

electroindustry

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A High-Quality Grid for A High-Powered Century



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electroindustry

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A woman with blonde hair, wearing a grey blazer, is looking down at a tablet computer she is holding. She is standing in a large industrial facility, likely a factory or warehouse, with various equipment and shelving visible in the background. The image is framed by a diagonal split, with the top-left portion being a solid dark grey and the bottom-right portion being a solid teal color.

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FROM THE **PRESIDENT**

The U.S. electrical grid may be the largest interconnected machine on Earth, but is it high quality enough for our high-powered century? The short answer is: probably not.

Achieving this objective means we understand what we need to do and how to measure it. Frequently, one hears calculations regarding the grid's individual parts, often in monetary terms. According to Joshua D. Rhodes at the University of Texas at Austin, the depreciated value of the grid—including power plants, wires, transformers, and poles—is between \$1.5 trillion and \$2 trillion.¹ Upgrading those individual parts while simultaneously keeping the grid running would cost even more.

The grid's value may be less about past expenditures and more about the attributes of reliability, resiliency, and efficiency. A reliable grid provides power to users as needed. A resilient one recovers quickly after adversity. Efficiency means responsible stewardship and not passing wasteful costs on to consumers. To understand reliability and resiliency, we need only look at recent disasters like Hurricanes Florence and Michael. In the aftermath of any disaster, re-establishing power is a top priority.

Last month, President Trump signed into law The Disaster Recovery Reform Act of 2018, a series of reforms to federal programs to help communities better prepare for and recover from disasters of all types. This applies to all disasters occurring after August 1, 2017, meaning it covers the storms that ravaged Florida, Texas, and Puerto Rico last year and of course, those of this year too. More information on these programs can be found on page 17.

In recent years, some have suggested sustainability should be included in the value equation. One definition of sustainable energy is an energy system that serves the needs of the present without compromising the ability of future generations to meet their energy needs. In popular discourse this usually gets shortened to depending less on fossil fuels and more on renewable sources to generate energy. Efforts in this direction are underway but come with their own set of challenges. For instance, in the case of periodic sources of generation like solar and wind, systems will be needed that can store power at scale for on-call dispatch to the grid. The NEMA Energy Storage Systems Section is actively engaged in this work. Sustainability is important, but at the end of the day reliability and resiliency are what people expect the most from their grid.

NEMA Member companies manufacture and help to integrate the technology that has improved the reliability, resiliency, and efficiency of America's power grid. But achieving a truly 21st century-capable grid is bigger than industry alone. Much bigger. Consequently, government at multiple levels will have a role. Encouragingly, the Administration and Congress have promised to invest in infrastructure. NEMA will be making the point—in a nonpartisan way—that upgrading the grid is the essential step to virtually all other infrastructure improvements. Electricity was, is, and will be how America runs. ☺

Kevin J. Cosgriff
President & CEO

¹ <https://oilprice.com/Energy/Energy-General/US-Electric-Grid-Could-Cost-5-Trillion-To-Replace.html>

Coming next month

U.S. electrical manufacturers are deeply involved in the electrification and digitization of America's transportation infrastructure. Find out what NEMA Members are doing in the vehicle-to-infrastructure (V2I) framework as connected, electrified, and (ultimately) autonomous vehicles of all types hit the road. ☺

Product Security in Electrical Infrastructure— Never More Important



Driven by rapid growth in connected, intelligent devices and decreasing costs of computing and connectivity, digital technologies are changing our world and our electrical grid. What electrical manufacturers are able to achieve today far surpasses what we've done and represents just a fraction of what we'll be able to accomplish tomorrow.

At the heart of this innovation are all the “things” that generate, collect, and process data. Forecasts call for 31 billion connected devices by 2020.

In this world of amped-up connectivity comes an increased risk of cyber attacks on critical infrastructure. It only takes a single security breach to impact safety, lifecycle costs, and reputations.

Cybersecurity threats must be met proactively with a systemwide defensive approach specific to organizational needs. When selecting suppliers, it's critical to ensure they have a robust process for designing secure products.

Manufacturers need to address device security. The idea is to make sure all of the components within the power system meet the same high standards. Electrical infrastructure is often composed of equipment from various manufacturers. If each manufacturer has a different view of what makes a device cyber secure, customers may be concerned about the safety of their installations.

In power distribution and control systems, suppliers who are truly dedicated to their customers' success need to provide evidence that the products sold comply with industry cybersecurity Standards. This process builds trust and ensures the highest level of defense against emerging cybersecurity threats.

Eaton, for example, has maintained strict procedures at every stage of the product development process for years. This discipline has paved the way for collaboration with UL. We now have the capability to test Eaton products with intelligence or embedded logic to key aspects

of the newly developed UL 2900-1 and 2900-2-2 Standards that apply to network-connected power management products.

Our customers across industries don't want to take chances with their systems. Providing independent, third-party authentication offers peace of mind. With products tested in specialized labs, customers can rest easier knowing that devices are compliant with industry cybersecurity requirements before they're installed in critical systems.

We recognize that no protection method is completely secure. A “defense in depth” mechanism that is effective today may not be effective tomorrow because the ways and means of cyber attacks constantly change. This is why manufacturers also need to be ever alert to changes in cybersecurity and work to prevent any potential vulnerability.

In many companies, security is an afterthought, made evident by the number of updates deployed for process miscues. Cybersecurity should be an integral consideration, with strict protocols placed on the people, processes, and technologies at every phase of product creation.

From inception through deployment and maintenance, the modern manufacturer needs to instill cybersecurity best practices via training, threat modeling, requirements analysis, implementation, verification, and ongoing support. Likewise, customers need to make periodic vulnerability and security assessments of deployed solutions on their sites.


The nature of cybersecurity is a continuous journey with constantly evolving complexities, threat scenarios, and technologies. For the sake of our customers and their critical systems, it's important that we continue to embark on that journey together. ☯



BOOK-A-SPEAKER



Sue Bunning, industry director, positron Emission tomography, Medical Imaging & Technology Alliance (MITA), will address the Leaders Engaged on Alzheimer's Disease (LEAD) on November 14. LEAD is an independent national coalition committed to improving quality of life among people facing dementia and advancing science to prevent, slow, and eventually cure it.


Do you need an electroindustry subject matter expert to speak at your next event? Contact book-a-speaker@nema.org or visit www.nema.org/book-a-speaker. 

