Inside:

- Resilience in Community Settings
- Industry-Wide Power Transformers Group Addresses Resiliency
- New Collaboration Effort Guides Direction of Grid 3.0
- Energy + Water Strengthens Both

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Mark your calendars now for NEMA’s 89th Annual Membership Meeting
November 5–6, 2015
Ritz Carlton, Washington, D.C.
www.nema.org/annual-meeting.

Nominate Electroindustry Leaders for Falk, Kite & Key Awards
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Across the street from NEMA’s headquarters in Rosslyn, Virginia, the internet was born. One of the most significant infrastructure achievements of the 20th century, ARPANET, was developed by the Department of Defense Advanced Research Projects Agency between 1970 and 1975 to facilitate communication among geographically dispersed military and university research computers. The core concepts developed for ARPANET became today’s internet, which has been the enabling technology for email, search engines, and, more recently, the management of increasingly networked and interconnected 21st century infrastructure systems.

Many NEMA member CEOs will tell you that customers are seeking more control, automation, and information from electrical products. No longer are building owners satisfied with whole-building energy statements—they want to view tenant- and system-specific submeter data in five-minute increments on a tablet. Homeowners want to control their thermostats and lights from their smartphones. Manufacturers want real-time diagnostic updates from their automation equipment to detect problems before they result in downtime. Electric utilities are using synchrophasors, advanced metering infrastructure, and other distribution automation technologies to optimize grid performance, reduce outages, and limit energy loss. Networked systems of sensors, controls, and information management systems are making transportation systems safer and less congested.

By 2020, some estimate that there will be more than 28 billion things connected to the internet, and many of those devices will be made by NEMA members. To prepare for this, we reorganized NEMA’s nine divisions into seven end-use-focused ones: Industrial Products and Systems, Lighting Products and Systems, Building and Transportation Systems, Commercial Products, Utility Products, Connected Systems, and the Medical Imaging and Technology Alliance. While the work of sections will proceed as it always has, this reorganization will allow NEMA to more nimbly seize emerging opportunities and address cross-cutting problems stemming from this industrywide transition toward a more connected future.

NEMA is also proactively exploring new activities through our Strategic Initiatives program, which will be discussed by the NEMA Board of Governors at its meeting this month. Proposals for 2016 include a continuation of our forward-thinking work on smart cities, as well as a new initiative on the Internet of Things. Beyond these initiatives, we are asking the Board to think more broadly about where it sees market forces—principally, but not exclusively, the convergence with the IT world—taking the industry in the coming five to ten years. These efforts should identify and capitalize on the vast industry knowledge resident in NEMA members to make the 21st century every bit as important to the electroindustry as was the twentieth.

Forty years after the birth of the internet across the street, we are looking forward. How we shape the future of electricity, transportation, water, buildings, and manufacturing is up to all of us. The opportunities are limited only by the creativity of NEMA’s current and future members.

Kevin J. Cosgriff
President and CEO
The architects of our Constitution recognized the inherent value of the United States Navy and Marine Corps. Article 1, Section 8, gives Congress the responsibility to “provide and maintain a Navy,” because our Founding Fathers knew that the nation needed a naval force to operate continuously in war and peace.

Today, that continuous operation requires us to be energy resilient. To fulfill our duty, the Department of the Navy (DoN) continuously looks to pursue new and better energy initiatives and form the partnerships necessary to execute them.

“Energy resilience” is a term that has gained significant popularity in recent years. A 2013 White House report describes a resilient energy grid as “one that is better able to sustain and recover from adverse events.” These events are anything that disrupts the flow of energy and normal operations, including equipment malfunctions, severe weather, and cyber or physical attacks. DoN focuses on strengthening our ability to endure these disruptions while maintaining critical operations and restoring normal operations as quickly as possible.

This focus was crystallized in 2009 when Secretary of the Navy Mabus set five aggressive energy goals to reduce our vulnerabilities and make us better warfighters. One of these goals is that by 2020, at least 50 percent of our shore-based energy requirements come from alternative sources. The secretary saw that renewable resources like solar, wind, and geothermal would enable more distributed generation and make our installations more self-sufficient and able to operate under extreme circumstances. It would increase our resilience.

The process to achieve the secretary’s goal and strengthen our energy infrastructure has three critical elements: technology, partnerships, and culture. With the right distribution network and equipment, an installation with a large photovoltaic array can detach itself from the commercial grid and generate the power needed to support critical operations within the fence line.

Installing a microgrid can enable a base commander to redirect power where it is needed most. A forward operating base optimizing energy management requires less power and can climb back to normal operating levels faster.

Energy is a critical component of successful mission accomplishment and the reason why we are changing how we factor it into acquisition, planning, and execution strategies.

To lead the department’s charge in building energy resilience, we stood up the Renewable Energy Program Office (REPO). Its mission is to work with Navy and Marine Corps leadership and the private sector to identify and execute cost-effective, installation-based renewable energy projects. Thanks in large part to REPO, we are on track to procure one gigawatt of renewable power by 2016. Examples include 17 megawatts at Marine Corps Base Camp Lejeune and more than 30 megawatts of rooftop solar on privatized Navy housing in San Diego.

In addition to producing energy better, we are also investing in how we store and use our power. Recently, Alstom, a leading smart grid company, and Pennsylvania State University signed a memorandum of understanding to establish a microgrid research center inside the fence line of the Navy Yard in Philadelphia. This collaboration will help advance the microgrid systems, which naval installations are installing, to build energy resilience.

Technology and equipment will not be enough. We need to focus on culture so that commanders and mission planners are including energy use and transport in their tactics and strategies. During the recent Operational Reach 2015 war game at Marine Corps Base Quantico, Marine Corps and Navy personnel identified energy-based tactics and tested new operational concepts. Participants took a hard look at using next-generation, more energy-intensive platforms and systems that bring their own set of logistical risks and obstacles.

The Navy and Marine Corps mission is to ensure stability, deter potential adversaries, and present options in times of crisis. Energy is a critical component of successful mission accomplishment and the reason why we are changing how we factor it into acquisition, planning, and execution strategies. It is why we are putting greater emphasis on increasing efficiency and diversifying supply. And it is the primary driver behind our growing partnerships to increase energy resilience at our installations and enhance our energy security.

Dennis McGinn, Assistant Secretary of the Navy, Energy, Installations and Environment

Energy Resilience is a Military Necessity
For the third year in a row, members of the NEMA High-Performance Buildings Council celebrated Congressional High-Performance Buildings Week by meeting with members of the House of Representatives on May 27 to discuss the need for legislation to promote energy efficiency in homes, commercial buildings, and the federal government.

NEMA representatives met with 16 office staffs to discuss tax reform, energy savings performance contracts, and accounting for energy efficiency in the appraised value of homes. They encouraged offices to join the High-Performance Buildings Congressional Caucus, which was founded nearly a decade ago to heighten awareness and inform policymakers about the major aspects of building performance, including energy use, health, safety, occupant productivity, resilience, and sustainability.

Pictured in front of the Capitol are (from the left) Stephanie Byrd, Schneider Electric; Russ Smith, Lutron; Paul Townsend, Lutron; Patrick Hughes, NEMA; Steve Rood, Legrand; and Joseph Eaves, NEMA.

In early June, the House of Representatives took up trade legislation of importance for the electroindustry, but as of press time its work was not yet complete.

On June 11 the House approved (397-32) an amended version of the Senate-passed Trade Preferences Extension Act, which contains a renewal of the Generalized System of Preferences (GSP) program. GSP facilitates duty-free importation of manufacturing inputs from developing countries. Once voted on again by the Senate, the act would reauthorize the program retroactively to July 2013 and forward to the end of 2017, allowing a 180-day period for importers to apply for refunds on duties paid over the past two years.

On June 12, the House approved (240-190) the Trade Facilitation and Trade Enforcement Act. This legislation authorizes and reforms the trade facilitation functions of U.S. Customs and Border Protection (CBP), including two NEMA priorities: implementation of the “single window” concept for trade compliance filings and provisions to combat importation of counterfeit goods. On the latter, the bill requires CBP to share images and allows CBP to share samples of imports the agency has detained based on suspicion that the goods violate intellectual property rights of U.S. companies. The Senate and House bills agree on NEMA’s priority items, but differ on other provisions that must be resolved through negotiations and another vote on a compromise bill.

On the same day, however, the House failed to approve one-half of the trade act that contains the NEMA-supported Bipartisan Trade Priorities and Accountability Act (TPA-2015). The TPA-2015 portion of the act, a NEMA priority that is necessary to strike and approve market-opening trade agreements, received bipartisan support. Unfortunately, the entire measure remains delayed pending a vote this month on a Labor Department program on worker retraining.

He was joined by Sen. Dan Sullivan (R-AK); Dan McGroarty, American Minerals Policy Network; Jean-Sébastien Jacques, Rio Tinto; and Sandy Montalbano, Reshoring Initiative.

NEMA President and CEO Kevin J. Cosgriff participated in a panel at a June 4 event held at the U.S. Chamber of Commerce to highlight the links between U.S. federal mining and minerals policy and the competitiveness of U.S. manufacturers.

“The importance of minerals to products and the minerals’ availability risks are why our companies always keep a weather eye on their supply sources, especially those that are essential to their products’ performance and their competitive success,” Mr. Cosgriff said.
In 2014, the Department of Justice estimated losses caused by economic espionage, including trade-secret theft through cyber-assaults and other illegal activity abroad, costs the American economy tens or even hundreds of billions of dollars annually. Fortunately, the U.S. International Trade Commission (ITC) signaled that American companies have a new weapon in the fight against trade-secret theft, even when it occurs outside the United States.

