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Rethinking **Manufacturing**

Use greater automation to
thrive during times of disruption



NEMA

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Let's Write the Next Chapter of American Industrial Infrastructure

As we emerge from a once-in-a-century pandemic, a once-in-a-generation opportunity lies before us: the chance to revitalize American manufacturing and industry.

It's not just new Federal investment that is creating this opportunity—there is also a paradigm shift underway. After decades of the lean regime, businesses are rethinking supply chain strategies. They are shifting to remote work models and digitalized operations. They are looking for a new way to do business.

Once again, the electrical manufacturing industry is right in the middle of the conversation. We will be answering the call to modernize legacy brownfield sites. And we'll be mobilizing to build new greenfield—whether it's 70,000 more electric vehicle charging sites or doubling renewable generation capacity by 2030.

Although new greenfield builds will attract more headlines, I think the brownfield modernization story will be just as significant. In developed countries like ours, 65 percent of the buildings that will exist in 2060 exist today.¹ If we are going to bolster supply chains, meet ambitious net-zero goals, and elevate U.S. manufacturing's global competitiveness, we will have to do it largely with the industrial facilities that are already built.

This issue of *electroindustry* explores technologies and ideas to transform any industrial site digitally. As it turns out, you can teach an old factory new tricks, and we will see that up close in a feature story about Schneider Electric's smart factory in Lexington, KY.

Our factory has manufactured electrical products for over six decades. And even though it's the definition of a brownfield industrial site, it didn't stop us from modernizing it over the years with industrial IoT connectivity, cloud analytics, predictive demand modeling, and energy-efficiency optimizations.

Often, the only list a 63-year-old building can expect to land on is the National Register of Historic Places. Not so in this case. Last year, the World Economic Forum designated our industrial site as an "Advanced Lighthouse"—a recognition given to a few dozen of the world's smartest factories.

I hope that our factory's story, along with many other inspirational examples set by NEMA Members, provides proof of concept and creates momentum for change. The entire U.S. manufacturing base needs to make the leap, with cybersecurity at the forefront, from Industry 3.0 to 4.0 and from 4G to 5G.

How do we make that leap? How do we invigorate American industrial infrastructure? Read on and find out. ☞

Annette Kay Clayton
Chair, NEMA Board of Governors

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¹ World Green Building Council, *Global Status Report 2017*, p. 3.

What Is Edge Computing, and What Does It Mean for Industrial Applications?

Gartner estimates that by 2025, 75 percent of enterprise-generated data will be “created and processed outside a traditional centralized data center or cloud.” As manufacturers exponentially increase their development of data with the adoption of Internet of Things (IoT) sensors and devices, they must adopt computing capabilities that can keep up with this flood of information. Edge computing enables intelligent manufacturing for today and the future.

DEFINING EDGE COMPUTING

As the world becomes more connected and the cloud’s influence extends into the industrial and manufacturing domain, the need for faster and more efficient information processing is increasing. Real-time constraints, cybersecurity threats, and overburdened communication channels have highlighted the need also to process manufacturing data at the point of production, complementing the processing of data transmitted to a cloud server. This localized focus on data processing and storage is known as edge computing.

ENABLING INTELLIGENT MANUFACTURING

One of the largest disruptive trends in recent years has been Smart Manufacturing, which integrates the Information Technology (IT) and Operational Technology (OT) layers by harnessing manufacturing data’s value. Edge computing capabilities can be leveraged to address some of today’s critical Smart Manufacturing initiatives, such as Digital Transformation and Industry 4.0, by building upon the connectivity of Industrial Internet of Things (IIoT) assets across multiple customer facilities. Data from manufacturers can be utilized across the network, empowering end users to make better business decisions based on the current status. Providing this transparency to data allows for improved operational productivity that will shorten time to value for our customers.

ENHANCING LEGACY SYSTEMS

Previous generations of connected systems limited the user to technology and information available at the time the system was manufactured. Evolution

of cloud computing applications leveraged increasing communication network capability, allowing data to be accessible from outside the system, but typically required a costly security infrastructure that was not tailored to the needs of the individual manufacturer. With its more modular architecture and secure connectivity, edge computing can be updated to meet any new technologies, threats, or regulatory requirements that may impact the manufacturing segment. Manufacturers are therefore able to remain current without the costly burden of having to update their entire system.

Edge computing provides pathways for information to flow from end devices through the system layers and can be positioned at the control layer, reducing the need for complex networked solutions with a high attack footprint, as the data remains local to the asset. This proximity also allows for faster information flow, enhancing the compute capability to make timely decisions when unforeseen events occur, such as anomaly detection on conveyance lines. Another advantage of edge computing is its ability to communicate on standardized industry networks, such as Ethernet/IP.

As devices and new technologies grow with time, information flow can continually be updated, mitigating the forced obsolescence faced by traditional systems. Here at Rockwell, we see edge computing as the next step toward building the most efficient, environmentally responsible, and secure manufacturing system possible. ☯



During his tenure at Rockwell Automation, Mr. Kulaszewicz has held several key leadership roles in the Drive Systems, Standard Drives, and Control & Visualization businesses. Most recently, he served as Senior Vice President, Control Products & Solutions.

NEMA Announces Next President and Chief Executive Officer



Debra Phillips will be the next President and CEO of the National Electrical Manufacturers Association.

Phillips joins NEMA from the American Petroleum Institute, where she led the Standard-setting, revenue-generating businesses and global operations division as Senior Vice President of Global Industry Services. Phillips previously served as Vice President of Sustainability at the American Chemistry Council and earlier in her career held director and engineering positions in private-sector chemical and manufacturing companies.

“Debra’s leadership and track record of success will not only serve NEMA Member companies incredibly well but also propel the direction and mission of our organization to new heights during a pivotal time for the electroindustry,” said NEMA Board Chair Annette Clayton, CEO and President, Schneider Electric North America. “With an energy landscape that is more sustainable and increasingly more electrified, Debra’s more than 20 years of

leadership on sustainability, Standards, and globalization in D.C. trade associations will enable the NEMA membership to deliver even more benefits to consumers, businesses, and the U.S. economy overall.”

“I am honored to be joining the NEMA team and an industry that enhances the lives of Americans every day while pioneering innovations that spur long-term infrastructure modernization and economic growth,” said Phillips. “I look forward to continuing the work of the talented NEMA team during an inflection point when digitalization, energy security, connectivity, and workforce of the future are critical issues for NEMA Members, businesses, and consumers alike.”

