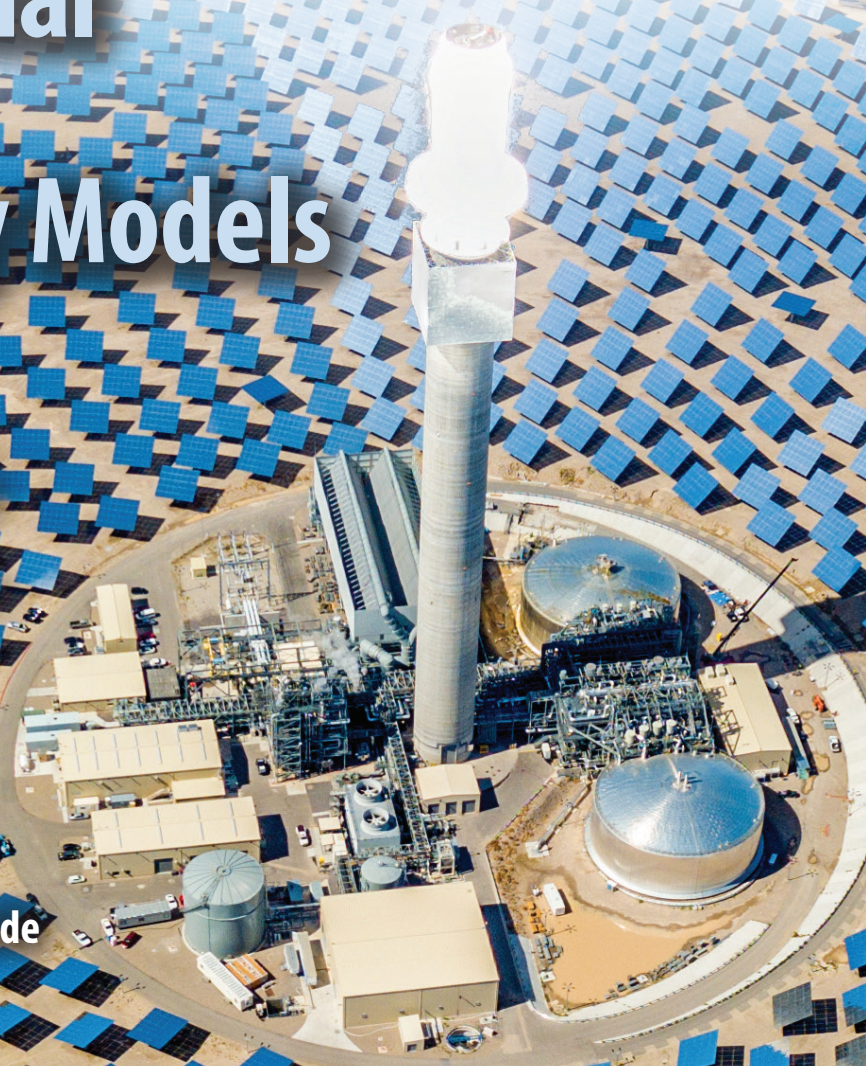


# electroindustry

www.nema.org | January/February 2019 | Vol. 24 No. 1

## Transformational Technologies Reshape Utility Models

- 4 | **Transactive Energy—  
An Overview for Manufacturers**
- 9 | **Transformational Technologies  
Reshape Grid Modernization**
- 14 | **NEMA Division Moves Toward  
Coalition of Sections**
- 16 | **Outlook for 116th Congress:  
Infrastructure, Climate, and Trade**



# CONTENTS

2



Itron's John V. Lampe on Leveraging the Power of a Grid in Transition

3



FERC Commissioner Richard Glick on facilitating a robust and resilient grid

15



Don Leavens analyzes key macroeconomic variables that drive the electroindustry at the IEC Business Summit.

## electroindustry

**Publisher** | Tracy Cullen  
**Editor in Chief** | Pat Walsh  
**Contributing Editors** | Ann Brandstadter, Mariela Echeverria, Andrea Goodwin, William E. Green III  
**Art Director** | Jennifer Tillmann  
**National Sales Manager** | Tilman Gerald  
The Townsend Group  
202.367.2497  
tgerald@townsend-group.com

*electroindustry* (ei) magazine (ISSN 1066-2464) is published bimonthly by the National Electrical Manufacturers Association (NEMA), 1300 N. 17th Street, Suite 900, Rosslyn, VA 22209; 703.841.3200. Periodicals postage paid at Rosslyn, Virginia, and additional mailing offices. POSTMASTER: Send address changes to NEMA, 1300 N. 17th Street, Suite 900, Rosslyn, VA 22209. The opinions or views expressed in *ei* do not necessarily reflect the positions of NEMA or any of its subdivisions. The editorial staff reserves the right to edit all submissions but will not alter the author's viewpoint. Every attempt is made to ensure that information is current and accurate. Subscribe to *ei* at [www.nema.org/subscribe2ei](http://www.nema.org/subscribe2ei). Contact us at [ei@nema.org](mailto:ei@nema.org).

Follow NEMA:



We thank this issue's advertiser:

idea4  
EXCHANGE™

[idea4industry.com](http://idea4industry.com)

4

### Transactive Energy— An Overview for Manufacturers

Ron Cunningham, American Electric Power  
David Forfia, Electric Reliability Council of Texas  
Leonard Tillman, Partner, Balch & Bingham LLP

9

### Transformational Technologies Reshape Grid Modernization

Gary Rackliffe, Vice President, Smart Grids and Grid Modernization, ABB Inc.

12

### Back to the Future: The Latest Fuel Cell Revolution

Garry Golden, Futurist, Forward Elements

1

### Comments from the Chairman

2

### Views

14

### Electric News

16

### Advocacy

17

### Codes & Standards

18

### International

19

### Spotlight

20

### Business Analytics

21

### Endnotes from the President

### Coming in March/April:

The Quality of Light = Quality of Life. Look for articles that address new technology, applications, systems, and innovations that focus on the quality afforded by lighting systems.



## officers

### Chairman

**Mark Gliebe**

Chairman & CEO

Regal Beloit Corporation

### Vice Chairman

**Raj Batra**

President, Digital Factory

Siemens Industry, Inc.

### Treasurer

**Revathi Advaiti**

Chief Operating Officer

Electrical Sector

Eaton

### Immediate Past Chairman

**David G. Nord**

Chairman, President & CEO

Hubbell Incorporated

### President & CEO

**Kevin J. Cosgriff**

### Secretary

**Clark R. Silcox**

**T**his is truly an exciting time to be an electrical manufacturer.

Over the course of my career, I have had the opportunity to be engaged in a number of NEMA industries, from lighting to electric motors. But today is different. Not only must we compete on the basis of well-understood product parameters, but also on a new market underpinning that requires a value based on the ability of these products to connect.

Take the example of the electrical grid, the topic of this magazine. While we still have all the recognized 20th-century components of the grid, they are enhanced by integrated networks of smart meters, communication devices, and data management systems. Not surprisingly, innovation in the electrical and medical imaging industries extends well beyond utility products and systems. Throughout the year, we will see how each NEMA Division is experiencing its own transformation.

For nearly a century, NEMA Member companies have been renowned for products that are safe, reliable, and efficient. When it comes to the energy efficiency of our products, we have made enormous progress—so much so that we are now at the point where there are technical and economic limits to further component-level improvements but we can't stop here. In this third century of electrification, we can expect continued growth in electrification demand, much of that demand enabled by the very efficiencies that we have built into our products. We need to continue our innovation journey with a focus on system efficiency and connected products.

As we position ourselves at the forefront of a connected, digitalized, and electrified world, we will see how data generated by our connected products can be used to learn, correct, and enhance the systems where our products operate. We will also better understand the status of our systems and use that knowledge to make real-time operating and maintenance decisions. We can even build virtual replicas of real systems and operate them using real-time data to predict and monitor performance and even train our workforce. The progress we have made is incredible, but in a connected world, there is so much more we can do.

