

electroindustry

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**Sustaining the
Electroindustry**
for People, Profit,
and Planet



NEMA

SPOTLIGHT

John Malinowski Retires, Anticipates New Challenges

John Malinowski announced his retirement from Baldor/ABB in February after 34 years with the company. Fittingly, his final days with Baldor were spent at the NEMA Motor & Generator Section (IMG) meetings in Key West.



John Malinowski

While John was the IMG section chair from 2009-2015, he called me almost every day. Although our conversations were often about motors, section work, DOE regulations, and the MG1 standard, we also talked about what was going on in our lives and in the world in general. When John relinquished his chair because of term limits, the section added the position of immediate past chair to take advantage of John's knowledge, intellect, and passion for the motor business.

John is a fierce competitor—he competes against excellence, not against average. In our frequent conversations, he always pushed and questioned me. He made me a better section partner and person.

I asked some of his business competitors and fellow section members for their thoughts on John's legacy. Current Section Chair Dan Delaney of Regal

Beloit said, "John has included the NEMA position in his activities in other industry associations and standards development organizations, ensuring that NEMA's industry requirements were embedded in standards such as IEEE, API, and Hydraulic Institute, along with other international standards."

Section Vice Chair Dale Basso of WEG agreed, saying John's involvement "helped to raise awareness and status of NEMA and our motor industry."

Section Technical Committee Chair Tim Schumann of SEW Eurodrive described John as having a "powerful voice for the motor industry in all levels of government relations and standardization." Section Energy Management Committee Chair Rob Boteler of Nidec was more poetic, calling him a "voice of reason in the wilderness of government regulation."

John is not likely to ease into the next chapter of his life. It is more likely that he will challenge zero to 60 in one of his cars. He may even turn up at the occasional NEMA meeting. He will be welcomed wherever he focuses his substantial talents and intellect. 🇺🇸

William Hoyt, Industry Director, NEMA

I Am the Electroindustry



Tricia Breeger
General Manager, Electrical Distribution Division
Mitsubishi Electric Power Products Inc.

The U.S. power grid is in the midst of a technology upgrade, with a focus on power generation and distribution. As one of America's most valuable resources, its health and resiliency is in the spotlight. Several entities support the successful navigation of the challenges ahead, including NEMA.

As a member of the NEMA Distribution Automation Section and the Grid Modernization Leadership Council, my focus is on advancing and adopting new technologies in the areas of power electronics, integrated sensors, and digital controls. It is a pleasure

supporting NEMA efforts in educating stakeholders, the general public, federal and state regulators, energy policy officials, and utilities on the subject of advanced, digital technologies as the key to reliability, resiliency, and agility across the grid.

NEMA sections and committees facilitate the collaboration and education that will drive future innovation. I am honored to be a contributor to these efforts. I am the electroindustry. 🇺🇸

Ms. Breeger discusses volt/VAR technologies at www.nema.org/adopting-voltvar-optimization-technologies.

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electroindustry

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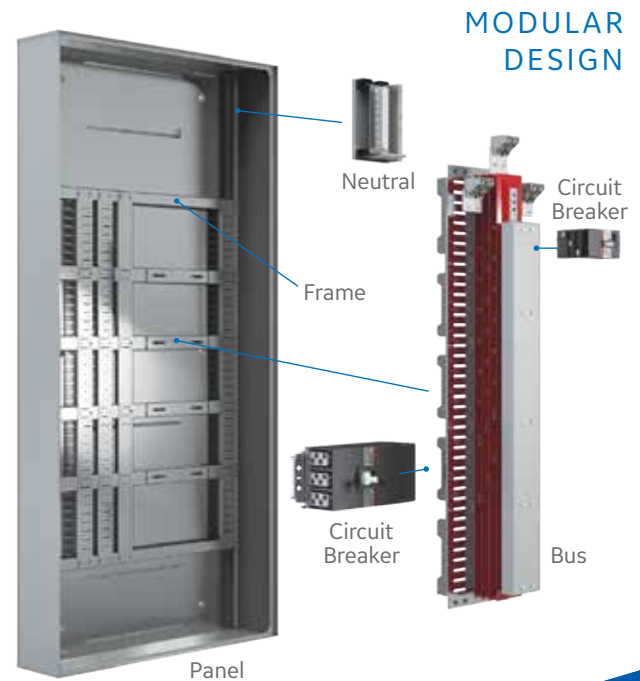
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We often think of sustainability from a purely environmental perspective—leave no trace, use fewer natural resources, and minimize our footprint on the planet.

Corporate sustainability is about environmental responsibility; it is also about the overall wellbeing of the corporation and the business. As manufacturers, we have an obligation to contribute to society with safe goods and services that improve people's lives. We must balance the scientific evidence that guides us to be conscious of our environmental impact with our commitment to meeting evolving customer expectations. This is where NEMA can, and will, have the greatest impact.

Each member of NEMA can get involved to help support and influence manufacturing standards and regulations, simultaneously protecting dwindling resources and preserving consumer choice. Part of the process is to carefully consider the entire value chain and ask this provocative question: If NEMA Member companies do a better job of minding their own sustainability stores, can that signal regulatory agencies to consider less stringent, more open-minded policies?

Rules and regulations often create order out of chaos. NEMA has the opportunity to be proactive and engaged with regulatory agencies before there is a perceived problem, potentially easing the tendency to create ever-more-restrictive standards that ultimately limit consumer choice and drive up costs with little offsetting societal benefit.

Several specific examples come to mind:

The High-Performance Building Council is open to any NEMA Member. By taking an active role in this council, companies can influence new product standards that may incur a higher initial cost but will ultimately create more sustainable buildings with higher returns on investment. LEED, the Well Building Standard, and other international guidelines for sustainable construction can benefit from NEMA's informed voices in the field of energy-saving electrical products.

NEMA has an opportunity to weigh in on the growing attention to chemical management, an issue especially critical to medical imaging product manufacturers. Chemical management addresses an essential balance of interests, i.e., which chemicals and how much of them can be safely used while still ensuring that we continue to provide products that improve the quality of life, or even save lives.

Energy storage and renewable energy are increasingly important in manufacturing, but guidelines for measuring and reporting energy storage are relatively new. NEMA is using a new protocol, developed under the leadership of the U.S. Department of Energy, as a starting point for international and U.S. standards for energy storage system performance. By staying active with this initiative, we can continue to inform and influence the broader use of renewable energy.

NEMA plays a key role in advising its membership on environmental requirements and health product declarations that will impact future regulation. Get involved, become active in NEMA committees and councils, and stay engaged. Remember, we get out of our association what we put into it. 🌱

Michael Pessina
Chairman, NEMA Board of Governors

Energy Efficiency Equals Jobs for Our Future

Without question, the American economy and our workforce are evolving. Technology is changing at lightning speed, and competition is becoming increasingly global. To keep up with these changes, American workers are constantly seeking new education, certifications, and opportunities to advance. For many, this evolution sometimes creates uncertainty and anxiety, but I believe it also creates huge advantages.



Historically, the United States always has risen to the challenge of bringing the world new inventions, ideas, and better ways of living. This ingenuity is particularly on display in our energy efficiency sector, which grew by six percent and added 133,000 new jobs in 2016, according to the Department of Energy (DOE) in its 2017 *U.S. Energy and Employment Report*.¹

Today, 2.2 million Americans work in energy efficiency jobs including construction, manufacturing, installation, and repair;

that is more than a third of the entire U.S. energy workforce. Employers told DOE that they expect this growth to continue, estimating their industry will add another 198,000 jobs by the end of 2017. I am particularly proud that in my home state of Illinois nearly 90,000 people work in energy efficiency, the majority of them at family-owned or small businesses.

Congressman Adam Kinzinger serves on the House Energy and Commerce Committee and on the House Foreign Affairs Committee. He also serves on the Subcommittee on Commerce, Manufacturing and Trade; the Subcommittee on Communications and Technology; and the Subcommittee on Energy and Power.

Beyond creating jobs for our nation's engineers, electricians, manufacturers, and construction workers, the energy efficiency industry is helping businesses meet their bottom lines and lowering costs on energy bills for families nationwide. While the individual products may include more efficient lighting or an upgraded HVAC system, the real product the industry creates is the ability for our entire economy to be more productive. Energy efficiency improvements and technologies are creating more comfortable, productive, and efficient homes, schools, and businesses across the country.

Given that the federal government is the single largest consumer of energy in the world, in my work as a member of Congress I focus on writing legislation to improve efficiencies in our federal data centers and to encourage government agencies to take advantage of the energy and money saving benefits of Energy Savings Performance Contracts. Just as a family that upgrades to an ENERGY STAR® dishwasher or invests in a more efficient air conditioning system saves money, the federal government saves taxpayers' money through energy efficiency.

Energy efficiency jobs are truly jobs for our nation's future. This industry is improving our economy and environment by allowing us to accomplish more by using fewer natural resources. With this strong industry, and the continuously growing and evolving workforce it supports, our country is ready not only to improve the efficiency of the appliances, electronics, and building systems we use today but also to prepare us for future technologies and ideas that the next generation of American innovators undoubtedly will bring.

We have a lot to look forward to, and it starts here with energy efficiency. ☺

¹ <https://energy.gov/downloads/2017-us-energy-and-employment-report>

Consumers Redefine Distribution Automation

Distribution automation (DA) is a family of technologies including sensors, processors, communication networks, and switches that can perform a number of distribution system functions depending on how they are implemented.

