2020				2021			

products. The implications of 5G on the seven major U.S. markets that NEMA serves are summarized in Table 1.

Why 5G in Manufacturing?

5G is certainly a powerful communication Standard, but industrial manufacturing already has several connectivity Standards, both proprietary (e.g., Profinet) as well as open (e.g., OPC UA and Industrial Ethernet). Wi-Fi is also well established in the manufacturing domain.

However, all existing technologies lack the carrier-grade and robust nature that 5G can offer, which can include full support for mobility throughout a factory floor. For example, an automated guided vehicle (AGV) may lose connectivity for seconds when entering the coverage area of a new Wi-Fi access point and leaving another. This may cause continuity challenges for the AGV platform, which can even stop operating.

On the other hand, 4G and 5G offer "handover" between cellular access points in milliseconds, something that Wi-Fi cannot achieve without proprietary extensions. Because of this more robust handover, AGVs controlled via cellular connectivity can be operated with up to 30% higher speeds; this translates to a significant operational efficiency boost compared with typical AGVs.

This is just one example where 5G can revolutionize the way factories are being built and become the foundation for digital twins, reconfigurable production lines, and even "lights-out" factories. The following use cases have already been deployed in existing factories around the world:

1) Osram, Philips, and Deutsche Telekom have prototyped and tested a mobile robotics platform in an Osram factory in Germany, using a private cellular 4G network.

2) Edzcom (previously Ukkoverkot), a private cellular network operator, has deployed numerous private 4G networks in Finland for mining and manufacturing clients. Edzcom is also deploying private 4G in the port of Oulu, Finland.

3) Ford UK is deploying a private 5G network in its electric car factory in the UK in order to speed up the production of car batteries.

This short list of deployments and trials is a small sample of what 5G can achieve. With the completion of 3GPP Release 16, ABI Research expects manufacturers and the supply chain to rapidly create new products and start deploying them in 2020.

Conclusions

5G will accelerate enterprise digitization and improve efficiency as well as productivity across several verticals. Manufacturing is a particularly interesting vertical for two reasons: it has stringent requirements for connectivity that 5G can fulfill and is also in the middle of the Industry 4.0 transformation. 5G can be a key pillar for automation and digitization in manufacturing, and its diverse set of features, including eMBB, URLLC, and mMTC, can fulfill even the most demanding factory floor requirements. The transition to 5G will not be an overnight process, but ABI Research expects 5G to be fully entrenched in the manufacturing space in 2026. ⊕

To download
*5G Best Practices
A Technical Report,* visit
www.nema.org/5GReport

NEMA Members can download a copy for free at
www.nema.org/
5GReportMembers

**Table 1:** 5G Implications on NEMA Markets (Source: ABI Research)

NEMA Markets	5G Implications
Building Infrastructure	To address backhaul considerations resulting from the high data throughput, cable trays, busses, and ties need to be designed to accommodate additional fiber deployments.
Building Systems	In-building systems will be upgraded to 5G, driving demand for new components, including cables, connectors, and other peripherals.
Industrial Products & Systems	TSN, CoMP, mMTC, and URLLC transmissions will increase reliability and efficiency in manufacturing through integration IT, OT, and CT domains.
Lighting Systems	Integration of sensors, networks, and LED infrastructure in 5G Smart Grid applications will increase demand for connected lighting controls, light sources, and emergency lighting.
Medical Imaging and Technology	Anticipating a lifecycle of >10 years for medical equipment, the deployment of cellular connectivity will require the retrofitting of medical equipment and devices, increasing demand for chipsets and processors. Furthermore, existing patient data management Standards (e.g., FHIR, HL7) might need to be adjusted to guarantee full functionality when being applied to a cellular network.
Utility Products & Systems	Smart 5G connected microgrids require the combination of intelligence (AI) with conventional utility products and systems. The demand for smart meters and intelligent capacitor solutions will rise. The powering of necessary infrastructure for cellular network deployments will increase demand for electrical connectors.
Transportation Systems	5G-enabled intelligent transportation systems (ITS) will increase the demand for data processing capabilities in the car and the network infrastructure, requiring more powerful chipsets and processors. To guarantee full interoperability between LTE-V2X and NR-V2X, dual chipsets will be required, supporting both 4G LTE and 5G NR.