Broadly, trade secrets are defined as: (1) information; (2) that gives the holder an economic benefit because such information is not publicly known; and (3) which is subject to reasonable efforts to maintain its secrecy, often through confidentiality agreements or strict access controls. Examples of trade secrets can include manufacturing techniques, lists of industry customers, or even the Coca Cola formula.

Trade secrets are typically the product of substantial investment in research and development. Trade-secret theft can destroy the competitive advantages gained through those efforts. Particularly concerning is growing trade-secret theft originating in China. Reuters reports that since 2010, Chinese companies and individuals have been the perpetrators of “far more [trade-secret theft cases] than any other country.” The Office of the U.S. Trade Representative reports this may be due to Chinese authorities that do not view trade-secret thefts “as serious violations of the law.”

Amsted licensed its trade-secret technology, pursuant to confidentiality agreements, to a Chinese manufacturer to make products for Amsted. A competitor, TianRui Group, hired nine employees away from Amsted’s Chinese manufacturer and, through those employees, stole Amsted’s trade secrets. The ITC found TianRui had misappropriated Amsted’s trade secrets and banned importation into the U.S. of TianRui’s competing products.

The Federal Circuit upheld the ITC’s decision on appeal. The court determined for the first time that the ITC has the power to enforce extraterritorial violations of U.S. trade-secret protections as “unfair methods of competition.” The decision is significant because it extends the reach of Section 337 to include purely foreign conduct as the basis for an import ban.

The TianRui decision now provides U.S. manufacturers with the power to protect their trade secrets from theft abroad. Many manufacturers outsource production to foreign countries and previously could only rely on the trade-secret and intellectual property protections available in those foreign countries. Now, manufacturers have a new weapon to combat unfair competition and trade-secret theft abroad without having to enter a foreign court. In the ITC, U.S. companies can protect their investments in a fast, cost-effective form of litigation designed specifically to confront the realities of our global economy.

Mr. Abate and Mr. deLacy litigate patent, trade secret, and other intellectual property infringement cases in the courts and the ITC.
The Internet of Things (IoT) is our time’s industrial revolution. At least, that is the news from pundits and research firms. Pick any source and the numbers are staggering. IDC forecasts the worldwide IoT market will grow from $655.8 billion (10.3 billion endpoints) in 2014 to $1.7 trillion (29.5 billion endpoints) in 2020.1 That is many devices, dollars, and cents. What’s lacking is a clear sense of what is being talked about.

The term “IoT” is so ubiquitous that it is unlikely to be replaced by another marketing term, yet that phrase does little to describe what the internet of things is, what it does, and what purpose it serves.

WHAT IT IS
A thing in the Internet of Things has three parts:

- The physical object
- Smarts—a permutation of sensors, processors, data, controls, software
- Connectivity—antennae, communication ports, and the ability to play in the network stack

The Internet of Things is the network of these items.

WHAT IT DOES
The combination of the object, smarts, and connectivity alone does not provide much value. The data that is generated and the ability to act upon that data in increasing levels of automation is why the IoT is important. The operation of the things can be described in six levels of intelligence, which correspond to increasingly greater sophistication and value. See table 1.

ITS PURPOSE
Levels 4 and 5 are connected systems, where the third part of the thing (i.e., connectivity) in the IoT becomes necessary and where attention is needed. Devices are and will be communicating with other devices—with which they previously did not need to communicate and in ways that were never possible or necessary. Thus, manufacturers must work in a collaborative way toward open architectures because no one company or industry will be able to restrict customers to one supplier.

Connectivity constitutes a design element in production and operation, just like materials. Manufacturing with connectivity reshapes the capabilities of the thing and the revenue stream it can provide by allowing it to do more than its primary function. It also allows the manufacturer to do more than produce; it can provide analytics and services as well.

The purpose IoT is for products, and our world, to be increasingly efficient, effective, safe, reliable, and useful by existing—not on its own—but in a connected system.

Mr. Franks (ryan.franks@nema.org) coordinates NEMA’s efforts in the energy storage and microgrid industries. As an engineer, he performed private intellectual property analysis.

Table 1. Levels of Intelligence

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Manual operation</td>
<td>No observability, no controllability. The thing has no awareness of its own operating state and all monitoring, control, and actuation are external. Any signaling that requires direct human presence is Level 0.</td>
</tr>
<tr>
<td>1</td>
<td>Electronic digital communications</td>
<td>Local state awareness with remote reporting capability and/or remote actuation. The ability to signal/transmit beyond the physical boundary of the thing is Level 1. The reporting must be able to be passed via electronic digital communications to another device. Level 1 devices increase observability of the system but all status verification and decision making are executed via a means external to the device itself.</td>
</tr>
<tr>
<td>2</td>
<td>Self-actuation, basic automation</td>
<td>Local control. Local measurements are used by the thing for its own actuation. Simple, closed-loop controllers are examples of devices of Level 2.</td>
</tr>
<tr>
<td>3</td>
<td>Self-optimization, adaptive behavior</td>
<td>Awareness of a desired operating state. The thing will pursue actions in order to adjust its performance with respect to that state. Independent local decision making characterizes this level as the thing reconfigures itself in order to obtain its optimal performance parameters.</td>
</tr>
<tr>
<td>4</td>
<td>Collaboration</td>
<td>Hierarchical operating states and networked intelligence. Beyond self-optimization, the sphere of influence at this level involves two or more things functioning jointly in order to obtain a desired system state. A key function in terms of interoperability at this level is a “common semantic framework.”</td>
</tr>
<tr>
<td>5</td>
<td>Prediction and plan development</td>
<td>Automated analysis. Operational goals and plans to achieve them are generated by a network of things. This includes any system-wide application of advanced control technologies, including algorithms that will analyze, diagnose, and predict conditions and take appropriate actions to adapt to a state.</td>
</tr>
</tbody>
</table>

1 blogs.wsj.com/cio/2015/06/02/internet-of-things-market-to-reach-1-7-trillion-by-2020-idc
Every community in the United States faces the risk of natural, human-caused, or technological hazards. While most hazards do not rise to the level of extreme events, natural hazards often inflict significant economic losses and disruption to lives and commerce due to damage to buildings and infrastructure systems.

Our infrastructure and buildings have dependencies that affect the time required to recover from a disruptive event. Buildings and infrastructure systems, such as water, wastewater, and communications, rely on electric power to function. Dependencies among the transportation systems, liquid fuels, and the electrical power grid can affect the rate at which power is restored following an outage. Identifying and understanding the importance of social and economic functions and the dependencies that exist among the social functions and buildings and infrastructure systems allows for proper planning and implementation of practices or improvements that lead to greater resilience.

To address this problem, the National Institute of Standards and Technology (NIST) developed a Community Resilience Program. The first major deliverable under this program, the Community Resilience Planning Guide for Buildings and Infrastructure Systems (Guide), was released as a draft for public comment on April 27, 2015. The Guide benefits from input from a broad range of stakeholders and experts, including the NIST Disaster Resilience Fellows and participants in a series of workshops that informed the development of the Guide. The final document will be released around September 2015. The Guide is intended for implementation by communities with local government as the logical convener of the relevant stakeholders, from individual community members and organizations to building owners, utility owners and operators, business and industry, and state and federal government agencies. It recognizes that no one entity can address resilience by itself. The Guide lays out a practical approach based on the principle that by establishing a shared set of goals aiming to maintain—or quickly restore—important social and economic functions, communities can plan and undertake improvements in the ways buildings and infrastructure systems are built, maintained, and operated so that resilience improves over time.

Long-term planning and implementation of measures to improve resilience can often support community goals, such as providing an attractive, vibrant place to live and a reliable environment for businesses to locate. A resilient community can also provide day-to-day community benefits by reducing daily disruptions through improved planning, design, and construction practices. If an extreme event occurs, the extent of disruption and recovery time is reduced with pre-event planning for recovery. Communities with well-developed resilience plans can use the recovery from a hazard event as an opportunity to improve the performance of community functions after recovery—to build back better.

The Guide helps communities prioritize improvements to buildings and infrastructure systems based on their role in supporting social and economic functions during recovery, and addresses dependencies and cascading effects of system failures. By being a part of the planning process, electric utilities can evaluate and propose cost-effective solutions that may include operational (e.g., mutual aid agreements) and engineering options (e.g., automated switching, undergrounding) to achieve shared community and utility goals.

Step-by-Step Guidance

The Guide is organized into two volumes. Volume 1 contains the methodology for developing a community resilience plan and includes a worked example for resilience planning in a fictional town. Volume 2 serves as a resource document and provides guidance on characterizing the social environment, addressing dependencies and cascading effects, and buildings and individual infrastructure systems.

The Guide methodology has six steps:

1. **Form a collaborative planning team.** Leadership is needed to promote and integrate coordination and outreach activities and should come from within the local government. The planning team may include representatives from local departments, such as community development, public works, human service, and building departments; county, state, or federal government agencies with buildings or infrastructure in the region;
public and private owners and operators of buildings and infrastructure systems; local business and industry; individual community members, community organizations; and any other significant community groups.

2 **Understand the situation.** Resilience planning must begin with an understanding of the individual's community's social systems and the extent of disruption that can be tolerated before there are detrimental effects. An understanding of the social dimensions addresses the needs of individuals and the social institutions that meet those needs, including government, business, industry, financial institutions, health, education, community service organizations, religious and cultural belief groups, and the media. Once the social dimensions are characterized, it is then important to characterize the built environment by identifying the key attributes and dependencies for buildings and infrastructure systems, as well as how they are linked to the social institutions.