Over the last 20 years, utilities have been applying DA to improve reliability, service quality, and operational efficiency. More recently, DA is being applied to perform automatic switching, reactive power compensation coordination, and other feeder operations and control.

Consumers soon may have significant control over their destinies for energy requirements. DA and the Internet of Things will play a significant role in facilitating consumers' operation of their assets. Utilities will increase their competitive products and service capabilities to keep existing consumers and attract new ones. DA will facilitate utilities' ability to achieve this goal by significantly improving system reliability and resiliency, resulting in increased consumer satisfaction, retention, and attraction.

CONSUMERS GET SMARTER

Consumers now can control home systems from their mobile phones—everything from appliances and HVAC to home security and electronic surveillance of intruders, kids, and pets. Consumers also can power their homes with their own distributed generation assets, e.g., solar or gas generators. Third-party service companies and utilities can automatically monitor, maintain, and service consumers' distributed generation assets when problems occur.

According to Navigant Research, the global market for smart city solutions and services is expected to grow from \$40.1 billion in 2017 to \$97.9 billion in 2026. It starts with smart buildings that can be controlled such as smart homes and are environmentally friendly.

Consumers are installing microgrids for critical loads like hospitals, R&D centers, and manufacturing plants. Many institutions believe microgrids have the potential to be aggregated to power entire cities, so they are developing designs to accomplish this task.

Traditionally, a consumer had no choice but to pay a monthly energy bill to the local utility. Now, if consumers generate power through solar panels, for example, they have the opportunity to sell power back to the utility and independent system operators (ISOs) like PJM.

PJM pays attractive rates to suppliers of fast frequency power (ability to send power quickly after receiving a signal from PJM) from energy storage. Several companies have developed sophisticated software to enable consumers to profitably sell energy storage to ISOs.

Consumers and energy companies are using blockchain technology as a decentralized (peer-to-peer), highly encrypted method to record and get paid for their energy trading transactions.

L03, a blockchain energy solutions company, engages in projects and tool development to proliferate the use of distributed energy. L03 has three primary projects:

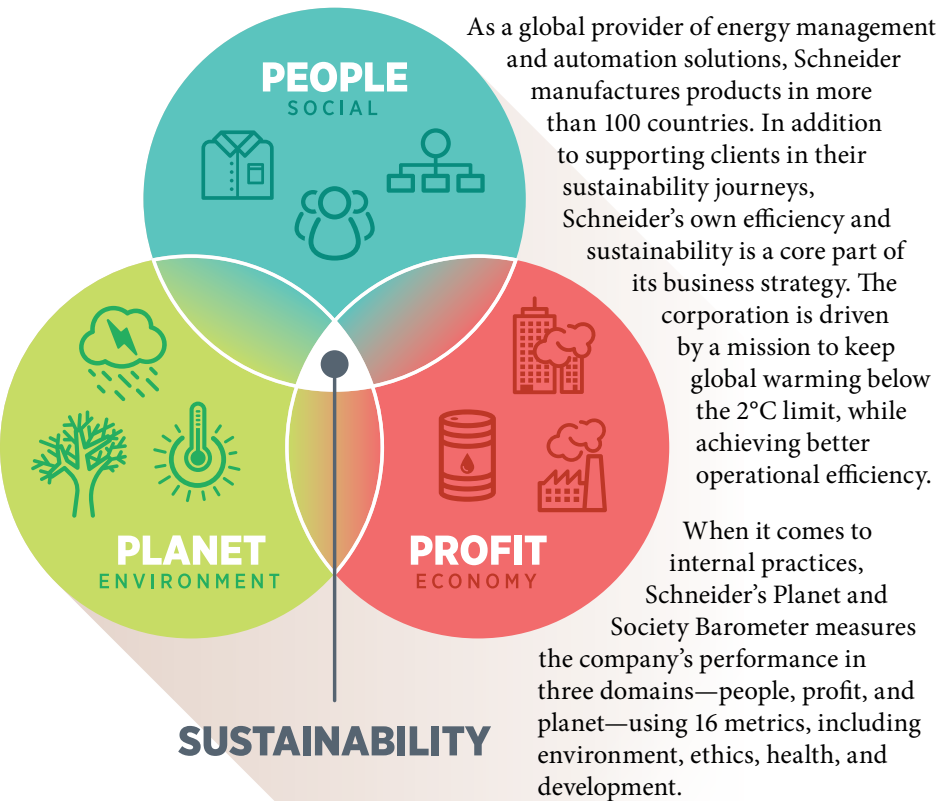
- **Project Exergy:** An effort to turn computers into heat in order to recapture wasted resources. L03 offers cryptographically secured grid services in order to monetize underused computational capacity and store thermal energy.
- **Brooklyn Microgrid:** A distributed energy infrastructure that can be used during emergency needs of the local community. An additional intent is to boost the local economy through the creation of new community energy job opportunities.
- **Transactive Grid:** A joint venture with Consensus Systems to deliver real-time metering of local energy generation and other relevant data over the Ethereum blockchain. This platform is open source, transparent, and peer-to-peer. The pilot will be in Brooklyn.

Savvy consumers are redefining the power industry by using DA and other tools to achieve reliable, resilient, and profitable energy. ☞



Corporate Sustainability for People, Profit, Planet

Schneider Electric believes that energy is the base of life. Life is fuller and more sustainable if energy is safer, more reliable, more efficient, and more sustainable. The company is dedicated to inventing technologies that transform the places we live, work and play to make sure “life is on,” as we say at Schneider, for everyone, everywhere, and at every moment.



Highlights of the current three-year program goals, ending in 2017, include the following:

- 10 percent energy savings
- 120,000 tons of carbon dioxide (CO₂) avoided through maintenance, retrofit, and end-of-life services provided by our field services operation
- 100 percent of new products designed using our trademarked eco-design criteria
- 75 percent of product revenue through sale of our eco-label products
- 100 percent new large customer projects with CO₂ impact quantification

- 120,000 tons of CO₂ avoided through maintenance, retrofit, and end-of-life services
- 30 percent reduction in injuries

The company is also committed to superior energy performance for its industrial facilities. Schneider Electric undergoes third-party certification audits to verify sites meet the U.S. Department of Energy's Superior Energy Performance standard (ANSI/MSE50021) and ISO50001, its energy management standard, with more than 100 ISO50001-certified sites.

Schneider Electric offers sustainability solutions to customers around the world. The company's technology delivered the world's most sustainable building, The Edge in Amsterdam, a net-zero energy commercial building that uses the Internet of Things (IoT) to maximize energy and comfort. Solar panels, aquifer thermal energy storage, and rainwater used in restrooms are just a few of the building's many sustainable and intelligent features. Tenants rely on an app for personal comfort as they move from a board room to an office. The IoT-enabled app also helps make the building smarter by collecting and analyzing data based on users' habits and behavior.

In a long-lasting partnership with Schneider, Hilton has saved 14.5 percent energy in its hotels since 2009, a significant savings considering that energy is Hilton's second largest operational cost. Schneider Electric's energy management application harmonizes energy data from Hilton hotels with a customized dashboard. Automated energy billing solutions reduce late payment penalties and resolve invoice discrepancies.

Other Schneider Electric products deliver three-percent energy savings for Hilton facilities worldwide. From negotiating utility prices for a better balance sheet to timing automated blinds for a sunny wake-up call, Schneider Electric solutions help free up energy savings to be reinvested into Hilton's most important asset: its guest experience.

Schneider Electric believes that sustainability is an integral part of the well being of our society and delivers on that belief for both its customers and its own facilities. 

NEMA Welcomes New Members



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Siemens Tops Green Revenue List

German manufacturing and electronics company Siemens has ranked first on the latest Clean200 list from As You Sow and Corporate Knights.

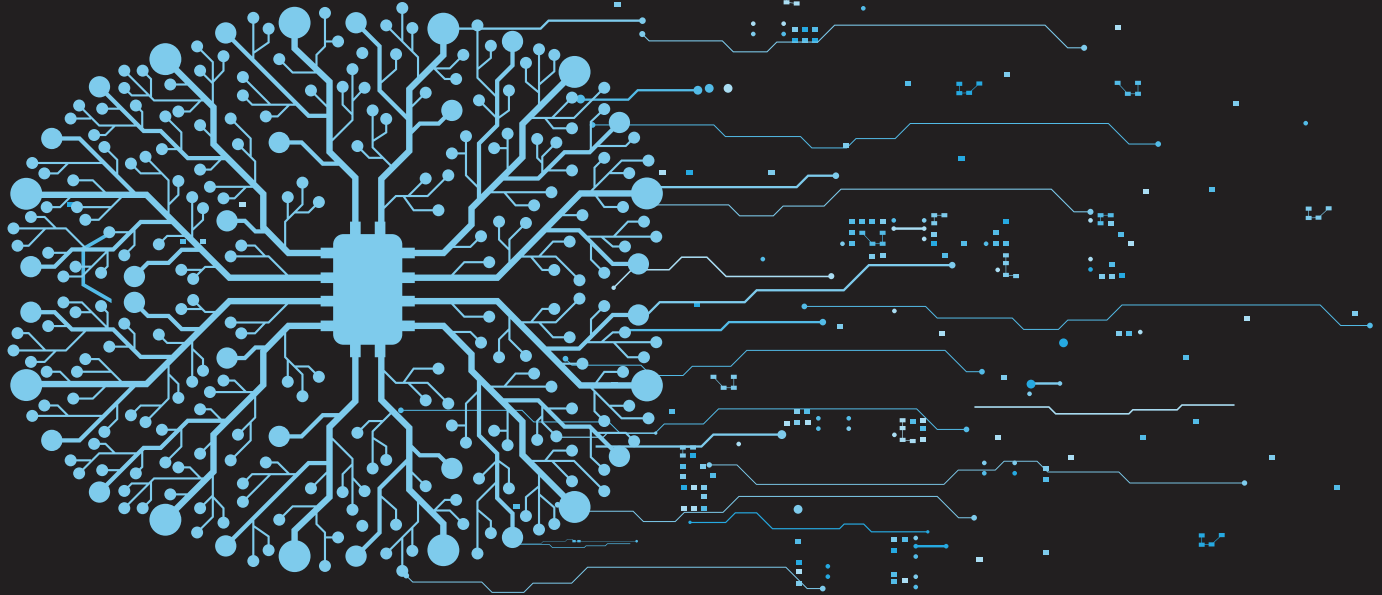
The Clean200 ranks the largest publicly listed companies based on their total clean energy revenues. In addition to Siemens, NEMA members among the top 10 are Schneider Electric, ABB, and Philips Lighting.