To maximize these opportunities, NEMA manufacturers will continue to imagine and innovate. I urge all of us to innovate aggressively around connected products and energy-efficient systems. Take advantage of this unique opportunity in time for your company and our industry to make a difference in the lives of our citizens, the health of our businesses, and the well-being of our countries. 🌐

Mark Gliebe

Chairman, NEMA Board of Governors

## Leveraging the Power of a Grid in Transition



John V. Lampe, Itron

The electrical industry is in transition from a predictable grid—with few sources of energy and few monitoring and control points—to a dynamic one with many monitoring and control points. Three categories of change motivate this transition:

- the public's reduced tolerance for outages;
- increased emphasis on cybersecurity; and
- society's desire to employ more renewable energy for electricity and transportation.

These changes require greater resilience from the grid and its supporting systems. One successful model of a resilient yet flexible system is the internet. Its architects designed it to withstand losses of network segments while maintaining functionality. As we work with global utility customers, we see that many utilities are beginning to rethink modern smart grid requirements. Emerging from this is an architectural construct to meet new divergent requirements while maintaining fundamental principles such as safety and reliability.<sup>1</sup>

Similar to the internet, this modular federation of a microgrids architectural model enhances resilience as broadly as possible in any situation, even when segments of the electrical or information network are non-operational. In this context, microgrids mean interconnected sections of the grid intended to act with central coordination but able to function locally when reconfigured or even isolated by events. In urban and suburban areas, reconfiguration is more common, while in rural, island, and developing areas, subsystems may be isolated (electrically or from central data communications).

A key element of this transition is that both the electrical network and its supporting information network are becoming more modular. Each must be able to withstand reconfiguration or loss of central connections yet continue best-effort functionality in a safe manner. As the electrical grid becomes more dynamic, its supporting information network becomes more mission-critical. When isolated, microgrids can leverage

peer-to-peer communication and distributed energy resources to respond quickly to changing local conditions.

This transition is evidenced across three classes: traditional distribution automation devices, new grid-edge devices, and new uses of smart meter data.

For many utilities, deploying automated switch devices, such as reclosers, is a key first step in enhancing reliability and supporting reconfiguration. As they see increased traction in renewables, storage, and electric vehicles, many utilities are now deploying the second class of devices in greater numbers closer to the grid edge to support greater resilience and possible isolation. These include line sensors, dynamic volt-ampere reactive (VAR) sources deployed at the service transformer, direct inverter monitoring/control, distribution transformer monitoring, and pole sensors.

Finally, utilities are also finding new use cases leveraging insights from smart meter data in combination with the new grid-edge devices. We have customers using meter data for conservation voltage regulation—volt/VAR optimization as well as for condition-based maintenance of transformers and conductors.

The transition is also seen as utilities move toward unified software and data platforms for managing the increasing complexity of the grid. Such network platforms support both existing and new classes of intelligent devices and software solutions that improve efficiencies, enhance system resilience, and enable new services.

Utilities have an opportunity to move toward a more modular, resilient, and flexible grid that harnesses a more diverse and distributed set of energy sources. This must be supported by a more modular information network. Combined, the new architecture, devices, software, and data network platforms are empowering the modern utility to meet these new requirements while maximizing value for their ratepayers. With collaboration and foresight, our industry is making real progress on this challenging journey. 🌐

<sup>1</sup> <https://www.itron.com/industries/electricity/grid-management#whitepaper>

## Integrating Expected Growth in Renewable and Distributed Resources

The Intergovernmental Panel on Climate Change (IPCC) recently concluded that we are on track to see global temperatures rise by 1.5°C as early as 2030. The Trump Administration's most recent National Climate Assessment also indicates that, absent a dramatic reduction in greenhouse gas emissions, the annual economic consequences of climate change will reach into the hundreds of billions of dollars by the end of the century.

Until recently, the electricity sector had been the largest source of greenhouse gas emissions in the United States. A combination of improved energy efficiency and significant reductions in the cost of renewable and natural-gas generation has caused electricity-sector emissions to decline by 28 percent since 2005. But much more needs to be done. According to the IPCC, carbon dioxide emissions must be reduced by at least 45 percent from 2010 levels over the next 12 years. Avoiding the worst effects of climate change will likely require the electrification of other parts of the economy, especially the transportation sector, which is now the nation's principal source of greenhouse gas emissions.

Despite these daunting challenges, we have the technology to reduce greenhouse gas emissions. Wind and solar generation continue to grow at exponential rates, producing as much as 60 to 70 percent of all electricity consumed in markets as diverse as California and the Southwest Power Pool.

Repeating the mindless mantra that “the sun doesn't shine and the wind doesn't blow all the time” ignores that we possess technologies that address the variability of renewable energy resources. For instance, operational protocols and greater regional coordination can smooth out the ebbs and flows of variable generation technologies, just as they accommodate fluctuations in demand. Energy storage technologies like batteries, pumped hydro, and compressed air can enhance the flexibility of the grid and reduce the cost of electricity at peak periods.

We cannot, however, achieve a decarbonized electric generation sector without a robust grid. Although the U.S. has some of the best renewable resources, they are often situated in remote locations. Accessing them will require a

significant investment in long-haul transmission facilities. Developing interregional transmission infrastructure has the potential to deliver billions of dollars in savings to consumers by reducing congestion and unleashing new renewable projects trapped in interconnection queues across the country. For example, the Eastern Interconnection States Planning Council recently found that increasing interregional and other proactive planning could provide \$90 billion in system-wide savings for consumers.

A stronger grid is also necessary for distributed energy resources (DERs) to achieve their potential. While DERs represent only two percent of installed capacity, consumer demand and state targets are transforming how we build and consume power, resulting in a tremendous increase in their installation.

In 2016, more than 12 percent of all new generating capacity in the U.S. came from distributed photovoltaic solar. Nowhere is this more evident than in California, which is well on its way toward procuring 12,000 MW of distributed renewable resources by 2020. Integrating these new DERs reliably and efficiently will require the development of a more modern, nimble grid that can handle the substantial growth in two-way transactions that DERs and energy storage will facilitate.

Although FERC is not an environmental regulator, our actions affect the country's ability to achieve meaningful greenhouse gas emissions reductions. It must continue to remove barriers to new technologies and ensure that these resources can compete on a level playing field. Similarly, FERC must facilitate the development of a robust and resilient grid that is capable of integrating the expected growth in renewable and distributed resources. ☺