Phillips will succeed Kevin Cosgriff, who is retiring at the end of 2021. During his seven years leading NEMA, Cosgriff strengthened the electrical equipment and medical imaging industries by modernizing industry Standards processes, expanding market analytical offerings, and overseeing focused and effective advocacy.

“It has been a privilege to serve such exceptional and important Member companies and lead a truly wonderful team,” said Cosgriff.

“On behalf of the NEMA Board of Governors, I would like to thank Kevin for his outstanding leadership, unwavering commitment to our industries—especially his steady hand during COVID—and his many important contributions,” said NEMA Board Chair Annette Clayton. “He has prepared NEMA for the future, and we wish him well in his retirement.” ^{ci}

NEMA Shares 2022 Strategic Initiatives and Council Updates

The NEMA Strategic Initiatives Program is an idea accelerator and project incubator created to seize emerging market opportunities and solve impending challenges. Participation and the output from the Strategic Initiatives is a benefit of NEMA membership. Visit www.nema.org/si to sign up for one of the existing Strategic Initiatives or the ones approved for 2022:

BEYOND EFFICIENCY

Work with Members and industry partners to advocate for the holistic benefits of electrical systems in buildings, industrial facilities, transportation systems, and the electrical grid, with a focus on attributes including safety, reliability, resiliency, digitalization, connectedness, and sustainability.

GLOBALIZATION 2.0

Examine current and future trade trends and detail global risks and opportunities to our industry; increase American influence in international Standards; and improve import enforcement via e-labeling.

DIGITALIZATION

Analyze requirements of the General Data Protection Regulation and California Consumer Privacy Act and assess implications for NEMA Members; address artificial intelligence adoption barriers by filling Standards gaps (e.g., testing) and advocating for sound AI regulations and legislation; and develop a platform for machine-readable Standards.

TRANSPORTATION 2030

Develop a baseline of existing and future technical, educational, and policy/regulatory gaps with input from staff and Member companies and launch an advocacy campaign targeting State/local agencies.

INDUSTRY DEFENSE

Established to help NEMA Members address rising insurance rates, the Industry Defense SI Committee has been active this year hosting webinars and roundtables to educate Members on risk transfer mechanisms outside the traditional insurance market. In May, NEMA invited a guest speaker from the American Property Casualty Insurance Association to help Members understand the drivers behind surging premium rates across many lines of coverage. In June, NEMA hosted a roundtable discussion for Members to share their experiences



and perspectives, and explore the possibility for insurance captives, risk retention groups, and risk purchasing groups to address risk coverage gaps. Upcoming presentations will focus on helping Members identify existing insurance captives that are appropriate to cover their exposures.

SF₆ AND ALTERNATIVES COUNCIL

After four years of advocacy, the NEMA SF₆ and Alternatives Council was finally successful in getting a key provision of California's regulation for Sulfur Hexafluoride (SF₆) Emissions from Gas Insulated Switchgear amended. Regulated by the California Air Resources Board (CARB), California-owned utilities have been required since 2010 to track and report emissions from power grid equipment that utilizes the greenhouse gas for insulation and arc-quenching. An oversight in the original regulatory text governing how emissions are calculated sometimes leads to inaccurate emissions figures. As part of a broad overhaul of the regulation, CARB updated the language in response to proposed new text from NEMA. The revised regulation will take effect on January 1, 2022.

MATERIALS MANAGEMENT COUNCIL

The NEMA Materials Management Council (MMC) held its first formal meeting which was highly attended and productive. The MMC discussed the proposed scope of activities and through a follow up survey, identified three priority topics on which to focus initially: "Surveillance," "Chemicals," and "Critical Minerals." Task Groups are being formed to prioritize activities and deliverables for these topics, with additional topics to be addressed later. Kent Crawford, Director of Engineering at Schneider Electric, has volunteered as interim MMC Chair. The MMC is currently seeking nominations for additional leadership positions including a permanent Chair, a Vice-Chair, and Task Group leaders. ☺

Brian Marchionini,
PMP, Senior Program
Manager, Connected
Systems and Strategic
Initiatives, NEMA

Digital Transformation, Industry 4.0, and the New Model for Optimizing Supply Chains



This is the story of what happened in the last 60 years that made such a transformation possible. A transformation not just in one factory, but across Schneider's entire global supply chain—and across our customers' supply chains—using an Internet of Things-enabled solution.

Digital Transformation, Decades in the Making

Digitalizing the 63-year-old factory didn't happen overnight. The groundwork was laid for more than 30 years, starting with programmable logic controllers, drives, and other connected shop floor devices. Around 15 years ago, the plant integrated enterprise resource planning systems and manufacturing execution systems.

Despite these initial steps, the factory's operations remained siloed, with various teams collecting and analyzing—but not sharing—data. The data itself was stored on paper or in Excel sheets. Without standardized data, various departments analyzed and reported on different metrics. It made it difficult to see the bigger picture or focus on optimization.

It wasn't until the last three years that the Lexington site moved past the Industry 3.0 status quo. During this period, the factory progressively connected the physical infrastructure with Internet of Things-enabled devices. Doing so allowed the facility to integrate power distribution, building management systems, industrial automation equipment, and edge IT deployments for the first time. By modernizing these systems, operators could track key performance indicators (KPIs) such as energy use, power quality, and equipment health with much more granularity.

Beyond mechanical systems and machines, people processes were also digitally transformed, including maintenance, fault detection, and lean optimization



Ken Engel, Senior Vice President of Global Supply Chain for North America, Schneider Electric

A few miles northwest of downtown Lexington, Kentucky, a factory looks much like the other industrial buildings nearby. Its unassuming exterior is mostly brick, with an office area in the front.

When you walk inside, you'll hear the familiar hum of people and machines at work. You'll see more than 7,000 parts for load centers and safety switches conveyed overhead, journeying from fabrication to painting and assembly.

But if you look closely, you'll see this factory isn't quite like an ordinary factory. The first thing you'll notice is all the screens. You'll see workers using augmented reality-enabled tablets to diagnose equipment faults. You'll see dozens of human-machine interfaces broadcasting the same data throughout the facility. In short, what you'll see is the future of industry.

When the Schneider Electric Lexington plant opened in 1958, Dwight Eisenhower was president, and a single computer filled an entire room. Today, it's one of the most advanced factories on earth, according to the World Economic Forum's (WEF) Global Lighthouse recognition.

activities. It's easy to overlook how people fit into a digital transformation. But change management, process alignment, and training—not the technology itself—are often the biggest hurdles to overcome in terms of financial and time investments.

