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FROM THE **PRESIDENT**

Reliable power, integral to our everyday lives, is even more critical after a natural disaster. First responders and emergency communications, healthcare services, and potable water—to name just a few essentials—rely on electricity before, during, and after the event. NEMA has worked over the years to secure reliable power everywhere before natural disasters.

We launched a Rebuild Smart campaign after Sandy in 2012. Following that storm, NEMA spoke directly with local and state officials in the Northeast about best practices to evaluate affected equipment and then to rebuild in ways that prospectively would save lives, reduce service outages, and protect property. This year, in the aftermath of Hurricanes Harvey, Irma, and Maria, we amplified that message to communities throughout the Gulf of Mexico, the Eastern Seaboard, and the Caribbean.

After contacting other industry stakeholders to share our mission to Rebuild Smart, we are now taking that message directly to the Administration and Congress as they craft legislation that will direct and fund rebuilding efforts. We learned from past storms that rebuilding smart increases the odds of power staying on during future storms.

Texas and Florida, for example, invested wisely in electrical infrastructure. Their intelligent grids and advanced metering systems mitigated outages and facilitated the restoration of power in record time. These exemplify how the Internet of Things and its attendant data network can assess, monitor, and resolve problems using digital communications and real-time analytics. For example, not only were communities better prepared, both states had programs in place to deploy drones to survey damage in inaccessible areas.

NEMA encourages communities everywhere to create disaster mitigation and recovery plans that address the consequences of electricity loss, establish emergency procedures, and use infrastructure funds to deploy technologies that make the grid more resilient.

The NEMA *Storm Reconstruction Toolkit* helps local officials determine the electrical systems and products they may need not only to rebuild smart but to initiate proactive plans as well. As massive rebuilding efforts get underway, decision makers should dedicate reconstruction funds to deploy smart technologies that mitigate future power outages and ensure continued operation of critical facilities and services. Infrastructure rebuilding initiatives in storm-ravaged jurisdictions could usefully serve as national pilot projects.

The good news is that needed technology already exists. Systems are getting smarter—and safer. Because storm-resistant devices and utility systems now are networked, we can integrate energy storage, microgrids, and onsite renewable energy as next steps in building resiliency. In order to implement communities' demands for dynamically reliable electric grids, we must challenge legislators and regulators to enact broad and sweeping regulations.

This issue of *electroindustry* looks at utility products and systems, drones, distributive automation, and grid security. The NEMA principle behind these technologies is simple: Plan Ahead by (Re)Building Smart. ☛

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Upgrading Infrastructure Transcends Destruction



Ms. Clayton sits on the NEMA Board of Governors.

Electrical systems quite literally power the overall health and prosperity of our country, from construction to retail to healthcare. Once every few years, the national conversation turns to the need to add resiliency to the system, typically in the wake of a disaster wreaked by a major storm.

When our nation faces tragedies like what we've seen from Hurricanes Harvey, Irma, and Maria, we are first and foremost concerned with the devastating human impact. The way our industry has responded to provide relief, recovery, and rebuilding for communities in need is a source of pride for me.

Our companies are well-positioned to do more and lead a national discussion on an important reality: the current way of generating, transmitting, distributing, consuming, and managing energy is not sustainable. In fact, a major outage in San Francisco earlier this year demonstrated how fragile the system has become, even in the absence of a storm. A single circuit breaker failure disrupted more than 90,000 residents, closed businesses, and snarled public transportation.

We shouldn't wait until the next major storm ... to bring a resilient grid to the forefront.

The world of energy is undergoing a massive transformation. Digitization, decentralization, and decarbonization are redefining the basics of power generation and distribution. We can build a next-generation grid based on the principles of efficiency, sustainability, reliability, safety, security, and performance. As we shift toward a new energy landscape that prioritizes renewables, we must help customers and utilities alike embrace and invest in the technologies that allow us to make the most of our energy assets and unlock superior outcomes for all stakeholders.

Digitization is a no-regret move when beginning the journey to address our existing aging infrastructure. The performance of even the oldest

equipment can be significantly enhanced through better visibility and more finite control. Consider the impact of more insightful operation on safety, where new technologies allow us to better predict failures and safely take equipment out of service before people or equipment are harmed. In circumstances where a failure occurs without warning, we can limit the magnitude of the fault, the number of people affected, and the time without power.

For example, simple microgrid systems can protect a single home or facility or scale to power an entire community. We recently built a microgrid at our Boston One Campus (BOC), which serves as our U.S. headquarters, to avoid costly power outages, reduce time to recovery for the critical business facility, and provide a shelter option for our staff and their families. Microgrids ease the integration of renewable generation into existing infrastructure. The newest grid management software co-optimizes the primary role of our facility—keeping employees comfortable and safe—with superior energy outcomes: higher resiliency, better sustainability, and lower/more predictable costs. The BOC now serves as a real-world demonstration of how we can leverage energy technology advancement to drive meaningful impact in our businesses and communities.

We shouldn't wait until the next major storm or blackout to bring a resilient grid to the forefront. The challenge requires ongoing collaboration from technology providers, utilities, and regulators, as well as businesses and communities, to create meaningful change. By adopting microgrids and other electrical infrastructure upgrades, we can leverage technology for system transformation—introducing new levels of resiliency, speeding up recovery time after an outage, and even preventing catastrophic failures. This is a call to action for our entire community.

This new digital world of energy—with more decentralized generation, a two-way flow of decarbonized energy, and more digitization for flexible, dynamic energy management—gives us an opportunity to co-create the future of the electrical system. ☺

Major Infrastructure Investment Needed for Grid

These days in Washington, there is talk of improving our nation's infrastructure by fixing bridges and roads and installing fiber optic cables and high-speed broadband internet networks. Often forgotten in these proposals is perhaps our most important piece of infrastructure in serious need of reinvestment and reinvention: our nation's electrical grid.

As one of the few engineers working on Capitol Hill, and as a senator from a state that is home to incredible clean energy sources and two national labs that are on the front lines of energy research, I know that modernizing our nation's energy infrastructure is the key to meeting our future energy needs.

It would be wrong to say we have just one electrical grid. Although much of it is interconnected, even across immense geographic distances, its operations are disjointed. Traditionally, many of the lines running from central power plants branched out into smaller distribution networks that delivered all of the energy that homes and businesses used.

Modernizing our nation's energy infrastructure is the key to meeting our future energy needs.

Much of our energy infrastructure has not changed since the days when my father worked as a utility lineman. Our current transmission networks were not designed to integrate distributed renewable energy sources, incorporate new energy storage technologies, or allow different utilities and power consumers to work together efficiently.

Through my role on the Senate Energy and Natural Resources Committee, I've introduced legislation to reduce regulatory barriers for new transmission projects and promote renewable energy and energy storage deployment.