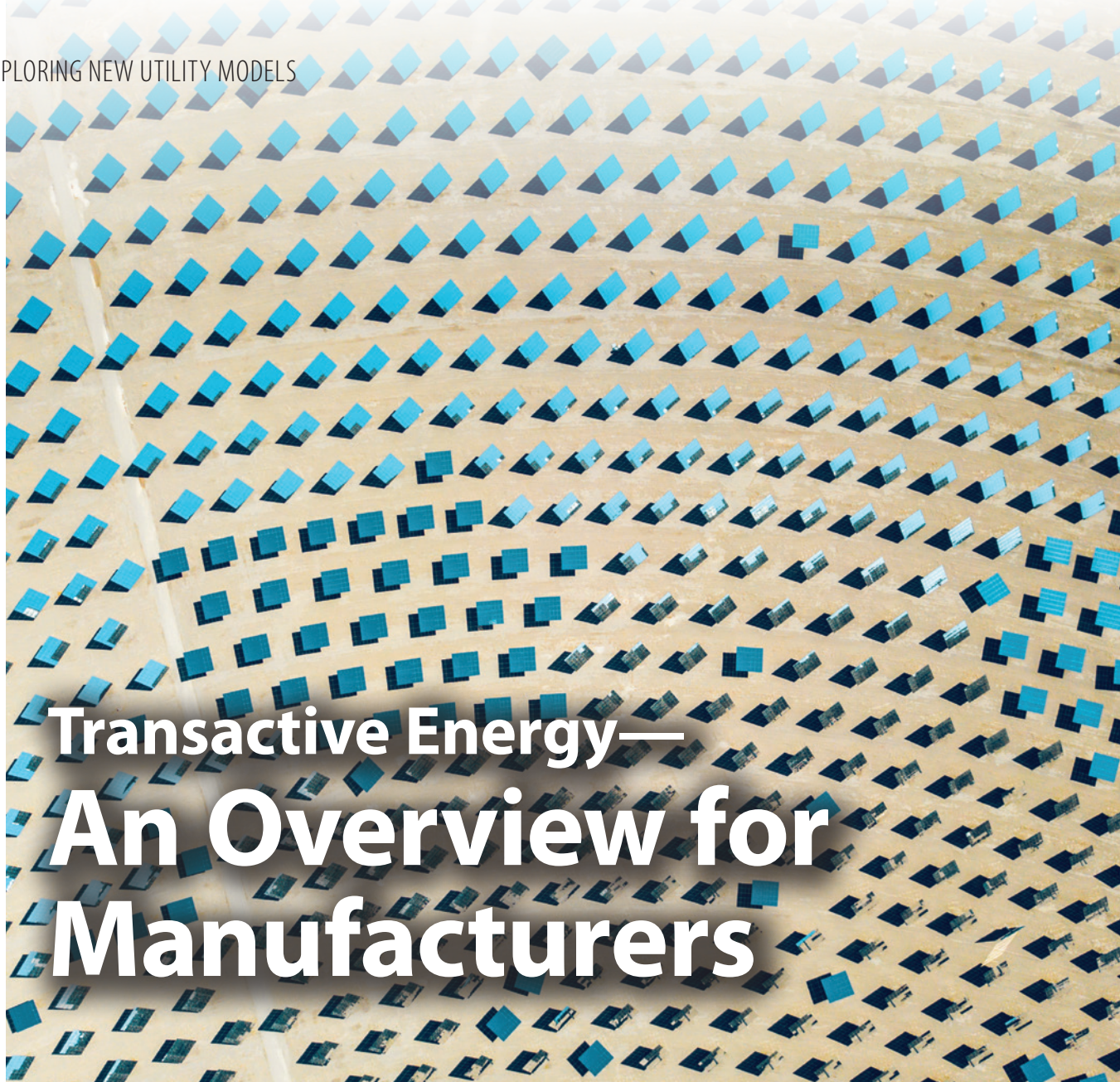
FERC Commissioner Richard Glick

Ron Cunningham,  
David Forfia, and  
Leonard Tillman

Mr. Cunningham is an IT enterprise architect at American Electric Power and is active in Smart Electric Power Alliance (SEPA), Grid 3.0.

Mr. Forfia, a GridWise® Architecture Council member, chairs the GridWise Architecture Council and the SEPA Technical Advisory Council. He is director of enterprise architecture and IT transformation at the Electric Reliability Council of Texas.

Mr. Tillman, a GridWise® Architecture Council member, is a partner with Balch & Bingham LLP. He represents major utility clients and advises on regulatory and commercial law matters.



# Transactive Energy— An Overview for Manufacturers

Interest in transactive energy (TE) is growing, as evidenced by New York's Reforming the Energy Vision discussions; as piloted by the national labs; and as implemented in the United States (by companies like Introspective Systems and L03), Denmark (by PowerMatcher), and Australia (by Power Ledger).

These and similar tactics are driven by the realization that new approaches are needed to efficiently and reliably integrate distributed energy resources (DERs) and adapt to the changing preferences of electricity consumers. TE is one piece of the solution.

## A Solution Framework

In 2011, the GridWise® Architecture Council (GWAC) held an initial workshop on TE that brought together researchers and practitioners from utilities, vendors,

labs, and academia. Since then, TE has grown to be the subject of annual conferences, the Smart Electric Power Alliance (SEPA) Transactive Energy working group, and the National Institute of Standards and Technology (NIST) Transactive Energy Challenges.

The GWAC defined TE broadly as:

*a system of economic and control mechanisms that allows the dynamic balance of supply and demand across the entire electrical infrastructure using value as a key operational parameter.<sup>1</sup>*

Neither a specification nor a standard, TE is an approach that describes economic and control tools for managing all elements of a grid, whether it is a single building or a series of interconnected, international utilities. Its key operational parameter—value—

does not have to be economic. It can be as personal as individual comfort or as global as delivering sustainable electricity to improve people’s lives.

The delivery of electricity is always about balance. According to Erich Gunther, former GWAC chairman emeritus, the pesky laws of physics require that generation, movement, and use of electricity be balanced.<sup>2</sup> Similarly, policymakers balance historical precedent, existing investment, and local views of what is fair and equitable. Consumers balance needs and desires with price, availability, and usability of electricity and associated devices. Finally, manufacturers balance the economic goals of their organizations with physical, regulatory, and market constraints.

## Local Drivers for Change

In 2015, GWAC produced a transactive energy infographic (Figure 1)<sup>3</sup> to summarize the applicability of transactive energy within four interoperable zones of the grid.

At the regional or bulk level, wholesale markets ensure reliability and efficiency by assigning a financial value to balancing supply and demand as well as measuring the financial cost for the uncertainties inherent with both sides of power delivery. These market and reliability structures enable the integration of intermittent technologies like grid-scale renewables and storage while maintaining availability, affordability, and reliability.

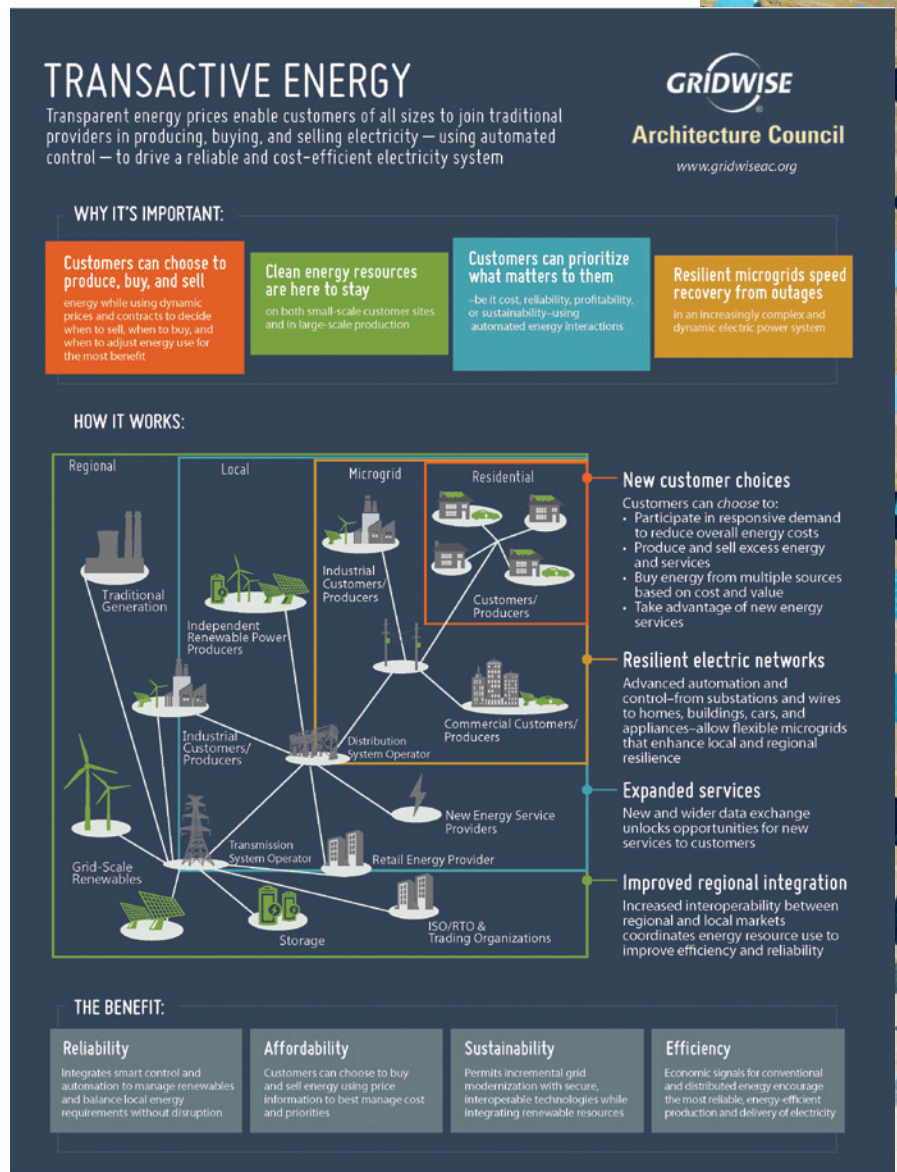
At the local, microgrid, and building level, significant change from the historical paradigm is needed and occurring. With enhanced performance and declining costs for many smaller-scale renewable energy sources and storage technologies, policymakers are incenting—and consumers are increasingly demanding—the acquisition and use of these technologies. As the cumulative effects of technological changes and greater customer options become significant, a more robust response to maintaining and enhancing the safety, reliability, and resilience of distribution energy systems and markets will be required.