NIST Workshops to Focus on Grid Operations and Economics

With the assistance of NEMA and other industry leaders, the National Institute of Standards and Technology (NIST) is updating its Smart Grid Interoperability Framework to advance grid modernization. The Interoperability Framework, developed and periodically revised in strong collaboration with the broad smart grid stakeholder community, has played a key role in grid transformation by guiding discussion, planning, and deployment of emerging smart grid technologies.

Through November 2018, NIST will convene four regional workshops to explore the most important ideas in the latest version of the Interoperability Framework. These workshops have been organized for the Northeast, Midwest, West Coast, and Southwest. These workshops will focus on grid operations and economics. Individual meetings will examine a conceptual model relevant to each region, followed by a panel of local stakeholders, and a discussion with all attendees regarding interoperability and the most important interfaces to grid modernization.

NEMA Members can use these sessions to understand the role interoperability will have in shaping today's complex electricity ecosystem.

For more information on the workshops, visit the NIST website (<https://www.nist.gov/engineering-laboratory/smart-grid/smart-grid-interoperability-framework-workshops>). 

Brian Marchionini, PMP, Senior Program Manager, NEMA


Data Workshop Explores Legal Barriers of Collection and Use



Michael Morgan shared findings of a NEMA study related to the collection and use of data generated by electronic products and systems. Photo by Ann Brandstadter

On October 17, NEMA held a workshop for its 2018 Strategic Initiative on Data Privacy and Ownership. "Legal Barriers to Using Device-Generated or Device-Collected Data" was prepared for NEMA and its Members by McDermott, Will & Emery LLP. Michael Morgan, partner and co-head, global privacy and cybersecurity, presented the findings on issues relating to the collection and use of data generated by electronic products and systems.

Attendees learned about practical solutions for addressing legal barriers facing electrical equipment manufacturers and how to develop legally compliant strategies for data collection, use, and monetization. They also participated in an idea exchange where they shared concerns and legal issues facing their companies to help identify cooperative industry solutions.

A comprehensive report detailing legal barriers and negative consequences of mishandling data is available to NEMA Members by logging into the Members-only area of the website or clicking [here](#). 

Ann Brandstadter, Manager, Standards Publications and Marketing, NEMA

Legrand Wins Prestigious Energy Efficiency Awards



John Sellendorff, CEO, Legrand, North and Central America, accepted the 2018 Industry and Manufacturing Star of Energy Efficiency Award presented by the Alliance to Save Energy. The award recognizes Legrand for demonstrated leadership in energy efficiency. Photo by Patrick Hughes

Legrand North and Central America, a leading provider of lighting controls, electrical components, and data center solutions, was named a 2018 Star of Energy Efficiency Award winner by the Alliance to Save Energy. The award recognizes Legrand for demonstrated leadership in energy efficiency.

Legrand was honored with the Industry and Manufacturing Star of Energy Efficiency Award for its commitment to driving efficiency and sustainability throughout the company's operations. The accomplishments cited by the Alliance to Save Energy include successfully meeting its second Better Plants goal of a 20.3 percent energy reduction five years ahead of the initial 2022 target year. This follows already having achieved a 28.2 percent energy improvement in energy intensity between 2009 and 2012. Legrand has also pledged to reduce its energy intensity by an additional 13 percent by 2021.

The recognition is the second such acknowledgment for Legrand's achievements in the past few months. In August, Legrand was honored with an award from the U.S. Department of Energy's Better Buildings Better Plants program, and earlier this year Legrand achieved LEED certification at the company's North and Central America corporate headquarters in West Hartford, Connecticut, where some of its buildings are nearly 100 years old. The West Hartford facility also generates approximately 80 percent of its electricity needs after installing a fuel cell on the property in 2016. ☼

NEMA

5G Communications: Better, Stronger, Faster

Nov. 19, 2018
1:00 - 2:00 pm EDT

IoTNOW webinars

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IoTNOW Explores 5G

5G—the fifth generation of wireless technology—is coming. With many wireless network carriers launching as soon as 2019, the electroindustry needs to keep pace with this technology.

5G technology will have an immense impact in the industry—improving system performance, automation, and efficiencies within manufacturing plants. The Internet of Things and 5G together are at the forefront of industrial digitalization.

To learn more about this technology, join us November 19 for an IoTNOW webinar hosted by Daniel Quant of MultiTech Systems.

Save your seat! Registration is free for NEMA Members and \$49 for nonmembers. ☼

Sustainability through Renewable Grid Integration

It's no secret that renewables are becoming a larger share of the overall generation portfolio. Wind and solar, for instance, are responsible for the majority of capacity increases. In 2017, combined wind and solar made up at least 20 percent of electric generation in 10 states.¹ In that same year, renewables accounted for 55 percent of the 21 gigawatts (GW) of capacity additions in the United States. This was the fourth consecutive year in which renewables made up more than half.²

According to the U.S. Department of Energy's Energy Information Administration (EIA), about eight percent (81 GW) of generating capacity in the United States in 2016 came from wind turbines, most of which were onshore.³

We need equipment that is capable of measuring and providing more information to other equipment that can process and apply it in the blink of an eye.

Meanwhile, the Solar Energy Industries Association (SEIA) reports that solar's increasing competitiveness allowed it to increase its share of total U.S. electrical generation from just 0.1 percent in 2010 to more than 2 percent today.⁴ The SEIA further estimates that 58 GW of solar generation currently installed across the U.S., reflects an annual growth rate of 59 percent over the last 10 years.⁵ By 2021, that figure could grow to 100 GW.