S&C's Kyle Seymour Assumes Committee Chair

Kyle Seymour, president and CEO of S&C Electric Company, has been named chairman of the NEMA Board of Governors' Strategic Initiatives and Councils Committee.

The committee oversees the NEMA Strategic Initiatives program, an idea incubator and accelerator that establishes short-term, innovative programs and projects to prepare NEMA members for emerging opportunities and to address new challenges that will impact multiple NEMA sections.

For more information on the program, visit www.nema.org/si.



Distribution Automation: Reducing Energy Losses and Improving Reliability

Bill Flerchinger,
Technical
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Schweitzer
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Joanna Hofer of
SEL and Mike
Watson, Jeff
Hauber, Clayton
Stubbs, and
Matt Bult of
Westar Energy
contributed to
this article.

More and more utilities want to take advantage of technology such as microprocessor-based controls and computing platforms, revolutionary communication technologies, sensor technologies, advanced algorithms, and advanced coordination of devices for holistic system optimization. To do this, the name of the game is automation.

Several challenges, however, continue to slow the attainment of this distribution automation (DA) nirvana, namely financial obstacles in the form of capital costs pertaining to implementation; integration challenges associated with communications and combining new and legacy systems; and fundamental operational design that changes the way we've always done it. Making sense of the costs and benefits often requires the help of professionals experienced in examining and explaining the complete picture of potential advantages and drawbacks.

What if we could just focus on a dream system? What does a modern, optimized, state-of-the-art DA system look like?

That's what one utility set out to discover in 2010 when it agreed to participate in a Department of Energy (DOE) smart grid project. Just how beneficial would automating their distribution system be? The answer: Very.

The three-year SmartStar Lawrence project installed advanced metering infrastructure, a meter data management system, and DA. Investor-owned electric

utility Westar Energy, based out of Topeka, Kansas, began with a wish list for its DA system. At the end of the DOE pilot project, they wanted their DA system to

- Increase system reliability;
- Reduce outage restoration times;
- Minimize distribution system losses;
- Reduce system loadings during peak conditions;
- Improve system operation and understanding;
- Improve service to customers; and
- Have the ability to pass information from DA system to their existing energy management system (EMS)/SCADA, i.e., with no new interface.

The idea behind the project was that economically adding automated fault location, isolation, and service restoration (FLISR), as well as voltage and reactive power (volt/VAR) control, would improve reliability and reduce system losses, delivering a highly beneficial project to Westar and its customers.

Operational Design

Westar's new DA system was implemented on 20 of the 1,338 circuits across its distribution network. The feeder circuits used reclosers at normally open tie points to interconnect two or more power sources. Additional reclosers were installed throughout the feeder circuits to allow sectionalizing capabilities in the event that permanent faults occurred on a line section.

The new system included the following equipment:

- Advanced recloser controls (33 units) and satellite-synchronized clocks (33 units) paired with reclosers
- Legacy recloser (1 unit) with form 6 controls
- Capacitor bank controls (53 units) retrofitted to existing capacitor banks
- Existing non-telemetered switches (39 units)
- Wireless 3G and 4G cellular modems (87 units) for feeder intelligent electronic device communications and control
- Real-time automation controller (1 unit) as a distribution automation controller (DAC), providing centralized system intelligence
- Ethernet security gateway (1 unit), providing comprehensive security measures and automated event collection capabilities from intelligent electronic devices

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Increasing Efficiency with Volt/VAR Technologies

Steve Griffith,
PMP, Industry
Director,
NEMA

The world consumes an enormous amount of electricity, some of which is lost on its way from where it is generated (e.g., power plants and wind farms) to where it is used (e.g., homes and businesses). The United States Energy Information Administration (EIA), a division of the Department of Energy, estimates that every year in the U.S. about six percent of the electricity that is transmitted and distributed is lost.¹

The EIA further estimates that increased energy efficiency could reduce national energy use by as much as 20 percent by 2020, resulting in net economic benefits for consumers and businesses.

Losses of electrical energy and demands on electric distribution systems can be reduced through a number of proven technology methods. Traditional volt/VAR (volt ampere reactive) management technologies have been used by the power industry for more than 30 years to reduce electric line losses and increase grid efficiency.

Unlike the traditional approach that uses uncoordinated local controls, volt/VAR optimization (also known as VVO) uses real-time information and online system modeling to provide optimized and coordinated control for unbalanced distribution networks with discrete controls.

As the number of renewable intermittent sources (e.g., solar and wind) increases, however, so does the complexity of the controls. VVO and other power

electronics-based technologies can mitigate rapid and large voltage fluctuations that result from high penetration of distributed generation.

Benefits for electric utilities to adopt these technologies include effective capacity utilization, photovoltaic generation support, avoidance of VAR penalties, and line loss reduction. Utilities that purchase power from transmission companies or independent power producers usually have financial incentives, including steep penalties for operating outside of specified power factor limits. The ability to optimize power factor is a key driver in a utility's ability to minimize these penalties. ☎

Learn more

Read "The Value of Volt/VAR Technologies" on NEMA Currents, the blog of the electroindustry, and "Volt/VAR Optimization Improves Grid Efficiency" on the NEMA website.

Listen to the differences between traditional volt/VAR management technologies and newer VVO technologies at www.nema.org/adopting-voltvar-optimization-technologies.

Buy ANSI C84.1 *American National Standard for Electric Power Systems and Equipment—Voltage Ratings (60 Hz)*. It is available for purchase on the NEMA standards store website.

¹ <https://www.eia.gov/tools/faqs/faq.php?id=105&t=3>

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Holistic Configuration

The SEL DAC communicates with the substation breakers and protective relays through messages relayed by the EMS/SCADA system to the substation remote terminal units. In order to maintain an awareness of system configuration, a server-based software solution was developed that monitors the company's outage management system and provides the status of the non-telemetered switches in the system back to the DAC, thus maintaining awareness of abnormal operating system conditions.

The modernized design allowed for the implementation of several communication protocols across the system. The protocols were selected either to provide desired intelligent electronic device functionality or to accommodate legacy equipment limitations.

In turn, the DAC acts as a protocol converter, allowing the various intelligent electronic devices in the DA scheme to communicate and operate as a holistic system. The DAC provides port-routing functionality for remote-access

capabilities using various proprietary vendor software interfaces. This allows for the use of a mix of new and legacy intelligent electronic devices, as well as controllers from different equipment manufacturers, thus minimizing the installation time and cost of implementing the system.

Leveraging Existing Technology

Since the automation system was deployed primarily for system restoration and VAR control, high-speed communications were not required.

The design, deployment, and maintainability of a company-owned communications system require a significant capital investment and would result in long-term operation and maintenance expenses, although there would be no recurring carrier charges.

This type of deployment would have stressed the existing and future technical workforce at Westar. Planned obsolescence also needed to be factored into the system, which would have required another future capital-intense system upgrade of the communications network. It was for these reasons that Westar chose to leverage cellular technology.

Cellular communications allowed Westar to minimize deployment times since there was no backend infrastructure to build and maintain. Although there are ongoing data charges, rate plans were negotiated with the cellular providers, which offset the costs that would have been associated with a company-owned system. The cellular network is continually being built to incorporate new technologies with increasing data throughput rates and decreasing costs of data plans.

System Implementation

Westar Energy and SEL Engineering Services implemented the DNA system in two phases, starting with the fault location, isolation, and service restoration (FLISR) capability (Phase One) and then adding volt/VAR control capability (Phase Two). This allowed the reclosers to be installed initially, followed by the replacement capacitor bank controls and LTC integration at a later time. SEL provided the initial FLISR and volt/VAR programming by creating a system model and configuring standard DNA libraries for the Westar Energy distribution system. Human-machine interface (HMI) displays were also developed for use during commissioning and testing.

SEL provided remote interactive training so that engineers at Westar would be proficient at maintaining and implementing changes to the system to accommodate additional intelligent electronic devices or feeder circuits in the future. Westar engineers further developed and implemented features in the system, including the deployment of automated password management, remote intelligent electronic device management capabilities, automated text and email routines, and HMIs to aid with routine system operations.