Building a network of new regional transmission lines is essential if we want to tap the full potential for clean energy development in Western states like New Mexico. We must work across state and local lines to update our transmission roadmap to send low-cost power from productive wind farms and solar fields to energy markets in urban centers. It will be essential to find ways to promote new transmission lines that are fully transparent and sensitive to community and conservation concerns.



Senator Heinrich is a member of the Senate Committee on Energy & Natural Resources.

Energy storage is the missing link in integrating renewable energy sources into our grid, building self-sustaining microgrids, and optimizing the use of all of our energy sources. The grid is already becoming much more of a multidirectional system, where consumers are increasingly also producers and electrons are flowing in multiple directions. As battery technologies advance, storage—at the utility scale and in homes, businesses, and electric cars—will shave peak periods, provide valuable supplemental services, and reduce the need to invest in expensive new generating stations and transmission lines.

We must also adapt to modern threats. I support legislation to protect our energy infrastructure from potentially catastrophic cyberattacks. A modern grid with more generation points and widespread backup power will also be more resilient to natural disasters and other emergencies.

Similar to the way the Interstate Highway System greatly improved upon a system of smaller highways and roads, a modernized electrical grid will deliver major advances to our economy. Making the investments necessary to modernize our grid will increase the reliability and security of our energy delivery systems, reduce carbon emissions, and, most importantly, bring down energy costs for consumers. ☪

Advanced Grid Technologies Weather the Storms

Kenny Mercado, senior vice president of electric operations at CenterPoint Energy, Inc., which is based in Houston, Texas, reported on the utility's response to Hurricane Harvey, the third-largest natural disaster in United States history. Because of intelligent grid technologies, the utility avoided millions of outages and saved 16.71 SAIDI (a measurement of interruptions) minutes. Advanced metering systems increased efficiency during the storm. Real-time analytics and digital communications were used to assess, monitor, and resolve outages.


Harvey by the Numbers

- 1.27 million meters affected
- 293 circuits locked out
- 755 million total minutes out over 10 days
- 17 substations and 7 transmission lines out of service
- 83 buildings in downtown Houston lost electrical service
- 36 airboats, 15 drones, and 15 amphibious vehicles were employed in restoration



Rebuilding with Resilience





















After any major storm, the core principles of reconstruction should be to rebuild strong and rebuild smart. Learn how:

- Visit the *NEMA Storm Reconstruction Toolkit* for more information.
- Evaluate electrical equipment that has been exposed to water by downloading NEMA's *Evaluating Water-Damaged Electrical Equipment*, now also available in Spanish (*Evaluación de equipos eléctricos dañado por el agua*).
- NEMA Members may download damage assessment reports on the *NEMA Intelligence Portal*. 

THE IMPORTANCE OF: REBUILDING & RENOVATING SAFELY

WATER-DAMAGED ELECTRICAL EQUIPMENT

ESFI.org

WATER DAMAGED ELECTRICAL EQUIPMENT		✗ MUST BE REPLACED	⚡ MAY BE RECONDITIONED
	Arc-Fault and Ground-Fault Circuit Interrupters	✗	
	Batteries	✗	
	High-Voltage AC Circuit Breakers	⚡	
	Lighting, Ballasts, and LED Drivers	✗	
	Low- and Medium-Voltage Fuses	✗	
	Low- and Medium-Voltage Switchgear	⚡	
	Low-Voltage Power Circuit Breakers	⚡	
	Molded-Case Circuit Breakers	✗	
	Motors <small>See Standard ANSI/IEEE 43-2013, A2 & A3, ANSI/FASA A11.00</small>	⚡	
	Outlet and Junction Boxes <small>See NEMA Standard 301-2008</small>	✗	
	Panelboards <small>See NEMA Standard: PB 1-1-2013</small>		⚡
	Receptacles	✗	
	Signaling, Protection, and Communications Systems	✗	
	Surge Protective Devices	✗	
	Switchboards <small>See NEMA Standard: PB 2-1-2013</small>	⚡	
	Switches and Dimmers	✗	
	Transformers <small>All dry type, control circuit, liquid-filled, cast-resin</small>	✗	
	Uninterruptible Power Supply	✗	
	Wire or Cable for dry areas	✗	
	Wire or Cable for wet areas that have not been damaged / ends not exposed		⚡

ESFI has teamed with the *National Electrical Manufacturers Association* (www.nema.org) to provide a detailed explanation on what electrical components can be reconditioned and which need to be replaced.

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ADVANCED GRID MODELING

The electrical power industry has undergone extensive changes over the past several decades and become substantially more complex, dynamic, and reliable as new market rules, regulatory policies, and technologies have been adopted.

As the electricity delivery system continues to evolve, the availability of more detailed data about system conditions from devices such as phasor measurement units (PMUs) used for wide-area visibility and advanced metering infrastructure (AMI) used for dynamic pricing and demand response will help improve the system's reliability and flexibility.

Working with the large volume and variety of data to make it more relevant and actionable to grid operators and utilities, however, poses significant challenges. Continuing to shift operational data analytics from a traditionally offline environment to expanded real-time situational awareness of grid conditions and faster, measurement-based control will require significant advancements in algorithms and computational approaches.

Advanced Modeling Grid Research

The U.S. Department of Energy's Office of Electricity Delivery and Energy Reliability (OE) is undertaking activities to accelerate discovery and innovation in transmission and distribution technologies and create next-generation devices, software, tools, and techniques to modernize the electrical grid. Projects are coordinated with partners from other federal programs; electric utilities; equipment manufacturers; regional, state, and local agencies; national laboratories; and universities. Coordination is critical to focusing federal efforts and ensuring that projects are properly aligned with public, private, local, and national needs.

OE provides national leadership to ensure that the nation's energy delivery system is secure, resilient, and reliable and provides input on federal and state electricity policies and programs that shape system planning and market operations. Not only does OE bolster the resiliency of the electrical grid and assist with restoration when major energy supply interruptions occur, but it also develops new technologies to improve the infrastructure that brings electricity into our homes, offices, and factories.

Ali Ghassemian, PhD,
Program Manager,
U.S. Department of
Energy's Advanced
Modeling Grid
Research Program

Brian Marchionini,
PMP, Senior Program
Manager, NEMA

Dr. Ghassemian's
has extensive
knowledge in the
areas of big data
analytics, modeling,
and simulation.
Mr. Marchionini
oversees NEMA
technical work on
energy storage,
distribution
automation, and
microgrids.

Continued on page 8

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Through its Advanced Modeling Grid Research Program, OE is supporting:

- transformation of data to enable preventative actions rather than reactive responses to changes in grid conditions;
- research and development of advanced computational and control technologies to improve the reliability, resiliency, security, and flexibility of the nation's electricity system;
- system operators and utilities to help prevent blackouts and improve reliability by expanding wide-area real-time visibility into the conditions of the grid;
- improvement of the performance of modeling tools and computations that are the basis of grid operations and planning; and
- tracking and expanding the use of quantitative risk and uncertainty methods by federal- and state-level energy system decision-makers regarding energy infrastructure investments.