Fueling the Evolution

What's driving this growth? One factor is state policies, known as renewable portfolio standards (RPS), which call for mandatory goals of renewable generation by a given date. According to the National Conference of State

Legislatures, there are 29 states, Washington, D.C., and three territories that have RPSs in place. California, for example, set 50 percent renewables by 2026, 60 percent renewables by 2030, and 100 percent carbon-free energy by 2045. Hawaii set 30 percent by 2020, 40 percent by 2030, 70 percent by 2040, and 100 percent by 2045.⁶

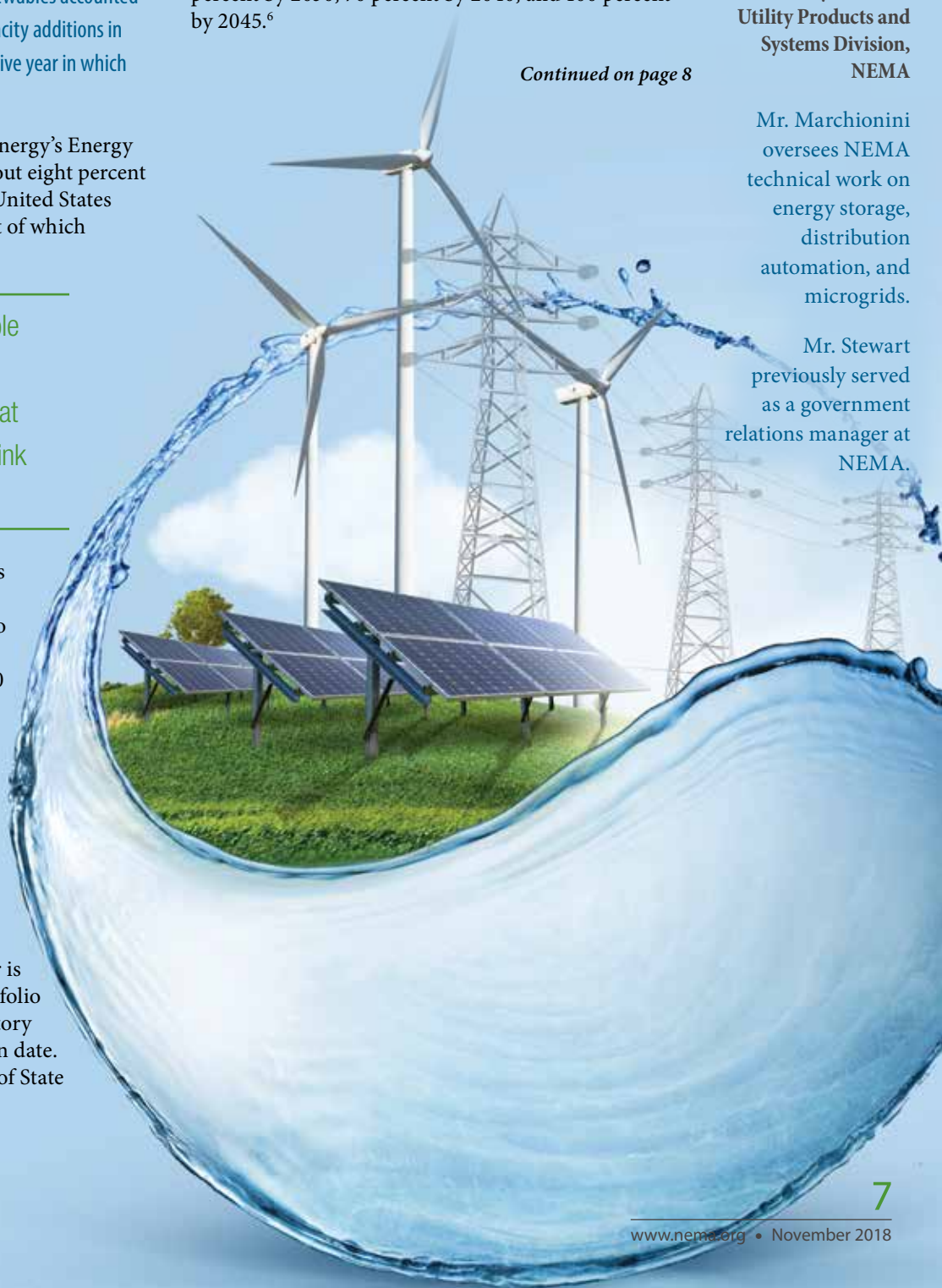
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Brian Marchionini,
PMP, Senior Program
Manager, NEMA

Jonathan Stewart,
Industry Director,
Utility Products and
Systems Division,
NEMA

Mr. Marchionini oversees NEMA technical work on energy storage, distribution automation, and microgrids.

Mr. Stewart previously served as a government relations manager at NEMA.



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Corporations are getting in on the action as well. RE100 is a growing group of more than 150 companies with public voluntary commitments to meet all of their energy needs through renewables. Brands such as Adobe, Apple, Facebook, GM, Google, IKEA, and Kellogg's speckle the star-studded roster. Aside from being recognizable brands, these companies all operate in large energy-consuming industries such as data centers, manufacturing, and food processing.

Other catalysts such as tax credits and falling prices also make renewable technologies more affordable and practical every year.

NEMA Takes Action

NEMA Members build the equipment that distributes the electricity from renewable and fossil-fueled resources to a vast network of end users. In order for our grid to work properly, electricity must be essentially generated and consumed at the exact same time. Over time, grid operators have become very good at estimating how much electricity the population will consume over a given time period, even though this amount varies from month to month, day to day, and even hour to hour.

NEMA Members have the products and systems to incorporate clean, renewable technologies into a safe, reliable, and efficient electrical grid.

A major challenge posed by renewable generation is its variability. Fifteen years ago, all of the electrons your devices consumed probably came from a few centralized, fossil-based sources. Fifteen years from now, the electrons your devices consume might come from many distributed sources that cycle online and offline over the course of a week, a day, or even minute to minute. Not only does this complicate current grid operations, it also foreshadows more difficulties if forecasts for renewable generation market growth hold true.

NEMA Strategic Initiative Analyzes Grid Modernization


Innovative technologies have the potential to improve electric power system resilience and flexibility, but only if they are adopted by utilities.

NEMA is undertaking a Strategic Initiative to quantify the costs and benefits of grid modernization projects. Ten rate cases for recent grid modernization projects across the United States are being studied to better understand cost recovery mechanisms.

The results may help stakeholders to justify grid upgrades by understanding best practices and lessons learned as utilities plan and execute grid modernization projects. [ei](#)

We need equipment that is capable of measuring and providing more information to other equipment that can process and apply it in the blink of an eye. This ensures that the amount of electricity being generated—and dispatched from storage—is equal to the amount being consumed and stored. Equipment developed by NEMA Member companies with those capabilities, like smart meters, smart transformers, and smart inverters, as well as the operating systems to run them, has not been needed on a large scale until now. Although the technology does exist to accomplish all of this, it takes time to build into the system.

Finally, there's the financial aspect. Installation of one large energy storage system could cost millions of dollars. Utilities, which are largely responsible for modernizing their portions of the grid, either have to assume the substantial cost or raise electricity rates to pay for the upgrades, which they can't do without permission from regulatory agencies.