System components include advanced recloser control, satellite-synchronized clock, and wireless 3G cellular modems. Photo courtesy of SEL



Human-machine interface and distribution automation EMS screens aid with routine operations. Photo courtesy of SEL

PHASE ONE: FLISR DNA SYSTEM CAPABILITIES

Centralized automated controls were added that perform autonomous fault location, isolation, and service restoration activities. The SEL solution included the following features as part of the FLISR functionality:

- Loss-of-source detection
- Open-phase detection
- Discoordination detection and mitigation (provides operator notification and sectionalizes the correct portion of the system with the fault)
- Overload mitigation and load shedding, (smartly selects an alternate source with available capacity, shifts sources if loading increases beyond limits, or sheds load if no alternate sources with capacity are available)

PHASE TWO: VOLT/VAR CONTROL

The implementation of automation and control for voltage and reactive power

will use the same centralized system DAC and feeder information but will add control of voltage regulators, capacitor banks, and substation transformer LTCs to the system model. This simplifies the effort to add volt/ VAR control while allowing both systems to operate as an integrated system. A benefit of implementing the system in this manner is that, even after system reconfiguration, volt/VAR capabilities could still be performed on the reconfigured system.

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Putting the Pieces Together

The following devices flatten and lower system voltage to improve power efficiency and reduce demand, resulting in substantial energy savings.

Actively switched capacitor bank: The main purpose of a distribution capacitor bank is to counteract or correct a power factor lag or phase shift in an AC power supply.

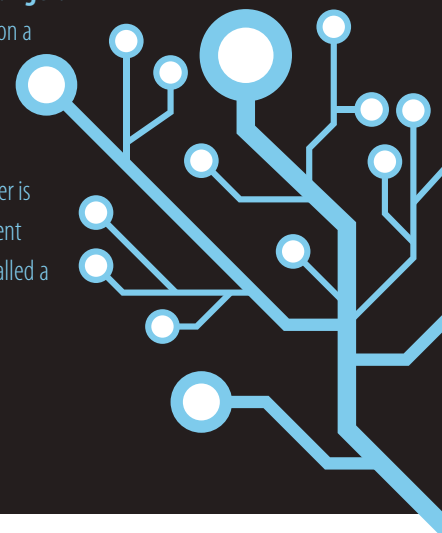
Active VAR controller: Power electronic FACTS (flexible alternating current transmission systems) devices control reactive power and, therefore, voltage in a circuit on a continuous basis both accurately and dynamically. The main differences in the performance of traditional voltage control devices when compared to a FACTS device are

- faster speed of response (milliseconds);
- finer control;
- lower maintenance; and
- increased longevity of secondary equipment.

Buck-boost voltage regulator: A voltage regulator is a device that maintains a relatively constant output voltage even though its input voltage may be highly variable.

Substation transformer load tap changer:

The simplest tap-changing device operates on a "break before make" principle and changes taps on the primary winding. Such a device cannot be operated when the transformer is carrying load or even when the transformer is energized, because it would break load current and/or magnetizing current. This device is called a tap changer for de-energized operation. ^{ei}



Coming Wave of Transmission Innovations: The Future Grid

The basic technologies used to deliver electricity from generator to customer remained largely unchanged from the 1880s to the 1980s. But technological advancements in the past few decades have significantly improved the efficiency, reliability, and security of that electricity delivery and will continue to do so.

NEMA members are developing many new and innovative technologies for energy storage, electricity transmission line efficiency, and overall system control. So how might these technological advances—and others—impact the grid of the future? The distinction between transmission and distribution is increasingly blurry; microgrids, distributed generation, and demand response are shifting the electricity system from a central-station model to a more distributed one.

Direct current—already used in computers, lighting, and possibly as the future sole power source in buildings—will increasingly improve the efficiency of long-distance transmission and reduce losses from distributed generation sources, such as solar.

Energy storage will allow electricity to be optimized over the course of a day while increasing the utilization rate of transmission and distribution lines, smoothing the integration of variable renewable energy resources, and providing backup power in the event of a power outage.

Transmission operators will need control systems with the ability to process millions of data points per second because there will be a proliferation of sensors, such as phasor measurement units collecting data from the grid. In turn, operators will be able to move from reactive to proactive decision making.

Investments will continue to be needed in both long-distance transmission and distribution infrastructure to deliver cost-effective, reliable, and clean electricity.

Learn about the NEMA Grid Modernization Leadership Council at www.nema.org/coming-wave-of-transmission-innovations-future-grid. ei

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Additional System Benefits

Currently, the system is fully integrated with capacitor banks, but full LTC control is still being implemented. The system has been operating in a VAR optimization mode only, but benefits in efficiency have already been realized. Moving to a full voltage control mode will allow for even more operating benefits.

Flexible operator control modes optimize:

- voltage on the feeder;
- power factor (PF) on the feeder;
- PF on the station bus;
- demand response for peak load reduction; and
- VAR set point on the primary side of the transformer for transmission VAR support.

Secure communication to substation and feeder devices enables remote engineering access. Westar engineers can retrieve and change intelligent electronic device settings, as well as pull event data (sequential event records and oscillography) from all devices on a feeder circuit, facilitating faster event analysis and helping to refine settings for improved system operation and protection. Westar also implemented automated password management and automated text and email messaging routines for configured alarms and events.

The system has successfully handled many faults and correctly performed automated reconfiguration on four different permanent fault events. It is estimated that these restoration events resulted in a savings in customer minutes interrupted (CMI) of 211,382 minutes. The system identified sympathetic faults on feeders in the automation scheme. As a result of remote data collection capabilities provided by the system, engineers identified two separate incidents involving locations upstream of faulted line sections in which conductors were “slapping” together due to magnetic fields associated with high fault current levels.

Another benefit of adding reclosers and recloser controls to the system is the reduction in customer interruptions, even without FLISR system interaction. The reclosers alone eliminated approximately 587,000 CMIs.

Lessons Learned

There were valuable lessons learned during design and implementation:

- Building relationships with IT groups and personnel involvement, including IT security, was instrumental to successfully designing and securing the system.
- Early stage and continuing cross-functional group communication was key.
- New devices deployed en masse, in contrast to a small trial installation, resulted in some challenges with wildlife protection.
- The use of cellular modems required some communications handshaking and latency issues to be overcome, some of which required vendor firmware modifications.
- Autonomous (closed-loop) system acceptance by operating groups was aided by education and training.
- “Fault bit” logic in recloser controls and an early warning system for problem areas was beneficial.



An example of volt/VAR optimization for a specific feeder.
Photo courtesy of SEL

Microgrids and Sustainability

NEMA MGRD 1-2016 *Powering Microgrids for the 21st-Century Electrical System* explains microgrids as an integral component of the modern power delivery system.

Download a copy at
www.nema.org/microgrids.

Increased Sustainability

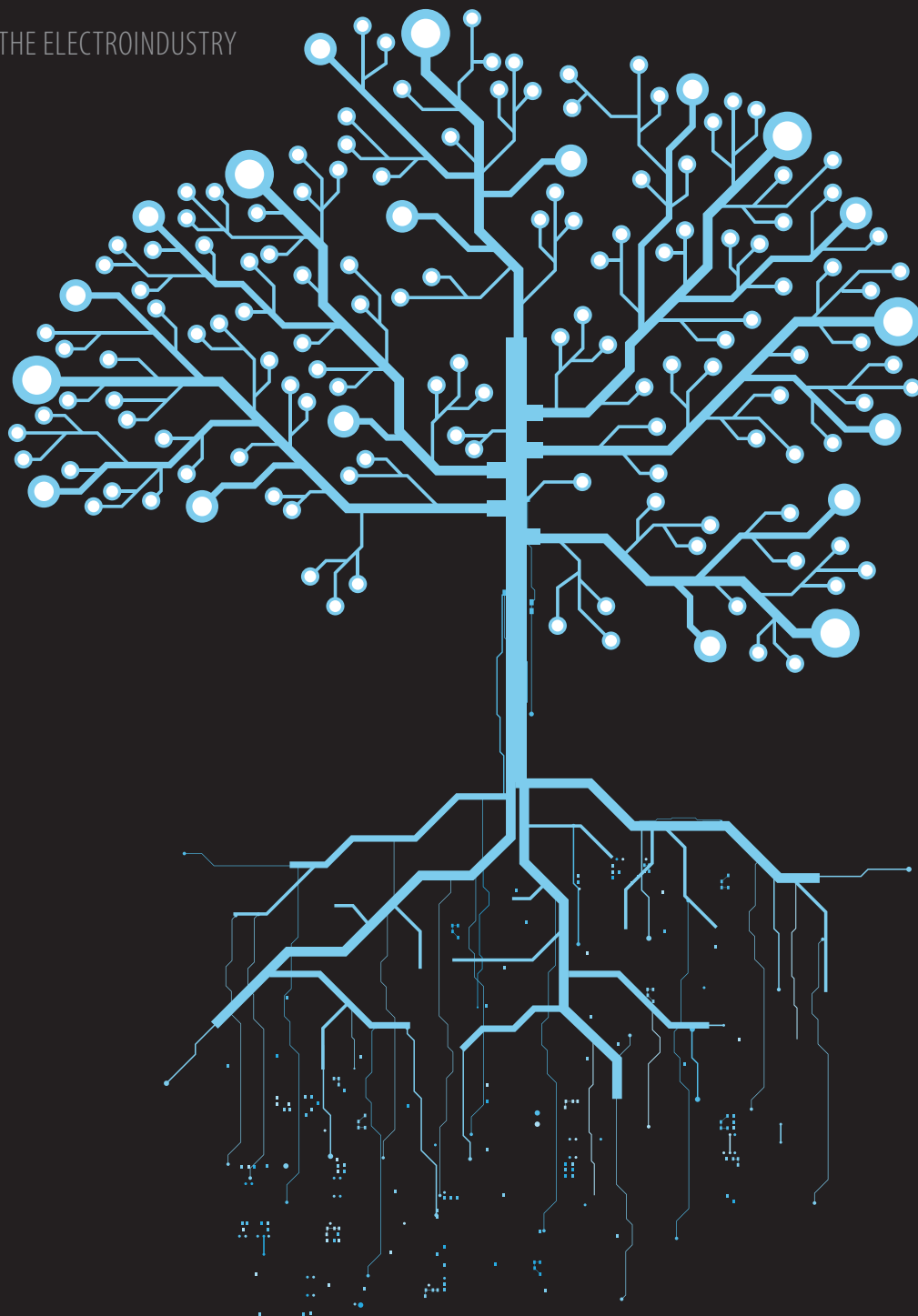
Westar’s new economical and cost-effective DA system is providing a fully automated FLISR and VAR distribution solution, with voltage control soon to be implemented. The system can translate between various communications protocols and seamlessly interface with Westar’s existing EMS system, leveraging some of Westar’s existing legacy equipment and positioning the company for future enhancements.