Drones Fly High in Hurricane Restorations


In the aftermath of 2017's major hurricanes, the commercial drone industry is quickly becoming a major player in disaster relief efforts. Following Hurricanes Harvey and Irma, the Federal Aviation Administration issued permits to commercial drone operators to assist in a number of different functions that expedited recovery.

Earlier this year, CenterPoint Energy, the electric utility serving Houston, Texas, launched a drone program to survey damage from severe weather. The drones proved instrumental in the company's restoration efforts after Hurricane Harvey dumped nearly 52 inches of rain in some sections of Southeast Texas. Flooded roads made it difficult for crews to assess damage, which in turn hindered response and restoration. Fifteen drones were used to capture high-resolution imagery in real time to help crews assess damage and deploy the right resources in the right places to restore power.

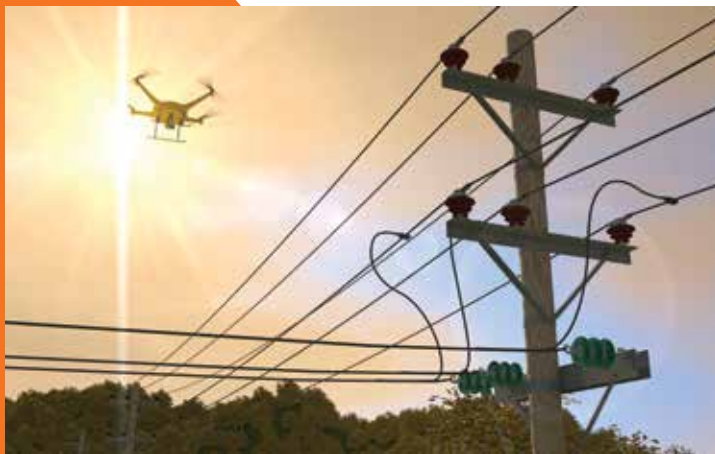
In advance of the hurricane season, Florida Power & Light (FPL), the electric utility serving Southern Florida, hosted a training program that included the use of unmanned aircraft systems. Employees were trained for what would be a massive logistical response to a major hurricane, involving the deployment of thousands of workers and the use of equipment and advanced technology (including drones) to rapidly survey damage. Drones played a significant role in FPL's efforts to restore electricity for its 4.4 million customers after Hurricane Irma. The company had 49 drone teams surveying parts of the state that were not accessible by vehicles. 

To achieve these objectives, OE's Advanced Modeling Grid Research Program is furthering work in three main areas: data management and analytics, mathematical methods and computations, and models and simulations.

Data management and analytics activities focus on the way data is collected, used, stored, and archived to improve applicability of large, multisource datasets for real-time operations and offline planning studies. Efforts to address emerging mathematical and computational challenges arising in power systems are resulting in new algorithms and software libraries. Research on a new class of fast, high-fidelity capabilities that underpin better grid operations and planning in large-scale, dynamic, and stochastic environments will be aided by models and simulations.

Building and maintaining effective public-private partnerships is vital. In achieving this vision, OE is fostering strategic, university-based power system research capabilities. Such partnerships facilitate additional research and development and enable industry (and ultimately, consumers) to capitalize on the benefits of making this wealth of data more accessible and actionable. 

NEMA's 2018 Strategic Initiatives include a webinar series on the Internet of Things Trends that will cover the role of big data analytics in grid modernization as well as other topics.



Steve Griffith, PMP, Industry Director, NEMA

Recycled Electric Power: Simply Efficient

As a manufacturer of arc-welding equipment, Miller Electric Manufacturing Co. provides innovative and reliable solutions to customers' metal joining needs. A key component of providing reliable products is extensive reliability testing.

When reliability-testing a power source, an effective way to emulate a welding arc is to use a resistive load. Unfortunately, all the electrical output energy of the power source is converted to waste heat when using resistive loads.

In 2011, Miller Electric undertook an initiative to make a positive impact on the environment by reducing energy consumption in reliability testing. After investigating many possible solutions, including renewable energies such as wind and solar, the company determined that simply recycling the electrical energy using regenerative loads would be the most impactful method of reducing energy consumption.

A regenerative load is much like a solar converter in that it converts, isolates, and synchronizes the direct current output of the welding power source into alternating current that can be transferred back to the grid.

The first regenerative loads were installed and fully functional by November 2015. Since then, Miller Electric has significantly reduced electrical energy usage and receives a favorable return on investment. To date, the regenerative loads have saved more than \$100,000 in electrical energy costs.

As a result, Miller Electric will continue adding regenerative loads in the reliability test area and is considering expanding electrical power recycling to other test areas throughout the company. ☞

Mike Madsen, Regulatory and Reliability Director, Miller Electric Manufacturing Co.



Digital Substation Upgrade Safeguards Lower Manhattan

Consolidated Edison (ConEd) suffered major damage to its distribution network during Hurricane Sandy in 2012, requiring replacement of major components and 80 percent of control cabling. Since then, ConEd significantly invested in safeguarding its power infrastructure, including substation protection, by reinforcing perimeter walls, gates, and floodwalls.

Recently, the utility completed a major upgrade of a key lower Manhattan substation that serves Wall Street and the World Trade Center, an area that experienced significant flooding from the storm surge.

Project highlights:

- A new elevated design with modular 420 kV plug-and-switch system (PASS) hybrid switchgear was installed more than 35 feet above the original substation level; PASS delivers a 50 percent space savings over traditional solutions and incorporates special rotating bushings.
- Multiple layers of legacy control systems compromised by Hurricane Sandy floodwaters were upgraded to a new automated system.
- ABB replaced most of the substation's copper control cabling with a few fiber optic cables.
- IEC 61850-based open communication standards make it possible for ConEd to interconnect a large system with multivendor installations, enable faster data mining and business intelligence, and facilitate a shift from traditional time-based maintenance to condition-based maintenance.

The digital upgrade and transformation of this critical substation, along with new weather-fortification measures, is already bringing greater grid resiliency and improved reliability to Manhattan consumers. ☞

Steve Kunsman, Director of Product Management and Applications, ABB Grid Automation

Microgrids Provide Resilience and Reliability



Are microgrids the answer to keeping electricity flowing during natural disasters? In the aftermath of three devastating hurricanes, stakeholder interest in microgrid development is growing. Integral to the power delivery system of the 21st century, they fundamental building blocks for grid modernization.

Microgrids can help integrate a range of distributed energy resources (DER). These include renewable energy resources, conventional and alternative distributed generation, and electric energy storage as well as load management and demand response. Microgrids can also be an effective way of balancing the variability of renewable resources and loads.