Demand for sustainable, renewable generation is beyond question at this point. People want it and the suppliers can build it. NEMA Members have the products and systems to incorporate clean, renewable technologies into a safe, reliable, and efficient electrical grid. 

1 <https://www.eia.gov/todayinenergy/detail.php?id=37233>

2 <https://www.eia.gov/todayinenergy/detail.php?id=36092>

3 <https://www.eia.gov/todayinenergy/detail.php?id=31032>

4 <https://www.seia.org/solar-industry-research-data>

5 <https://www.seia.org/solar-industry-research-data>

6 <http://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx>

Fastest Growing Occupations

According to the Bureau of Labor Statistics, photovoltaic (PV) installers and wind turbine service technicians are the fastest growing occupations in the United States.

From 2016 to 2026, employment of PV installers is projected to grow 105 percent. Employment of wind turbine service technicians is projected to grow 96 percent.


Coachella Valley Stays Hot



Photo by Jonathan Stewart

Southern California's Coachella Valley and its San Geronio Pass is one of the windiest places in the United States, making it a hotbed for renewable generation since the 1970s. It promises to remain so for many years to come. Although Danish manufacturer Vestas has the largest footprint in this desert valley, its wind farms also employ products from NEMA Members GE Power, Mitsubishi, and Siemens.

The smallest turbines, some of which were installed in the 1980s, are rated to only 500 kW of electricity while newer and larger models rate up to 3 MW. Project developers such as AVANGRID, AES, and NextEra operate many of the newer units.

While there is room for growth, development has slowed because of wind patterns in the valley, the fact that the best spots are already taken, and hefty spacing requirements for optimal performance. New technologies that allow propellers to "follow" the wind will allow for some further development, but photovoltaic panels, which do not face the same challenges, may present the best option. 

Jonathan Stewart, Industry Director, Utility Products and Systems Division, NEMA

Accelerating Energy Storage for More Dependable Power

John Vernacchia,
Segment Manager
for Renewable
Energy, Eaton

As the mix of distributed energy resources on the grid increases and central coal-fired plants are retired, new strategies are needed to support grid stability. Energy storage systems provide a powerful platform to keep the power on and operate critical assets.

These systems were developed, manufactured, installed, and commissioned in less than six months from the date the project was awarded—an industry first for energy storage assets of this size on a distribution system. Typically, projects have involved procurements that take a year or more and are then deployed and installed over the course of two to three years. Four of the six projects used Eaton grid connection switchgear and medium-voltage transformers.

What does it take to slash project timelines? Based on lessons in California and energy storage deployments around the world, it involves:

- **Local manufacturing and expertise:** Knowledge of local codes and regional requirements is critical to project success. Local manufacturing and engineering support centers can also help expedite equipment and simplify commissioning and startup.
- **Intelligent control:** System requirements are unique, yet the hardware and software do not need to be custom engineered. Time-tested substation control technology can provide off-the-shelf capabilities that are customizable to specific projects.
- **Engineered solutions:** Electrical systems can be a critical path in energy storage deployments: pre-configuring electrical system connections reduces engineering, manufacturing, and installation time.
- **The virtual advantage:** System modeling enables the project team to see how the system functions in a simulated environment before ground is broken on the project.

Whether balancing renewables or acting like an on-demand power plant, energy storage systems are supporting more dependable power for homes and businesses. ☞



The Eaton Experience Center, a demonstration and testing facility in Pittsburgh, helps customers understand power system alternatives. Energy storage, solar, natural gas generator, and utility power support the facility's power requirements, even during a grid outage. Photos courtesy of Eaton

By 2030, Bloomberg New Energy Finance anticipates the energy storage market will double six times, and one-fourth of those deployments will be in the U.S. Recent projects are revealing ways to shorten project timelines, reduce costs, and more effectively deploy these systems.

In Southern California, for example, six energy storage projects from five different developers totaling about 84.5 MW were built in late 2016 to provide critical grid support and capacity.

The systems were built in response to the California Public Utilities Commission's order for emergency energy storage procurement.

The projects in Southern California were fast-tracked following a massive methane leak at a natural gas storage facility outside Los Angeles that supplies fuel to electric utility peaker plants. Energy storage was used to balance renewable generation to avoid electricity service interruptions.

Increasing On-Shore, On-Hand Supply of Transmission Equipment

The Importance of Building a U.S. Strategic Transformer Reserve

Ensuring that the electrical grid is secure is nothing new, but with increased threats and risks like physical assaults, natural disasters, and cyber attacks, the question is not if, but when, a prolonged power outage will disrupt our quality of life, economic well-being, and overall safety.

With these increased threats come more questions. How prepared are we to respond to and recover from a high-impact, low-frequency (HILF) event that causes a large-scale, multi-site impact? How well defined are our plans and how well have we assessed recovery time if affected assets are transformers that require a long lead time and are difficult to transport? And how certain are we that suitable spare assets will be available immediately to aid in the restoration? What happens to our customers if we are not adequately prepared?

Industry-Based Solution

As an industry, we continue to look at ways to improve resilience and recovery, and rightly so. The industry needs to take the lead in developing comprehensive and cost-effective solutions for grid resilience. If resilience concerns remain unsatisfied by industry action, regulators and government officials may choose to develop their own solutions, resulting in new legislation, Standards, regulations, and other mandates.

While it is not practical to protect or harden the grid across the hundreds of thousands of miles of transmission lines and tens of thousands of substations, one option that has been considered as a way to improve grid resilience is to increase the nation's supply of large power transformers (LPTs).

Jeff Fleeman, Chief Operating Officer, Grid Assurance

Jeff Fleeman, Grid Assurance COO, is responsible for the development of the company's inventory, warehousing, and logistics. He is also with American Electric Power, one of the founding members of Grid Assurance.

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Utilities maintain some operational spares to replace large power equipment that fail due to normal wear and tear, but it is economically prohibitive for every utility to stockpile enough of these expensive pieces of equipment to prepare for their own worst-case scenario. Unless each utility is storing their backups in secure and off-site locations, it is likely that their backup transformers will be damaged by the same HILF event that damaged their in-use equipment.

In 2006, the power sector took a critical first step to address replacement of transformers damaged by terrorist acts. The Edison Electric Institute and several utilities formed the Spare Transformer Equipment Program (STEP). STEP provides participating utilities the right to buy large transformers from other participating utilities, but only after a presidentially declared terrorist emergency.