“Skill development was a critical focus area for us,” says Bharat Bhushan Virmani, Vice President of Supply Chain Performance. “It's not just about getting our team real-time data. It's about making sure they're ready to respond to the data the right way. To make digital upskilling meaningful, we also had to build core manufacturing skills.”

When all these factory subsystems and processes were finally digitalized, they could be brought into a single “system of systems,” uniting hardware, software, people, artificial intelligence (AI), and analytics. At its essence, this system enables people and machines to use the right data at the right time to make the right decisions.

What does that mean in practice? For our plant, it resulted in:

- A 300 percent explosion in operational technology data sharing
- 4.4 percent year-over-year carbon emissions reduction
- Energy savings of 3.5 to 4 percent year over year
- Shrinking paperwork by 90 percent
- Forecast accuracy improvements of 10 percent
- On-time delivery improvement of 18.7 percent over three quarters

And the list goes on.

As much as these numbers demonstrate the opportunities of Industry 4.0, there's more to the Lexington story than on-site optimization. The full impact of the factory's digital transformation comes into focus by zooming out to the broader supply chain.

From a Single Node to the Full Supply Chain

Upstream of the factory, raw material input and customer orders modify supply and demand. Without visibility into changing conditions, it was difficult for Lexington decision-makers to calibrate production to fit needs. By consolidating fragmented spreadsheets and sales data into a single system, they gained line of sight into demand forecasts and capacity risks. With



these analytics tools, decision-makers now work with enhanced forecasting accuracy that keeps the supply chain moving.

Downstream, the factory now responds faster to real-time customer feedback and satisfaction scores. These survey tools integrate with sales platforms so that all Schneider teams can access what customers are thinking. Using this data, teams have a head start in improving products and delivery times.

Schneider's vision is a digitalized global supply chain that can continuously optimize production and distribution to fit demand and remain strong enough to withstand global disruptions. It's a vision that was put to the test almost immediately.

Uncertainty, Agility, and Resilience

Over the past 18 months, nearly every company's supply chain has been impacted—including Schneider's. And yet, the company's investment in digitalized operations helped it bounce back and continue delivering critical infrastructure to its customers.

“We had to do two things at the same time,” says Jean-Pascal Tricoire, Chairman & CEO of Schneider Electric. “Operate our facilities safely—but operate them. There was no choice to stay home and say, ‘Call us in two months.’”



Remote monitoring applications, temperature scanning, and AI-guided facial recognition helped protect workers and keep production on track. Demand forecasting simulations and supplier hot spot visibility helped plant decision-makers plan for changing upstream conditions.

“Digital transformation enabled us to survive and operate in a complex global supply chain,” says Kenneth Labhart, Schneider’s North America Innovation Leader for Supply Chain Performance.

Ultimately, Lexington plugs into Schneider’s broader push for agility and resilience across the supply chain. The pandemic is just one disruption amid a changing world. Trade and tariffs, decarbonization initiatives, and fluctuating commodity prices also factor into the equation. The ability to retool, reimagine, and reorganize production quickly will be a decisive advantage in the years to come.

“We’ve tailored our supply chain for customers, but this isn’t enough to protect business resilience against a stressed supply base and the growing number of black swan events,” says Annette Kay Clayton, CEO & President of Schneider Electric North America. “We’re modeling a new approach in partnership with Massachusetts Institute of Technology and Dr. David Simchi-Levi that optimizes for lead times, time to survive, and time to recover. It’s about finding the just-right balance between just-in-time and just-in-case. We’re focusing investments in the supply chain where they’re needed and thereby avoiding the potential to overspend and drive excess cost on redundancy.”

Proof of Concept

The real significance of this story is that it’s replicable. It proves that you can take any brownfield manufacturing site—no matter its age—and turn it into a world-class facility.

Every manufacturing organization in the U.S. can do this. As the WEF Lighthouse designation affirms, the Lexington factory is a beacon for others making the journey. In fact, during the last two years, the plant has given more than 1,500 virtual and on-site factory tours to our customers, partners, and other interested parties. Schneider is now implementing the same Internet of Things technology used in Lexington at its customers’ smart factories across the country, including a global medical equipment manufacturer and a top three automaker.

Even if every manufacturer can make this journey, not all will. A digital transformation such as this one doesn’t just happen through inertia. It requires buy-in from the entire organization, top to bottom—from production line workers to the C-level.

And not every brownfield facility will follow the same path. Each digital transformation is different. Many, thankfully, will occur much quicker than the 30-year journey that the Lexington factory took—especially now that there’s growing momentum for revitalizing U.S. manufacturing.

Caveats aside, the bold idea stands: Every manufacturer can do this. Successes such as the Lexington factory illuminate the path forward. 🌟

NEMA Industrial Products and Systems Department Highlights

- The **Insulating Materials Section** voted to renew John Gauthier to represent the U.S. for International Electrotechnical Commission (IEC) Secretary TC 15
- The **Industrial Automation Control Products and Systems Section** is considering taking over 11 Technical Advisory Groups (TAGs) related to Electromagnetic Compatibility (EMC). If approved, this would nearly double the number of TAGs the Section manages; also, Bruce Desmond (Phoenix Contact) and Joe Uphaus (Eaton) were voted as Chair and Vice Chair, respectively for the Industrial Automation Control Products and Systems, Government Affairs Committee
- The **Motor and Generator Group, Industrial Automation Control Products and Systems Group**, and Members of the **Adjustable Speed Drive Group** held a two-hour joint meeting with Members of the European Committee of Manufacturers of Electrical Machines and Power Electronics (CEMEP) to explore Standards gaps, and programs to promote energy savings using these advanced products
- After nearly 100 years, NEMA MG 1 is now available at no cost. Check out nema.org/standards/view/motors-and-generators to register, complete a short survey, and get access to the No. 1 resource on NEMA motors dimensioning and performance requirements
- Benjamin Hinojosa (CME Wire) were voted as **Chair of Power and Control Wire**
- The **NEMA Wire and Cable Section** will host the Annual Wire and Cable Forum in conjunction with the NEMA Annual Meeting. For information, contact Kirk.Anderson@nema.org

Mr. Engel has more than 30 years of supply chain management experience and 26 years with Schneider Electric.



Next-Gen AI: The Star of Industry 4.0

Editor's Note: Turning the potential of Artificial Intelligence (AI) into business value at scale brings many challenges, some of which are more human than technical. To explore these issues, Siemens partnered with Longitude Research to survey over 500 senior executives. Their responses offer unique insight into the future of industrial AI. Here is an excerpt from the study.