Considering these linkages aids communities in grouping or clustering, buildings and infrastructure systems into subsets that support common functions.

3 **Determine goals and objectives.** Long-term community goals guide plans to strengthen resilience, including prioritization of resilience activities. Performance goals for the built environment are based on times to recovery of function and are established at two levels: desired performance as a long-term goal and anticipated (likely) performance for existing systems.

The desired performance goals should consider the social needs of the community and consider the functions that buildings and infrastructure systems need to provide, as well as dependencies between systems or cascading effects caused by failures. Desired performance goals are set independently of prevailing hazards because they are driven by social needs, not by a hazard event.

Once performance goals are set, prevailing hazards and the effects of changing conditions, such as sea-level rise or drought, are identified. Then, the anticipated (likely) performance of each group, or cluster, of buildings and infrastructure systems is evaluated in terms of its expected time to recovery of function.

The Guide recommends that the performance of the built environment be evaluated at three levels for each hazard (i.e., routine, expected, and extreme levels) to help communities understand performance across a range of hazard levels. Understanding how the built environment will perform and understand performance across a range of hazard levels (i.e., routine, expected, and extreme levels) to help communities.

The Guide recommends that the performance of the built environment be evaluated at three levels for each hazard (i.e., routine, expected, and extreme levels) to help communities understand performance across a range of hazard levels. Understanding how the built environment will perform and understand performance across a range of hazard levels (i.e., routine, expected, and extreme levels) to help communities.

4 **Plan development.** Initially, a comparison is made of the desired and anticipated performance of the built environment to identify gaps in performance. Then, these performance gaps are prioritized according to community goals, and possible solutions are identified. There may be multiple solutions or stages to achieve desired performance, including temporary or short-term solutions to meet immediate needs, as well as long-term, permanent solutions. These solutions can then be prioritized, based on meeting the desired performance goals established in the previous step.

5 **Plan preparation, review and approval.** A resilience plan that documents the community goals, desired performance goals, anticipated (likely) performance prevailing hazards, and short- and long-term implementation strategies and solutions are prepared and shared for review and comment with stakeholders and their organizations, as well as with community members. The review process will differ from community to community. After review, the plan is finalized and adopted by the community.

6 **Plan implementation and maintenance.** The community then executes the administrative, operational, and construction solutions in the approved plan. It will be important for the community to evaluate the plan on a periodic basis, and to update as needed. Updates may include modification of the short- or long-term implementation strategies.

**Flexibility is Key**

The Guide does not specify technologies or measures that can or should be implemented but allows for selection of solutions that fit the goals and available resources of the community. It is intended to be flexible, so that it may be applied to communities of varying sizes, complexity, and available resources and allows for the application of innovative technical solutions to address resilience gaps.

The Guide is one element of a larger NIST program to provide guidance and tools to improve the resilience of local communities. NIST plans to convene a stakeholder group, called the Disaster Resilience Standards Panel, to inform future versions of the Guide and the implementation guidelines.

NIST’s work also involves development of tools to measure resilience at the community-scale and to support decisions on measures to improve resilience. These efforts are supported by a multi-institution Center of Excellence, led by Colorado State University. The new NIST-funded center will develop modeling approaches and data architectures needed to develop and validate tools that can be widely used to measure community resilience. Mr. Cauffman manages the Community Resilience Program within the Engineering Laboratory at NIST.

Eyeing the Storm: Past and Future

The Atlantic hurricane season is June to November, with the peak season from mid-August to late October. On average there are six hurricanes, three of which are categorized as "major," each year. History provides important examples of the potentially dangerous impact hurricanes can have and the need to be prepared.

The deadliest hurricane in U.S. history, referred to as the "Great Galveston Hurricane," struck Texas in 1900 and resulted in an estimated 11,000 deaths.

Since 1851, the top three states for hurricane landfalls are Florida (114), Texas (63) and Louisiana (54), according to data from the Atlantic Oceanographic and Meteorological Laboratory in Miami.

Hurricane Sandy caused 8.5 million power outages across 21 states, the highest outage total ever.

23 days after Hurricane Katrina local utilities had power restored to only three-quarters of their customers.

11,000 deaths
231 hurricane landfalls in top 3 states (since 1851)
8.5 million power outages
3/4 had power restored

ESFI offers these safety tips to help you:

Prepare
- Unplug your appliances and power cords from outlets to protect them from power surges.
- If you plan to use a portable generator, ESFI recommends a licensed electrician install it to ensure it will operate safely.
- Test your home's carbon monoxide detectors and smoke alarms to ensure they're functioning.

Weather
- Stay indoors during the hurricane and away from windows and glass.
- Use flashlights as a source of light. Candles are a fire hazard.
- Never operate a generator inside your home or in other enclosed or partially-enclosed spaces, including the garage.
- Use a battery-operated radio to stay informed about important safety updates.

Recover
- If flood waters reached the level of electrical outlets, contact a licensed electrician before attempting to use electricity in the home.
- Prior to use, have a qualified service repair dealer determine what electrical equipment should be replaced and what can be reconditioned.
- Never touch a fallen power line or drive through standing water if a downed power line is nearby. Report downed lines to local authorities.

Additional severe weather safety information is available at www.esfi.org.
Our energy system is rapidly changing because of a need to make electricity generation cleaner and our use of it more efficient. This is leading to an increase in the operational efficiency of the building stock to reduce energy consumption.

At the same time, the integration of renewable energy, energy storage, and electric vehicles to the electric grid is adding new challenges. Buildings also include many systems that interact with each other and potentially with the grid. In an environment where so many components operate without complete knowledge of their environments, centralized control is very challenging.

Software applications—or “agents”—are designed to accomplish tasks independent from their environment and other agents. This local decision making and cooperation makes agents a natural fit for controlling complex distributed systems. However, deploying agents into control systems, including buildings-grid integration, requires software to meet strict requirements for security, resource utilization, and reliability. Transaction-based building controls offer a control systems platform that fulfills those security requirements, freeing developers from these problems and speeding up the time to deployment.

The U.S. Department of Energy’s (DOE’s) Building Technologies Office is supporting the development of a “transactional network” concept that enables energy, operational, and financial transactions between building systems (e.g., rooftop units) and the grid using agents that reside either on the equipment, on local building controllers, or in the Cloud.

Continued on page 12
Figure 1. Major Modules/Services of VOLTRON

The transactional network vision is delivered using a real-time, scalable reference platform that adapts to the needs of the changing energy system. This platform, called VOLTRON™, is an innovative distributed control and sensing software platform that supports modern control strategies, including agent-based and transaction-based controls. It enables mobile and stationary software agents to perform information gathering, processing, and control actions. It can also manage the connectivity of independent agents to monitor and control HVAC systems, electric vehicle charging, distributed energy, or entire building loads, leading to improved operational efficiency.

VOLTRON is a flexible and open platform that is not tied to a single application (e.g., demand response) or a single protocol (e.g., OpenADR). It is designed to be an overarching integration platform, bringing together vendors, users, and developers to enable rapid application development and testing. The major modules/services of VOLTRON, as shown in figure 1, provide the functionality needed to transport and receive agents, verify their authenticity, allow them to communicate within VOLTRON and between other platforms, and ensure that they do not exceed the host’s resources.1

1 More detailed description of the various components can be found at transactionalnetwork.pnnl.gov/volttron.stm.

Designed with Transactions in Mind

To address concerns regarding unauthorized access to or attacks on smart technologies, VOLTRON was designed with cybersecurity in mind. It includes security features such as memory protection, resource constraints and guarantees, authentication, authorization, and trust. For advanced diagnostic and control applications that require software to “move” between platforms, VOLTRON supports secure application transport, including code, configuration, and collected data.

VOLTRON supports a number of transaction-based control use cases, as described in the transaction-based building controls framework, Volume 1.2 Those use cases define essential components that would enable transactions in four broad categories: end-user services, energy market services, grid services, and societal services.

An example of VOLTRON end-user services for buildings and third-party service providers is operation and maintenance. This service is used to maintain, repair, replace and/or operate buildings and equipment within buildings, leading to enhancements in overall customer comfort and convenience.

An agent hosted on the VOLTTRON platform would monitor the condition of packaged rooftop air conditioners on small- and medium-sized commercial building, continuously providing monitoring and diagnostics. The results of the diagnostics can be sent to the third-party service provider who, based on the contract with the building owner, can dispatch service technicians when there is a need for a service.

The VOLTTRON platform can be used not only to share the condition of the unit, but also close the financial transaction in a fully automated way. An interoperability framework is one essential element to making transactional energy networks viable. This derives from the need to support a vibrant and growing ecosystem of vendor products and services that interoperate as an interacting network on a common basis, and that readily enable secure machine-to-machine connections with minimal effort for installation and maintenance.

VOLTTRON supports grid services as well. These are defined as energy and energy-related products, services, and rights that support enhanced grid planning, operations and metering within both centralized and decentralized structures of asset location and ownership. Grid services, such as peak-load shifting and ancillary services, help maintain grid reliability and resiliency, as well as aid in renewables integration by providing system flexibility.

An example of a grid service would be support to a customer who signs up for a critical peak pricing (CPP) tariff with a retail utility or a retail service provider. An agent hosted on the VOLTTRON platform can automate HVAC system responses when the utility declares a CPP day. The main goal of the building owner/operator is to minimize the electricity consumption during peak periods on a CPP day. A VOLTTRON agent can execute a set of control actions in a fully automated way, including pre-cooling the building in anticipation of the high price period, increasing the set points during the event period, and performing a post-event sequence to restore the building to normal operations.