Electrical Infrastructure Systems and Components Can Increase Factory Floor Efficiency, Productivity, and Safety

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

There are many things that help us become more efficient where we work, live, and play, and production and industrial facilities are no exception. By carefully selecting your electrical infrastructure, you can boost efficiency, enhance productivity, and cut down on costs. Whether it's planning for a new space or rehabbing an older one, the electrical infrastructure can make a big difference.

Benefits of a well-designed electrical infrastructure include many top-of-mind items, including lower initial cost, lower lifetime maintenance cost, operational productivity and efficiency, and overall facility and worker safety.

◀ Walkerduct   ▲ Trench
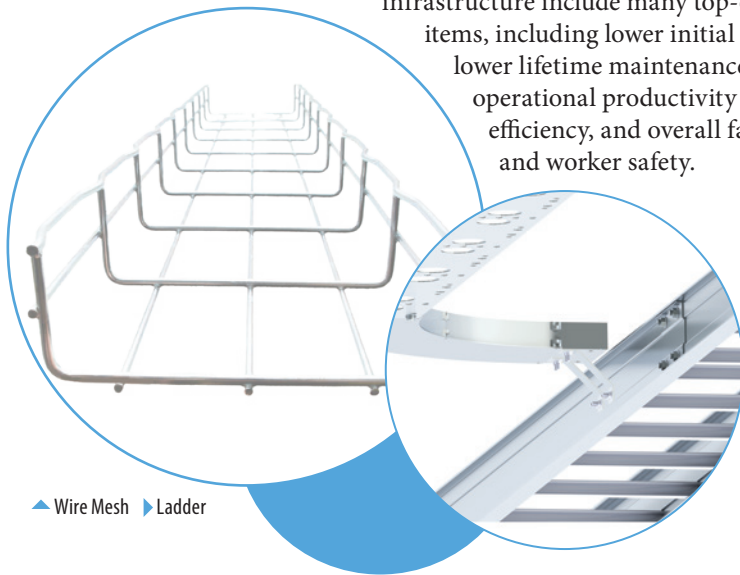
▲ Wire Mesh   ▶ Ladder

To begin, it's wise to take a closer look at open cable management systems like ladder tray and wire mesh cable management systems. These options provide lower installation and lifetime costs, which can help anyone designing a factory floor. Additionally, open cable management is highly flexible and installs easily. This means that you can quickly repurpose the space, making changes when you need to.

Once installed, a grid of ladder or wire mesh tray gives a facility an open system with better access to electrical infrastructure. It also permits greater flexibility in where you place machinery, conveyors, and workstations. A properly designed cable management system will yield benefits for the life of the facility.

For new construction projects, consider in-floor systems, which provide easy access to power and communications wherever you want them. They also offer the flexibility to move, add, or change your system activations at any time without added cost. In-floor trenches and ducts are a trusted, reliable system for flawless performance in open spaces. With extremely large cable capacity and many different widths/depths, these systems can accommodate all jobs.

Trench ducts are installed flush with the finished floor and provide easy access to cabling after installation via removable cover plates. Duct systems provide wire management while maintaining the right look and feel in a space. Because they're buried in the floor, cables are out of sight and safe from abuse. Duct runs provide a range of capacities to suit any situation and to future-proof the wire management system. Ducts can be used individually or combined with other ducts or trenches to deliver power and communication services to workstations wherever needed.

▲ Cord Reel ▶ Power Pole

If your facility design requires your infrastructure to serve from overhead, power poles and retractable cord reels let you easily place power access throughout a facility.

For permanent installations that are unlikely to require frequent change, power poles are an optimal way to run power and communications down from the ceiling. This neat and efficient method blends right into the space around it. Power poles also allow in-field modifications such as device and height changes. You can select from many receptacles to deliver whichever services you need, right to the point of use.

Retractable cord reels protect and organize cables, so they're ideal for assembly and fabrication workstations. Cord reels also help factory workers save steps and time by putting safe, reliable power and static discharge right by these workstations. They also increase the flexibility you have when setting up workstations. Because they're so simple to add, you can place them wherever they're needed. Cord reels are durable and rugged, providing years of reliable service with little maintenance and few components. You can also specify and configure them to meet the specific needs of your facility.