Hheavy industry companies—those in manufacturing, engineering, metals, textiles, chemicals, and related sectors—boost efficiency, safety, profitability, sustainability, innovation, strategy, and more by pioneering advanced automation and analytics.

Now, manufacturers are in different stages of Industry 4.0, which includes integrating physical and digital assets and using sensors, connectivity, robotics, computing power, and operational models and innovations that combine human ingenuity and automation.

Artificial intelligence—which employs human-like, adaptable capabilities and helps us analyze data collected from machines, processes, assets, markets, and the environment—is a principal player in Industry 4.0.

So, how do manufacturers benefit from AI now? How quickly will organizations change to accommodate more AI-driven operations? And how will industrial companies deal with issues of trust, governance, safety, and cybersecurity?

To answer these and other questions, Siemens surveyed 515 senior leaders who have some responsibility for, involvement in, or knowledge about their organization's existing or planned use of AI. Following are insights from the 158 industrial sector respondents.

So far, industrial companies have seen only modest benefits from AI, with leading use cases providing a significant or moderate benefit for less than a third of companies. Those use cases include systems that:

- Intelligently optimize systems automatically (30 percent experienced a major or moderate benefit)
- Provide market or system forecasts (30 percent)
- Automate and/or improve quality control (30 percent)
- Improve existing products and services (29 percent)
- Identify risks/issue warnings (27 percent)
- Predict asset maintenance needs (25 percent)

In all the cases above, between 77 percent and 84 percent expect a major or moderate benefit in just three years. Part of this expected growth will be down to the increasing accessibility of AI, particularly for companies that do not have specialist AI capabilities.

Only 44 percent of respondents have an in-house team building customized AI-driven solutions, but many are taking advantage of products with AI functionality. For example, neural network processors are being built into machine control modules, which means companies can buy “off-the-shelf” visual or auditory discrimination tools (for example, for quality checks or process monitoring).¹

New Opportunities Where Context Matters

AI applications are developing rapidly, and as industrial companies increase their adoption, the next generation of innovations and applications will create new opportunities.

Advances in the way data is managed, generated, represented, and shared drives innovation.

“AI is about generating value from data,” says Norbert Gaus, Head of R&D for Digitalization and Automation at Siemens. “It is driven more by data than by technology.”

Sometimes, it will be advances in how manufacturers represent, blend, and manage data that will lead to AI breakthroughs. Knowledge graphs are one example. Often visualized as giant spider diagrams, knowledge graphs capture the meaning of, and relationships between, items in diverse data sets.

“Knowledge graphs add context to the data you’re analyzing,” says Gaus. “For example, machine data can be analyzed in the context of design data, including the tasks the machine is made for, the temperatures it should operate at, the key thresholds built into the parts, and so forth. To this, we could add the service history of similar machines, including faults, recalls, and expected inspection outcomes throughout the machine’s operational life. Knowledge graphs make it much easier to augment the machine data we use to train AI models, adding valuable contextual information.”

What kind of contextual data would be most useful? According to the survey, it’s:

- Performance data from sold products in use with customers (75 percent)
- Data from suppliers (71 percent)



- Internal data from other divisions, regions, or departments (70 percent)
- Data from manufacturers of equipment or assets (67 percent)

AI Is a Powerful Tool

A company that uses knowledge graphs to bring these kinds of data together would train a single AI model with information about the life of previous products, operational inputs, variables, and dependencies. The AI model could identify valuable patterns and clusters in this diverse dataset, which could drive better predictions, valuable ideas, new efficiencies, and more powerful automation.

Even the respondents' top choice alone could be transformative for AI applications. Performance data from sold products can complete feedback loops that have historically been hard to close.

"This would help us understand, for example, whether something was poorly designed, whether something went wrong in the manufacturing process, or if customers are using the product in unforeseen conditions,"¹ says Gaus. "Perhaps the design makes manufacture complicated, which affects durability in certain conditions. Having these feedback loops automatically flow back from the whole product lifecycle could help us isolate issues and improve products. For some organizations, this could be game-changing."

AI and Big Decisions

The advance of AI brings with it new challenges for industrial companies. One of the most interesting is how much confidence to have in the results, insights, and decisions generated by AI, especially when the stakes are high.

To explore this, we asked the survey respondents to imagine that their organization had installed a brand-new AI model called Maintain-AI, which had been trained on 20 years of performance data from their machinery manufacturer. We told them that Maintain-AI had recommended immediate lengthy, high-cost, disruptive refurbishment work on necessary machinery but that their head of operations—with 20 years of industry experience—strongly disagrees. Having inspected the machinery, the head of operations says the work would be an unnecessary waste of time and money.

The 158 industrial company respondents considered this scenario, and a modest majority (58 percent) said that their organization would side with Maintain-AI, which suggests many are open to trusting in the results of AI-driven analysis.

However, it is important to point out that we told respondents that Maintain-AI had outperformed the organization's best people in a yearlong pilot before the refurbishment recommendation. With that in mind, the fact that a sizeable group (42 percent) still opted to go with the head of operations is more concerning: It indicates a potential bias against AI that could stop some companies from progressing.

Falling Barriers, Rising Benefits

The relatively high proportion that opted not to trust AI in our hypothetical scenario could be attributed to industrial companies' top barriers to progress with AI. Cybersecurity risks and liability risks are both cited as major or moderate barriers by 80 percent of respondents. However, things may be about to change. Both these barriers are expected to fall within the next three years—to 52 percent and 40 percent, respectively.