DOE’s vision for transactive controls is to enable and promote the development of efficient, secure, and reliable transaction-based energy services, markets, and operations that integrate energy supply, demand, and related services to promote a diverse, reliable, cost effective, and sustainable domestic energy economy.

In this vision, the future energy model will include an open, interoperable, transaction-based system that facilitates physical transactions of energy, energy-related services and rights, and the financial settlements associated with these transactions.

A reference platform such as VOLTTRON is the key to achieving that vision.

Download VOLTTRON at https://github.com/volttron.

The authors are with Pacific Northwest National Laboratory participating in the DOE’s buildings-grid initiative advancing the ability of connected buildings and their equipment to interact for greater energy efficiency and grid services.

VOLTTRON Security

VOLTTRON uses a threat model approach for determining threats and vulnerabilities and how to reasonably reduce the attack surface and/or harm after a compromise. Initial versions (VOLTTRON 1.0 and 2.0) focused on:

- protecting the integrity of agent programming through cryptographic means
- protecting agents from using excessive system resources to prevent platform instability
- protecting agent configuration from manipulation
- securing communications between VOLTTRON platforms and external data sources
- securing communications between platform instances, including agent transfers

VOLTTRON 3.0, scheduled for release in September 2015, will improve agent trust and integrity, including agent message authentication, encryption, and full agent “containerization” or “sandboxing.” These features include:

- Linux operating systems to take advantage of built-in security features, such as powerful file system permissions, user management, Linux capabilities configuration, control groups, and a first-class firewall
- remote resource access utilizing the latest versions of TLS/SSL protocols with the largest key size available to both endpoints. Within VOLTTRON, OpenSSL is used for TLS/SSL encrypted links; the system’s OpenSSL libraries are kept as up-to-date as possible to prevent vulnerabilities such as HeartBleed
- remote ØMQ sockets using CurveZMQ elliptical curve encryption for multi-platform communication
- Linux control groups CPU and memory subsystems to limit excessive processor and memory usage
- platform control (Unix domain) socket utilizing a mixture of file permissions and access control lists to limit access to authorized users
- peer reviewed code for correctness and security
- signed and verified agent code and packages using RSA encryption with x.509 certificates; unsigned code is not executed unless explicitly allowed by the administrator
NEMA invited power transformer manufacturers—members and non-members—to attend a facilitated brainstorming session. Eight NEMA member companies and four non-NEMA companies attended the meeting.

The primary objectives of the NEMA Power Transformer Committee are to:

• identify issues in the power transformer industry that are important to NEMA members
• develop strategies and tactical plans to address those issues, and
• implement the plans within the budgets of the Transformer Section.

Focusing on Future of Power Transformers

For the purpose of this committee, a power transformer is defined to be a transformer greater than 36 kilo-Volt (kV) class and greater than or equal to 10 million volt amperes (MVA) at its base rating. The group noted that the scope should include both liquid filled and dry-type transformers.

Over the past decade, NEMA’s Transformer Section has largely focused on distribution transformer energy-efficiency standards. Distribution transformers are used on all electric distribution circuits to convert higher primary voltages (typically 12,000V, 19,900V, and 34,500V) down to lower voltages (such as 480V, 240V, and 120V) that are used in commercial and residential buildings as well as most industrial plants. The efficiency of these distribution transformers is regulated by the U.S. Department of Energy (DOE).

In 2012, NEMA very successfully negotiated with DOE, utilities, and energy-efficiency advocates efficiency levels that both provide huge energy savings and support the U.S. transformer industry. These new energy-efficiency regulations become effective on January 1, 2016.

With a brief respite in distribution transformer activities, the NEMA Transformer Section is putting more resources toward power transformers. Power transformers are used primarily by utilities and transmission companies to convert high transmission voltages (such as 230,000V and 500,000V) down to the distribution voltages that local utilities use. To better understand the issues of the power transformer industry, NEMA invited power transformer manufacturers—members and non-members—to attend a facilitated brainstorming session. Eight NEMA member companies and four non-NEMA companies attended the meeting.

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Industry-Wide Power Transformers Group Addresses Resiliency

John Caskey, CEM, Assistant Vice President, Operations

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Some of the issues that brought the group together include:

- physical security issues such as the damage that occurred at the Metcalf substation in California
- long lead times required to manufacture large power transformers (LPTs)
- transportation issues including roadway permitting and transportation logistics
- increased frequency of severe storms such as Hurricane Katrina and Superstorm Sandy
- cybersecurity
- energy efficiency

These and many other issues were discussed. Following discussion, the committee selected four key issue areas to pursue, or continue to pursue:

1. RESILIENCY RELATED ACTIVITIES.

   This key area includes a wide range of resiliency and reliability concepts including but not limited to:

   - Inform Congress on the importance of large power transformers and the long process required to replace LPTs.
   - Work with DOE and the Edison Electric Institute on a LPT replacement/reserve program as well as transportation and supply chain issues.
   - Evaluate the concepts of a portable power transformer program to speed the replacement process.
   - Investigate the prospects of developing standards or guidelines around physical security to minimize the impact of attacks (e.g., the Metcalf substation) and/or standardized transformer designs to speed the manufacturing process.
   - Provide guidance and the potential impact of geomagnetic disturbances and other electromagnetic surges.

2. SMART GRID–RELATED ACTIVITIES. This key area covers topics such as:

   - How transformers can participate in smart grids or the Internet of Things (IoT)
   - How the adoption of more electronics, battery chargers, distributed generation, battery storage, etc., might change loading and harmonic content
   - The possibility that NEMA may develop a standard around the proper way to monitor the health of a transformer and what attributes to monitor.

3. EDUCATION/WORK FORCE DEVELOPMENT ISSUES. This area recognizes that many utilities and manufacturers will lose a large portion of their trained power engineers over the next few years. The industry needs to start now to:

   - Promote science, technology, engineering and mathematics (STEM) at the middle- and high school levels, and provide more trade school options that support the power industry.
   - Investigate the industry salary structure that may reward software and IT engineering more than electrical and power engineering.
   - Explore opportunities to work with governments and universities to make sure we have trained high-voltage power engineers.

4. FAILURES FROM SURGES. Reducing the number of electrical surges that power transformers are exposed to can help increase the transformers’ survival rate:

   - The industry may need to revise the definition that the IEEE uses for switching surges in IEEE C57.142.
   - The adoption of more solar and wind applications creates new issues for power transformers.
   - Additional data collection and analysis may be needed to understand the failure mechanisms and to design transformers that survive surges and other transients.

The committee cannot address all of the above issues at one time. The next step is to prioritize the above issue in terms of importance to the industry and probability for success. Then the committee will develop a work plan to guide the work of the committee over the next 18 months.

Mr. Caskey (john.caskey@nema.org) is the industry director for utility products at NEMA, a director of the Smart Grid Interoperability Panel, and a member of the U.S. DOE Appliance Standards and Rulemaking Federal Advisory Committee (ASRAC).
A large number of federal and industry groups have joined together to spearhead a national stakeholder engagement effort around Grid 3.0, the resilient, flexible, and highly-interactive grid of the future. The group aims to develop a roadmap of the critical activities needed at a national level in order to achieve a fully integrated, fully interoperable grid as well as the most efficient ways to perform the research and development needed to get there.

The U.S. Department of Energy, the National Institute of Standards and Technology, NEMA, the Electric Power Research Institute (EPRI), Smart Grid Interoperability Panel (SGIP), the GridWise Architecture Council, UCA International User’s Group, and the Institute of Electric and Electronic Engineers developed a two-stage approach for engaging stakeholders: host an Electricity Sector Issues Roundtable followed by an open workshop to address the issues identified at the roundtable.

The team hosted its roundtable in November 2014 and the subsequent workshop March 26 and 27. It identified several critical issues to address the Grid 3.0 vision in the areas of:

- reliability and resiliency
- distributed energy resource integration
- consumer behavior
  - skills and workforce development

Below is a more detailed look at each of these issues and paths forward.

### Stage One Outtakes

The collaboration hosted the Electricity Sector Issues Roundtable: Grid 3.0 and Beyond at the NIST campus in Gaithersburg, Maryland. This event brought together thought leaders from a variety of stakeholder categories including utilities, regulators, federal agencies, manufacturers, and researchers to discuss and align on the critical issues facing the electricity sector. Several critical issues were identified, including:

#### 1. The grid needs to become more reliable and resilient

- Utilities are responsible for reliability but with the increased deployment of distributed energy resources, they don’t necessarily own or control the assets. As new players become involved in the operation of the grid, there needs to be clear roles, responsibilities and accountabilities.

- Severe weather events are occurring more frequently than in the past and utilities need to harden the electricity infrastructure and adopt new technologies to make the grid more resilient.

#### 2. Changes need to be made to the electric utility regulatory framework and business model

- All of the costs and benefits of providing electricity service need to be identified and need to be reflected in the price of electricity.
• Clear roles, responsibilities and accountabilities are needed for all of the players in providing electricity service (both regulated and unregulated).

3. Distributed energy resources (DER) need to be optimally integrated into the grid

• The nation needs a grid with central, dispersed and dispatchable and non-dispatchable generation.
• There is a need for policy and regulatory guidelines to enable the effective integration of DER into the grid.
• There needs to be coordinated control and plug-and-play interoperability for distributed energy resources.

4. Consumer attitudes, preferences and behaviors for electricity service is changing

• Consumers have greater expectations for information.
• Consumers demand simplicity and control over their information.