Regardless of whether a particular device or system can provide electricity to the grid or simply make electricity more controllable, DERs impact the distribution grid to which they are connected, irrespective of the side (i.e., utility or customer point of connection) on which they are located.

The existing distribution system that was deployed decades ago was not designed for large-scale deployment of DERs with potential power flows in multiple directions. The impacts and challenges of expanding DER use are broad:

- Customer reliance on utilities may be reduced, especially if distributed generation is paired with storage and smart inverters, which in turn affects utility planning, operations, and cost recovery.

*Continued on page 6*



**Figure 1.** Transactive energy enables customers to drive a reliable and cost-efficient electricity system. Infographic courtesy of GridWise Alliance

*Continued from page 5*

- Voltage variability increases that affect operational costs and the more frequent operation of equipment may reduce reliability and lifespan.
- Traditional generation may need to adapt to a “duck curve” of a day’s utility load, requiring a steep ramp up or down as intermittent DER suddenly increases or stops because of wind, cloud coverage, or time of day.
- Distribution planning must address increased risks to reliability and related costs in a constructive manner that meets the regulator’s requirement for economic fairness and the customer’s requirements of value.

TE provides a set of techniques that can be used to address these challenges:

- Building owners can be compensated for aligning their individual values with the holistic needs of the distribution system either by varying their production or consumption of electricity.
- Regulators can enable the recovery of shared cost of electricity transport with more granularity to meet the values of their stakeholders.

- Distribution engineers can ensure safe and reliable operations with solutions that utilize wires and non-wire alternatives.
- Manufacturers and entrepreneurs can provide innovations that unlock the value of capabilities embedded in the building, microgrid, and local levels of the grid.

The GWAC TE roadmap<sup>4</sup> (Figure 2) outlines a vision to deploy TE systems at scale as an operational element of the electric power system to facilitate the integration of DERs and dynamic end uses, such as connected buildings.

As the volume and capabilities of installed distributed resources increase, the need for collaboration among the parties using the distribution grid likewise increases, eventually driving a further automated—and potentially market-based—operation.

## Policy Provides Technology Solutions

Henry Ford allegedly quipped that if he had asked customers what they wanted, they would have said a faster horse. Providing solutions envisioned in the TE roadmap will require similar innovative thinking from policy, business process, and technology standpoints.

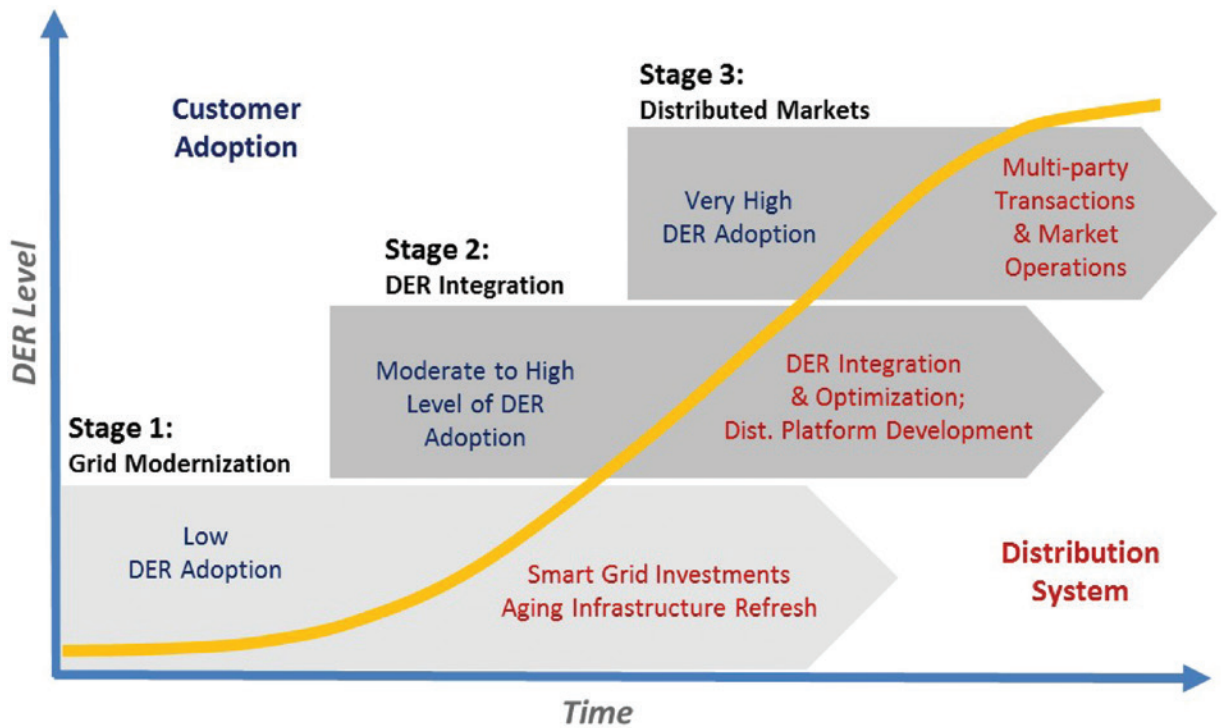


Figure 2. The GWAC TE roadmap outlines a vision to deploy TE systems at scale as an operational element of the electric power system. Illustration courtesy of GridWise Alliance



The primary challenge is policy and business models, not technology. For example, reselling power over utility lines is not yet legal in most states, so buying local power and consuming it with intelligent loads is restricted. Without regulatory guidelines and operational flexibility, customer participation will not adequately develop and additional service providers will not participate. Without such flexibility and participation, consumers will lack certain options and incentives—the primary requisites for the transactive energy future.

Finding a way to create and make available actual consumer benefit is essential to success. If consumers do not perceive and receive benefits from a smart appliance, for example, they will have no interest in buying one. On the other hand, opportunities for equipment manufacturers are enormous and encompass the customer, the utility, and service providers.

At the building level, the customer needs capabilities that

- achieve value that is individually determined;
- integrate not only with the traditional utility but also with other customers and service providers; and
- align their values holistically with the physical requirements and economic signals of the grid.

At the local level, utilities and new service providers need technologies that

- allow localized distribution grid peak power reduction to decrease cost and risk;
- enable grid resilience to respond to operational stress and speed recovery in the event of an outage;
- provide a financial incentive to industrial and other consumers to provide grid services;
- respond to physical conditions, economic signals, and defined consumers' preferences allowing local optimization;
- interoperate with customer, utility, and service provider devices seamlessly; and
- upgrade or can be replaced easily without risk or the need for outages.