Overall, our research shows that the industrial sector is optimistic about AI, with a clear majority (60 percent) reporting that their organizations are eager to use as much AI as possible. With barriers expected to fall as swiftly as benefits are expected to rise, we may be about to see the next generation of AI emerge as the star of Industry 4.0. 🌟

¹ <https://press.siemens.com/global/en/pressrelease/artificial-intelligence-simatic>





Automation Is Key to Reshoring America's Critical Supply Chains

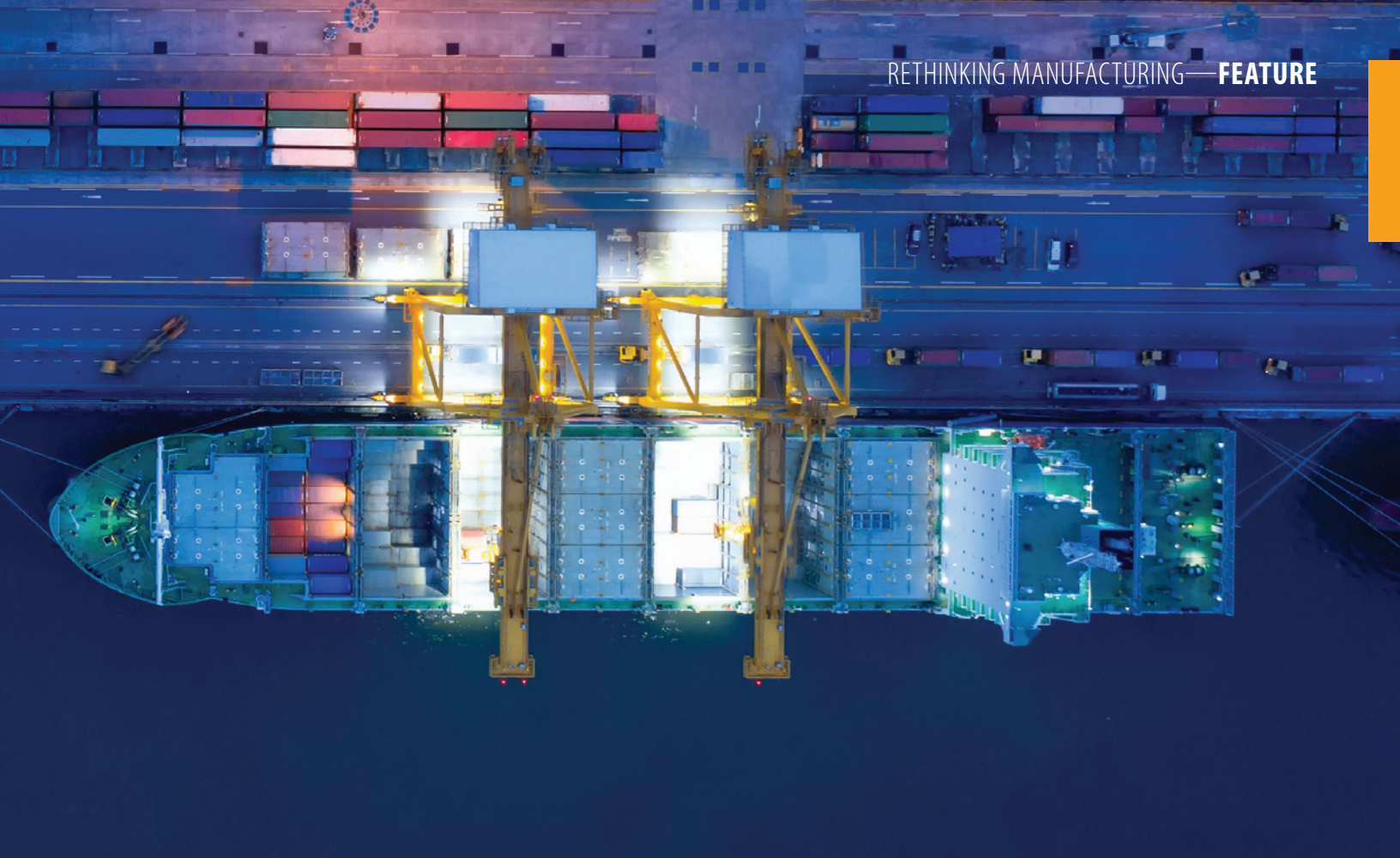


John Sheff,
Director of
Public & Industry
Affairs, Danfoss
North America

The concept of “reshoring” America’s critical supply chain has gained attention since the beginning of the year. The well-publicized semiconductor chip shortage has brought new awareness to this issue, as has an executive order from the Biden Administration. This issue, however, has been gaining momentum for years. Dependence on Chinese processing for rare earth materials has been a challenge for decades and was brought to light again during the initial stages of the trade war several years ago. And, of course, the broader topics of globalization and bringing manufacturing jobs back to the U.S. are generally controversial.

The subject of automation arouses similarly strident opinions. To some, it’s a job-killing non-starter; to others, it’s the future of work in which millions of high-paying jobs are produced. Industrial automation is, in fact, neither of those things. It’s neither good nor bad, but rather the current and future state of this country’s advanced manufacturing base. And, if we want to pursue the strategic goal of reshoring our critical supply chains, implementing modern automation in our factories is the only option.

Often, we think of industrial automation as machines placing tiny chips onto motherboards, but it’s so much more. A modern American factory needs data, and those data are measured and retained by automated systems. Those data help people make decisions that redefine the meaning of productivity. They help run



supply chains and predict future demand. They speed and enable manufacturing. They help us build things without waste—wasted materials, wasted space, and wasted time. Automation is the key to increasing efficiency daily.

The most common argument against investing in automation is that it eliminates jobs, but this simply isn't true. Automation does, however, redefine the jobs it affects and changes their requirements. Automation requires workers to develop new skills and unlock what makes American workers so special—our ingenuity and creativity. We need to stop thinking about automation in terms of what it diminishes and start thinking about what it has the potential to create. Automation is not a jobs killer; rather, it is a manufacturing enabler, and the jobs created by automating our supply chains help us to compete on a global scale and to solve the problems that a 21st century economy presents.

The choice we have in front of us is not between automation and jobs. It's between automation and irrelevance. American industries are not going to compete with overseas factories by manually building product faster. American workers are not going to accept lower wages and a lower standard of living to compete with their overseas counterparts. In fact, it's logistically impossible to recreate overseas manufacturing models in this country. We simply don't have enough workers or square footage to replicate overseas manufacturing. The only way for us to compete globally is to out-innovate and out-perform our competitors. If we can shorten supply chains and use domestic suppliers with proximate inventories, our industries will be able to maintain less capital, become more efficient, and decrease transportation costs. These are the little things that, collectively, make a big difference in our overall competitiveness.

Investing in automation is not only about increasing efficiency and competing in the 21st century economy. The other side of that coin is mitigating supply chain risk. The long, complex supply chains that developed over the past few decades created vulnerabilities that have been exposed during the last several years. Disruptions to shipping routes, overseas labor supplies, and trade relationships affected markets thousands of miles away. Investments in automation make it possible for global manufacturers to build strong domestic supply chains close to their markets and, thereby, help to offset those disruptions.

Find Energy Savings and Reliability

Motors paired with adjustable speed drives can reduce energy costs by an estimated 40 percent in pump applications. To find out how Infinitum sees pairing these two devices can be applied to heating, ventilation, and air conditioning applications to create safer work environments while reducing energy costs, please visit nema.org/news-trends/ei/pairing.