This was a good first effort, but this option has some shortfalls. Mutual aid provides no increased capacity of critical equipment for the industry. When a catastrophic event occurs:

- the equipment available is on an “if available, as is, and where is” basis;
- utilities may not know the exact specifications of the equipment they may receive and therefore may not know in advance if, or how well, it will interact with their system needs; and
- it is not likely that a transportation strategy to ensure timely delivery of the equipment will be developed.

Some utilities continue to place additional reliance on mutual aid. In today’s world, relying on mutual aid alone is not enough. Mutual aid-based solutions are vulnerable to competing needs and could break down if those who could help either have been hit by a similar event or fear that they will be hit.

The U.S. Department of Energy (DOE) noted in its 2015 Quadrennial Energy Review that STEP alone is not sufficient to address large-scale grid vulnerabilities. The STEP inventory is not big enough to respond to a large, coordinated attack.

There are many factors needed to develop a successful strategic transformer reserve. Each utility has a unique mix of equipment that reliably delivers energy every

day. Procuring LPTs requires an extended lead time. The time between order and delivery can take up to two years.

So, how do you develop a transformer reserve program that works for every utility, make sure it is cost-effective, ensure that equipment is quickly and efficiently delivered when needed, and find the funding to make it happen?

Upfront Planning

In 2017 the DOE released its *Strategic Transformer Reserve* report,¹ which supports an industry-based approach.

According to Michael Deggendorf, CEO of Grid Assurance, one industry-driven option that provides a solution to many of these questions is Grid Assurance.

“Increasing the security and resilience of the U.S. bulk power grid is a must for our country. Having an adequate supply of on-hand, on-shore access to long-lead-time equipment is the biggest challenge to utilities when recovering from catastrophic events,” Mr. Deggendorf said. “As a 30-plus-year veteran of the electric industry, I felt compelled to advance a solution that provides greater certainty, greater transparency on price, and greater ability to plan to restore service sooner to customers after a catastrophic event.”

Several major utilities agreed and were the initial subscribers to Grid Assurance. American Electric Power, Berkshire Hathaway Energy’s MidAmerican Energy Company, NV Energy, Eversource, FirstEnergy, Kansas City Power & Light, and National Grid signed on as subscribers of Grid Assurance in May of this year. These companies have 31 participating transmission affiliates with facilities in 26 of the 48 lower continental United States.

Grid Assurance works with each utility to identify relevant transmission equipment they will need to confidently and completely recover after a catastrophic event. They then order, store, and maintain that equipment in secure, strategically located warehouses, ensuring the equipment will be ready and in good condition when needed.

¹ <https://www.energy.gov/sites/prod/files/2017/04/f34/Strategic%20Transformer%20Reserve%20Report%20-%20FINAL.pdf>

Cost is another challenge when one looks at creating a transformer reserve. As the industry continues to enhance grid resilience, electric utility commissioners and customers expect the most cost-effective answers.

The Grid Assurance solution divides the cost among many utilities. This shared inventory approach provides savings in purchasing, warehousing, protecting, and maintaining replacement equipment, making it more affordable for each subscriber to have immediate access to on-hand, on-shore large-scale equipment.

When a catastrophic event happens, a transmission owner is focused on returning operations to normal as quickly as possible. Grid Assurance works with each subscriber on logistics plans for equipment delivery before an event occurs. This upfront planning ensures the equipment will be delivered in the timeliest manner following an event. Knowing when critical replacement equipment will arrive provides an added layer of confidence for a utility that they will quickly return power to their customers.

Restoring Quality of Life

Another challenge is regulatory approval. It's well recognized that utility companies are hesitant to make major investments without some level of regulatory assurance that their "prudently incurred" costs will be recouped in rates.

Grid Assurance has been proactive and received two positive orders from the Federal Energy Regulatory Commission (FERC) that provide regulatory clarity on issues related to prudence, compliance, ratemaking, and affiliate pricing for transmission-owning entities participating in Grid Assurance.

While not FERC regulated, Grid Assurance charges cost-based subscription fees, like FERC-regulated transmission formula rates. These cost-based subscription fees along with the FERC orders will facilitate members' ability to recover their Grid Assurance subscription expenses.

Grid Assurance was formed to answer a need in the electrical industry: to restore the electrical grid more quickly following HILF events by increasing the on-shore, on-hand inventory of critical transmission

equipment. The company helps utilities quickly restore power delivery, helping to protect consumers and communities from the devastating impacts that delays in restoring electricity have on quality of life and the nation's economy.

Customers expect the lights to turn on when they flip the switch even during a catastrophic event. Transmission owners must ask themselves how many days they can afford to be without power.

Each transmission-owning utility needs to act now to prepare for HILF events. This additional layer of available assets increases the on-shore, on-hand supply of large-scale transmission equipment while providing much-needed support of a utility's resilience plans. It deserves careful consideration by transmission owners and regulators, given the growing risks to the grid. ☞



One option to improve grid resilience is to increase the nation's supply of large power transformers that can respond to grid attacks. Photo courtesy of Grid Assurance

Improving Reliability and Speed of Distribution Automation Networks



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Suraj Chanda,
Application
Engineer, Siemens
Industry, Inc.

Alexandr Stinskiy,
PhD, Application
Engineer, Siemens
Industry, Inc.

Farel Becker, Product
Manager, Siemens
Industry, Inc.

A distribution feeder automation automatic transfer system was deployed in a remote area in North Carolina to improve system reliability. Photo courtesy of Siemens

Many utilities are looking for better and improved ways to optimize distribution feeder automation by exploring cellular communication services.

Distribution feeder automation systems provide many different types of solutions. The primary reliability improvement functions provided by these systems include fault locate, isolate and service restoration, and automatic transfer functionality. These functions greatly improve the reliability indicators of distribution feeders and can be centralized, decentralized, or a combination of both.

New Possibilities for Reliability

Centralized systems have traditionally been the solution of choice to automate distribution feeder networks. However, these systems react slowly, as they have to wait for the protection systems to disconnect faults in the network before they can take action to locate the faulted feeder segment, reconfigure the feeder, and supply alternate power to unaffected areas.

Decentralized systems, by contrast, provide the capability to synchronize protection and automation functionality in field devices to provide faster fault isolation and system configuration actions.

The combination of decentralized distribution automation (DA) systems and cellular communications provides new possibilities for greater reliability of the distribution network.