Deployment of the SEL DAC and security gateway hardware at Westar has opened the door to a system-wide modernization of communication devices across their service territory. The systems have been designed to maximize system effectiveness, improve system awareness, and increase work efficiencies, thanks primarily to new remote access capabilities.

The Lawrence area is benefiting from improved system reliability and reduced system losses, resulting in a win-win for Westar Energy and its customers. ☺

Kerrick Johnson,
Vice President
of Strategy and
Communication,
Vermont Electric
Power Company
(VELCO)

Mr. Johnson
conceived and led
VELCO's work to
secure the nation's
only successful
statewide smart
grid project
through a \$68
million DOE
investment grant.



Empowering the Next-Generation Power Grid with **Big Data**

Picture a tool that sees precisely into the near future and enables utilities to better protect communities, meet customer needs, and realize renewable energy's full value. That was the vision of the Vermont Electric Power Company (VELCO) in creating the Vermont Weather Analytics Center (VWAC).

The ways in which we generate, move, and use power—and how we pay for it—are changing faster than at any time since electric power came of age. Throughout the United States, steadily increasing amounts of solar and wind generation—intermittent power—are plugging into a grid that was designed to rely on stable and predictable baseload resources.

At the same time, public policy in many states is propelling the development of a grid that is more reliant on renewable sources. Customers, too, are driving the transformation with their own desires for greater control and the ability to generate some of their own power but still rely on the grid when they need it.

Severe weather events pose additional threats to the power grid. For example, Vermont has experienced eight federally declared weather disasters since 2011. Extreme weather has increased storm response budgets by 35 percent in three years for Vermont's largest distribution utility. Similar weather trends create safety and economic threats to communities, as well as utility and public infrastructure.

Adapting the legacy grid to these radically changing demands and conditions will require new tools and new ways of managing the system. In 2014, VELCO began work with IBM, Vermont's distribution utilities, and other partners to develop VWAC, which integrates IBM's precise weather forecasting with Vermont's customer load data and output data from the state's renewable generators to turn this mass of data into actionable information using leading-edge analytics.

Superior Accuracy

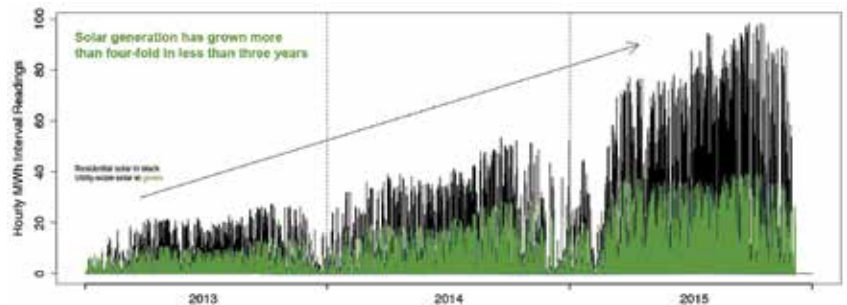
VWAC's analytics innovation lies in the powerful ability to feed multiple data streams into four integrated forecasting models

- **Weather:** The Vermont-specific version of IBM's weather model produces high-resolution, accurate, and specialized forecasts. Traditional 72-hour forecasts provide information to a 12 km² resolution, updated every on to three hours; VWAC's tools provide 72-hour advance forecasts to the 1 km² level, including wind speed and direction by elevation, solar irradiance, and precipitation for every ten-minute increment. It is, in effect, a four-dimensional forecast.

- **Electricity demand + net metering:** This model uses smart meters, weather forecasting, and other data sources to analyze customer-owned generation to predict demand and better plan for future system reliability needs.
- **Renewable Power:** This model forecasts solar and wind production, and separately correlates hydro to improve power supply planning efficiency.
- **Renewable integration stochastic engine (RISE):** This coupled model with a probabilistic framework synthesizes the other models' output for best use of Vermont's renewable generation, efficiency, demand response, and transmission resources.

Transforming Data into Intelligence

Which data, and in what form, matters. VELCO and IBM explored terabytes of data from telemetry, revenue metering, smart meters, geographical information systems, weather archives, and numerical weather prediction models. Through painstaking, collaborative analysis, we now can secure the right data at the right time in the right format necessary to generate actionable information.



Solar generation has grown more than four-fold in less than three years. Chart courtesy of VELCO

In order to represent relations between input data, the electrical grid, contextual information, and predictive models, VELCO and IBM developed a generic data model, which establishes the foundation for future business application development. This data model is the key for replicating the VWAC breakthrough with other energy companies.

More than a hundred users from VELCO, 17 distribution utilities, five state agencies, and one regional transmission organization (ISO New England, an independent system operator) access the information and insights through a weather and grid portal that includes forecast videos, statistical or interactive mapping, graphs, data tables, or archived data.

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The portal turns millions of bits of data into a model that gives users unified, structured, and meaningful access to information that enables smarter power supply decisions, disaster preparedness, storm restoration, grid planning, and more.

The development of a big data architecture for the ingestion, cleansing, and exploration of terabytes of smart meter data enables an unprecedented level of analysis and understanding of solar energy in Vermont. We now know the installed capacity, location, size, and output of grid-connected renewable generation. VELCO and IBM's work also revealed precisely, for the first time, the exponential growth rates of photovoltaics: by the end of 2015, up to 15 percent of Vermont's energy was supplied by solar systems on sunny days—a percentage that continues to rise.

Value Continues to Grow

VWAC has already produced significant benefits. It strengthens emergency response coordination calls and utility crew augmentation decisions and enhances field crew protection by providing targeted wind chill and lightning potential indices. VWAC enables more accurate, site-specific customer updates and has improved traffic safety through an effective partnership with the state transportation agency.

The system has substantially improved outage scheduling and contingency analyses with reliable 72-hour forecasts of expected system conditions. It gives utilities the ability to determine grid capacity for additional solar generation from the transmission system down to the substation level. It also enables demand analysis to the substation level—another first.

Furthermore, VWAC increases planning assessment reliability due to smart meter data integration, significantly improving the analysis of non-transmission alternatives to system upgrades. It refines our ability to assess transmission constraints and storage options and reduces power supply market risk by more accurately assessing supply needs. VWAC improves developer-customer collaboration on solar installations and enables refined comparative generation assessments of prospective solar and wind sites.

Finally, VWAC provides greater visibility to potential demand response events based on demand forecasts, from the substation to the distribution service territory to the statewide level. VWAC enhances the utilities' ability to manage statewide peak demand, and helps

analyze the cost-benefit of energy efficiency programs more precisely.

Next steps are underway to further strengthen core services and generate even greater value for more partners. Linking VWAC output to VELCO's energy management system will improve core grid reliability and more accurately integrate weather-dependent generation in it.

Connecting VWAC to Vermont emergency management, environmental, and agriculture agencies helps emergency operations keep communities safer and provides a detailed weather record for federal cost reimbursements. The Agency of Natural Resources can better monitor stream health, manage habitats, and protect field crews, and the Agency of Agriculture can provide farmers with information that will improve their operational efficiency and protect against damaging farm run-off discharges.

Through painstaking, collaborative analysis, we now secure the right data at the right time in the right format necessary to generate actionable information.

A pilot study initiated by ISO New England will share data streams and lessons learned to help this regional grid operator best meet its need to accurately account for rapidly growing renewable generation, especially solar, in the six New England states. Using VWAC to unlock additional value from renewables through documented performance results may support project and policy changes and could save customers millions in future system upgrades tied to load growth.

Reduced uncertainty of production from behind-the-meter (BTM) solar will result in better commitment and dispatch decisions by ISO New England, reducing production costs and avoiding unnecessary supplemental commitments and fuel consumption. Conservatively, savings associated with better commitment estimates (based on current BTM penetration levels) are on the order of \$1 million per summer season, growing as BTM penetration increases.

Expanded use of VWAC tools will improve accuracy and reduce uncertainty associated with grid-connected solar and wind resources in the day-ahead market, leading to more efficient commitment and dispatch decisions by the system operator. Applied nationally, the savings would be in the billions. ☼

Fast-Track Energy Storage Delivers Reliability

Recently expedited energy storage projects in California demonstrate an ability to dispatch stored electricity quickly.

It all started with the 2015 Aliso Canyon natural gas storage leak outside of Los Angeles, which emitted an estimated 109,000 metric tons of methane and took regional power plants offline. This event compelled the California Public Utilities Commission and affected utilities to quickly address potential capacity shortfalls.