The pandemic has pushed manufacturers toward automation more than ever. In February 2020, just prior to lockdowns, the unemployment rate in the United States was less than 5 percent. By April, it had risen to nearly 15 percent. Once governments issued the stay-at-home orders, we saw industries begin laying off workers. While the government tried instituting programs to stop massive layoffs, certain markets were more affected than others. For example, oil and gas production saw massive reductions in personnel because the oil commodity price went down, and when the commodity price goes down, a reduction in capital spending soon follows. Fast-forward a year and

we're back to a position where it's hard to find skilled workers. Nearly everyone who was laid off found a job elsewhere—unemployment is back down to less than 6 percent. As we see an increase in GDP and in manufacturing activity, we're going to need to find better ways than just hiring more people to get output back to full capacity. Doing it with just more hands isn't effective and it simply won't work in this modern economy. Automation isn't optional; it's required. If we're going to grow output without adding space, factories, and people, we need to automate.

Even if another global pandemic isn't coming, we need to have more flexible manufacturing where we can ramp production up and ramp down to meet demand, so we don't lose much when the economy fluctuates unexpectedly. When we see a reduction in activity in the short term, we tend to reduce employee headcounts. This can be economically dangerous—when we lose a skill, we'll eventually need to replace it. The flexibility that automation provides not only allows production to meet demand with fewer layoffs but also allows companies to retain their most skilled and innovative workers through economic downturns.

An increased focus on automation and manufacturing efficiency will be critical moving forward. The U.S. cannot compete on labor costs, and we shouldn't want to. We need to work smarter to be globally competitive. However, there is no single magic bullet. So, we need to focus on doing the right things, on paying attention to the details, on building a pool of creative talent, and on pushing innovation. In the past several months, we've seen how strategically important it is for the U.S. to bring its critical supply chains back to American soil. As prices rise and critical components become scarce, our workers and industries are put at risk. In addition, reshoring these industries would shorten supply chains and utilize domestic suppliers with nearby inventories, allowing companies to keep less capital on hand and become that much more efficient. We cannot achieve these important goals without investing in automating our industries. Strategic reshoring and industrial automation are, in fact, two sides of the same coin. ☞

Prior to joining Danfoss, Mr. Sheff served as a Senior Policy Analyst for Energy and Environment in the office of former Maryland Governor Martin O'Malley.

NEMA Field Representative Program Explained

The NEMA field representative program acts as the eyes and ears for the implementation of code requirements for NEMA Member products throughout the country. The program offers NEMA Members a method to reach out to the industry to educate on the use of products and code-compliant installation methods. NEMA Sections and industry councils can rely on the field reps to relay information regarding these concerns about their products from the field. One function of the FR program is to network with the Authorities Having Jurisdiction (AHJs) and installers of products under the scope of NEMA.

One association the field representatives frequently align themselves with is the International Association of Electrical Inspectors (IAEI). This association's membership is not limited to AHJs but is open to all aspects of the electrical industry. This includes contractors, AHJs, engineers, electricians, etc. The field reps engage these members of the industry through educational sessions at chapter meetings or large annual section meetings held throughout the country. Building these relationships allows the field reps to participate in one-on-one conversations regarding the installation rules governed by the *National Electrical Code*® (NEC) and other installation codes, e.g., International Building Code (IBC), International Energy Conservation Code (IECC), and even the International Mechanical Code (IMC). The adoption of these codes throughout the country is not always the latest and greatest, and therefore the field reps must engage with the regulatory agencies within each State to ensure up-to-date code adoption. The field reps must also be ready to help in interpreting in whatever version is adopted in any jurisdiction.

The Industrial Control Panel Council was developed by NEMA to help an industry that has seen many rules added to the last couple of versions of the codes related to control panels. Article 409 in the NEC and UL 508B have gone through some changes, and educating the industry is important to ensure proper installation and application of industrial control panels. Through the Council, the field representatives can determine what the biggest obstacles or concerns are from the industry, and through associations

like the IAEI, the field representatives can help the industrial control panel sector educate the AHJs and installers.

Some goals that the field representatives can help this sector with are:

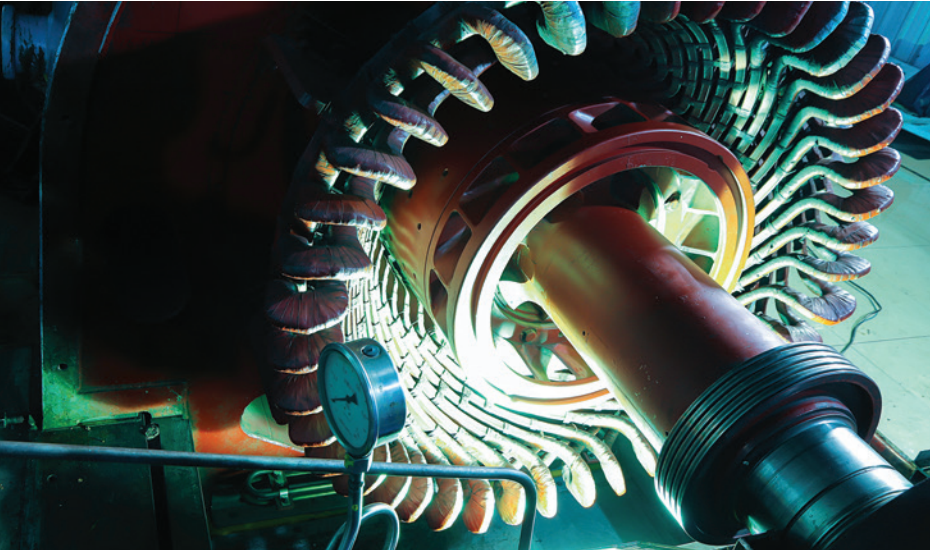
- 1) Help Council members understand local and NEC code differences, interpretations, and changes
- 2) Improved access to electrical installers and AHJs to help resolve issues
- 3) Represent industry at electrical boards/Council meetings when discussing matters on industrial control panel issues
- 4) Educate people about NEC Art. 409 related to UL 508A certification

The field reps engage with the States by participating with many of the regulatory agencies that are responsible for code adoption or even code interpretation within the State. The field reps monitor activities within their territories that may affect the installation of NEMA Member products. The field rep program is open to AHJs and individuals that have field questions or concerns about products and their compliance with current code requirements. Control panel applications that may trigger questions and concerns might be short circuit current ratings, overcurrent protection, etc. The tools that are developed by NEMA Sections and Councils like the Industrial Control Panel Council will assist the field representative program with delivering the correct information to the end users of products.