Interlocks, safety switches, and disconnects at the point of use are easy to apply. Their compact dimensions and flexible wiring complement the versatility you have with installation; they
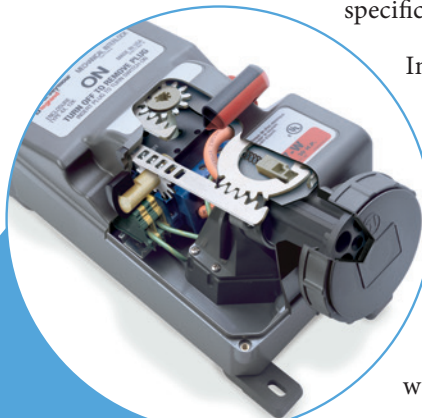
▲ Interlocks

also offer adjustable mounting options. Once installed, they'll withstand tough conditions like water in washdown areas, accidental impact, furnace or welding heat, vibration from equipment, and contamination from shavings, dirt, and dust.

Interlocks can be fusible or non-fusible. They also feature a tamper-resistant activating assembly and cover-integral switch mechanism to protect against unauthorized overrides. Highly visible ON/OFF designations make statuses easy to read with just a quick glance. Many interlocks can also meet OSHA lockout/tagout requirements.

Fusible and non-fusible safety switches deliver many of the same features and benefits of fusible and non-fusible mechanical interlocks. They provide maximum protection against water, dirt, heat, and vibration—as well as just about any other harsh condition you'll encounter. You get the same installation flexibility, too. Safety switches put control right at the point of use. With multiple amperage capacities, there's a fusible or non-fusible safety switch that's ready to provide safety and functionality for you in any industrial environment.

▲ Safety Switches

If you have a harsh environment, consider stainless steel industrial switches, which won't corrode. Type 316 steel should be used in these switches to withstand repeated exposure to salt, acids, and chemicals—even washdowns at extreme temperatures—without corrosion or breakdown. Choose switches with handles that can be padlocked to meet OSHA lockout/tagout requirements. It's just another way to commit to keeping your plant and employees safe and compliant.

▶ Safety Switches

▲ Dust/Watertight and Corrosion-Resistant Plugs and Connectors

Corroded electrical devices are simply not an option. They open the door to electrical failure on your line. Especially in the case of food and beverage plants, they can become a breeding ground for contaminants that can cause food-borne illnesses.

As you know, downtime is expensive. In the industrial environment, select properly rated plugs and connectors for your environment that resist dirt, water, oils, lubricants, and soaps while maintaining NEMA 4, 4X, 6, and 6P and IP65, 66, and 67 ratings. Using rugged dust-tight or watertight plugs and connectors can protect your system integrity and help prevent outages.

Portable ground-fault circuit interrupters, or GFCIs, can be used where needed for equipment and personnel protection. Choose rugged housings that stand up to impact and hard use. You can also select water-resistant designs for wet and corrosive indoor/outdoor environments. Units with automatic reset ensure continuous power for pumps, freezers, refrigerators, and more.

Temporary power solutions for recovery and restoration may become important in the event of disaster. Keeping some temporary portable power solutions on hand will permit quick recovery, protecting production schedules and profits. Power distribution units can be set up throughout the facility, wherever you need them. In addition, heavy-duty cable protectors ensure your facility remains safe and that all connections are secure.