5. Utility workforce needs are changing

• The skill sets are changing for utility workers; they need to know information technology and telecommunications as well as power.
• Everyone wants innovation but nobody wants to change. The culture within utilities needs to change to welcome innovation.

Stage Two Outtakes

The subsequent workshop to develop action plans around each of the issues identified at the roundtable was organized around six themes—Enabling New Entrants and Innovation, Impact of Technology and Flexible Resources, Enhancing Reliability and Resiliency, Enabling New and Evolving Markets, Architecting the Change, and Evolving Industry Structure.

Panel sessions were held for each theme. Several common needs for achieving Grid 3.0 emerged from the workshop, including:

• ubiquitous, low-cost, reliable, and resilient communications
• clearly defined common and stable (control) business, data management, communications, and physical systems architecture
• well-defined points of interoperability with built-in security
• reference designs (e.g., microgrid systems and distributed generation support systems)
• regulatory jurisdictional certainty with clear metrics
• education of the workforce
• broad, equitable collaboration model

At the conclusion of the workshop, the Grid 3.0 Leadership Committee (G3LC) agreed to develop a roadmap for addressing these common needs and identifying the desirable future states associated with each need.

On May 12, 2015, G3LC held a public webinar to present the findings from the workshop, the roadmapping process and the future states. The G3LC meets weekly to develop the Grid 3.0 roadmap. People who would like to get involved in the activity can:

• join the G3LC by sending an email to dvondoll@epri.com
• receive email updates activities and notification of webinars by adding their addresses to the Grid 3.0 Listserv at www.smartgridlistserv.org/cgi/wa.exe?SUBEDI=GRID3PT0&A=1
• sign up for the Grid 3.0 LinkedIn discussion group at www.linkedin.com/groups/Grid-30-8285190/about
• visit the Grid 3.0 SharePoint site at www.smartgridsharepoint.org/grid3pt0/

All working documents are posted to the SharePoint site.

Mr. Von Dollen is a leader in industry smart grid activities.

1 The presentations that were made during the panel sessions and video recordings of several sessions can be found at https://www.pointview.com/c/983.

2 Materials from the webinar can be found at: sgip.org/webinars (webinar section on the website); sgip.org/N5P/files/ClientLibrary/Files/0000000000174/May12_GRID3_webinar_final2.pdf (pdf of webinar); and https://attendee.gotowebinar.com/recording/4774913284070850561 (Recording of webinar)
Direct current (dc) electric power is an emerging disruptive technological area that has the potential to stimulate economic growth, inspire innovation, increase research and development opportunities, create jobs, and simultaneously advance environmental sustainability.

Its technology and applications offer the promise of enhanced energy efficiency, improved power quality and reliability, and inherent alignment with renewable and clean energy development.

Power of DC

Dc power is beginning to evolve toward replacing alternating current (ac) as a worldwide standard for electricity delivery infrastructure in many applications, based on nine reasons:

1. Dc power is significantly more energy efficient than ac power.
   - Dc motors and appliances have higher efficiency and power to size characteristics.
   - Dc-based lighting (for example, light-emitting diode, or LED, technology) is as much as 75 percent more efficient than incandescent lighting.
   - Greater efficiency resulting from recent developments in dc converter technology allows improvements in electricity delivery over long distances.

2. Dc is inherently compatible with renewable sources of energy such as solar and wind. Renewable sources generate power intermittently (i.e., when the sun shines or the wind blows), requiring storage (batteries) as part of the system in order to provide a reliable supply, and also require a power conversion interface to the grid. A photovoltaic (solar) system is inherently a dc energy supply (as are batteries), making dc a more naturally compatible interface.

3. Energy storage integration is enhanced. Energy storage is required to improve the capacity utilization of renewable energy supplies. Most energy storage technologies are dc-based (primarily in the form of battery technologies), creating opportunities for improved integration efficiencies and reduced operating losses.

4. Electronic equipment operates on dc power. There is a loss of five to 20 percent when ac power is converted to dc power. The increasing reliance on electronic equipment creates a greater need for dc power. Eliminating these conversion losses from ac to dc will become even more important, and will motivate a shift to dc power, and require advances in new power conversion technologies.

5. Dc and hybrid ac/dc microgrids are being developed. Microgrid applications can effectively integrate local power generation with the main power grid to effectively serve defined end-use loads; improve reliability, especially under disturbance event conditions; and create opportunities to buy and sell (net metering) power to minimize energy costs to the consumer.

6. The technology needed to gain the advantages of dc power in data centers, homes, and communities is making significant advances.
   - Dc power is already in use at the “bottom of the pyramid,” for example in rural India and China, because the national (ac) power grid does not reach there. Four states in India are experimenting with providing dc power to homes; a 2014 initiative was created and led by a partner in the Business of Humanity® project, with the financial support of the Central Government in India.
   - The most significant new consumers of electric power today are the companies (Google, Apple, Visa, etc.) at the “apex of the pyramid,” which operate computer data centers and server farms. They need dc power because electronics require dc power.
All of China’s new high voltage transmission is planned as HVDC, with dozens of systems already in operation and more than 20 new systems in planning stages. Europe is expanding and upgrading much of its transmission infrastructure with HVDC being a significant part of their plans, including interconnection of nations and continents.

HVDC transmission is cheaper than ac at a certain distance for power delivery, because of recently developed disruptive technologies involving power semiconductors. Other esoteric technical reasons (such as elimination of the “skin effect” that arises with ac) and reduced losses through advanced power converter designs motivate the shift to dc transmission. Moreover, the investment for HVDC transmission is less because the gauges (thickness) of the wires can be smaller, and because one less wire is required (two poles for dc vs. three-phases for ac).

Therefore, many of the major reasons why the world went with ac at the turn of the 20th century are no longer relevant. Today there are strong economic reasons and sustainability-related incentives to invest in dc infrastructure.

In China and Europe, new cities and villages are being envisioned that will be entirely dc powered. In green-field applications, from resource and delivery infrastructure to end-use applications, complete Dc system concepts and operation are being considered in many developing parts of the world. As we look to electrify more remote parts of the globe, there are many advantages to employing dc infrastructure.

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Dr. Reed, an associate professor of electric power engineering in the Swanson School’s Department of Electrical and Computer Engineering, is also the director and technical lead of the Grid Technologies Collaborative for the U.S. Department of Energy’s National Energy Technology Laboratory, and an inaugural member of the National Academies of Science and Engineering’s Energy Ambassador Program. He is the owner and principal consultant of Power Grid Technology Consulting, LLC.
In the past 18–24 months, numerous public and political statements have been made about the Energy-Water Nexus and its importance. But what is this “nexus”? Simply put, there is energy use embedded in the supply, gathering, and treatment of clean water and wastewater in the U.S. infrastructure; and there is water embedded in the generation and application of energy as well.

Where the two converge is their nexus—a crossing point that is poorly understood outside facilities management. More importantly, some view it as a strategic opportunity either for security or for business opportunities.

Out of Sight, Out of Mind

Most Americans have experienced a water-related traffic snarl. In larger cities this can be a weekly occurrence. Likewise, most are familiar with the post-WWII trends of urban sprawl and suburban growth, which included water infrastructure. Much of it remains in use today, slowly expanding and undergoing repairs as needed. Since the only way to see the infrastructure in most cases is to witness the trenching operations necessary to lay pipe and culverts, it is easy to lapse into an “out of sight, out of mind” frame of reference. This is all too common, and the result is that water facilities can be and often are in a state of poor repair when it comes to improvements and maintenance.
Tight city and municipal budgets leave facility managers unable to undertake elective maintenance upgrades while privatized utilities can find themselves at the mercy of shortsighted shareholders who do not favor investments in efficiency. All this is converging in a less-visible version of recent years’ attention on aging bridges and dams—though both typically involve water! This time the problem is underground and easier to miss.

Only in areas where water is becoming increasingly scarce as a result of environmental events, such as the ongoing California drought, are we beginning to see public campaigns that might begin to incentivize and promote water-energy efficiency efforts. Otherwise, water management regulations and laws focus on low-water usage appliances, or situations involving lawn sprinkler system repair and design.

As energy efficiency gains increasingly more attention on national and local fronts, often enabled and assisted by NEMA member products, it has been beneficial for companies to open business arms related to efficiency, or for new efficiency-minded business to be founded. The prime example of this is the Energy Service Company (ESCO) model where business is generated in servicing, improving, and monitoring a building or facility or municipal power grid.

A favored vehicle to undertake capital improvements such as these is through an Energy Savings Performance Contract (ESPC) whereby the business performs retrofitting and improvements for no charge, and in turn is awarded a percentage of the operating funds saved by the facility owner post-completion over some period of years. Many NEMA members function as ESCOs in the energy sector, selling contracts for energy-efficiency upgrades and services. This contrasts with the current unavailability of ESCO opportunities for energy embedded in the water supply, or for water savings through efficiency improvements.

**Water and Electricity Do Mix**

A substantial amount of water is embedded in the production of electricity. Nuclear cooling towers are an excellent visual example; they assist in cooling water used during the steam generation cycle.

Every power generation method, save wind, relies on water. Even solar uses water to clean the panels. Interestingly enough, “clean coal” power plants use the most water of any generation process. Hydroelectric power generation is 100 percent water-driven, obviously, but this water is not consumed so it is not an equal comparison.

It costs money to source, deliver, gather, and treat water, but currently this is a facility-specific challenge and most facility owners and managers receive little to no incentive or assistance to perform upgrades beyond expansion and leak stoppage and mitigation.

NEMA can change this, assisted by a coalition of like-minded organizations who provide more efficient products, monitoring and control services, certification services, or water efficiency guidance. We are undertaking an examination of the embedded energy in the water supply and where energy and water are both consumed in the process.