By May 2016, regulators approved approximately 100 megawatts of energy storage to address peak capacity needs and provide on-demand power. In less than six months, more than 70 megawatts of storage was brought online. Beyond supporting regional capacity, these storage projects provide voltage support and store excess renewable power generated during the day.

Investments in new technologies, new services, and long-term collaborations are yielding results. To complement investment in battery technology, electrical manufacturers are delivering integrated and complete energy storage inverters and power distribution technologies to help meet project timelines.

Inverter and balance-of-system equipment can be rapidly deployed to meet a variety of grid service requirements, such as addressing outages, balancing renewables, and improving grid reliability. Higher-power energy storage inverters designed for grid-tied, utility-scale projects provide a more cost-effective solution for large-scale projects while delivering performance and reliability. This technology is helping to increase electrical resilience in large-scale applications while using a variety of battery chemistries to store and transmit power.

These technological solutions are critical, but long-term collaborations with contractors and battery suppliers are also key to moving energy storage projects from the drawing board to completion. Developers and financiers look for suppliers with strong reputations and balance sheets to support energy storage projects. Suppliers who have been delivering on solutions and supporting utility-scale installations for decades are critical to winning projects expected to serve for years to come.

A single-source supplier for power conversion and the electrical balance of system equipment has an advantage. It may provide all of the electrical equipment and the engineering expertise to design a solution that helps reduce capital expenditures, as well as operational and maintenance costs, when combined with medium-voltage transformers and interconnection switchgear, metering, monitoring, control systems, and commissioning services.

Regional manufacturing centers meet local and specific project needs faster through proximity and the ability to fast-track orders. This reduces shipping time, works around larger facility commitments, and helps equipment get delivered in record time—all while providing access to expert resources who are familiar with local utility requirements.

Investments in research and development have also yielded control technologies and platforms that are able to integrate storage and renewables onto the grid to further support electrical resilience. Those efforts have resulted in control technologies that are modular and scalable to accommodate our evolving energy infrastructure. Ⓔ

John Vernacchia,
Segment Manager
for Renewable
Energy Solutions,
Eaton

Mr. Vernacchia helps customers connect solar, wind, and energy storage resources to buildings and the utility grid.



Energy storage inverters increase electrical resiliency in large-scale applications and work with a wide range of battery chemistries to store and transmit power. Photo courtesy of Eaton



Using submeters to bill end users reduces overall consumption and waste. Submeter photo courtesy of EZ Meter

Adapting to Changing Times with Submeters

Ryan Fetgatter,
Partner, EZ
Meter

Mr. Fetgatter was one of the first to explore the potential for a NEMA section on submetering.

Although electric submetering has been around for years, most people are unaware of its importance to energy consumption management. This mindset is poised to change, however, as the future demands accountability. The most accurate, efficient, practical, and affordable solution to monitoring electric energy consumption for management, preventive maintenance, and billing purposes is electric submeters.

When government programs began to promote energy conservation, they used a platform based on an algorithm: volts $\times$ amps $\times$ power factor = watts. Though brilliant on paper, the model is flawed. It cannot be relied on for analysis or benchmarking purposes. This prompted the formation of the NEMA Electrical Submetering Section (5ESM) to educate the public and unite the industry in one cohesive voice.

Submeters are the electrical metering devices and associated data acquisition and communication equipment that are connected downstream from the utility meter and provide details of energy use for one or more electrical loads. Such equipment is rated at not more than 600 V AC.

Currently, submeters are lumped into a larger safety standard developed for utility meters that don't operate or function in the same manner as an electric submeter. To this end, 5ESM is working with UL on a standard that addresses safety for electric submeters. A related task is to establish an accuracy standard. Determining the testing ranges has been complicated, but the subcommittee expects to have a version ready to present to ANSI within the next six months.

The section also promotes the benefits of electric submetering within key market segments: the revenue-grade electric kilowatt-hour submeter and the electric energy management and monitoring submeter.

Revenue-grade billing submeters measure the consumed kilowatt-hour of a load with the intent of billing for electricity used. Common applications are multi-family housing, marinas, RV parks, retail rentals, and other properties where a manager wants to pass electrical consumption onto tenants.

Electric management and monitoring submeters accurately monitor real electrical consumption, productivity, and quality for benchmarking, regulation, and preventive maintenance. Data may include kilowatt-hours, volts, amperes, power factor, kVAR, and kVA—all beneficial to facility and plant managers.

By monitoring an HVAC unit, for example, a facility manager can see the factors that fall out of a desirable range over a period of time. The manager who can forecast that a component is going to fail can properly prepare for it. Whether the equipment is serviced or replaced, the end result is no surprise shutdowns.

The 5ESM Government Relations Committee is presenting a common platform to federal, state, and municipal entities who are writing submeter language. According to Navigant Research, legislation is being written now that will turn a \$949.7 million-per-year industry into a \$2.5 billion-per-year industry by 2024.¹

When that date arrives, will you have used submeters to adapt to the changing times? 🌱

¹ <https://www.navigantresearch.com/newsroom/global-revenue-from-electric-submeters-expected-to-reach-2-5-billion-by-2024>

In recent years, regulatory policy in the United States and elsewhere has been influenced to a broad extent by philosophical concepts such as product stewardship, the precautionary principle, and zero waste.

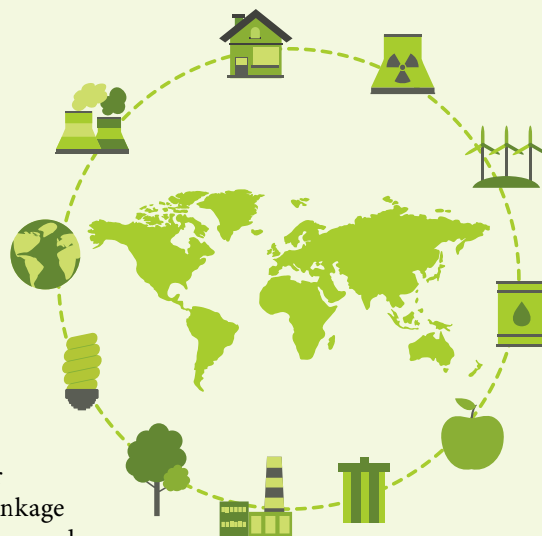
At the same time, another model has risen to become the conceptual framework for environmental activists and lawmakers: the circular economy. According to its chief proponent, the UK-based Ellen MacArthur Foundation, this framework is restorative and regenerative by design and aims to keep products, components, and materials at their highest utility and value at all times, distinguishing between technical and biological cycles.”¹

Not surprisingly, governments provide motivation in the form of statutory initiatives and policy strategies aimed at capturing the benefits that are expected to accrue from essentially designing waste out of the system, which the circular economy purports to do. In the forefront as usual, the European Commission adopted a circular economy package in 2015 that included legislative proposals on waste, in addition to an action plan to support the circular economy in each step of the value chain. Early this year, the commission touted the progress made in implementing the key elements of this action plan.³

1 <https://www.ellenmacarthurfoundation.org/circular-economy/overview/concept>
2 [https://www.greenbiz.com/article/defining-circular-economy-beyond-recycling-](https://www.greenbiz.com/article/defining-circular-economy-beyond-recycling-material-reuse)
3 http://europa.eu/rapid/press-release_IP-15-6203_en.htm
4 <https://www.ontario.ca/laws/statute/16r12>

Philips, a NEMA member, states on its website, “In a circular economy, the more effective use of materials enables to create more value, both by cost savings and by developing new markets or growing existing ones.”

The underlying premise of the circular economy is that societies can rethink how things are made and used to a far greater and more productive extent than in the past. For manufacturers it's a direction that, while not without risk, provides fertile ground for innovation and opportunity for leadership. 🌱



Mr. Kohorst has consulted on environmental and public health issues for more than 25 years.

- 1 <https://www.ellenmacarthurfoundation.org/circular-economy/overview/concept>
- 2 <https://www.greenbiz.com/article/defining-circular-economy-beyond-recycling-material-reuse>
- 3 http://europa.eu/rapid/press-release_IP-15-6203_en.htm
- 4 <https://www.ontario.ca/laws/statute/16r12>

5 <https://www.fastcoexist.com/1681904/5-business-models-that-are-driving-the-circular-economy>

Advancing the Use of 3D Printing in Medicine

Ms. McDaniel is vice chair of the America Makes & ANSI Additive Manufacturing Standards Collaborative Workgroup. She is also a member of DICOM WG-17 3D Manufacturing.

In the last few years, headlines have suggested that the use of additive manufacturing (AM), also known as 3D printing, in medicine is a new way to save and improve lives. The truth is, it's not so new.

Twenty years ago, anatomical models were used for planning complicated surgeries. In 2000, hearing aid cases were 3D-printed, and within a few years they became the industry standard. Medical applications have been a leader in taking 3D printing technology far beyond product development. The combination of using medical imaging data to create patient-matched devices and the ability to manufacture structures difficult to produce with traditional technologies is compelling to an industry always looking for ways to innovate and improve care for patients.

of medical imaging files, facilitated an investment in an area that is not yet included in reimbursable expenses by payers.

SME is a nonprofit organization that promotes advanced manufacturing technology. It has been a gathering point for users and developers of AM since 1990, when it convened an event that has come to be known as RAPID+TCT. It now counts clinical and medical device AM applications as an essential component of the annual convention. In 1997, SME published *Rapid Prototyping Technology: A Unique Approach to the Diagnosis and Planning of Medical Procedures*, the first book on medical applications of AM.