Design flexibility, efficiency, productivity, and safety right into the electrical infrastructure of your facility. There is plenty of innovation in this space, so don't accept the arguments to build subpar systems because that's what has always been done. You can save money upfront and during operations with an electrical system that delivers efficient use of space, flexibility in operations, better reliability, and easy maintenance—all while helping to ensure worker safety and comfort. ⊕
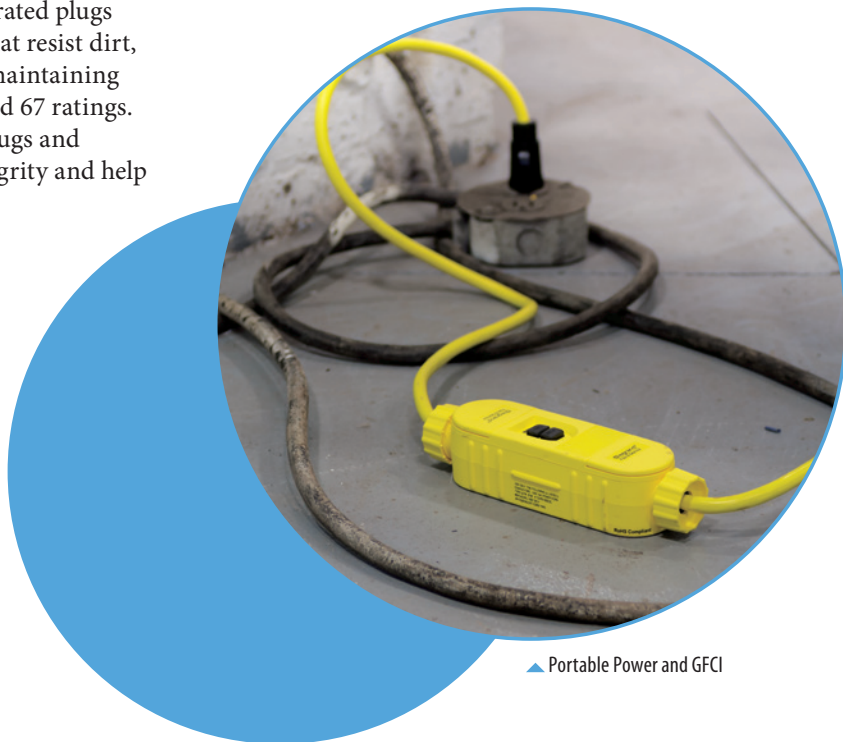
▲ Portable Power and GFCI

I am NEMA

My career started in the intellectual property field working as a patent examiner for the United States Patent and Trademark Office for 4.5 years specializing in storage devices, displays, and input devices and then for a boutique law firm specializing in wireless devices, medical devices, heads-up displays, and telecommunications. Prior to joining NEMA, I worked at an HVAC trade association for just over six years working with chillers, variable frequency drives, terminal units, and other applied product manufacturers on Standards, regulations, and certification activities.

I was excited to join NEMA since the work couples my undergraduate degree in electrical engineering and my experience in Standards development. As a program manager, I am responsible for the management of Standards, codes, and regulatory issues in the Building Infrastructure and Transportation Systems Divisions. Both Divisions are very active, and I look forward to promoting the goals of each on behalf of Members.

Another aspect of NEMA I enjoy is the collaborative work environment. The importance of developing and fostering relationships throughout the industry is vital in building consensus and achieving stakeholders' desired outcomes. I am excited to participate in these meetings and work with the experts. **ei**

Kezhen Shen, Program Manager, Transportation and Building Infrastructure, NEMA

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NEMA Members Educate the Industry on the National Electrical Code

Tim McClintock
Midwest Field Representative, NEMA

NEMA and its Members play a key role in educating the industry, and it is through these efforts and collective expertise that we continue to see technological and safety advancements move forward.

Active participation with the development of the *National Electrical Code®* (NEC®) and other model construction codes ensures that codes do not pose a barrier to implementation of new and advancing technologies.

As technology advances at a rapid rate, it is constantly shaping the electrical industry. As new methods, products, and installation requirements are considered, the manufacturing sector is always out in front and plays a lead role with supporting the industry. This includes providing information and education to ensure leading-edge technology is installed and used safely for the public to derive their full benefit.

The NEC is the most widely adopted code in the world and serves as the standard for safe installations of electrical systems. NEMA and its Members play a significant role by participating in the development of the NEC and are relied upon for information and education in a multitude of areas and different forums.

Three key areas where the industry relies on the manufacturing sector include the development, adoption, and application of the NEC.

Code Development—The development process includes a broad cross-section of representation of the industry on each of the NEC Code-Making Panels, and the manufacturing sector is frequently relied upon for their expertise and technical information related to the topics being discussed. Providing that information is essential to ensuring the code recognizes the latest electrical products and does not create a barrier for equipment manufacturers, while maintaining the singular focus of ensuring safe electrical installations.

Code Adoption—One of the keys to successful adoption begins with education, and it is a multipronged approach. Information can be misrepresented by those who are misinformed, incorrectly interpreting information, or misguided in their assessments. The electrical industry views NEMA and its Members as experts in the industry and will often call on NEMA to provide training for various educational conferences, state and local adoption committees, and boards—or simply call for guidance on a specific issue related to the NEC or Member product. Following successful adoption, there is further opportunity for engagement, and NEMA and its Members are frequently called upon for guidance.