This information will be analyzed for identification of opportunities for improvements in these processes and estimates of what the potential yields will be. These findings will be built into a tool that can identify potential improvements in a given facility by type, water source, and throughput. In turn, this information can either be used to generate interest in an ESCO approach or used by individual facilities to justify and encourage private improvements.

NEMA will dedicate the remainder of 2015 to gathering data and building relationships. In 2016, we will begin transitioning into a marketing and action stance that includes:

- publishing findings
- establishing a foundation for ESPC activity in the water sector
- encouraging private facility upgrades using the tools, techniques, and products identified in our analyses.

Making the Energy-Water Nexus a strategic reality begins with these tactical pursuits.

Mr. Boesenberg (alex.boesenberg@nema.org) has two decades of experience in applied systems engineering practices.
The types of loads we connect to a building’s electrical system today vary greatly from what may have been connected 50 years ago. Today’s buildings rely heavily on electronics, communications, and microprocessors for some of the most basic functions. These include electronic controls built into a compact fluorescent or LED (light-emitting diode) light bulb, as well as sophisticated building control and automation systems. Automated systems are incorporated in a building’s emergency system as well.

This increased use of electronics demands an electrical infrastructure that takes into account the increased sensitivity of electronic loads to voltage transients that can enter the electrical system. These transients can enter through external sources such as lightning and other electrical faults occurring outside the building, as well as through the routine switching of loads inside the building that occur as part of normal operations.

Emergency Systems

A new section requiring surge protection has been added to the National Electrical Code® (NEC) 700.8; Article 700 covers emergency systems. These systems cover illumination and power for essential equipment such as emergency lighting for egress. Emergency systems cover safety for human life where legally required by municipalities, state agencies, federal agencies, or local governments having jurisdiction.

A distinction is drawn between Articles 700 and 708 Critical Operations Power Systems in that Article 708 requires systems to be continuously operated throughout an emergency. The new addition to Article 700 is 700.8 Surge Protection, which states: “A listed SPD shall be installed in or on all emergency systems switchboards and panelboards.”

The intent of the new requirement is to illustrate the need for continued surge protection throughout emergency power distribution when critical power is required. Too often surge protection is installed at the service entrance only, with little regard for the critical requirements of life safety systems. It does not promote effective egress when the emergency system does not function due to damage from a transient event.

The addition of surge protection to NEC 700.8 addresses this issue by installing surge protection throughout the emergency power distribution network, thus eliminating the chance for the emergency system to be made inoperable by a surge event that did not come directly through the service entrance conductors.

Additional equipment covered under this section may include:

- automatic transfer switches
- emergency warning systems
- emergency communications systems
- public egress / evacuation sites
- egress illumination
- fire alarm systems
- remote operated doors
- smoke alarms and detectors
- high-rise elevators
- fuel cell power systems
- UPS systems

Missing Guidance

What the code does not include is guidance on what size and type of surge protection must be used. What are appropriate guidelines in setting the correct levels of surge protection to address this new code requirement?

Article 700.8 does not state a surge current rating for the SPD, nor are there any size recommendations provided elsewhere in the NEC.

Guidance is provided, however, in NFPA 780. This standard covers lightning protection systems (LPS) and requires that surge protection be installed as an integral part of the LPS system.

NFPA 780 STATES:

"4.18.2 Surge Protection Requirements

Surge protection devices are intended to be installed ahead of the service entrance equipment and other incoming wiring to limit transient voltage by discharging or bypassing transient currents to ground. ... A fault can occur by lightning directly striking a phase conductor or striking a nearby-grounded object, such as a transmission shield wire or tower."
“4.18.3.1.1 Surge Threat Levels

SPDs at the service entrance shall have a nominal discharge current (In) rating of at least 20 kA 8/20 μs per phase.”

Guidance can be taken from the lightning protection standard as it gives a minimum recommendation of 20 kA (In).

When dealing with critical power, it is best to cover all protection modes. IEEE establishes this practice in Standard 1100 Powering and Grounding of Electronic Equipment.

SECTION 8.6.3 STATES:

“In addition to SPDs installed in the service entrance equipment, it is recommended that additional SPDs of listed Category B or Category A, as specified in IEEE Std C62.41, be applied to downstream electrical switchboards and panelboards, and panelboards on the secondary of separately derived systems if they support communications, ITE, signaling, television, or other form of electronic load equipment.”

SPDs are very effective in mitigating transient overvoltages thus preventing equipment damage or malfunctions caused by excessive voltage being driven into equipment from switching, direct or indirect lightning strikes, or high voltage power lines crossing into low voltage power lines. Any of these events can cause the system voltage to abruptly spike.

The nature of a transient event is a very short, fast event, generally in the 5 to 200 microsecond range. This momentary increase in voltage may create a permanent conductive path resulting in an electrical component’s destruction.

For emergency system installations, this is not acceptable. These systems must have reliable power. An unwanted transient overvoltage should not be allowed to cause an emergency power system to become inoperable. That is why the cascade approach for surge protection is recommended.

The cascade approach is simply layering SPDs throughout the electrical system, starting at the service entrance and including the downstream panelboards. The key is to identify where electrical equipment is used, and install SPDs in those distribution panels. SPDs used at the service entrance should have a nominal discharge current rating of 20 kA and the distribution panels should have a nominal discharge current rating of 10 kA or 20 kA.

When an SPD is selected, the maximum continuous operating voltage (MCOV) becomes an important consideration in addition to the nominal discharge current rating (kA). When the MCOV exceeds the line voltage with an excessive level, the SPD will allow low-amplitude transients to pass through into the equipment.

If the SPD is selected with an MCOV that is too low, or too close to the operating voltage, the SPD may turn on for events that are not transients but are fluctuations in the normal power system. This operation would result in an untimely end of life for the SPD. The end of life is caused by the SPD attempting to become a voltage regulator for the power system. When this happens the SPD will not last as intended due to its operation (conducting rated fault current) when the normal power system voltage is within predictable tolerances, i.e., the SPD is not operating on transients but is operating on power system swells.

Normal tolerances for SPDs are up to 15 percent above the nominal incoming voltage. The SPD must be installed with appropriate voltage and surge current ratings. The SPD needs to be able to handle the voltage tolerance of the power system and be able to withstand the surge current expected at that location in the power distribution system.

**Keeping Emergency Systems Safe**

The 2014 edition of the NEC is now in effect in nearly half the states and continues to be adopted nationwide over the next few years. Each state has its own adoption policy for the inclusion of updates to it. The inclusion of multiple levels of surge protection will be a great improvement to keeping the emergency system operational at all times. These changes are important for consulting and specifying engineers to incorporate into their specifications now.

Ms. Haa, Mr. Mossop, and Mr. Rood are members of a task force within the Industry Development Committee of the Low Voltage Surge Protective Devices Section.
Nominate Electroindustry Leaders for Falk, Kite & Key Awards

Mark your calendars now for NEMA’s 89th Annual Membership Meeting, November 5–6, 2015, at the Ritz Carlton in Washington, D.C. Stay up-to-date at www.nema.org/annual-meeting.

BERNARD H. FALK AWARD
We are soliciting nominations for the Bernard H. Falk Award, NEMA’s highest honor that recognizes individuals for outstanding contributions to the electroindustry. The winner will be honored Friday, November 6.

Award criteria:
- A recognized leader within and beyond his/her field
- Outstanding achievement in technology, management, marketing, international trade, education, medicine, public affairs, or any other field important to the electroindustry
- Past interaction or connection to the NEMA mission
- Presence in person at the annual meeting to receive the award

Nominations should include examples of how the individual meets the above principles in 500 words or less. Email submissions by Friday, July 31, to Vi Lilly at Vi.Lilly@nema.org.

KITE & KEY AWARD
Nominations are also sought for the 28th annual Kite & Key Awards. This award shows the industry’s appreciation for individuals who have advanced its interests through steadfast and active association involvement. The winners will be recognized on Friday, November 6.

Nominations should include the individual’s accomplishments in the electrical and medical imaging equipment manufacturers industries in 500 words or less. Email submissions by Tuesday, September 1, to Vi Lilly at Vi.Lilly@nema.org.

Vi Lilly, Senior Director of Member Services and Value | vi.lilly@nema.org

When incomplete isn’t enough.

IDEA’s Data Certification Program guides manufacturers in providing trading partners the product and pricing data necessary for business. Compliant data ensures that product information is complete, so you don’t have to worry about missing the things that matter.

For more information on IDEA’s Data Certification Program, please contact IDEA or visit: www.idea4industry.com

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Drewbo
Longtime Honeywell Fire Safety representative Isaac Papier received a plaque for his lifetime contribution to the NEMA Fire, Life Safety, Security and Emergency Communication Section from Andrew Berezowski, committee chair, at his final in-person industry meeting in May. Photo by Dan Finnegan, Siemens Industry, Inc.

The Electrical Safety Foundation International (ESFI) warns consumers to be aware of electrical dangers associated with severe weather during the summer months. Lightning strikes, power outages, and storm-induced electrical hazards such as flooding and downed power lines often cause deaths and injuries during this otherwise carefree time of year.

The Industry Data Exchange Association, Inc. (IDEA) announced that 25 percent of the items in the Industry Data Warehouse (IDW) are compliant within IDEA’s Data Certification Program.

ESFI is providing new and updated resources about how help prevent electrically-related deaths, injuries, and property loss by taking a few precautions during and after severe storms and other natural disasters.

Visit ESFI’s newly redesigned website (www.esfi.org) to learn more.