The field rep program offers four basic services to Members in the following categories: Codes and Standards Development, State and Local Codes and Standards Adoption Activity, Education and Training Activities, and Core Member Services. These offerings can help NEMA Members provide the end user with the proper guidance and understanding of all Standard-based products and the correct application for use. For more information, or to access the NEMA Field Representative Program, log on to nema.org/standards/technical/fieldreps ☎



NEMA Publishes Guide for Validating Predictive Modeling



One of the most important aspects of designing new products is ensuring the actual performance matches the predicted performance. With end-users requesting specialized designs for their applications becoming more common, finding an accepted and reliable means to predict performance for end-user and manufacturer is a growing need.

Twenty years ago, the motor industry struggled with a similar situation: the US Department of Energy passed a series of regulations that encompassed hundreds of basic ratings that required efficiency testing. Over time the number has grown to well over 100,000 models and continues to grow with custom variations and regulatory expansion. Given it can take more than a day to complete setup and testing, there aren't enough test facilities in the world to evaluate all the necessary motors using the traditional direct-testing methods.

Clearly an alternative method was needed: Enter an Alternative Efficiency Determination Method. Using Industry's input, the Department of Energy

documented an approach combines rigorous testing requirements with statistical sampling to validate whether manufacturers' design programs and processes can be relied on for accuracy. The result: instead of having to test (literally) thousands of products, the verification testing can be reduced to a total of 25 samples without losing confidence on the accuracy of results.

While this approach was documented within the Federal Regulations and has benefited motor manufacturers seeking to meet the US Department of Energy regulations, no industry standard with a similar approach was available.

Seeing there might be an opportunity to help other industries, the NEMA Motor and Generator Section undertook the effort to extract the relevant parts to create a new Standard MG G2-2021, Guide for Validating an Alternative Efficiency Determination Method (AEDM). The hope is that by providing this template, other industries can determine if their predictive models are sufficiently robust and would benefit from reduced testing using this approach.

"While this Standard addresses reduced samples for efficiency testing, industry hopes this could be used to reduce sample requirements for other testing as well, potentially saving thousands of laboratory hours each year," said Kirk Anderson, Industry Director of Industrial Systems at NEMA. "Industry has talked about 'digital twins' for years; finally we have a standard that provides tangible benefits of developing predictive modeling programs."

NEMA MG G2-2021 Guide for Validating an Alternative Efficiency Determination Method (AEDM) is due to be available later this month. For questions related to this standard and predictive modeling, please contact Mike Leibowitz. [@](#)

New Magnet Wire Standard Now Available

Extruded Insulated Magnet Wire (NEMA XW 1000-2021) is a new Standard that presents all existing NEMA Standards for round, rectangular, and square extruded insulated copper and aluminum magnet wire for use in electrical apparatus.

Included are the definitions, type designations, dimensions, constructions, performance, and test methods for extruded insulated magnet wire used in the winding of coils for electrical apparatus.

Readers of this Standard include manufacturers of extruded insulated magnet wire, motors, generators, transformers, and electric and conventional automobiles.

It is available on the NEMA Standards Store for \$88.

Other recently published Standards:

Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy (ANSI/NEMA WC 70/ICEA S-95-658-2021) is available for \$208.

Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts (NEMA 410-2020) is available for \$120.



High Ambient Temperature Test Procedure for Wiring Devices (NEMA WD 50000-2020) is available for \$42.

Guide to General-Purpose Synchronous Motors without Excited Rotor Windings (NEMA SM 1-2021) is available for \$330. ☎



ANNUAL MEETING 2021

AMERICA'S ELECTRIFIED FUTURE

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

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



NEMA President and CEO
Kevin J. Cosgriff



www.nema.org/annual-meeting

Senate Passes Major Infrastructure Bill

By a vote of 69-30, the Senate passed the *Infrastructure Investment and Jobs Act of 2021*, on Tuesday, August 10, culminating several months of bipartisan negotiations.

In the lead-up to this vote, NEMA President and CEO Kevin Cosgriff released a statement expressing support for the bill:

“NEMA Members support policies that enable forward-looking technologies and projects that help America meet its 21st Century electrical and other infrastructure needs. The Infrastructure Investment and Jobs Act under consideration by the Senate contains a wide variety of provisions that will upgrade America’s energy and connected transportation infrastructure.

While we believe additional provisions related to the building sector are needed, enacting the bill and implementing the law

quickly will expand the economy and provide employment prospects to rewarding careers. Importantly, the nation can do this in ways that protect the environment and contribute to improved quality of life for all Americans. We are pleased with the Senate’s progress towards passing this bill and look forward to assisting the Administration and States in bringing its benefits to life.”

NEMA and many industry leaders worked together with Congress to ensure that our important priorities were included in the bill. Our core principle of supporting a comprehensive and modernizing approach, rather than simply repairing roads and bridges, was achieved. Now that the Senate has passed its bill, attention once again focuses on convincing the House of Representatives to expand the scope of its narrower bill passed earlier in the year. ☺

SPOTLIGHT



Shayna Knazik

I Am MITA

Modern healthcare demands a close working relationship between users and manufacturers, particularly in the development of Standards. This can be seen in the history of the DICOM Standard, which originated with the American College of Radiology (ACR) and NEMA working together to develop the initial Standard in the early 1980s. DICOM is now the de facto Standard for all medical imaging and is used to collect, send, receive, store, process, query, and display medical images across virtually all manufacturers, machines, and modalities. Conformance to interoperability Standards like DICOM facilitates reliable and stable clinical workflows over products from multiple vendors, bringing maximum benefit to patients and clinical staff.

Updates to the DICOM Standard via Supplements (large extensions) and Change Proposals (small clarifications) represent improvements and advances in imaging technology and techniques. DICOM allows this innovation to reach the customer more quickly, as a single Standard works across all vendors

in increasingly multi-vendor customer sites. By having a single imaging exchange Standard that is free to access and use, new vendors can more easily enter the market since they do not have to develop novel interfaces.

In my role as Senior Project Manager of DICOM, I manage the workflow of 15 DICOM Working Groups (WG) and their Subgroups. I administer the WG-06 Base Standard, to which the DICOM Standard Committee has designated the responsibility for the technical consistency of the Standard. All work from any DICOM WG or submitted by the public must flow through WG-06, which holds five weeklong meetings per year.