Code Application—Along with code development and adoption, the manufacturing sector also provides guidance and information related to the application of the code and related Standards. While the NEC is the baseline for safe electrical installations, NEMA and its Members prove once again that they are the go-to resource by providing guidance via Standards, engineering bulletins, and white papers.

NEMA and its Members continue to educate the industry in these challenging times by capitalizing on the digital meeting tools that we have at our disposal. This has provided an opportunity to more frequently reach out to the industry throughout the year; going forward, it will serve as another medium to continue providing valuable education and information to the industry. ei

Ann Brandstadter

Manager, Standards Publications and Marketing, NEMA

Standard for High-Voltage Power Interrupters Includes New Performance Requirements

American National Standard for AC High Voltage Power Vacuum Interrupters—Safety Requirements for X-Radiation Limits specifies the maximum permissible x-radiation emission from ac high-voltage power vacuum interrupters that are to be operated at voltages above 1,000 V and up to 38,000 V when tested following procedures described in this Standard.

For this new edition, the voltage range was increased to 72.5 kV and performance requirements were revised.

"This revision enhances operator safety by imposing the same x-ray emission limits from vacuum interrupters undergoing power-frequency withstand tests at rated voltage (which are used in the factory as production tests) rather than the 75 percent of rated voltage test levels which are recommended for field tests," said John Webb of ABB and Chair of the Accredited Standards Committee C37 Power Switchgear.

Industries that use the products covered by this Standard are utilities and testing laboratories.

ANSI C37.85-2020 is available on the NEMA Standards Store for $87 in hard copy and at no cost as an electronic download.

OTHER RECENTLY PUBLISHED STANDARDS

Cable Ties and Fixing Devices for Electrical Installations—Type Classification Guide NEMA CTTC P1-2020 is available at no cost.

NEMA and IEC Devices for Motor Service—A Guide for Understanding the Differences NEMA ICS 2.4-2020 is available for $95 in hard copy and at no cost as an electronic download.

American National Standard for Lighting Equipment—Electromagnetic Compatibility (EMC) General Requirements and Criteria ANSI C82.77-1-2020 is available for $80.

American National Standard for Lighting Equipment—Injected Currents ANSI C82.77-9-2020 is available for $50.

NEMA 250 Enclosure Types NEMA EN P1-2020 is available at no cost.

Industrial Control and Systems Part 1: Electromechanical AC Transfer Switch Equipment NEMA ICS 10 Part 1-2020 is available for $92 in hard copy and at no cost as an electronic download.

Industrial Control and Systems Part 2: Static AC Transfer Equipment NEMA ICS 10 Part 2-2020 is available for $92 in hard copy and at no cost as an electronic download. ⬡

Danny Abbate

Industry Director, Building
Infrastructure Division, NEMA

Mexico's New Normal: Law on Quality Infrastructure

The United States' neighbor to the south, Mexico, is a key trading and manufacturing partner for NEMA Members. Since 1992, manufacturers have worked within the framework of the Federal Law on Metrology and Standardization (LFMN, or "Metrology Law"). For all merchandise sold into the Mexican market, this national mandatory regulation stipulated the procedures for certification, accreditation, and verification.

In July, Mexican President Andrés Manuel López Obrador published in the Mexican Official Gazette the new Law on Quality Infrastructure (LIC) that went into effect on September 1, 2020. The primary objectives of this update are to organize standardization, compliance testing, and metrology procedures. Additionally, the new law will streamline the regulatory framework to properly reflect commitments assumed by the Mexican government pursuant to international treaties and best practices.

The structure of the Quality Infrastructure Law will be as follows:

- Book One, *The National Quality Infrastructure System*
- Book Two, *The Quality and Innovation System*
- Book Three, *Metrology*
- Book Four, *Final Provisions*

Key changes from the LFMN to the LIC:

- Mexico now accepts international Standards such as ISO and IEC.

- Voluntary Standards can be developed by many types of organizations, including industry chambers, academic and research institutions, schools, and associations.

- Voluntary Mexican Standards (currently NMXs) will be referred to only as "Standards."

- Editorial modifications to existing Standards will no longer have to be authorized via the annual National Standardization Plan.

- Each Standard is required to include a section identifying relevant international Standards with a description of the similarities between them.