*Continued on page 8*

## Section-Related News:

### Dry-Type Outdoor Terminations Emerge

For decades, oil-filled terminations have been the norm for high-voltage cables. Moving away from this traditional technology are pre-molded dry-type outdoor terminations.


In 2018, 138 kV pre-molded dry-type outdoor terminations were installed in three different regions of the world for the first time: Malaysia, the Philippines, and Ansonia, Connecticut; each applied mechanical shrink installation technology to new and existing grids.

To meet the growing demand for regional grid efficiency and modernization, the 138 kV termination brings several benefits. It is the first termination installed at this voltage level utilizing a mechanical shrink installation method. The 138 kV dry-type outdoor termination is a single-piece pre-molded rubber body with a built-in stress control electrode. To provide protection from harsh weather, the termination has weather sheds that lock out environmental elements.

The rubber construction offers significant benefits. Dry-type terminations are 20 to 30 percent lighter, allowing for easier installation. They are fully tested and pre-expanded in the factory, making for straightforward installation in the field and reducing the potential for field damage and installation errors. No longer containing oil, these terminations avoid field damage from any potential leak that requires maintenance and can lead to power outages.

With fewer parts to install, no installation tools required, and the weight reduced, this product significantly reduces the risk of field damage, installation time, and dependency on jointers, all while improving overall grid efficiency. The lightweight and flexible design allows for vertical, horizontal, and angled mounting positions. Installing oil-filled equipment typically requires heavy-duty machinery, which drives up labor costs and limits installation options because of proximity to energized overhead lines.

Installing pre-molded dry-type is in greater demand where new grids are being developed and the level of electrification is low, as in some developing countries where it is an easier and cost-effective option.

While the transition in the U.S. might be slower, the installation in Ansonia may be the beginning for American utilities to start moving toward dry-type single-piece pre-molded outdoor termination with a mechanical shrink installation method to improve grid efficiency. 

**Ivan Jovanovic, Managing Director, Cable Accessories,  
G&W Electric Company**

*Continued from page 7*

At the bulk level, system operators will need solutions that

- adapt to DER to self-dispatched distributed resources efficiently;
- refine load forecasts to reduce the need for ancillary services;
- provide situational awareness to grid operations during service restoration to distributed devices; and
- interoperate with utility, service provider, and customer devices seamlessly.

As the price point for DER declines and consumer preference for sustainable and local resources grows, it is not a question of if a locality will need to address the identified risks, but when. As an industry, the response should be to create an increasingly flexible network at all levels of the electricity deliverability system to expand customer participation and options.

Regulation must support the development of customer participation and flexibility to achieve these benefits, and differing innovative solutions will invariably appear. With potentially millions, if not billions, of interacting devices on humanity's largest synchronous machine, the ease, cost, and quality of their integration and interoperability on the grid will be at a premium.

The principles that drive the investment in this space are both familiar and new:

- **affordability:** minimizing cost must be considered in light of the value added;
- **interoperability:** solutions must operate in harmony with other devices through proprietary or open standards;
- **dependability:** devices must operate in a predictable and understood manner; and
- **maintainability:** a flexible or market-based distribution grid will need to adapt with more agility as devices enter and exit the network at a much faster cadence.

As the deployment of DER expands, the challenge it presents will drive transformation for regulators, utilities, customers, and manufacturers. It is far better to foster coordination, discussion, and agreement on the front end than to quickly cobble together solutions when immediate problems must be addressed. ☎

- 1 GridWise Architecture Council's Transactive Energy Framework, [https://www.gridwiseac.org/pdfs/te\\_framework\\_report\\_pnnl-22946.pdf](https://www.gridwiseac.org/pdfs/te_framework_report_pnnl-22946.pdf)
- 2 The Erich Gunther Memorial Fund commemorates the continuing work of the GWAC. Learn more at <https://www.ieeefoundation.org/erichgunther>.
- 3 GridWise Architecture Council's Transactive Energy infographic, [https://www.gridwiseac.org/pdfs/te\\_infographics\\_061014\\_pnnl\\_sa\\_103395.pdf](https://www.gridwiseac.org/pdfs/te_infographics_061014_pnnl_sa_103395.pdf)
- 4 GridWise Architecture Council's Transactive Energy Roadmap, [https://www.gridwiseac.org/pdfs/pnnl\\_26539\\_gwac\\_te\\_roadmap\\_overview.pdf](https://www.gridwiseac.org/pdfs/pnnl_26539_gwac_te_roadmap_overview.pdf)

## NEMA Provides Insights on the Microgrid Market Opportunity

In 2016, NEMA published **NEMA MGRD 1-2016** *Powering Microgrids for the 21st-Century Electrical System*, a white paper introducing the concept of microgrids as an integral component of the power delivery system of the 21st century. Microgrids, once viewed as islanded systems of generation and load, valued mostly for their ability to disconnect from the grid and serve individual customer facilities during outages, are now seen as part of distribution system operations, interacting with the distribution grid through advanced control and distribution management systems.

The paper presents business cases, enabling technologies, a Standards analysis, and a future vision. In 2017, NEMA focused its efforts in the microgrid space on investigating government policies and regulations to achieve its vision. Research identified the top regulatory barriers facing microgrid deployment in the United States.

NEMA also looked at policy/regulatory solutions to the identified barriers. Key points addressed in the paper include:

- Value beyond their ability to assist in disaster recovery
- Enabling technologies for microgrids
- Standards gap analysis
- Regulatory barriers to microgrid deployment

**NEMA MGRD 1-2016** *Powering Microgrids for the 21st-Century Electrical System* is available at no charge on the NEMA website.

### Related documents:

- **NEMA MGRD R2-2018** *State Regulatory and Policy Considerations for Increased Microgrid Deployment—A Public Policy Primer* is available to members at no charge. It is available to the general public for \$250 on the NEMA website.
- **NEMA MGRD R2.1-2018** *State Regulatory and Policy Considerations for Increased Microgrid Deployment—Summary* is available at no charge on the NEMA website. ei

# Transformational Technologies Reshape Grid Modernization

Similar to the smart grid concept introduced by the Energy Independence and Security Act of 2007 (EISA 2007), “grid modernization” is both difficult to define and subject to varying opinions.

In addition to operational and information technology (OT/IT) deployment, grid modernization builds on the previous smart grid definitions and addresses several underpinnings:

- Grid reliability and resiliency, especially the frequent occurrence and severity of storms
- Grid efficiency, which includes lowering feeder losses, improving asset utilization, and increasing workforce productivity
- Sustainability by supporting the integration of renewable generation and electrification of transportation, including the need to manage the impacts of variable resources, dispatch limitations, bidirectional power flow, and grid protection and control
- Operational effectiveness based on improved situational awareness of grid disturbances, asset conditions, and workforce management
- The ability to leverage non-wire alternatives and distributed energy resources as part of resource plans and grid operations
- Customer engagement that includes outage notifications and estimated restoration times, access to energy usage data, advanced demand response programs, and expanded options for energy management

## Investing Smart

Current investments in the grid were initiated by the American Recovery and Reinvestment Act of 2009 (ARRA, commonly referred to as the “stimulus”) as investment grants for smart grid technologies. The primary investment area was advanced metering infrastructure (AMI) or smart meters, which were deployment-ready and provided enabling infrastructure for advanced demand response, net metering, and operational efficiency with on-demand reads and remote meter connects and disconnects.

After the initial wave of investment, AMI funding sagged, but deployments have picked up again with grid modernization. The value proposition has

expanded to power outage notification, enhanced customer engagement with readily available consumption data, and leveraging strategic meters for grid operations.

Distribution automation (DA) also benefited from the ARRA smart grid investment grants, but DA investments were overshadowed by AMI. The continuing growth of DA since the ARRA grants has driven a sustained surge of investment. Early DA projects focused on distribution SCADA<sup>1</sup> and automation related to direct load control. As shown in Figure 1 (page 10), the industry moved to graphics-based distribution control room operations with integrated outage management functionality. A key change was establishing a network model for the distribution grid to support simulation, an operator load flow, and advanced applications.