Besides resilience to extreme weather events and contingencies, microgrids can reduce the cost of supplying electrical energy from central generation plants through a transmission network and diversify the energy supply. A key element is the control system that manages the DER and sends data to the distribution grid operator so that it can be islanded as required.

Two areas important to additional deployment of microgrids are related to standards development and overcoming regulatory barriers.

First, standards are a key enabler to the deployment of microgrids and the associated DER within them. Standards for microgrid control systems that meet minimum interconnection and interoperability requirements are particularly important.

The other is regulatory barriers, the overarching determinant of the microgrid's role in the power delivery system. Regulation is the single most important barrier to microgrids as independent entities and as systems integrated within distribution utilities.

NEMA is undertaking a strategic initiative on microgrids that will explore:

- Lessons learned from successful deployment
- Top regulatory barriers
- Policy and regulatory solutions
- Codes and standards hindering adoption

For more information, contact brian.marchionini@nema.org.

Brian Marchionini, PMP,
Senior Program Manager, NEMA

Microgrid Sets High Standard for Integration



Ameren integrates wind into its microgrid.
Photo courtesy of S&C

The best way to learn about the benefits of a microgrid is to operate one.

When Ameren, an Illinois utility, expressed interest in learning how microgrids could affect its overall system reliability, S&C responded. It designed, built, and commissioned a system of four interconnected generation sources: energy storage, wind, solar, and natural gas generators. These assets are managed by a comprehensive, cyber-secure, distributed microgrid controller to power dynamic consumer loads.

The system runs 16 use cases and can transition from grid to islanding mode as

necessary, charging the storage and powering the surrounding customer load on 100 percent renewable generation. When the main grid returns, the microgrid seamlessly returns to the grid from island mode without an outage.

As the operator of one of the most advanced utility-scale microgrids, Ameren sets a high standard for system integration. Its microgrid is a benchmark that will help answer industry challenges to integrating distributed resources. ^{ei}

David Chiesa, Senior Director-Business Development,
S&C Electric Company

Is Your Smart Grid Secure?

As communication and intelligence are added to power supplies, is the industry prepared to address software security? While there is little risk a hacker could reach a single digital point of load (POL) at board level, the risk increases exponentially as we move upward in the value chain. In that chain, the smart grid is probably the most exposed to attacks.

Are we safe?

Between March 2007, when the United States demonstrated in the Aurora Generator Test that hackers could take control of a power plant and physically destroy a generator with only 21 lines of code, and April 2016, when a water and electricity authority in Michigan became the victim of a ransomware attack that forced it to keep IT systems locked down for a week, the number of cases reported to security authorities rapidly increased.

Black Christmas

Florida International University estimated that during the first six months of 2015, more than 100 cyber incidents affected infrastructure in the U.S., and the energy sector had the largest number of attacks. Cyberattacks on the smart grid are a global threat.

In February 2016, the U.S. Department of Homeland Security described an attack on a power grid in Ukraine that involved physical sabotage; this case motivated the smart grid community to strengthen efforts to accelerate sustainable security.¹ On December 23, 2015, the Ivano-Frankivsk region was plunged into darkness for several hours and more than 220,000 customers lost power. The IT and communications systems of the electric companies were severely damaged by the attackers.

The attackers employed several tools. They sent a phishing email containing a variant of BlackEnergy 3 and KillDisk malware, exploited MS Office documents' security holes to get into the IT network of the electric companies, and bypassed security filters in the firewalls. At the same time, they managed to break credential codes to access deeper levels of the system, controlling industrial communication busses such as the ones interconnecting uninterruptible power systems (UPS) and the supervisory control and data acquisition (SCADA) systems.²

SCADA systems are process control sources (PCS) that monitor, gather, and analyze real-time environmental data. PCSs are designed to automate electronic systems based on a predetermined set of conditions, such as traffic control or power grid management. Managing to control the SCADA systems, the hackers accessed the electricity network, with the possibility of shutting down and severely damaging equipment.

Making Smart Safer

According to Michael McElfresh, adjunct professor of electrical engineering at Santa Clara University, technological advances in grid operation and the Internet of Things have made the power grid increasingly vulnerable to cyberattacks. "The growth of smart grid...has created many more access points for penetrating grid computer systems."³

All over the world, governments, consortiums, and groups of experts are engaged in a race to deploy security methods and protocols to make the grid safer. In the U.S., the set of critical infrastructure protection (CIP) standards issued by the North American Electric Reliability Corporation (NERC) became mandatory in 2007 for owners, operators, and users of the Bulk Electric System (BES) to ensure that certain assets on the grid critical to reliable operation are protected from both a cybersecurity and physical security standpoint. CIP is undergoing a wave of revisions, moving from CIP V3 to CIP V5, skipping V4, and accelerating V6.

Patrick Le Fèvre, Chief Marketing and Communication Officer, Powerbox

Mr. Le Fèvre is the author of numerous papers and articles related to power electronics.

¹ *Cyber-Attack Against Ukrainian Critical Infrastructure*, IR-ALERT-H-16-056-01, U.S. Department of Homeland Security, February 25, 2016, <https://ics-cert.us-cert.gov/alerts/IR-ALERT-H-16-056-01>.

² *Analysis of the Cyber Attack on the Ukrainian Power Grid*, SANS and E-ISAC, March 18, 2016, www.nerc.com/pa/CI/ESISAC/Documents/E-ISAC_SANS_Ukraine_DUC_18Mar2016.pdf.

³ Michael McElfresh, "Can the power grid survive a cyberattack?," *The Conversation*, June 8, 2015, <https://theconversation.com/can-the-power-grid-survive-a-cyberattack-42295>.

This pace reflects the situation faced by organizations that develop security standards in a fast-evolving world of threats.

Despite a number of initiatives within the European network and information security community to establish frameworks and standard operating procedures, the EU-level response to cyber incidents lacks consistency, although projects such as the EU-funded Smart Grid Protection Against Cyber Attacks (SPARKS) are showing very good signs of progress.

Step by step, the worldwide smart grid is getting stronger and safer, though the potential of threats remains high.

Because of the complexity and variety of connected devices (Figure 1), power supplies manufacturers

will have to consider security when their products are integrated within a grid. Software-defined power architecture is being deployed quickly in the information and communications technology industry. Some systems, already installed in data centers, are connected to the grid and communicate through the SCADA system.