- Goods and services offered for importation must show evidence of compliance with the Official Mexican Standard, in accordance with the applicable Compliance Testing Procedure, such as certificates, rulings, or test results from a Compliance Testing Agency or from an outside third party in accordance with the provisions in the Regulations.

  - If no Official Mexican Standard is applicable, relevant authorities can require that the goods/services demonstrate compliance with applicable International Standards or Technical Regulations of the country of origin or, in the absence of these, those pertaining to the manufacturer.

- The new law allows for more accreditation and certification bodies.

- Compliance Testing Agencies may subcontract compliance testing assessment or inspection services to a third-party Compliance Testing Agency that has been accredited and approved in the subject matter.

- Certifications performed by foreign laboratories will not be accepted outright. There must first be a mutual recognition or equivalence agreement in place.

- For enforcement, verification is under the purview of the Mexican government and surveillance is overseen by Standards developing organizations and certification bodies. ⊕

Fred Ashton

Economist, NEMA

Manufacturing Productivity Has Stagnated Over the Last Decade

Productivity growth in the United States has downshifted over the past decade and has become an important focal point among economists and policy makers. Along with a growing labor force, increased productivity is a driving force of overall economic growth, increased wages, and corporate profits. Given the advancement in industrial automation equipment and data informatics over the same time period, the decade-long downshift is a conundrum.

Using multifactor productivity (MFP) data from the Bureau of Labor Statistics (BLS),[1] we can compare how manufacturing in general—and the electrical equipment, appliances, and components manufacturing sector in particular—compares with productivity gains in the overall economy.

The BLS defines MFP as:

The efficiency at which measured inputs are utilized in producing outputs of goods and services, measured as output per unit of combined input. Combined inputs include capital and labor (for major sectors) or capital, labor, and intermediate inputs (for industries).

While the more widely followed labor productivity measure is often cited, it is important to factor in capital when discussing the productivity of the manufacturing sector.

Multifactor productivity growth in the private nonfarm business sector averaged 1.4 percent from 2000 to 2007. By comparison, overall MFP fell to a compound annual growth rate of 0.4 percent between 2007 and 2018. The decline among manufacturers was even more pronounced, dropping from 1.7 percent between 2000 and 2007 to -0.3 percent over the 2007-2018 period.

With growth averaging 1.5 percent from 2000 to 2007, electrical equipment, appliances, and components manufacturers lagged productivity growth in the manufacturing sector. However, from 2007 to 2018, the industry struggled to sustain an average growth rate of 0.1 percent.

The nearby table shows the compound annual multifactor productivity growth rates for private nonfarm business; manufacturing; and the electrical equipment, appliances, and components sector during six periods as defined by the BLS.

Economists have not reached a consensus as to why productivity growth, specifically manufacturing productivity, stagnated over the past decade. One possible explanation is that the adoption of technological advancement has been slow or not fully implemented and has yet to yield the highest levels of productivity. For an example, consider a sensor that provides limitless amounts of data that are not adequately leveraged to improve a process.

A second possibility, offered by Andrews, Criscuolo, and Gal in a 2015 Brookings Institution paper, is that "a productivity growth rate gap has opened between frontier firms and their less efficient industry cohorts."[2]
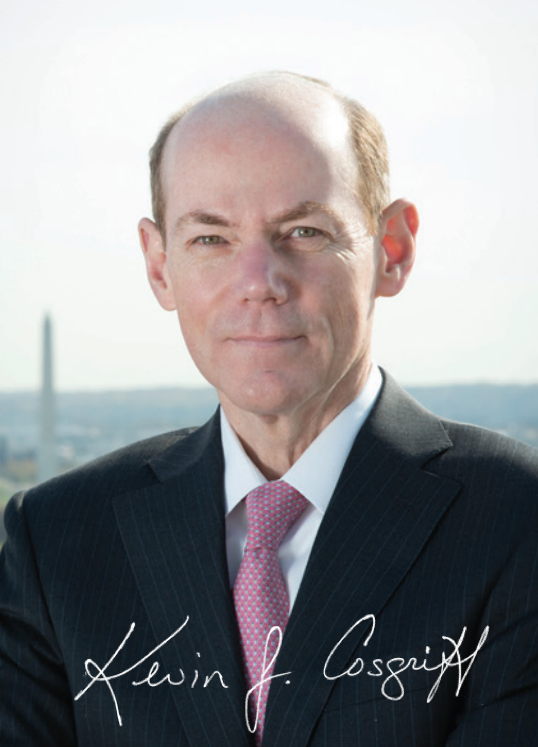
Both explanations are plausible, but it is likely a combination of the two, mixed with public policies that discourage capital equipment and human capital investment, can explain the slowdown in manufacturing productivity. ⊕