**Gary Rackliffe, Vice President, Smart Grids and Grid Modernization, ABB Inc.**

## NEMA Report Analyzes Grid Projects

Examples of grid modernization investments are analyzed in the NEMA report *Reviewing the Business Case and Cost Recovery for Grid Modernization Investments*. The report is available at no charge to NEMA members in hard copy and electronic download for \$100 at [www.nema.org/grid-modernization-report](http://www.nema.org/grid-modernization-report).

Utilities today are integrating distribution management systems with distribution SCADA, outage management, and advanced applications. These include automated switching for improved reliability and volt/VAR<sup>2</sup> control for reducing feeder losses and managing feeder voltages, and creating advanced distribution management systems (ADMS). These systems also incorporate:

- integration to AMI systems for outage notification;
- customer information systems for account meter data to link physical account locations to the grid's distribution transformers and an electrical address;
- geographic information systems to establish connectivity and impedance models;
- mobile workforce management systems for crew dispatch; and
- sensors such as fault current indicators to enhance situational awareness.

The next phase of DA investment will be focused on managing distribution feeders with more distributed energy resources such as solar photovoltaic (PV), energy storage, and electric vehicle charging infrastructure. Distributed energy resource management systems (DERMS) address the volt/VAR management of distribution feeders with smart solar PV inverters and other controllable devices. They also address the virtual power plant functionality of registering, aggregating, forecasting, scheduling, dispatching, and settlement for grid-connected DERs.

Looking to the future, distribution markets may emerge to support energy transactions at the grid edge.

## Driving Grid Modernization

Four transformational trends will drive grid modernization: renewable generation, energy storage, the electrification of transportation, and digitalization.

### RENEWABLE GENERATION

The modern grid will need to be able to accommodate renewable generation and integrate these variable resources into grid operations. At the transmission level, adequate transmission capacity to mitigate congestion and connect remotely located renewables will be needed. Grid-scale storage will be able to capture excess generation to avoid curtailment, and renewable resources will require coordination with centralized generation ramping requirements and spinning reserve. At the distribution level or grid edge, advanced technologies for protection and control and feeder volt/VAR optimization will be necessary.

### ENERGY STORAGE

Energy storage is a transformational technology since it decouples generation from demand. Over 90 percent of grid storage today is pumped hydro, but most of the recent storage investments have been based on lithium ion batteries. Grid applications for batteries have benefited from the transportation industry, and battery energy storage prices have dropped by approximately 80 percent since 2010. Applications include capacity firming, spinning reserve, capture of excess generation, and black start capability. Storage can also be used as the grid-forming resource for islanded microgrids operating with 100 percent renewables. FERC Order 841<sup>3</sup> opens wholesale markets to energy storage. Independent system operators and the storage industry are now implementing the order.

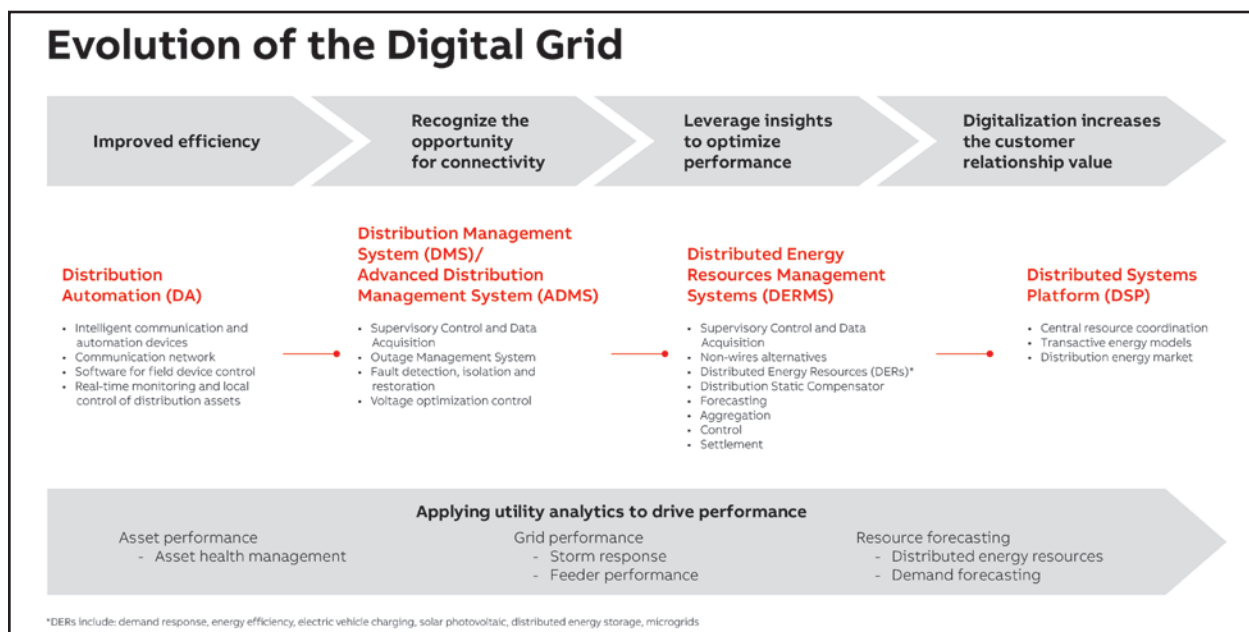


Figure 1. Evolution of Grid Modernization. Courtesy of ABB Inc.

## ELECTRIFICATION OF TRANSPORTATION

Electrification of transportation includes cars, light trucks, fleets, medium- and heavy-duty trucks, transit buses, and rail. Growing concerns over greenhouse gas emissions have resulted in roadmaps to reduce 2030 emissions by 40 percent and 2050 emissions by 80 percent from 1990s levels. Reaching these goals requires significant electrification of transportation, resulting in terawatt hours (TWhs) of additional load. An important objective of the modern grid will be to accommodate these loads without contributing to the system peak demand or eroding the reliability of the network. Managed charging strategies, energy storage, and capturing regenerative braking from urban rail systems will complement the grid’s make-ready requirements to serve this load growth.

## DIGITALIZATION

Digitalization and the industrial IoT are transforming asset management and operations. They leverage cloud computing, grid edge gateways and distributed intelligence, software for control and analytics, and connectivity to controllable devices and sensors. Early applications include digital substations, asset performance management, and digital distribution. Communications such as field area networks to reach grid devices and sensors between the substation and meter are also elements.

Utility analytics including artificial intelligence, machine learning, and deep learning are being applied to asset performance, forecasting renewable generation and net load, analyzing grid performance, and situational awareness. The digital grid is gaining momentum and may be the next industry term for its continued modernization, evolution, and improvement.

## Policies to Guide Grid Evolution

Grid modernization will evolve like the smart grid and technologies will continue to advance. For example, the National Institute of Standards and Technology (NIST) produced a grid modernization roadmap (see Figure 2) and the U.S. Department of Energy has a consortium of national labs working on grid modernization. Also, battery prices are expected to continue to drop based on technology advancements and the experience curve.