Even if there is little risk a hacker can send a command to a POL blasting a local core processor, it is still possible for UPS and even front-end rectifiers to receive fatal commands. The Ukrainian case triggered the alarm for all of us involved in developing power systems connected to the grid, sending a signal that we should never forget about the final application—to be smart security innovators to power the smart grid with excellence. ☯



Figure 1. The complexity of the smart grid makes it very difficult to protect globally. Illustration courtesy of Powerbox

Growth Forecasted for Distribution Automation

The findings presented in this article are based on the completion of two major studies related to distribution automation (DA) conducted by Newton-Evans Research Company.^{1,2} The research firm estimates the total number of primary distribution feeders in the United States and Canada to be 175,000–180,000. Of this total, some 34,122 feeders were in operation in 2015 among the participating utilities. Figure 1 indicates that most of the surveyed utilities operate a substantial portion of their primary medium voltage (MV) feeders at 13/15kV ranges.

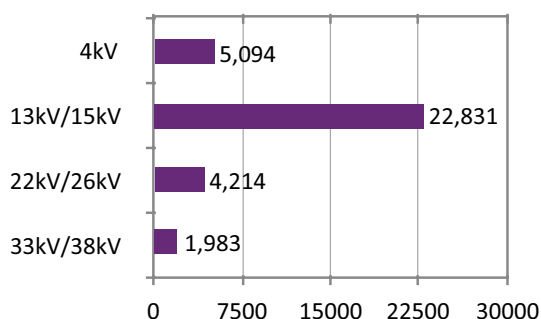


Figure 1. Number of feeders indicated as being in operation by sample of 75 responding utilities

Automatic Feeder Configurations

The percentage of feeders indicated by respondents as configured with fully automatic and supervisory control and data acquisition (SCADA)–controlled sectionalizing switches and reclosers climbed from 5 percent of the 4kV feeders to 24 percent of 13–15kV feeders, and higher yet—to 34 percent—for 22–26kV feeders. About 21 percent of the upper voltage ranges of MV feeders were listed as fully automatic and with SCADA-controlled switches and reclosers installed as of early 2015. By mid-2017, this percentage has likely increased to about 25 percent based on recent informal surveys, as estimated by Newton-Evans.

On a summary basis, nearly one-third of the responding utilities in the DA study cited operation of at least some feeders configured with fault detection, isolation, and recovery (FDIR) / fault location, isolation, and service

restoration (FLISR) capabilities. Six percent of 13–15kV feeders and 7 percent of 22–26kV feeders reportedly were configured to provide FDIR/FLISR functionality.

Volt/VAR Control and Optimization

Nearly one-half of the sampled utilities reported having at least some feeders supporting integrated volt/VAR control / volt/VAR optimization (IVVC/VVO) or conservation voltage reduction (CVR). For utilities operating 4kV feeders, nearly one-third (30 percent) reported some use of IVVC/VVO or CVR. The percentage was about the same among those utilities operating 13/15kV feeders. Utilities operating 22/24kV feeders reported high percentages (59 percent) of some of these feeders supporting IVVC/VVO or CVR. At the upper voltage range of MV feeders, respondents stated that they had equipped about 7 percent of their 33–38kV feeders with IVVC/VVO or CVR capabilities.

Overall, 68 percent of the utilities replying to this question indicated that at least some primary feeders will support integrated IVVC/VVO and/or CVR by year-end 2017. See Figure 2.

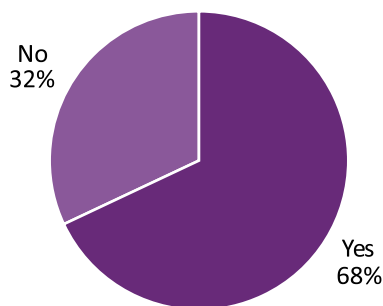


Figure 2. Utilities operating at least some feeders with integrated VVC/VVO by year-end 2017

Thirty-eight percent of respondents further indicated that the single-most mentioned driver for VVO implementation was the savings that resulted from reducing the need for infrastructure enhancements.

Cost savings brought about by reducing the need for additional generation was second in importance, at 33 percent. About one in five respondents also cited regulatory compliance as a significant driver for implementing VVO. See Figure 3.

¹ *The World Market Study of SCADA, EMS, DMS and OMS in Electric Utilities: 2017-2019 Volume 1: North American Market*, Newton-Evans Research Company.

² *North American Distribution Automation Market Assessment & Outlook 2015-2017*, Newton-Evans Research Company.

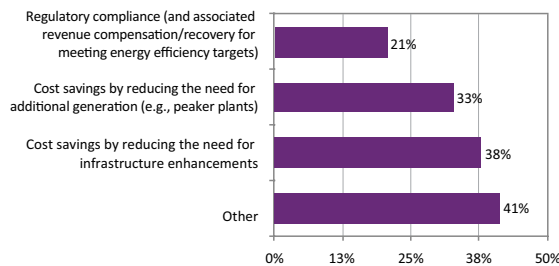


Figure 3. Reasons for implementing VVO

FDIR/FLISR Placement

As had been observed and reported in earlier Newton-Evans studies of distribution automation, respondents continue to provide a mix of replies to this very important question. Among the 42 percent of utility officials indicating some implementation of FDIR/FLISR on their distribution systems, many have controls implemented at two or three locations. Among the utilities identified (in 2015) as then-current FDIR/FLISR user utilities, controls were listed as being located at the control center (58 percent), in the substation (45 percent), and in the field (52 percent).

To date, research findings indicate control placement for FDIR/FLISR in the future is anticipated to be primarily in the control center, as cited by 67 percent of all respondents. Nearly 40 percent indicated future control location would be in the field, while 29 percent cited plans for substation-based controls. The trend toward placing DA controls in the control center has increased, based on the Newton-Evans 2017 control systems study findings.

Integrating DER

Well over one-third of the survey respondents reported having a trial deployment to manage distributed energy resources (DER) within the system either underway (15 percent) or planned (23 percent) by year-end 2017. Among investor-owned utility (IOU) respondents, the percentage rose to 64 percent with activities underway or planned for DA systems to include some level of deployment of DER management tools.

Among respondents to the very recent mid-2017 Newton-Evans study of distribution management systems (DMS) and other control systems who indicated they had implemented or planned to implement an advanced DMS (ADMS), most of this subgroup (82 percent) said they plan to include DERs in their ADMS functionality in the future. See Figure 4.

If you have an ADMS, does the SCADA functionality and network modeling include Distributed Energy Resources (DERs)?