Traditionally, low-powered unlicensed radio devices, and more recently, direct fiber-optic cable connections, have been common methods of data communications in DA applications. For electrical utilities, using cellular communication is not new; in fact, it is usually an IT service used to communicate field device information data back to the utility for use in various systems, such as advanced metering infrastructure (AMI).

The use of cellular communication to transmit data in time-critical applications such as Direct Transfer Trip (DTT), Fault Location Isolation and Service Restoration (FLISR), and Automatic Transfer System (ATS) is now possible by securing a reliable communication link between the field device controllers.

To accomplish this, an operational technology (OT) type of service to support these unique requirements is needed. OT systems are deterministic in nature and able to produce actions based on information received. The system requires security, dependable latency, and reliability in accordance with previously established substation protection Standards.

To further explore this, let's take a look at the use of a private network and how a DA solution provider, such as Siemens, establishes a private network within the cellular provider's network for DA applications.

Simply Self-Healing

Unlike a public plan, the basic premise of a private network is that there is no connection to the internet. On public networks, unsolicited internet traffic is data sent to a wireless device that was not solicited by the wireless device owner. This data could be a result of random queries from unknown third parties or could be malicious attempts to cause a service disruption.

On a private network, no unauthorized traffic can travel over the network, eliminating the risk of unsolicited traffic from external sources. All data is sent to and from devices configured for a specific private network and is segregated from all other traffic. In a private network, customers can acquire a pool of allocated machine-to-machine (M2M) data plans that is required for the DA application.

To support these applications, cellular modems and routers are preconfigured by the solution supplier and are used with IPsec tunnels, firewalls, and special filtering to securely transmit data between field devices. M2M data plans for DA solutions are well defined and tested to support the applications.

For example, a manufacturer's systems may use small Ethernet IEC 61850 Generic Object Oriented Substation Event (GOOSE) messages to communicate information peer to peer between pole-mounted field controller devices/servers on cost-effective M2M data plans that are designed to support applications such as DTT, FLISR, and ATS within the private cellular network.

These DA systems rely on communications availability to perform as designed. As a failsafe, if the system detects that a modem was abnormally disconnected from the cellular network, the system will automatically notify the operator that a link is down. This notification service ensures that our customers can better maintain their communications systems that support important OT applications.

For the progressive electrical utility, the combination of cellular communications and the new approaches to distribution feeder protection and automation is yielding improved system reliability. In contrast, the traditional approach consists of two distinctly different functions: protection first and then automation.

The new protection system disconnects the fault from the network through coordinated overcurrent tripping and auto-reclosing actions. The automation system then locates the faulted segment of the feeder, isolates this faulted segment, and executes automatic closing of the field switch to provide alternate power from a different power source to unaffected feeder segments. This is often referred to as self-healing.

The new approach eliminates the complexity of adapting the coordinated overcurrent settings on devices when topology changes are executed by the automation system. In order to accomplish this, the protection and automation systems must be closely coordinated in actions for both protection and automation functions to operate effectively and the protection and automation actions must be executed synchronously.

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Automating Protection

Today, most digital protection devices have powerful logic programming capability; therefore, it is possible to move the automation functions to the protection devices. This logic is used to isolate the exact section of the distribution network where a fault has occurred. A jump differential (jDiff) is detected in the feeder current on both sides of the faulted line segment. It was developed to gain the benefits of a selective differential protection function on distribution feeders using various forms of wireless communications systems.

[T]he combination of cellular communications and the new approaches to distribution feeder protection and automation is yielding improved system reliability.

The jDiff method makes it possible for each device in the field to communicate in multiple upstream and downstream devices across the communications network. The jDiff algorithm converts magnitude changes in the phase currents to logical signals called “Positive Jump” and “Negative Jump.” These signals are transmitted through the communications network as binary signals to the upstream and downstream devices. The cellular network provides communications infrastructure that makes it possible to both enable and simplify this new approach. The jDiff locates the fault location and can block and unblock a simplified coordinated overcurrent protection system.

GOOSEing Communication

Another advantage that can be gained by this type of decentralized system operated in combination with a cellular network is the speed of operation of the automation system. If one considers adapting protection systems to incorporate all feeder automation actions, it is possible to greatly improve the combined system performance while maximizing the reliability by exposing less of the system to protection and automation operational interruptions.

To get this approach to work, it is essential that the field and substation devices communicate and share information in real time. GOOSE messages are likely the best possible platform to communicate this information between protection devices.

What makes GOOSE ideal for this application?

- It is a small data packet, ideal for wireless systems.
- Analog and binary information can be shared for processing by the protection and automation controllers.
- Data traffic can be managed using set time intervals of the GOOSE packets.
- The GOOSE packets contain quality information. Therefore, devices can filter and discard GOOSE packets with incorrect quality information.
- An additional layer of security is added to normal IT cybersecurity requirements.

The implementation of cellular networks for peer-to-peer communications of the pole-mounted DA controllers has the potential to increase the reliability and speed of DA networks.

jDiff is a proven method to locate a faulted line segment by comparing positive and negative phase current measured on both sides of the fault. When a fault is located, the logic within the DA controllers executes a series of commands to automatically isolate the fault and restore power to the unaffected line segments.

Although several types of communications methods may be used, an M2M data transfer across a private cellular network provides a secure, cost-effective, and easy to deploy solution. 📶

Coming in January

*e/*looks at new utility models that encompass substation network architecture, capacitors that protect against geomagnetic disturbances, and the impact of high-voltage direct current.

Rebuilding Strong— Federal Disaster Program Includes NEMA Priorities

On October 5, 2018, President Trump signed into law a series of reforms to federal disaster programs to help communities better prepare for and recover from such events. The Disaster Recovery Reform Act of 2018 contains a number of provisions supported by NEMA.

- **National Public Infrastructure Pre-Disaster Mitigation Assistance:** Allows the Administration to establish a new program using six percent of disaster relief funds to provide technical and project support for states to improve infrastructure to reduce future costs caused by disasters.
- **Upgrading Facilities for Future Resilience:** Allows disaster relief funds to be used “to conduct activities to help reduce the risk of future damage” rather than simply replacing the equipment with the same types that were in use before the disaster. Importantly, this applies to *all disasters occurring after August 1, 2017*.
- **Building Code Enforcement:** Allows state, local, and tribal governments to use federal funding to hire personnel to improve implementation and enforcement of building codes.
- **Electric Vehicle Charging Along Evacuation Routes:** Directs the Federal Emergency Management Agency (FEMA) and the Federal Highway Administration (FHWA) to collaborate on evacuation route guidance.