About 10 years ago, SME members recognized the need to develop consensus standards for additive manufacturing. Since SME is not a standards development organization (SDO), it approached ASTM, an established SDO, and created the F42 Committee on Additive Manufacturing Technologies.

Spreading the Word

Despite all of this, widespread medical use of 3D printing in medicine has been fairly slow. Industry professionals, clinicians, technology developers, and researchers are working together to identify challenges and then develop tools and resources to address them through the SME Medical Additive Manufacturing/3D Printing Workgroup (SME WG).

The SME WG is addressing those challenges through several projects:

STANDARDS AND QUALITY ASSURANCE

From the collection of imaging data to the use of parts, devices, and models, the workgroup has described the current state of the industry and identified gaps as the foundation for further development. Much of this work has been done supporting the Additive Manufacturing Standardization Collaborative (AMSC), a joint project with America Makes (a national accelerator for AM) and ANSI. Supporting work resulted in the creation of an open, searchable database of existing and in-development standards that were developed specifically for AM. The database can be found at www.sme.org/am3dp.



Interest has been fueled by many factors, including the expiration of patents, beginning in 2010. As competition intensified, the effort by machine builders to bring down prices accelerated. At the same time, the availability and increased reliability of metal printers and multi-color machines expanded interest and use.

Metal printing systems allowed device manufacturers to produce porous structures for orthopedic implants that would be difficult to produce with traditional methods. For hospitals, the drop in prices and improvement in multicolor machines and materials, as well as development of supporting software for critical segmentation

OUTREACH

Two groups were identified for outreach: students and professionals. To share the excitement and possibilities of additive manufacturing with students, this effort will identify opportunities, develop tools and templates, and provide advice to connect with K-12 and college students.

Since many AM users are new to manufacturing, the workgroup also gathered existing information into an interactive website for professionals that helps them navigate cases and connects them to existing standards, regulatory information, technical articles, how-to information, and vendor resources.

MEDICAL APPLICATIONS

Connecting all key stakeholders in clinical, scientific, and medical device fields encourages them to share best practices and identify effective methodologies and reliable protocols. This initiative lays the groundwork for producing solid evidence on 3D-printed medical devices, with a particular focus on anatomical models, patient-matched guides, and implants.

FILE FORMAT

SME WG identified gaps in the Digital Imaging and Communications in Medicine (DICOM) standard, a global information technology standard under MITA's purview that ensures the interoperability of systems used to produce and process medical images. The workgroup will integrate the needs of 3D printing into DICOM in a way that is consistent with patient privacy concerns and best practices.

The combination of using medical imaging data to create patient-matched devices and the ability to manufacture structures difficult to produce with traditional technologies is compelling to an industry always looking for ways to innovate and improve care for patients.



Through the AMSC, SME connected with MITA to discuss the gaps and possible ways to address the needs in the existing DICOM standard. Allan Noordvyk of McKesson Imaging, volunteered and joined the SME WG. Based on his consultations, a proposal to create WG-17 3D Manufacturing was unanimously approved by the DICOM Steering Committee on December 1, 2016. Mr. Noordvyk and Justin Ryan of Phoenix Children's Hospital, co-chair the workgroup.

Now is an exciting time to be advancing the use of AM in medicine. SME will continue to facilitate and support these efforts through collaborations and resources. To learn more, visit www.sme.org/medical-additive. 

What's in a Name?

What's the difference between additive manufacturing (AM), 3D printing, and rapid prototyping (RP)? Basically, none.

RP is the term that refers to the technology's use primarily as a quick method to prototype. AM began to be used around 2005 when materials and processes evolved to permit production of end-use pieces. 3D printing initially referred to a specific process developed at MIT and then encompassed the early low-cost, low-end machines.

Today, *additive manufacturing* is the ISO standard term and is used by those in traditional manufacturing (e.g., device, aerospace, and automotive). *3D printing* is the term most often used by media and those engaged in point-of-care manufacturing in a clinical setting.

Regardless of what it's called, advancements and opportunities are sure to increase. 

Senate Dems Propose Infrastructure Blueprint

On January 24, 2017, Senate Minority Leader Charles E. Schumer (D-NY) and top Senate Democrats unveiled a major infrastructure proposal, *A Blueprint to Rebuild America's Infrastructure and Create 15 Million Jobs*. This plan requires a \$1 trillion investment and, by their projections, would create more than 15 million jobs over the next 10 years.

The blueprint would provide billions for funding essential road and bridge improvement projects,

Reconstruct roads & bridges	\$100B	Improve airports	\$30B
Revitalize Main Street	\$100B	Address ports & waterways	\$10B
Expand TIGER	\$10B	Build resilient communities	\$25B
Rehabilitate water and sewer	\$110B	21st-century energy infrastructure	\$100B
Modernize rail infrastructure	\$50B	Expand broadband	\$20B
Repair & expand transit	\$130B	Invest in public lands & tribal infrastructure	\$20B
Vital infrastructure program	\$200B	Modernize VA hospitals	\$10B
Rebuild public schools	\$75B	Provide innovative financing tools	\$10B

repairing critical rail systems, modernizing Veterans Administration hospitals, rebuilding public schools, expanding port and waterway infrastructure, rehabilitating water and sewer structures, and building new transmission lines.

The costs would be covered in some part by closing tax loopholes used by both corporations and individuals. The breakdown of the funding is shown in the chart. The blueprint's total cost is the same amount that President Trump has suggested for his plan. Details on the president's plan have yet to be released.

During his recent speech to Congress, Mr. Trump again called for the need for an infrastructure package. While Congress previously started hearings on the fixing the aging infrastructure, its members are hesitant to move forward until the president releases his own plan.

The need for an infrastructure package is one of the few policy areas in which Republicans and Democrats agree, but it will come down to how it is funded. ☎

Microgrids Figure in Infrastructure Proposal

Hundreds of avoidable power failures occur each year, costing the U.S. economy between \$25 and \$70 billion annually, according to the blueprint proposed by U.S. Senate Democrats. Microgrids keep the power flowing to their customers during power outages by islanding away from trouble on the grid and employing on-site

energy. When the grid is functioning normally, microgrids supply services to strengthen grid operations and lower costs.

Including microgrids in the blueprint won praise from Rob Thornton, president and CEO of the International District Energy Association, who said that the technologies offer tremendous potential "to strengthen and modernize the grid while enhancing economic resiliency with more sustainable, secure energy services for customers."

By way of example, he described the Boston area's Veolia Kendall Station Green Steam CHP project, which he said generated over \$21 million in direct labor investment in high quality jobs for pipe fitters, construction, electrical, and other trades while producing significant energy and environmental community benefits. ☎



Elisa Wood

Chief Editor, MicrogridKnowledge.com
Excerpted from *Microgrid Knowledge*,
January 26, 2017, with permission

Major Changes to 2017 NEC Covered with IEEE/IAS

addressed changes to the 2017 *National Electrical Code* (NEC) at the January meeting of the Oakland/East Bay Chapter of the Institute of Electrical and Electronics Engineers/Industry Applications Society (IEEE/IAS).

The 2014 NEC has only been in effect in California since January 1, 2017, and the 2017 NEC will likely not be in effect until January 2020. The IEEE members, however, were interested in the 2017 NEC changes since they reflect a lot of new technologies that industry is seeing.

According to Jim McGeough, western region drives sales manager for Eaton in the Northern California area, “The topics have far-reaching considerations for everyone in the electrical industry.”

In this two-hour presentation, I covered several major topics:

- New articles in the 2017 NEC, including Article 691, “Large Scale PV Electric Power Production”; Article 706, “Energy Storage Systems”; Article 710, “Stand Alone Systems”; and Article 712, “DC Microgrids

- New areas in the code that require the calculation and documentation of available fault
- Two new sections in Article 110 regarding reconditioned, refurbished, or remanufactured equipment (110.3 and 110.21)
- A new exception for the calculation of lighting loads (220.12) and another lighting load exception in the 2014 NEC, which just went into effect in California
- The elimination of the temperature adder Table 310.15(B)(3)(c) for raceways or cables on or above rooftops
- Changes to 404.2(c) regarding the requirement to have a grounded conductor present at switch locations to allow for the operation of lighting controls
- Requirement in 408.3 for barriers to cover live service parts in service panelboards
- New requirements in 725.144 for power over Ethernet cables

The presentation was well received. There was interest expressed for more detailed presentations on solar and energy storage. ☺



Ann Brandstadter

Manager, Standards Publications
and Marketing, NEMA

This Month in Standards for April 2017

ANSI C81.61-2017 *American National Standard for Electric Lamp Bases—Specifications for Bases (Caps) for Electric Lamps* and **ANSI C81.62-2017** *American National Standard for Electric Lampholders* now include G6.6 designations for lamp bases and holders, respectively.

ANSI C81.61-2017 is available in hard copy or as an electronic download for \$517 on the NEMA website. **ANSI C81.62-2017** is available in hard copy or as an electronic download for \$380 on the NEMA website.

ANSI C82.9-2016 *American National Standard for Lamp Ballasts—High-Intensity Discharge and Low-Pressure Sodium Lamps—Definitions* can be purchased in hard copy or as an electronic download for \$105 on the NEMA website.

NEMA ICS 19-2002 (R2007, R2011, R2016) *Diagrams, Device Designations and Symbols for*

Industrial Controls and Systems can be purchased in hard copy for \$106 or as an electronic download at no cost on the NEMA website.