Julie Chavanne, Communications Director, ESFI | julie.chavanne@esfi.org

The Industry Data Exchange Association, Inc. (IDEA) announced that 25 percent of the items in the Industry Data Warehouse (IDW) are compliant within IDEA’s Data Certification Program.

IDW has seen growth from a baseline of 0.66 percent, or 16,000, compliant eligible items in early February to 600,000 compliant items today. Ten additional manufacturers have also reached 95 percent compliance or higher in the past month.

According to IDEA President and CEO Paul Molitor, “600,000 items in the IDW are fully attributed and ready for distributor web store catalogs. In addition, each of these items has 42 other fields of complete transactional data. This growing amount of rich manufacturer-supplied information will help distributors’ web commerce to become more competitive and profitable.”

IDEA’s Data Certification Program measures the item-level completeness and quality of data available within the IDW and focuses on product information distributors need to conduct business and sell manufacturers’ products (e.g., brand, packaging, product attributes, etc.). An item is compliant if its attributes and transactional data fields are fully populated.

More than 140 manufacturers have committed to achieving at least 95 percent compliance for their IDW items by October 1.

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ESFI is providing new and updated resources about how help prevent electrically-related deaths, injuries, and property loss by taking a few precautions during and after severe storms and other natural disasters.


ESFI Emphasizes Safety during Severe Weather

Visit ESFI’s newly redesigned website (www.esfi.org) to learn more.

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Recognizing the importance of staying current with electrical safety, many states initiated their processes to adopt the next edition of the National Electrical Code® (NEC). To date, 24 states adopted the 2014 NEC; many adoptions were a result of the electrical industry working together to advance electrical safety in each of those states. Of the 24, eleven are located in the Midwest. As the NEMA Midwest Field Representative, I would like to focus on changes that are in the works and what is yet to come in those states.

**OHIO**

**Ohio Commercial Code**
The Ohio Board of Building Standards (OBBS) is the state agency responsible for reviewing/adopting NEC in two separate tracks—commercial and residential (one-, two-, and three-family). A petition filed on behalf of the Ohio Electrical Code Coalition (OECC) resulted in OBBS initiating adoption processes for commercial, industrial, and residential occupancies excluding one-, two-, and three-family dwellings. On January 1, 2015, the state adopted the 2014 NEC for commercial structures. That adoption came about because OECC petitioned OBBS to begin the adoption process. This coalition was made up of representatives form IAEI, NFPA, UL, IEC, NECA, IBEW, NEMA and other associations. During the process there was very little if any pushback from the opposition.

**Residential Code Update**
Back in 2005, Ohio formed the Residential Code Advisory Committee (RCAC) to review the residential code. This was the result of homebuilders pushing the state for a statewide uniform residential code (which is good), but homebuilders have used it as a platform to delay adoption and amend a code that has already been vetted by panels of experts from the industry.

Unfortunately, the committee was heavily weighted in the homebuilders’ favor after it its formation. This has slowed the adoption process considerably and put electrical safety in jeopardy.

Over the last several months, however, the electrical industry has been actively engaging with members of RCAC in the process to advance electrical safety. During a meeting on May 28, 2015, RCAC members voted to move the next edition of the NEC as referenced in the residential code with amendments. OBBS will now review and begin the process towards adoption with an anticipated effective date in early 2016.

**MICHIGAN**
Currently the Department of Licensing and Regulatory Affairs, along with the Bureau of Construction Codes (BCC), is the state agency responsible for adoption of all building codes in the state. BCC has been engaged in the process of adopting Part 8 (commercial) of the Michigan Electrical Code Rules, Part 5 of Michigan Residential Code (MRC), and Part 10 Michigan Energy Code. The state is in the final stages of its process for adopting the 2014 NEC for commercial structures with an effective date of early June.

There are people in Michigan who believe that costs are more important than electrical safety. They have proposed removing arc-fault circuit interrupters (AFCIs) from the MRC entirely. This attack has led the state to consider eliminating the requirement for AFCIs in all one- and two-family dwellings. However, all multi-family structures, which fall under the commercial code, will have this advanced fire protection available.

Individual homeowners are the losers in this situation. Most don’t even know this is happening.

Don Iverson, NEMA Midwest Field Representative | don.iverson@nema.org

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**What the industry is saying:**

**Best Defense—Strong Codes**
Strong statewide codes are our first and best line of defense again natural disasters.

White Paper Reports Industry Warming up to Electric Resistance Heating

French Version also Available

Market Benefits of Electric Resistance Heat, a recently released white paper by NEMA’s Electric Resistance Heating Section, provides a concise overview of recent developments in the world of electric resistance heating (ERH). It includes a high-level exploration of the different types of electric heating options; a review of common attributes, including comfort, efficiency, and flexibility of use; and a case study of electric heat used in “green” homes.

In simple terms, ERH warms working and living spaces using convection heaters such as baseboard or fan-forced heaters. While there are a variety of technical approaches available to consumers in the market, they all rely on the same basic physical property—passing an electrical current through a resistor converts electrical energy into heat. It is a safe and simple solution for many heating needs, and frequently offers meaningful advantages over other sources of heating. When used in residential, commercial, or industrial applications, ERH provides a comfortable, efficient, and affordable heating option that is often the preferred method.

It also covers a new variety of electric thermal storage (ETS) application, which is called grid-interactive electric thermal storage or grid electric thermal storage (GETS). GETS performs like traditional ETS products except that it is capable of two-way communication with the local utility.

ERH continues to be a popular choice with consumers and commercial users for good reason. It is affordable, efficient, clean, and comfortable. Moreover, ERH is uniquely situated to assist in the deployment of greater amounts of electricity generated from renewable energy sources like wind and solar power. As with the electric car, consumer consciousness surrounding the use of clean electricity is growing exponentially, and it is reasonable to think that favorable attitudes toward electric heating will grow accordingly.

NEMA’s Electric Resistance Heating Section represents manufacturers of heating products and systems that are produced in North America and:

• are used for residential, commercial, and industrial markets;
• are designed for comfort conditioning, snow melting and storage; and
• include infrared, resistance heating, and cable heating for fixed installations.

Market Benefits of Electric Resistance Heat may be downloaded at no cost on the NEMA website.

A French version, Avantages du chauffage par résistance électrique, also may be downloaded at no cost on the NEMA website.

Harry Massey, Industry Director | harry.massey@nema.org
NEMA Section Launches Cybersecurity Effort

NEMA, on behalf of its Transportation Management Systems and Associated Control Devices Section, has launched a cybersecurity effort with a goal of developing a standard that describes functional cybersecurity attributes along with minimum performance baselines of all the products under the sections scope and to enable agencies to use this for procurement purposes.

The section’s scope includes, but is not limited to products, subsystems, equipment, components, and services principally used to design, install, operate, and maintain vehicular transportation systems and related elements. The items included in the scope provide the means to realize integrated transport information management and control systems that are compatible with the intermodal operation of intelligent transportation systems.

Transportation systems were identified in 2013 as one of the sixteen critical infrastructure sectors in Presidential Policy Directive 21 on Critical Infrastructure Security and Resilience. In Executive Order 13636, “Improving Critical Infrastructure Cybersecurity,” President Obama ordered a consultative process to coordinate improvements to the cybersecurity of critical infrastructure sectors. The purpose of this document would be to identify potential threat areas and the severity of their consequences, prevention and mitigation techniques that manufacturers can use to minimize their impacts, and methods to effectively measure security performance. For more information or to join NEMA’s Transportation Management Systems and Associated Control Devices section, contact Steve Griffith.

Steve Griffith, PMP, Industry Director | Steve.Griffith@nema.org

NEMA Lighting Systems Division Addresses Flicker

NEMA Lighting Systems Division published Temporal Light Artifacts (Flicker and Stroboscopic Effects), a position paper on temporal light artifacts (TLAs). It addresses what is commonly referred to as flicker and stroboscopic effects.

According to the NEMA Working Group on TLAs, current standardization is hampered by lack of adequate assessment metrics. Currently applied metrics do not fully account for the effects of both the frequency and the wave-shape of the light stimulus. NEMA is working on a standard for TLA measurement that defines application-dependent recommendations.

Temporal Light Artifacts (Flicker and Stroboscopic Effects) may be downloaded at www.nema.org/TLA-Flicker.

RECENTLY PUBLISHED STANDARDS

The following standards are available at www.nema.org/standards.

- ANSI C78.376-2014 American National Standard for Electric Lamps—Specifications for the Chromaticity of Fluorescent Lamps. $65 electronic or hard copy
- ANSI C136.3-2014 American National Standard for Roadway and Area Lighting Equipment—Luminaire Attachments. $35 electronic or hard copy
- ANSI C136.21-2014 American National Standard for Roadway and Area Lighting Equipment—Vertical Tenons Used with Post Top-mounted Luminaires. $38 electronic or hard copy
- ANSI C136.30-2015 American National Standard for Roadway and Area Lighting Equipment—Pole Vibration. $50 electronic or hard copy
- ANSI/NEMA HP 9-2014 Electrical and Electronic Ethylene-Propylene Diene Elastomer (EPDM) Insulated Hook-Up Wire, Types EP (rated 125°C;600 V), and EPD (rated 125°C;5000 V). $75 electronic or hard copy
- ANSI/NEMA WC 27500-2015 Standard for Aerospace and Industrial Electrical Cable. $105 electronic or hard copy
- NEMA ICS 4-2015 Application Guideline for Terminal Blocks. Download at no charge or purchase hard copy for $64
- NEMA FB 2.20-2014 Selection and Installation Guidelines Fittings for Use with Flexible Electrical Conduit and Cable. Download at no charge or purchase hard copy for $103
- NEMA LE 6-2014 Procedure for Determining Target Efficacy Ratings for Commercial, Industrial, and Residential Luminaires. Download at no charge
- NEMA PRP 1-2014 Guidelines for Conduit-in-Casing Construction. Download at no charge or purchase hard copy for $53
- NEMA PRP 2-2014 Guidelines for Solvent-Cementing Joints for PVC Rigid Nonmetallic Conduit, Duct, and Fittings. Download at no charge
- NEMA RV 3 Application and Installation Guidelines for Flexible Metal and Liquidtight Flexible Metal and Nonmetallic Conduit. Download at no charge or purchase hard copy for $96
- NEMA SB 20-2015 Guide to Understanding Smoke Control Systems. Download at no charge or purchase hard copy for $27
NEMA members have been shipping products to customers in the Kingdom of Saudi Arabia (KSA) for more than 50 years. These products, which are designed to meet ANSI/NEMA/UL performance and safety standards, have performed reliably and safely during this entire period, leading KSA customers to continue to specify them.