1 Multifactor Productivity, U.S. Bureau of Labor Statistics, https://www.bls.gov/mfp/mprdload.htm#Multifactor%20Productivity%20Tables

2 Chad Syverson, *The Slowdown in Manufacturing Productivity Growth*, Global Economy and Development at Brookings, August 2016, https://www.brookings.edu/wp-content/uploads/2016/08/the-slowdown-in-manufacturing-productivity-growth_august-2016.pdf

U.S. Average Compound Annual Growth Rates of Multifactor Productivity, %			
	Private Nonfarm Business	**Manufacturing**	**Electrical Equipment, Appliances, and Components**
1987-2018	0.8	0.8	0.2
1987-1990	0.4	0.4	0.1
1990-1995	0.5	1.1	-0.1
1995-2000	1.4	1.8	-0.9
2000-2007	1.4	1.7	1.5
2007-2018	0.4	-0.3	0.1

Coming Next Year

January/February
Utility Products & Systems
Interconnections

March/April
Lighting Systems
Smart, Seamless, Imperceptible

May/June
Transportation Systems
Shifting Gears: Transportation Innovation

July/August
Building Systems
Redesigning and Repurposing Buildings
for the Next Normal

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

November/December
Building Infrastructure
Backbone of Our Connected Future

ENDNOTES FROM THE **PRESIDENT**

Technology has unlocked productivity gains during each industrial revolution. The steam engine powered the First Industrial Revolution in the 18th and 19th centuries. In the late 19th and early 20th centuries, standardization and electricity-, gas-, and oil-powered equipment helped push manufacturing productivity to new levels as part of the Second Industrial Revolution. Electronics, telecommunications, and computers automated the Third and the internet and data collection/analysis are hallmarks of the Fourth Industrial Revolution.

NEMA Members are already part of this latest revolution and, accordingly, are well-situated to meet an uncertain future.

As the power of the internet became apparent, electrical manufacturers began implementing end-to-end digitization across their supply chains, becoming more efficient than ever before. With more than 30 billion connected devices in homes and manufacturing facilities (and counting), workers monitor production lines, check inventories, and resolve malfunctioning equipment remotely. What previously took hours or days can now be completed in minutes, resulting in dramatic efficiency and productivity gains. Connected machines can notify plant managers of the optimum timing to perform preventive maintenance and detect potential issues before they happen using predictive analytics. These tools lead to more productive factories with less downtime and more reliable product shipments. Other benefits include increased sustainability, reduced operating costs, higher product quality, and smarter changeovers.

This latest Industrial Revolution will continue to expand manufacturing capabilities, but we will realize the next great technological leap using emerging wireless technologies like 5G. The speed and bandwidth benefits of 5G are well-known and impressive, but the real breakthrough is low latency, the time delay to transmit and receive information. The latency of newer networks can allow machine operators located hundreds of miles away to make custom products with the same precision as those physically in the factory. Manufacturers that have struggled with finding qualified staff to match factory output can now search across the United States, potentially without the need for people to relocate.

Implementing 5G and other Fourth Industrial Revolution technologies will require electrical infrastructure. Miles of conduit and cable, advanced power distribution systems, and various other technologies made by NEMA Members are required to enable a more productive industrial sector. NEMA companies' products run the data centers that provide connectivity, protect people and sensitive electronics from being harmed, and operate the robots that automate industrial processes.

Not surprisingly the electroindustry is at the forefront of these momentous technological changes, both as adopters and enablers. Electrical and medical imaging equipment manufacturers are reaping the supply chain efficiency and resilience gains enabled by Fourth Industrial Revolution technologies. Furthermore, electrical manufacturers empower these technological leaps by creating the safe and secure electrical backbone required not only to operate digital systems but every other aspect of our economy and society.

And no doubt, NEMA Members will be there when we the Fifth Industrial Revolution arrives… whatever it may bring. ⊕

Kevin J. Cosgriff, NEMA President and CEO