The other factor is policy, which influences utility business models and regulatory cost recovery. The GridWise Alliance has produced *Grid Modernization Index 4*, a report that looks at the policy and regulatory environment at the state level, in addition to the levels of consumer engagement and grid modernization investment, to track the progress of modernization.<sup>4</sup>

The next five years will be exciting as the industry responds to challenges to be more flexible, reliable, resilient, efficient, and automated. Transformational technologies will reshape the grid as we invest in grid modernization. ©

- 1 Supervisory control and data acquisition
- 2 Volt-ampere reactive (VAR) is a unit used to measure reactive power in an alternating current system.
- 3 Federal Energy Regulatory Commission, *Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent System Operators*, February 15, 2018, <https://ferc.gov/media/news-releases/2018/2018-1/02-15-18-E-1.asp#.XAb5TUnQY6Y>
- 4 <https://www.energy.gov/grid-modernization-initiative-0/grid-modernization-lab-consortium>
- 5 *Grid Modernization Index 4*, GridWise Alliance, November 6, 2017, <https://gridwise.org/grid-modernization-index-4>

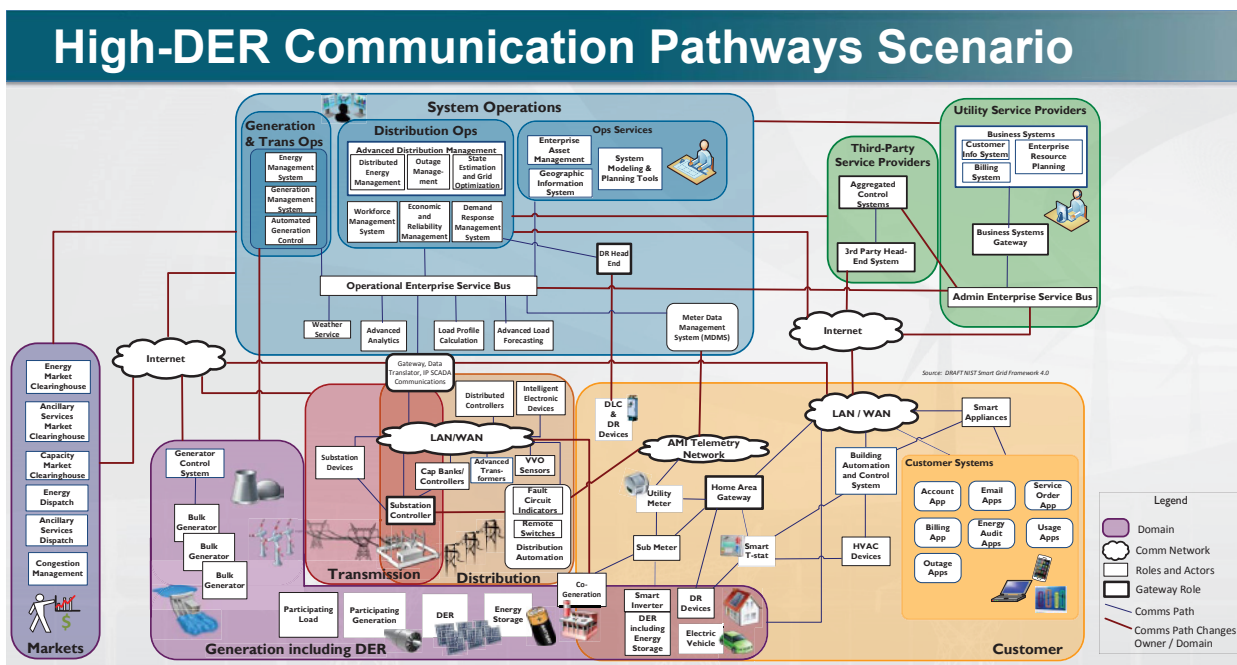


Figure 2. This graphic shows that structural changes are occurring on the grid with more distributed energy resources and increased system complexity. Courtesy of NIST

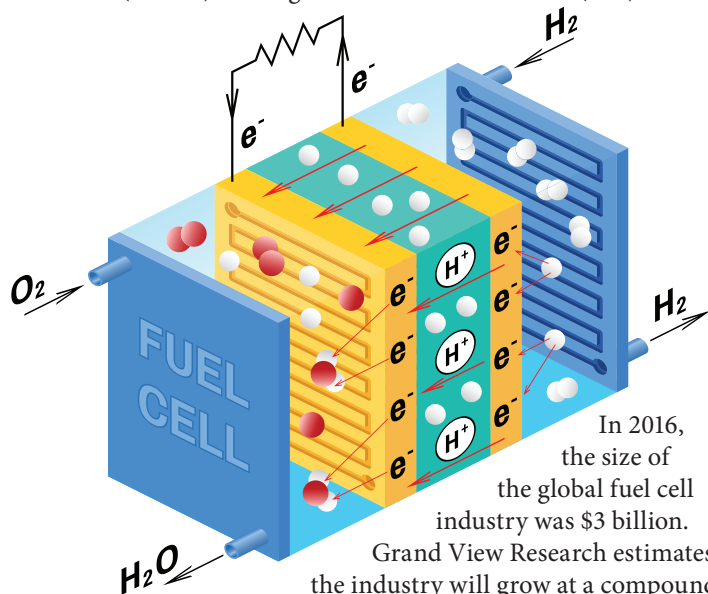
# Back to the Future: The Latest Fuel Cell Revolution

Garry Golden,  
Futurist, Forward  
Elements

Mr. Golden  
consults on issues  
shaping business  
and society in the  
21st century.

For years, fuel cells have been a disruptive technology that failed to meet expectations.

The technology gained popularity in the late 1990s as Ballard Power stocks went up and down with the dot-com boom and bust. Since the early 2000s, fuel cells found narrow success in remote power systems for telecommunications networks and as an uptime-focused solution for electric forklifts. Current industry headlines indicate that the sector is finally expanding confidently toward widespread adoption around stationary power in micro combined heat and power (mCHP), microgrids, and electric vehicles (EVs).



In 2016, the size of the global fuel cell industry was \$3 billion. Grand View Research estimates the industry will grow at a compound annual growth rate (CAGR) of 20.9 percent in the next few years into a \$25 billion sector by 2025.<sup>1</sup> In 2018, the industry saw significant capital investments for expanding manufacturing output and production automation equipment to meet high-volume orders. Much of this change has been driven by China's ambitious plans to expand fuel cells and hydrogen as a key part of its energy transition.

## Fuel Cell Fundamentals

Fuel cells are solid-state energy appliances that convert chemical energy into electricity with heat as a

<sup>1</sup> *Fuel Cell Market Size, Share & Trends Analysis Report By Product (PEMFC, PAFC, SOFC, MCFC), By Application (Stationary, Transportation, Portable), By Region, And Segment Forecasts, 2018 - 2025*, Grand View Research, September 2016, <https://www.grandviewresearch.com/industry-analysis/fuel-cell-market>

byproduct. Fuel cell types are based on their membrane architecture and operating temperatures. Two are particularly relevant for electrical and power systems:

- 1) Proton-exchange membrane (PEM) fuel cells use pure hydrogen as the feedstock. They operate at lower temperatures, giving them quick start capabilities that are versatile across applications in EVs, off-grid/backup power, and smaller portable systems (e.g., powering laptops).
- 2) Solid oxide fuel cells (SOFC) are more tolerant of carbon-rich feedstocks such as natural gas, propane, and renewable gas. Low-temperature SOFC can be used as range-extenders in battery-powered EVs. Higher-temperature SOFC are ideal in stationary solutions.

The benefits of fuel cells include reliability, uptime, and clean operation with zero or near-zero emissions. With platforms that are modular and scalable, they provide an efficient use of capital for expanding system sizes from kilowatt to megawatt arrays. They allow producers to focus on automating manufacturing lines and lowering balance of power system costs.

The use of fuel feedstocks is equally compelling. Natural gas is clean and abundant with direct connections into many homes and businesses. Hydrogen beats batteries as an energy storage option that can provide high-volume and long-duration storage.

## Getting Specific

Let's explore the latest use cases of fuel cells.

### SIMPLIFIED DATA CENTERS

In 2013, Microsoft and the National Renewable Energy Laboratory partnered to radically rethink the notion of energy infrastructure inside massive data centers using fuel cells.<sup>2</sup> In 2017, Microsoft announced the first gas-powered data center<sup>3</sup> that integrated natural gas-powered SOFC directly above server racks.