KSA, through the Saudi Standards, Metrology, and Quality Organization (SASO), however, recently adopted a policy of basing all national standards for electrical products on IEC standards. This has resulted in difficulty—and in some cases outright prevention of—importing NEMA members’ products based on ANSI/NEMA/UL standards.

There is an extensive residential, commercial, and industrial infrastructure in KSA that was built using products and systems designed to ANSI/NEMA/UL standards. The continued safe operation and maintenance of this installed infrastructure requires the use of replacement parts and products that meet these standards. NEMA took quick action to work with KSA officials to ensure that ANSI/NEMA/UL products will continue to be acceptable for use, but an ongoing plan of action was needed to forestall adverse business impacts to NEMA member companies. Preliminary senior leadership discussions with in-country distributors, original equipment manufacturers, large customers, and government ministries supported coordination with NEMA members to combat restrictions on NEMA products.

NEMA formed an access consortium of interested members and other stakeholders to work closely with the well-established U.S.–Saudi Arabia Trade and Investment Framework (TIFA) Council to identify and tackle existing and emerging issues. The consortium will maintain communication with Saudi officials and other stakeholders, such as SASO, Ministry of Commerce and Industry, Saudi Customs, Saudi Ministry of Water and Electricity, distributors, and customers.

It will also collaborate with U.S. officials in Riyadh, including embassy staff representing Commerce and State, as well as in the U.S. headquarters of the Office of the U.S. Trade Representative and Commerce.

**REFINING PLAN OF ACTION**

In its inaugural meeting in May in Dammam, Saudi Arabia, the NEMA–Saudi Arabia Market Access Consortium sharpened its plan of action to include:

- **Standards.** Adoption of national standards by SASO should completely and accurately reflect the needs of Saudi infrastructure and market demands. This will require a portfolio of standards that are based on IEC and UL standards. Consortium members will identify priority UL/NEMA standards for early adoption.

- **Conformity assessment.** The consortium will work with Saudi Customs to introduce a moratorium on the halting of shipments containing products with certificates of compliance from accredited certification bodies (CSA, Intertek-ETL, and UL). The consortium will work closely with SASO to develop market surveillance procedures that correctly reference the requirements of both IEC and UL standards, as applicable.

- **Channels of distribution.** The consortium will work with agents to ensure supply chain integrity, emphasizing the need to match each customer’s needs to the correct product standards. Orders containing both UL and IEC products should not be processed and shipped until manufacturers are consulted. The consortium will also educate service center personnel on the traceability of each incoming product using the latest electronic distribution databases.

NEMA will provide a single point of contact for all customs issues that arise during the period of performance, ensuring prompt, efficient, and effective action. The consortium ensures a legal forum to conduct business and will conduct no business without a representative of NEMA present. All activities will be conducted under the Guidelines for Conducting NEMA Meetings.

These efforts will lead to recognition of ANSI/NEMA/UL standards as acceptable within the framework of SASO; increased confidence by KSA officials that their national standards and quality system effectively identifies and quarantines counterfeit and other low-quality electrical products; and the recognition of the value of NEMA members’ products, which can be freely imported, sold, used, and manufactured to ANSI/NEMA/UL standards in KSA.

Gene Eckhart, Senior Director for International Operations | gene.eckhart@nema.org
NEMA made key presentations as part of the recent U.S.–Colombia Conference on Technical Barriers to Trade focusing on implementing the World Trade Organization (WTO) Code of Good Practice for the Preparation, Adoption, and Application of Standards.

The workshop was organized as part of the Standards Alliance, a program initiated by the Office of the U.S. Trade Representative (USTR), funded by USAID (U.S. Agency for International Development) and managed by ANSI (American National Standards Institute), to share experiences of U.S. and Colombian experts to minimize or avoid technical barriers to trade (TBT) that could result from future regulations.

Participants in the workshop included government and private sector representatives from both countries.

The workshop was organized around a number of different thematic sessions, each of which emphasized the importance of TBTs to the WTO, so much so that a standing committee has been established to both monitor and resolve TBT differences between the more than 100 member countries of WTO.

Topics that were covered during the workshop included:

- Overview of the WTO Technical Barriers to Trade Agreement and Code of Good Practice for the Preparation, Adoption and Application of Standards
- U.S. and Colombian experience in participating in ISO/IEC standards development.
- Participation in Codex (the international code of standards for food safety)
- U.S. and Colombian experiences working in other international standards organizations.
- Avoiding duplication and achieving consensus in standardization
- Specific practices used for the development of performance standards, including energy efficiency
- Establishing work programs for standards (specifically focusing on the NEMA standards development process as described at www.nema.org/How-NEMA-Standards-Are-Developed)
- Organizing public review and accepting comments from other WTO members
- Holding bi-lateral consultations on the operation of the Code of Good Practice

All of the presentations are available at www.mincit.gov.co/publicaciones.php?id=33437.

**FACILITATING TRADE DISCUSSIONS**

Following the workshop, the U.S. and Colombian governments held the first formal meeting of the Technical Barriers to Trade Committee of the United States–Colombia Trade Promotion Agreement. This committee was established during the implementation phase of this trade agreement (such committees are established for all the trade agreements implemented by the U.S.). It serves as a forum for private sector entities to work through their national trade ministries (USTR for the U.S., Ministry of Trade, Industry, and Tourism for Colombia) to resolve emerging trade issues before they escalate to the level of WTO.

Because NEMA members have two emerging trade issues in this regard (i.e., energy efficiency labeling and mandatory product certification), Gene Eckhart was invited by both governments to participate and elaborate on the impact of these issues on members. As chair of ITAC 2 (Industry Trade Advisory Committee, Automotive and Capital Goods), he has official standing in trade matters.

Building on the work of this committee, the NEMA Lighting Systems Division is now working to organize a technical workshop in Colombia in September to share information regarding performance of ballasts, high intensity discharge lamps, and LED drivers. This will be an effective mechanism to make changes to the current draft regulation to enable continued shipment of products that can meet the regulatory requirements in both the U.S. and Colombia.

Gene Eckhart, Senior Director for International Operations | gene.eckhart@nema.org
NEMA’s Primary Industrial Controls index decreased 0.2 percent on a quarterly basis (q/q) during the first quarter of 2015. The index showed an increase of 1.6 percent compared to the same period a year ago.

A broader measure of shipments, NEMA’s Primary Industrial Controls and Adjustable Speed Drives Index, was in positive territory during the first quarter, posting an increase of 0.2 percent quarter-over-quarter. The index was also higher on a year-over-year basis, climbing 1.6 percent.

Stacey Harrison, Director, Statistical Operations | harrisons@nema.org

NEMA’s Electroindustry Business Conditions Index (EBCI) for current conditions in North America declined for a third straight month in June. The index fell to 47.2 from 50 a month ago and from 54.8 in April as a higher proportion of panelists reported business conditions deteriorated in June than reported they improved.

In contrast, the EBCI for future North American conditions posted a modest advance on the heels of three consecutive monthly declines, rising to 52.8 in June from 52.2 in May. Thirty-nine percent of June’s panelists expect the business environment to improve over the next six months, while 33% expect it to decline.

Visit www.nema.org/ebci for the complete June 2015 report.
What Keeps You up at Night?

What keeps you up at night? We have all had sleepless nights over one thing or another—things we think we can control, things over which we have no control at all, and things we think we may be able to handle. We have concerns over jobs, family, children, friends, finances, and security. We all try to take control of what we can and find solutions.

This is also true for NEMA members. Every company, whether private or public, large, mid-size, or small, domestic or international, has business risks and concerns. If you ask a CEO what issues keep him/her up at night, you would get one list, a board member would have another, and the CFO yet another. Some of these issues may be solved within the company while others require expert, knowledgeable, and experienced support.

This is where NEMA comes in. We offer a forum where peers can solve problems as an industry. Member companies enjoy benefits and services that also include expert analysis, support, direction, and resolution on advocacy, business information, and standards.

It is my charge to help every member company be aware of and use all of the needed resources that NEMA makes available day in and day out. These member benefits and services can effect a successful outcome.

NEMA will continue to be a true partner and a trusted advisor. I look forward to working with you to accomplish successful business solutions for NEMA member companies and the industry.
Dim Down Your Costs

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Power & Control in a single cable.

In our fast paced industry, a speedy installation can help save you money. That’s why our NEW MC-LED combines Power and Class 2/Class 3 circuits into a single cable that is used with LED and fluorescent dimming and smart-control lighting systems.

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