NEMA MG 1-2016 *Motors and Generators* now includes *Part 34: Air-Over Motor Efficiency Test Method*. MG 1 is available in hard copy for \$484 and as an electronic download at no cost on the NEMA website. Part 34 is available as a download at no cost at www.nema.org/mg1-part34.

NEMA MG 10-2017 *Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors* is available in hard copy for \$87 and as an electronic download at no cost on the NEMA website.

NEMA MS 12-2016 *Quantification and Mapping of Geometric Distortion for Special Applications* is available in hard copy for \$72 or as an electronic download for no cost on the NEMA website. ☺

Wind Generation Heating Up in Mexico

Wind energy comes from the energy of the sun, since it is the changes in atmospheric pressures and temperatures that set air in motion, causing wind, which turns turbine blades to convert kinetic energy into electric energy.

The first wind developments in Mexico began with Federal Electricity Commission projects in Guerrero Negro (in Baja California Sur) and La Venta (in Oaxaca), in 1982 and 1994, respectively.

In 2008, the installed capacity of all renewable energy sources in Mexico was 2,000 MW, including wind. Guerrero Negro and La Venta were the only projects until 2009, when private participation led to multiple additional wind projects in Oaxaca, adding 510 MW of capacity when entering operation in 2012.

The mechanism of “open seasons” permitted the planning and development of new transmission infrastructure to accommodate wind generation resources. By 2012, wind power generation showed an average annual growth of 76.5 percent, with annual additions in capacity above 2,200 MW. At the end of 2012, nine projects with an installed capacity of 729.05 MW were in operation, of which 690 MW were installed in the state of Oaxaca.

According to the Clean Energies Progress Report, as of June 30, 2016, Mexico generated 19.68 percent of its electricity from clean sources. During the first quarter of 2016, more than 432 MW of wind

turbines came into operation, an increase of 15.68 percent over 2015.

As of June 30, 2016, Mexico achieved an installed clean generation total of 20,160 MW, which represents 28.39 percent of the total national capacity. This capacity grew by 6.29 percent, compared to that recorded in June 2015.

New fields are targeted in several states, including Baja California, Zacatecas, Hidalgo, Veracruz, Sinaloa, and the Yucatan Peninsula. Oaxaca remains a key region due to geographical conditions, such as in the Tehuantepec Isthmus area. According to the National Electricity System Development Program, wind capacity may triple in the next three years, with 2,456 MW at the end of 2018 and another 3,857 MW at the end of 2019.

The development of wind generation projects in Mexico is the result of a combination of domestic and foreign investment. Many companies already have an important role in the generation and use of wind energy, including Acciona, Demex, EDF, Femsa-Macquarie, Gamesa, Iberdrola, Peñoles, Wal-Mart, Grupo Bimbo, Grupo Modelo, Mittal, Cemex and Grupo Herdez.

The Mexican secretary of energy has set targets for a minimum share of clean energy in electricity generation of 25 percent by 2018, 30 percent by 2021, and 35 percent by 2024. ☞

TFA Takes Aim at Red Tape

On February 22, the World Trade Organization (WTO) Trade Facilitation Agreement (TFA) entered into force with ratification by the 112th WTO member country.

What could the TFA mean for NEMA? In short, cheaper, better, and faster “just-in-time” trade:

- Expedited release of shipments by customs authorities
- Online availability of import and export procedures, with contact points for questions

- Acceptance of electronic payments and, when possible, electronic documents
- “Single-window” entry points for customs and regulatory compliance

The WTO estimated that, in the long run, full TFA implementation will reduce trade costs by an average of 14 percent, with developing countries such as Peru, Bolivia, and South Africa seeing even greater savings.

For more information, NEMA members should consult the NEMA Intelligence Portal. ☞

Craig Updyke

Director, Trade and Commercial
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Mixed Views Leave EBCI Unchanged

At an aggregate level, business confidence remained unchanged in February, hitting the same 72.2 mark as it did in January. A sense of wait-and-see has crept into some of the monthly comments by senior managers at NEMA member companies who contribute to the Electroindustry Business Conditions Index (EBCI). This resulted in an 11-point drop in the percentage of respondents reporting both better and worse conditions, along with a 22-point increase in the share of those who see current conditions as unchanged.

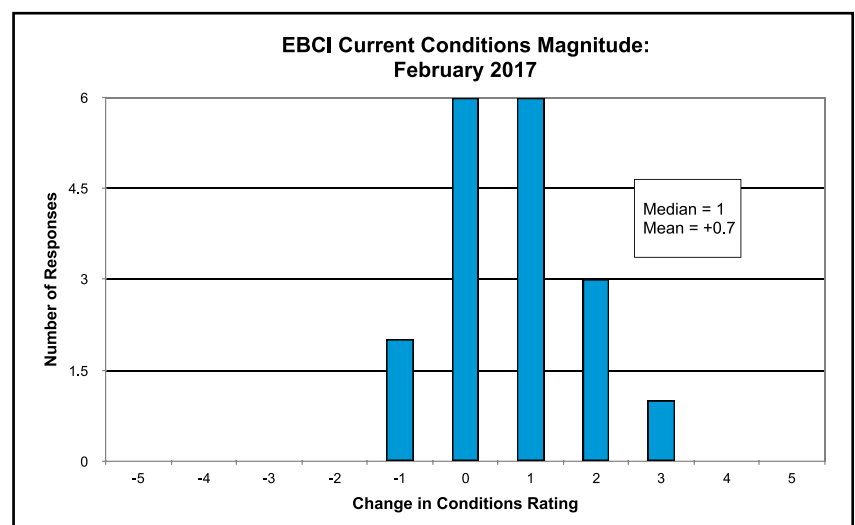
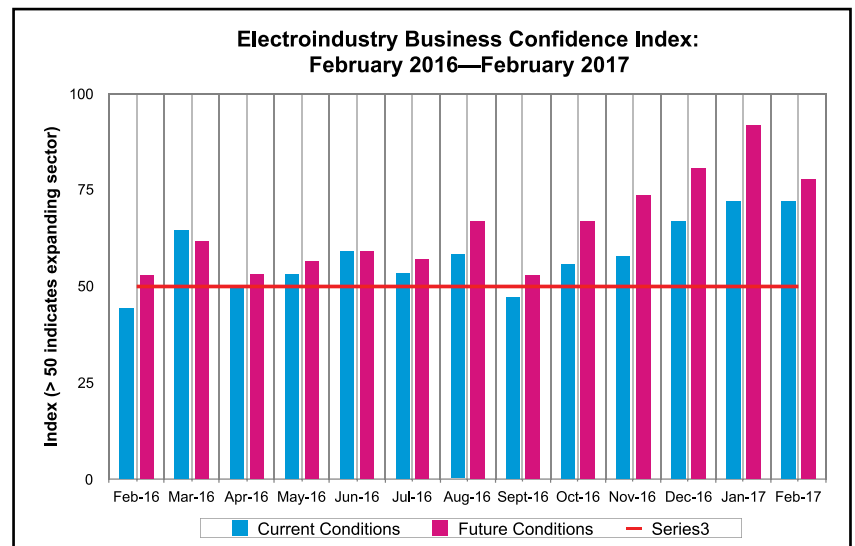
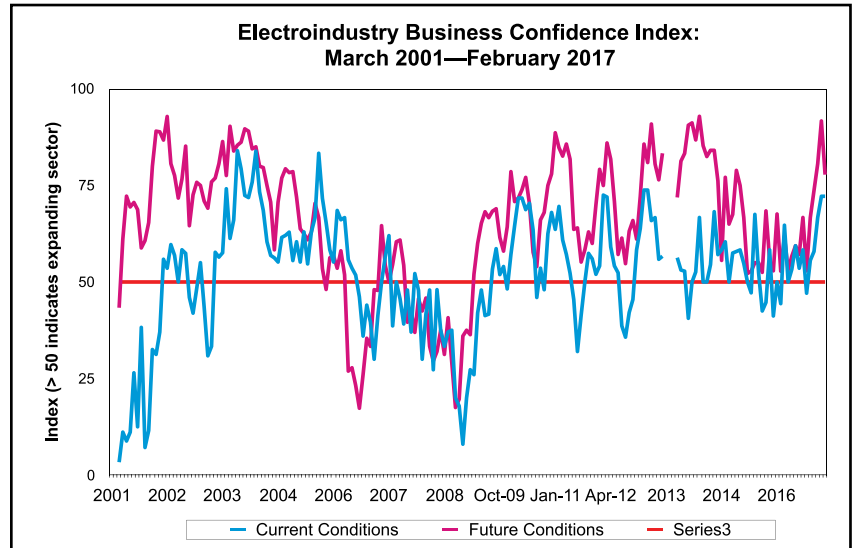
Despite the internal churning, the current index remains quite firmly in the expansionary range.

The survey's measure of the intensity of change in electroindustry business conditions continued to move further into positive territory as the mean rating increased from +0.6 last month to +0.7 in February. The median score remained at 1, where it landed last month following many months at 0. Panelists are asked to report on the intensity of change on a scale ranging from -5 (deteriorated significantly) through 0 (unchanged) to +5 (improved significantly).

The future conditions index had reached stratospheric levels last month, nearly matching an all-time high with an aggregate score of 91.7. That number came down by 13.9 points to 77.8 in February, which still reflects a robust level of confidence in conditions six months from now.

The most significant shift in the underlying data comes from the 16-percentage-point decline (from 83 percent in January to 67 percent now) in those expecting conditions to be better. Also, 11 percent of the panelists now expect worse conditions, up from zero with that expectation last month.

Visit www.nema.org/ebci for the complete February 2017 report. 📄



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