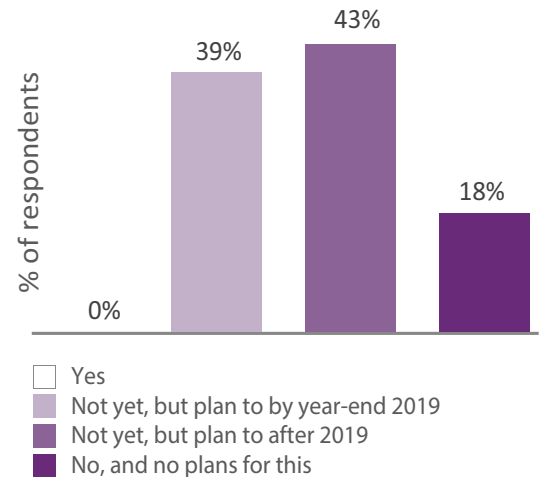


Figure 4. Integrating DERs

Optimal Placement of DA Device Controls

ADMS and SCADA/DMS technologies will assuredly play an increasingly important role as field-based DA investments continue to grow. There will likely be an increasingly complex array of field devices to monitor and control. Thus the decision on optimal placement of DA device controls will continue to be discussed and debated, as illustrated in Figure 5.

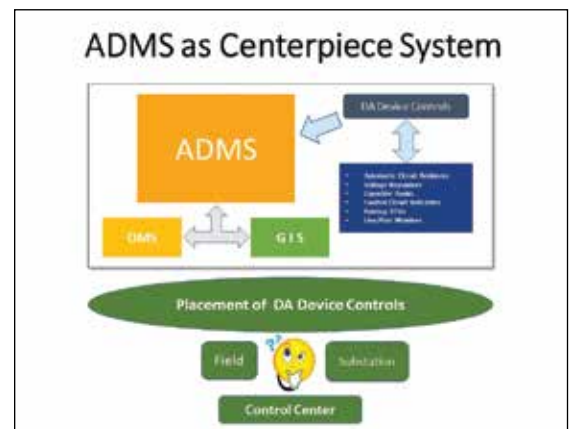


Figure 5. ADMS and SCADA/DMS technologies present an increasingly complex array of field devices.

Market for DA Equipment and DMS to Grow

The combined development of smart DA field devices, associated controls, and software as developed for ADMS and SCADA/DMS systems provides a DA market in the United States alone for NEMA Members that stands at about \$1.5 billion currently and will likely exceed \$2 billion by 2021.

The DA market will continue to show strong growth through at least 2024, when we expect U.S. DA-related shipment values of about \$2.5 billion (see Figure 6). Canada will add another several hundred million dollars to this total. Globally, the DA-related market values are likely to exceed \$6.5 billion by 2024. 🌐

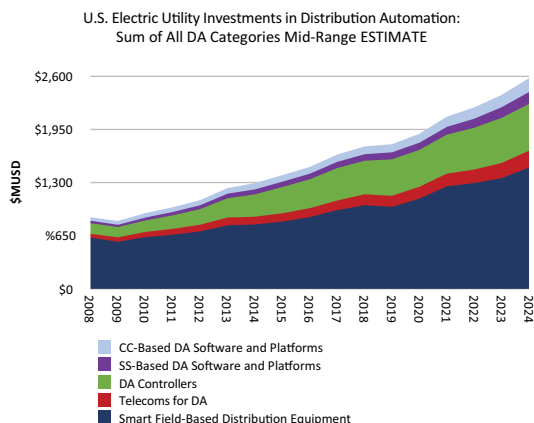


Figure 6. DA-related shipments



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Transportation Section Visits Congress

Did you know there is a group of NEMA Members that provides technologies and systems to manage traffic flows, prevent accidents, enable network performance measurement, and contribute to the future of connected transportation? With virtually all roadways under the purview of federal, state, or local governments, these companies find value in regular engagement through NEMA Government Relations.

A core group of Transportation Management Systems and Associated Control Devices Section companies, led by Section Chair Bryan Mulligan of Applied Information, were represented during September 20 outreach meetings in Washington, D.C. The section organizes an outreach day in the nation's capital during spring and fall meetings.

The group met separately with subject matter experts at the National Association of Counties and the American Association of State Highway and Transportation Officials (AASHTO).

Later, on Capitol Hill, the group met with staff members working to craft bipartisan legislation on infrastructure investment and automated vehicle deployment. 📸



Visiting the Hill were (from the left) William Russell of Eberle Design, Ray Deer of Peek Traffic, Steve Griffith of NEMA, Bryan Mulligan of Applied Information, William Sowell of Eberle Design, Jan Bergstrom of Miovision Technologies, and Jean Johnson of NEMA. Photo by Craig Updyke

Jonathan Stewart

Government Relations Manager,
NEMA

Standards-Based Recommendations Support Energy

In September, the Renewable Energy and Energy Efficiency Advisory Committee (REEEAC) voted on and approved two standards-related recommendations to the United States Department of Commerce. Together, the recommendations indicate ways Commerce can support the U.S. energy sector through promotion of products built to North American standards and recognition of all internationally recognized standards.

NEMA Government Relations Manager Jonathan Stewart, who chairs the REEEAC's Market Access Subcommittee, worked closely with subcommittee and NEMA members Gary Rackliffe (ABB) and Greg Merritt (Cree) in drafting both documents.

REEEAC Charter IV-approved recommendations are:

- That the Secretary of Commerce work with the Export-Import Bank, Overseas Private Investment Corporation (OPIC), U.S. Agency for

International Development (USAID), U.S. Trade and Development Agency (USTDA) and other members of Trade Promotion Coordinating Committee Working Group on Renewable Energy and Energy Efficiency (TPCC-REEE) to provide training on the importance of requiring that products installed globally comply with internationally recognized standards in RE&EE projects; and

- That the Department of Commerce engage more aggressively in key market standards development and standards adoption bodies to ensure that locally adopted standards allow for installation of U.S. products (e.g. products that are built to North American standards).

The full text of each recommendation, including background information, can be found at https://build.export.gov/main/reee/eg_main_023040. 📸

From Patient to Advocate

Education is my passion. As a teacher and administrator, I know the importance of appropriate resources. In 2004, I found that these principles also rang true for health.

Six weeks after my eleventh normal mammogram, my doctor felt a ridge in my right breast and ordered an ultrasound, which detected a large lesion. I had stage 3C breast cancer with 13 metastasized lymph nodes. According to the American Cancer Society at that time, the five-year survival rate was less than 49 percent.

I was shocked and scared. Dense breast tissue appears white on a mammogram, as cancer does. Physicians were not required to share dense breast findings with the patient; this protocol did not sit well with me. I uncovered two decades of research on the limitations of seeing cancer in dense breasts by mammography, and that women with dense tissue have a greater risk of developing breast cancer. I found that supplementing a mammogram with ultrasound or MRI can nearly double cancer detection. My husband and I contacted a state senator, who championed this issue before the Connecticut legislature.

As I endured chemotherapy, radiation, and surgeries, I proceeded from patient to advocate. Connecticut enacted an insurance law in 2005 for ultrasound screening as an adjunct to

mammogram for women with dense breast tissue. After a year, when women were still not routinely told of the impact of dense breast tissue on the reliability of mammograms, we started Are You Dense, Inc., a nonprofit that educates the public about the risks and screening challenges of dense breast tissue as well as the effects of missed, delayed, and advanced breast cancer. Now, 31 states have density reporting laws. We continue to advocate for a national standard, a federal reporting law, and changes to the Mammography Quality Standards Act to include a woman's breast tissue composition as part of her The MITA State Government Relations Committee actively supports the advocacy efforts of Are You Dense.