The best part of my job is the interaction with DICOM Members from all over the world, and I enjoy recruiting participants to our various Working Groups. I look forward to doing more of this in person once travel restrictions are lifted. Through my work with DICOM, I’ve been afforded a unique opportunity to witness firsthand the impacts of interoperability in healthcare, and standardization in general. ☺

NEMA Market Data, Forecasts, and Scenario Planning Help Members Navigate Turbulent Times

Over the last two decades, the United States has suffered two largely unexpected and unusually deep recessions. The sudden downturns left some businesses and investors in vulnerable financial situations. Many companies and individuals were forced into bankruptcies. Economic weakness lingered in the aftermath of the 2007-08 recession as businesses and households struggled to deleverage bloated debt portfolios amid diminished income flows.

The 2020 recession, resulting from business lockdowns to contain the spread of Covid-19, was short-lived and followed by a rapid recovery initially as businesses adjusted to the restrictions and later as a vaccination rollout helped suppress the spread of the virus. The strong recovery, enhanced by monetary easing and record fiscal stimulus, strained supply chains, catching many companies unprepared to meet a sudden demand surge.

The recent experience highlights the need for businesses to plan for possible economic downturns and unexpectedly strong rebounds. NEMA Business Information Services offers a unique portfolio of products unavailable elsewhere in the marketplace to help Member companies prepare for these rapidly changing tides.

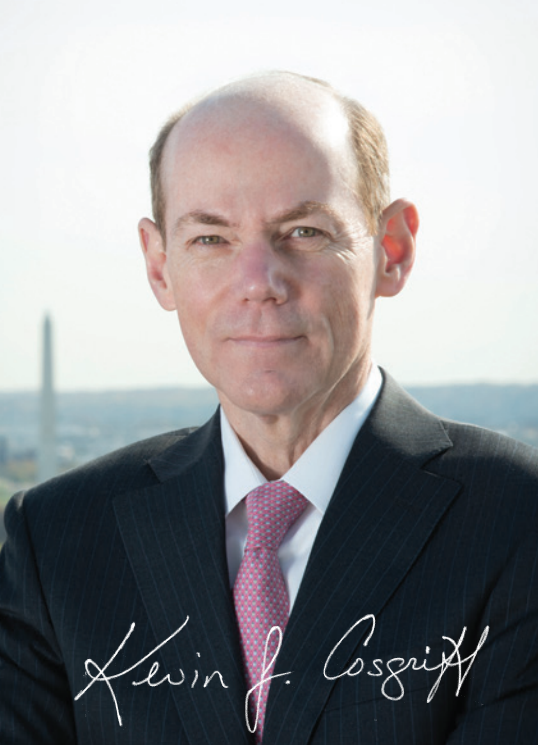
Since its inception, NEMA has offered its product Sections a variety of survey programs. A key strength is that NEMA/BIS can bring competitors together to develop custom data collection programs that meet their mutual needs as part of an association. We work closely with data collection participants to design surveys with clearly defined product categories that yield summary data that support valuable product market analysis. Surveys include sales and order data, geographic distribution information, and end-market analysis.

Equipped with such unique data sets, NEMA/BIS staff economists develop superior forecasting models for product shipments and industry trends, which are available exclusively to companies that



have supplied the data composing the industry totals. As a result, participants in statistical programs can know the previous demand and the expected demand for a product. While helpful during periods where economic variables are consistent with historical data, such forecasts can become less reliable when financial shocks such as housing market meltdowns and pandemic-induced restrictions cause a steep demand contraction.

Aware of the limits of business forecasts, some businesses turn to economic scenarios to develop strategic contingency plans. NEMA/BIS has added scenario planning to its portfolio of product offerings and routinely incorporates them in economic presentations. These scenarios are developed using alternate plausible assumptions and an economic model to generate a range of economic outcomes. One current scenario shows how a recession could materialize if the Federal Reserve decides to use monetary policy to prevent or contain a persistent acceleration in inflation. A balanced analysis of detailed forecasts and possible alternate scenarios is available to help Members make strategic investment decisions. 📊



ENDNOTES FROM THE **PRESIDENT**

Not surprisingly, automation of more and more functions across our economy and society is nearly 100 percent reliant on electricity. And the benefits arising from this one automation example (and its enabler the Internet of Things) continue to grow. For instance, manufacturers have access to machines that operate in areas where human hands cannot reach, and they have access to real-time data of “in-process” fabrication. So, as we wrap up this issue, we might reflect on what it really takes to provide the power we will need for an even more electrified world.

Electrification depends on the *infrastructure* or aggregation of products that generate, transmit, distribute, and convert electricity into various forms of useful work. On their surface, the many product subsectors needed to do the forgoing efficiently and safely are unassuming. Still, like the frame of a building, a subset of these products and systems, which NEMA defines as building infrastructure, enable the proliferation of electricity from the generator (or solar array) to the outlet into which your computer is plugged. And while their names – conduit, connectors, raceways and the like – bespeak their humility, they are nonetheless an essential part of the larger miracle of electricity.

As you might expect, NEMA Members are deeply committed to and involved in ensuring the proper installation of building infrastructure products, most importantly in the development and adoption of national, state, and local codes such as the *National Electrical Code*® (NEC). Up-to-date codes incorporate best practices from industry and feedback from ongoing experience of products in real-world settings. Step by step, year by year, the products of the electrical world continue to improve and meet the challenges of today and tomorrow. For example, the proliferation of rooftop solar arrays presented a new set of safety and performance challenges that building infrastructure is helping to solve.

How does this translate to everyday life? One might answer with two questions: Why during the onset of COVID were so many businesses able to continue to function with a largely remote workforce? And prospectively, how will they be able to adapt to hybrid working environment? Wires and cables of all types were (and will be) routed in cable trays, connected with cable buses, and organized using cable ties providing both the power and the connectivity to handle the exponential increase in digital traffic. And other devices such as surge protectors installed in appliances and buildings added a layer of reliability against possible damage from unwelcome fluctuations in power.

In the November/December issue of *electroindustry* Magazine, we will examine more closely these largely unsung building infrastructure products. You may not see them, but around the clock they enable our economy and the promise of modern society. No small accomplishment. 🇺🇸

Kevin J. Cosgriff
NEMA President and CEO

Coming Next

November/December

Building Infrastructure

Backbone of Our Connected Future

The NEMA Industrial Products & Services Division welcomes its newest Members:

Adventech LLC

Harbour Industries Canada

Exro Technologies Inc.

Judd Wire Inc.

Lenze Americas Corp.

STOCKART

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