NEMA will urge FEMA and FHWA to include electric vehicle charging infrastructure along evacuation routes to provide access to this type of “fuel” to facilitate the ability of electric vehicle owners to evacuate.

FAVORABLE FAA PROVISIONS

The new law also reauthorizes the Federal Aviation Administration (FAA) for an additional five years and includes a number of other favorable provisions.

- **The Airport Improvement Program:** Funds construction of critical infrastructure at airports of all sizes, including equipment and system upgrades that make airports more energy efficient and resilient. The program is designed to address the long-term sustainability of airports across the country and the entire National Airspace System.
- **Airport Electrification:** Adds airport ground support vehicle electrification as an eligible use of passenger facility charge revenues. It also highlights the importance of building microgrids to support airport resilience.
- **Air Transportation of Lithium Cells and Batteries:** Extends the requirement that U.S. regulations on air transportation of lithium cells and batteries be no more stringent than international model regulations. It ensures industry participation in the relevant international organizations to provide technical information and expertise. It also creates a private sector advisory group to ensure transparency of U.S. positions at related international meetings.

Finally, the law affirms the transportation secretary’s authority to permit emergency medical battery shipments, from which noncritical shipments are currently prohibited. 🇺🇸



Philip Squair, Vice President of Government Relations, NEMA

I Am NEMA

I am very happy to have the opportunity to work alongside NEMA Members to achieve their advocacy and public policy objectives.

I cut my teeth as a legislative staffer in the House of Representatives, back when President Reagan was in office, and ever since I have worked on energy, environmental, and safety issues for several different segments of the business community.

I left Capitol Hill to join the association of HVAC manufacturers, who were on the verge of significant regulation of refrigerants and mandatory federal efficiency Standards. After that I went to work for the propane

gas industry, whose mostly small member companies aggressively fought for regulatory relief at all levels of government.

Along the way I have met many knowledgeable and interesting people, all of whom contributed to my understanding of how to make progress on issues. In fact, a number of these people work for NEMA Member companies.

The U.S. faces many challenges in meeting its energy and environmental goals, but I strongly believe that NEMA Members will continue to thrive through unified and audacious advocacy. ☺

Front-Row View of Medical Imaging Advocacy

Aidan Murray

MITA Intern

As a recent graduate of George Washington University in biomedical engineering, I thought that I understood the medical device landscape with respect to regulatory challenges that companies face when bringing new products to the market. I could not have been more wrong. My experience at the Medical Imaging & Technology Alliance (MITA), a division of NEMA, opened my eyes to the complexities that medical device and technology manufacturers face in the regulatory world.

My internship exposed me to dedicated and committed individuals and the projects they handle through MITA Committees and Technical Sections. Highlights include high-level meetings with FDA officials on topics such as artificial intelligence and the harmonization of international Standards, drafting documents for the Centers for Medicare & Medicaid Services (CMS), and attending the MITA Board of Directors meeting.

Each meeting allowed me to observe firsthand discussions between MITA staff and Member companies; these provided me with a wealth of information and insights into the complexities surrounding medical devices. One of my most striking realizations was the depth and breadth in which MITA operates.

Not only did I familiarize myself with the regulatory side of medical imaging, but I also learned about several innovative technologies that may provide unique solutions to problems facing physicians. One such technology is theranostic drug agents. These drugs combine the ability to treat a condition with an image-guided tool for diagnosing and imaging that condition. This allows researchers and physicians to identify and treat conditions in real time and to recognize almost immediately if a treatment is working. This technique is safer, results in fewer side effects, and has better patient outcomes.

I witnessed many successes, including House passage of the Protect Medical Innovation Act, which freezes the tax on the sale of medical devices for two years and thus helps to reduce the costs of healthcare equipment and lower healthcare costs. It will also allow medical imaging manufacturers to invest more in R&D and create new jobs.

I also participated in researching the 2019 CMS Physician Fee Schedule and Outpatient Prospective Payment System rules that will affect how physicians, hospitals, and outpatient clinics charge patients for the services they provide.

My short time with MITA was eye-opening and extremely fulfilling. I hope for the ongoing success of the MITA staff in their advocacy for the medical imaging industry. ☺

Connector Systems Standard Includes Spreadsheets

ANSI C119.6-2018 *American National Standard for Electric Connectors—Non-Sealed, Multipoint Connector Systems Rated 600 V or Less for Aluminum and Copper Conductors* applies to aluminum-to-aluminum, aluminum-to-copper, and copper-to-copper conductors for above-grade electric utility applications. This revision includes spreadsheet files, which can be used to collect current cycle test data, calculate connector stability, generate graphs of the data, and print the data to provide test results as part of the test report. It is available for \$88 in hard copy and as an electronic download.



NEMA SB 11-2017 *Guide for Proper Use of System Smoke Detectors* provides information about applications of smoke detectors used in conjunction with fire alarm systems. It is available for \$32 in hard copy or as an electronic download at no cost. ☎

Don Iverson

Midwest Field Representative,
NEMA

Proposed Code Revisions Advance Electrical Safety

All 18 code-making panels updating the *National Electrical Code*® (NEC), which is published by the National Fire Protection Association (NFPA) with input from organizations that include NEMA, met and reviewed 3,730 public inputs in January 2018. These meetings resulted in 1,406 changes (first revisions). Some of the first revisions could significantly advance electrical safety in the built environment; they will now go through NFPA's process.

Pertinent revisions include:

- **Ground Fault Protection**

Section 210.8(A) in the 2017 NEC requires ground-fault circuit interrupter (GFCI) protection on 15–20 amp 125 V receptacles installed in locations specified in (A) (1) to (10). The proposed change would require GFCI protection on all 125 V through 250 V receptacles because of multiple instances where individuals were electrocuted when interacting with 250 V receptacles for dryers and range outlets.

- **Surge Protection in Dwelling Units**

A new proposed requirement in 230.67(A) would require that surge protective devices (SPDs) be installed for all dwelling unit service panels. This

would protect electronics and other safety devices that we see in residential structures.

- **Emergency Disconnects**

This new proposed requirement in 230.85 would mandate that all dwelling units have an emergency disconnect installed outdoors at a readily accessible location. The action was taken in response to a submission by a first-responder organization. It would help protect firefighters from a potential arcing event if they had to resort to removing the electrical meter while under a load.