While I am honored to inspire others to advocate for improved breast health, I recognize that a few sentences in a mammography report do not replace education and dialogue between patient and provider. Each year, 40,000 women die from breast cancer. Early diagnoses confer more treatment options and better survival outcomes. Just as I fought for education equality, I won't stop until all women with dense breasts have the resources they need.

For information on MITA's State Government Relations Committee, contact Cassandra Ricci, cricci@medicalimaging.org. ☎



Nancy Cappello

Richard Frank, MD, PhD

Chief Medical Officer, Siemens Healthineers

Imaging Inspires Innovation

Scrutiny drives innovation, especially in healthcare, where there is a shift away from paying for volume (i.e., fee for service) to paying for value (i.e., value-based care). Notably, Medicare adopted novel arrangements and adjusted payments according to quality metrics. These models represent opportunities for innovation, including expanded roles for imaging. For example, attaching payment incentives to the adoption of standards led to widespread reduction in radiation doses.

It is no longer enough for healthcare providers to treat the sick. Now they are to keep those who have fallen ill from being rehospitalized and to

keep healthy people out of the hospital. A vital component of this is detecting and characterizing disease at the earliest stage, when it is most treatable.

Although screening through imaging has saved and improved countless lives, its value is often questioned by policymakers who worry about false positives, unnecessary treatment, incidental findings, and radiation exposure. As providers effectively and efficiently manage these complexities, innovation can be part of the solution. MITA advocates greater use of imaging under innovative payment models. ☎




G. Wayne Moore, President
and CEO, Acertara Acoustic
Laboratories

I Am MITA

As a small-business owner in the medical imaging market, I am frequently asked why Acertara joined MITA. After all, isn't MITA all about huge multinational corporations? What drove Acertara to membership is the MITA mission: *reduce regulatory barriers, establish standards, and advocate for the medical imaging industry.*

Acertara wanted to be not only a member of MITA but also an active participant in the development and adoption of new and relevant domestic and international standards.

Along with Jim Gessert, Acertara's chief technical officer, I have served on several committees related to diagnostic ultrasound over the last 15 years. Interacting with the brightest engineering, regulatory, and quality assurance minds in the medical imaging industry has made Acertara a better company. 


CODES & STANDARDS

Making Healthcare Cybersecure

As medical technologies become more connected and healthcare facilities adopt electronic medical records, cybersecurity is a growing threat. Cybersecurity incidents may harm patients and healthcare providers, disrupt patient care, reduce the reliability of the healthcare system, and challenge the integrity of protected information.

The MITA Board of Directors has established cybersecurity as a top priority. Earlier this year, a group of government, industry, and healthcare stakeholders issued the *Report on Improving Cybersecurity in the Health Care Industry*. Taking its cues from this report, the MITA Cybersecurity Committee advances policies that:

- protect patient health and information;
- establish a regulatory and standards environment that protects the confidentiality, integrity, and availability of medical imaging devices and associated information; and
- coordinate, collaborate, and align with the broader healthcare cybersecurity policy, regulatory, and standards development community.

MITA will establish a framework for information sharing, develop incentives that will promote the use of cybersecure products, and align strategies and open communication with other critical stakeholders. 

Michael McNeil


Global Product Security & Services
Officer, Philips

Quality Is Critical in Servicing Medical Devices

For years, MITA has advocated for consistent application of medical device servicing regulations that protect patients and ensure device performance. Currently, the Food and Drug Administration (FDA) requires only original equipment manufacturer (OEM) service providers to have a quality management system (QMS). Although many non-OEM service providers perform excellent service, the lack of a requirement leaves the door open to low quality and unsafe practices.

In 2016, the FDA indicated that it would welcome a consensus solution to medical device servicing. MITA convened a large group of OEMs, independent servicing organizations, in-hospital healthcare technology management professionals, the FDA, the Joint Commission, and others to

develop a standard for quality management of servicing medical imaging devices under the guidelines of the American National Standards Institute (ANSI). Any entity that services medical equipment will be able to follow this vendor-neutral standard.

A properly implemented and managed QMS will drive an organization to continually improve. New problems will be investigated in an organized and timely manner. Root causes will be identified and solutions will be developed and implemented to prevent problems from reoccurring. Persistently identifying and eliminating problems will improve overall performance and reliability; reduce costs from product defects, work errors, and liability claims; and increase safety for employees, customers, and patients. 

Jim Nestel

Manager of Service Projects and
Installations, Hitachi Healthcare
Americas

Standardizing Vendor Credentialing

Healthcare industry representatives (HCIRs) must be credentialed prior to entering a medical facility to sell products and services. Credentialing may include background checks, drug screening, and immunizations. Although all stakeholders share the common goals of patient safety and quality care, inconsistencies in the current environment result in widely varying credentialing requirements. Currently, HCIRs must comply with multiple differing processes.

A staggering \$1.7 billion is spent annually on redundant credentialing processes and documentation. Of equal concern is the privacy and data security of multiple nonregulated systems. Since there are no standard requirements or processes, maintaining the accuracy and timeliness of the data is challenging.

The Consortium for Universal Healthcare Credentialing has developed a set of best practices to streamline burdensome and duplicative processes and introduce a comprehensive and scalable approach to vendor credentialing.

According to Chair Rhett Suhre, “The best practices have been vetted with suppliers,

providers, and governing bodies to ensure that they meet any applicable laws or regulations, while meeting the common goals of patient safety and confidentiality. The next step is to create the data standards to allow for more efficient and accurate communication on the compliance status for the representatives.”

MITA and the Consortium for Universal Healthcare Credentialing are developing an American National Standards Institute (ANSI) standard to ensure that all HCIRs follow one consistent protocol.

The consortium is made up of 32 members and supporting organizations, including health systems, healthcare professional organizations, and supplier companies. To join or learn more, visit <https://www.universalhealthcarecredentialing.org/members>. MITA is a supporting member of the consortium. 🌐



Rob Boteler

Government Relations, Nidec Motor
Corporation, and member of the
NEMA Motor & Generator Section

EMPLI to Enhance Business with Compliance Mark

The NEMA Motor and Generator Section benefits from the NEMA Premium® compliance mark. Introduced in 2003, it identifies motors that meet or exceed specifications detailed in NEMA MG 1 *Motors and Generators*, Table 12-12. The Extended Motor Product Label (EMPLI) is quite simply the extension of this concept to our customers' motor-driven products.

As the United States Department of Energy (DOE) began the process of developing regulations to cover fans, pumps, and compressors, the EMPLI collaboration reasoned that having DOE regulations with test standards, metrics, and a performance baseline would provide the foundation for a similar compliance scheme. NEMA and other trade associations, utilities,

and nongovernmental organizations joined the collaboration. Its goal is to deliver a prescriptive rebate scheme through the use of a compliance mark similar to NEMA Premium Motors.

The path to success has taken longer than expected, due in part to the slowdown in regulatory completion under the current administration. Pump manufacturers received a final rule from the DOE for their products and began the process of product identification with a special energy-rating performance label. The next steps will be to build a database of the compliant pump products that will be shared with the various utility commissions for inclusion in a rebate program. 🌐

Standard Ensures Safety for Lithium Cells and Batteries

ANSI C18.3M, Part 2 *American National Standard for Portable Lithium Primary Cells and Batteries—Safety Standard* specifies tests and requirements for portable lithium primary cells and batteries to ensure their safe operation under normal use and reasonably foreseeable misuse.



“This latest edition of ANSI C18.3M, Part 2 takes into account United Nations recommendations on the transport of dangerous goods. It also includes a normative annex on lithium coin packaging

and markings, which will become effective within the next 18 months,” said Khaled Masri, NEMA program manager and the secretary of ANSI C18.

ANSI C18.3M, Part 2-2017 is available for \$99 in hard copy and as an electronic download on the NEMA website.

NEMA BWCP 1-2017 *Aluminum Conductors Used for Building Wire and Cable* describes the history of the discovery, application, and acceptance of the AA-8000 series of aluminum conductors for building wire and cable applications. This white paper is available for no cost as an electronic download on the NEMA website.

NEMA LSD 55-2017 *Outdoor Lighting and Human/Animal Factors: An Industry Evaluation* outlines industry concerns and opinions regarding the subject of light at night and outdoor electric lighting as related to humans, animals, energy conservation, and the environment. It is available for no cost as an electronic download on the NEMA website. 📄

Midwest Faces Challenges to Code Adoptions

Don Iverson

Midwest Field Representative, NEMA

Recognizing the importance of staying current with electrical safety, many states initiated their processes to adopt the next edition of the 2017 *National Electrical Code*® (NEC). Of the 17 states in the Midwest region, there are seven that have currently adopted the 2017 NEC and four others that are on track to adopt by the end of 2017 or early 2018.

Let's now focus on the current challenges and what is expected to come in 2018.

WISCONSIN

In January, the Department of Safety and Professional Services held several public hearings on the adoption of the 2017 NEC. During those hearings, the Wisconsin fire community, the local electrical industry, the National Fire Protection Association, and NEMA spoke against the

proposed arc-fault circuit interrupter and ground-fault circuit interrupter amendments. Since January, a local coalition of fire and electrical professionals has held press conferences and face-to-face meetings with the governor's office to explain the loss of electrical safety if Wisconsin approves the current amendments.

OHIO

Although Ohio has adopted the 2017 NEC for commercial structures with an effective date of November 1, 2017, the state has a separate adoption path for its residential code that covers one-, two-, and three-family dwellings. It is modeled after the International Code Council (ICC) format with amendments. The review process is conducted by the Ohio Residential Code Advisory Committee, which is likely to begin reviewing the electrical portion of the document early in 2018. 📄

Collaboration to Catch Criminal Imports

As part of the 2017 NEMA Strategic Initiative on Import Enforcement, interested Member companies had a rare opportunity in September to participate in a roundtable meeting with several federal government officials responsible for compliance of imported electrical products with United States laws and regulations. They learned about the tools and strategies being used to catch products that unlawfully infringe on intellectual property rights (IPR), such as copyrights and trademarks, or fail to meet federal standards for energy conservation.

Marjorie Ottenville, an international trade specialist with U.S. Customs and Border Protection (CBP), emphasized the importance of registration and recordation of trademarks and copyrights with CBP as well as collaboration on guides that assist inspectors in determining whether products are legitimate. CBP's online "e-Allegations" filing tool, supplemented by personal contacts, helps target and interdict possible violations hidden in the vast and growing

volume of express and mail shipments, in addition to container loads.

Other speakers included Robert Copyak, chief of the IPR policy branch in the Office of Trade at CBP; Christopher Robertson, chief of the CBP Commercial Targeting and Analysis Center; and Laura Barhydt, assistant general counsel for enforcement at DOE and her colleague Steven Goering.

There is no way for DOE to undo harm of noncompliant products, Ms. Barhydt said, noting that the agency wants to stop things from coming in first. DOE wants to target incoming shipments that may contain noncompliant products but needs to develop tools beyond the existing public compliance certification database.

NEMA Members stressed that any system must mitigate burdens on compliant importers. The agencies agreed, and according to Mr. Goering, industry participation in the development effort is very important. 🌐

Steve Wilcox









Director, Market Research, NEMA

BUSINESS ANALYTICS

Confidence in Electroindustry Business Expands

Current conditions in NEMA's Electroindustry Business Confidence Index (EBCI) improved for the second month in a row, with September's value edging up three points to 68.8. The higher score is attributable exclusively to sentiment shifting away from "unchanged." The share of panel members that reported "better" conditions climbed six points to 50 percent in September while the proportion that saw unchanged conditions was six percentage points fewer than in August. The segment of respondents noting "worse" conditions remained stable at 13 percent.

The reported intensity of change in electroindustry business conditions has shifted in a positive direction after several months of flat or even declining results. The median value now stands at 0.5, up from 0.0 last month, and the mean value is three-tenths of a point higher than last month at 0.4 in September. Panelists are asked to report

	Current Conditions (Compared to Previous Month)	Conditions Six Months from Now (Compared to Current Conditions)
EBCI	68.8 	75.0 
% Better	50% 	63% 
% Worse	13% 	13% 
% Unchanged	38% 	25% 

intensity of change on a scale ranging from -5 (deteriorated significantly) through 0 (unchanged) to +5 (improved significantly).

The future index's expansion in September was even more pronounced than its current conditions counterpart.

Visit www.nema.org/ebci for the complete September 2017 report. 🌐

YASKAWA

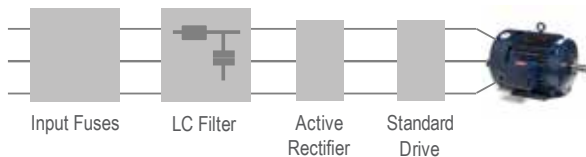
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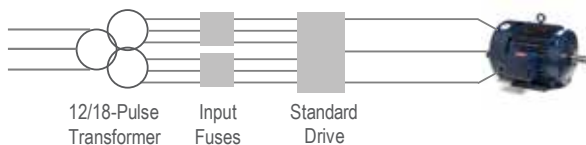
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12/18-PULSE SYSTEM



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