The code-making panels' task groups also discussed the 1,932 public comments that were submitted in January in response to the panel's actions. Overall code-making panel meetings were scheduled to run from October 21 to November 3, 2018. ☎



Motor Summit Addresses Energy Management

**NEMA is a proud
sponsor of the 2018
Motor Summit.**

If you ask my children if they would like another scoop of ice cream, they will scream, “more, more,” only to find they have stomachaches later. So it is with increasing energy-efficiency levels.

Over the last 30 years, the motor industry has increased efficiency for the typical 5 hp motor from 85 percent to more than 90 percent. Yet regulators and some energy advocates continue to propose higher levels. Requiring changes to one area, without considering how it interacts with other aspects of the system, may lead to *reduced* energy savings and other unintended consequences. Just as adding another scoop of ice cream isn’t necessarily reasonable, continuing to raise the efficiency levels on individual components doesn’t necessarily yield greater savings or better products.

While motors can be tested and measurements made, it does not always translate into reducing wasted energy. As a result, NEMA’s focus has shifted from merely increasing energy efficiency

to focusing on a more meaningful goal of total energy savings.

One hurdle to developing system efficiency Standards is a method to accurately estimate energy use during the intended use of the product, rather than at a single test point. This is reflected in IEC 61800-9-2 *Adjustable speed electrical power drive systems—Part 9-2: Ecodesign for power drive systems, motor starters, power electronics and their driven applications—Energy efficiency indicators for power drive systems and motor starters*. The next steps will be to shift from the existing mantra of more regulation is better (more ice cream, please) to a philosophy of better energy management by measuring energy savings.

NEMA will be among the industry experts presenting on energy management and other subjects at the 2018 Motor Summit, November 14-15, in Zurich, Switzerland. Learn more at www.motorsummit.ch/de/2018. @

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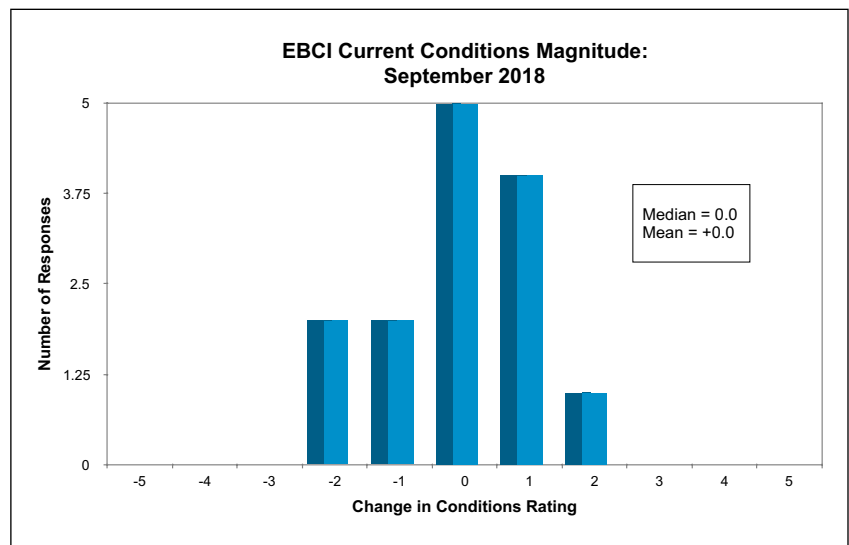
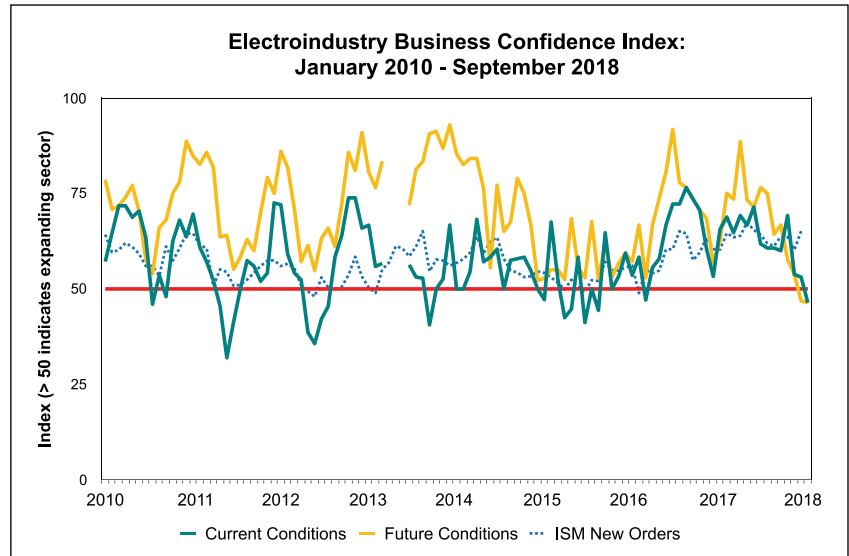
September 2018's Electroindustry Business Confidence Index (EBCI) reading of 46.4 marks the first time since September 2016 that the current conditions component dipped below 50.

With the exception of a one-month blip in June, the current conditions measure has been generally trending down since February. Although half of the panel reported unchanged conditions, the share of those noting worse conditions increased by 10 percentage points from August's results. Comments were mixed, with one mentioning transportation bottlenecks as a limiting factor.

The average value of the reported intensity of change in electroindustry business conditions did not change from last month. The mean value remained at 0.0, and the median value also held firm at 0 in September. Panelists are asked to report intensity of change on a scale ranging from -5 (deteriorated significantly) through 0 (unchanged) to +5 (improved significantly).

Marginal erosion in the future conditions component to 46.4 left its September score below 50 for the second straight month. Unlike the current component, the view six months ahead appears to be flattening rather than contracting further, as the proportion of respondents noting unchanged conditions surged by 31 points to 50 percent in September. Qualitative remarks were limited but pointed to increased export opportunities as well as possible improvement once the noise from the election cycle has quieted.

Visit www.nema.org/ebci for the complete September 2018 report. 📄



	Current Conditions (Compared to Previous Month)	Conditions Six Months From Now (Compared to Current Conditions)
EBCI	46.4 ▼	46.4 ▼
% Better	21% ▼	21% ▼
% Worse	29% ▲	29% ▼
% Unchanged	50% ▼	50% ▲

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