<sup>2</sup> Ana Carolina Riekstin, Sean James, Aman Kansal, Jie Liu, and Eric Peterson, *No More Electrical Infrastructure: Towards Fuel Cell Powered Data Centers*, Microsoft, November 2013, <https://www.microsoft.com/en-us/research/publication/no-more-electrical-infrastructure-towards-fuel-cell-powered-data-centers/?from=http%3A%2F%2Fresearch.microsoft.com%2Fapps%2Fpubs%2Fdefault.aspx%3Fid%3D203898>

<sup>3</sup> Christian Belady and Sean James, "Redesigning Datacenters for an Advanced Energy Future," Microsoft, September 24, 2017, <https://blogs.microsoft.com/green/2017/09/24/redesigning-datacenters-advanced-energy-future>

This approach provides reliability, reduced costs when individual server racks are taken offline, and energy-efficiency gains by avoiding losses associated with transmission from centralized power plants.

### SMALL-SCALE COMBINED HEAT AND POWER

Fuel cell manufacturers are positioning themselves as the preferred platform in small-scale mCHP systems that can achieve high-energy efficiencies of 75 to 90 percent by delivering electricity and heat for hot water systems that could augment or eliminate boiler-furnace systems.

Japan, the world leader with an installed base of close to 200,000 mCHP fuel cell systems, has set aspirational targets of one million residential systems by 2020 and five million by 2030. Europe's EU PACE program recently passed a 1,000 mCHP installation milestone on its way to nearly 3,000 units by 2021.

Program manufacturers also are showing signs of aggressive growth targets. Solidpower will expand manufacturing capacity of its SOFC to output of 16,000 units per year beginning in 2020. Some of these units are being tested in small residential and commercial settings in the United States. In the Pittsburgh, Pennsylvania, area, Peoples Natural Gas is installing SOFC that will be based in 100 homes and small businesses in a service area with 740,000 customers.

Conflicts between electric utilities and natural gas providers, however, may surface with mCHP. Imagine a scenario where building owners use fuel cells connected directly to natural gas lines or propane tanks for all of their onsite electrical needs. This dynamic could challenge a pure electrical utility business model and encourage the convergence of gas and grid infrastructure inside the built environment.

### GOODBYE, DIESEL GENERATORS

UK-based Intelligent Energy partnered with Taylor Construction Plant Ltd to develop a hydrogen fuel cell solution targeted at the construction industry. The PEM fuel cell provides rapid startup, quiet operation, and emissions-free power that make a compelling alternative to traditional diesel generators.

## EVs: Recharge or Refuel?

Discussions of EVs' future usually focus on the motor, not the battery. How we deliver electrons to that electric motor is a topic of intense debate. The long-game strategy for automotive OEMs is likely an EV platform that integrates fuel cells with batteries, creating a market where we refuel—not recharge—our electric transportation fleets.

Today, battery-powered EVs (BEVs) dominate early sales and capture media headlines that shape public awareness. Despite early success, this industry transition will take decades to unfold. Fuel cell EVs are likely to play a more dominant role over this longer time horizon. KPMG's *Global Automotive Executive Survey 2018*<sup>4</sup> showed that leaders believe the integration of fuel cells with batteries will allow the sector to scale out the next hundred million EVs.

In the next decade, BEVs will continue to capture sales of affluent consumers and early fleet adopters. We will see mass-produced fuel cell EVs from Toyota, Hyundai, and Honda. Spurred by 10,000 pre-orders, Nikola Motors is building a \$1 billion production facility in Arizona to mass manufacture fuel cell-powered Class 8 trucks. To support this transition, we saw significant commitments in 2018 from major players, including Air Liquide, Shell, and upstart Nel Hydrogen to build out refueling stations.

MarketsandMarkets™ estimates the automotive fuel cell market of 7,785 units in 2018 will reach a market size of nearly 270,000 by 2025 (a CAGR of 65.86 percent).<sup>5</sup> China, however, is actively driving down cost curves for fuel cell vehicle power systems. In 2018, state-owned Weichai Power made equity investments in PEMs and SOFC to help meet its aggressive target of one million fuel cell vehicles by 2030.

Over the next decade, BEVs will dominate EV sales, with most owners recharging at home. We will see a scaling out of recharging networks and hydrogen fueling stations. There is a risk that the recharging station buildout is premature if fuel cell EVs emerge in the 2030s as the OEM choice for EV platforms. For now, the electricity equipment industry should consider a future that is fragmented with many types of EVs.

## Slow Pace to Fast Change

The disruption of fuel cells may take 10 years to have an impact on our electrical energy systems, but we are now firmly in an early-growth stage of development for applications for transportation and stationary solutions for buildings and utility grids.

It is now time to imagine implications and plan for changes across our industry. ☎

<sup>4</sup> *Global Automotive Executive Survey 2018*, KPMG, 2018, <https://assets.kpmg.com/content/dam/kpmg/nl/pdf/2018/sector/automotive/global-automotive-executive-survey-2018.pdf>

<sup>5</sup> "Automotive Fuel Cell Market Worth 268,786 Units by 2025," PRNewswire, March 28, 2018, <https://www.prnewswire.com/news-releases/automotive-fuel-cell-market-worth-268786-units-by-2025-678142453.html>

## NEMA Division Moves Toward Coalition of Sections

Just as the electrical power grid is developing into a system of systems with millions of interconnected parts, so, too, is the NEMA Utility Products & Systems Division moving toward an integrated coalition of product Sections.

The Division is creating a Leadership Committee that reflects a movement within NEMA from a focus on being a product-centric technical organization to one that looks at systems-wide approaches to strategic planning and problem solving. When NEMA uses its convening power to coordinate work outside individual product sectors, Members benefit. Examples include initiatives in workforce development, the Internet of Things, and government relations.

The concept of a Division-level leadership group is based on two NEMA Divisions that have operated under the guidance of an executive leadership group: the NEMA Lighting Division and the Medical Imaging & Technology Alliance (MITA).

Under the guidance of its Leadership Committee, the Division will develop and oversee a three-year strategy with delineated goals and methodologies related to the digitization of the power grid and

preparation for grid impact due to electrification of new industries. As the electrical power grid evolves into a self-healing, self-driving system, the committee will determine what role NEMA and its Members can play to lead in this space. Components of the strategy will include business, policy, and technical objectives.

Committee activities may include engagement with outside groups representing the utility community, formal studies and data collection, and briefings from business strategy groups with expertise in the field. Areas of focus/priorities will be determined by the committee and might include strategy-based work such as integration of digital twinning, development of best practices for equipment production modeling, and deep-dive analysis of utility rate structures.

The committee will assume the policy activities of the former Grid Modernization Leadership Council. Specific policy activities may include:

- engagement with public utility commissions and other state-level policymakers;
- written and verbal comments to federal agencies and other federal policymakers; and
- briefings with entities governing the bulk power market such as regional transmission operators and coordinating councils.

Section chairs will oversee the development of new Standards, product promotion, and product-related research. They will also identify areas of cross-sectional work and create a strategy to oversee the execution of such work.

The overarching concepts of digitization and electrification affect the equipment that our customers purchase and inform their business decisions. NEMA represents a clear value proposition in its ability to convene a comprehensive group of Member representatives to ensure that our industry understands these decisions and prepares for the market dynamics that will result. ☺

**Jonathan Stewart, Industry Director, Utility Products & Systems Division, NEMA**

### NEMA Section to Develop DC Power Capacitor Standard

The NEMA Capacitor Section is initiating a project to develop a new Standard for direct current power capacitors rated ½ kVAR and larger. The Capacitor Section is part of the Utility Products & Systems Division and covers the use of power capacitors for power factor improvement and harmonic filtering.

Power capacitors are used in power generation, transmission and distribution, and industrial applications.

The need for a dc capacitor Standard stems from the growth of renewable energy and the requirements for managing the dc power generated by wind turbines and photovoltaic systems. DC capacitors are used in the transmission and distribution of HVDC power and for other growth applications, including storage batteries, dc motors, variable frequency drives, and data control centers.

The Capacitor Section is looking for input and support from the electroindustry. For more information, contact Gerard Winstanley at [gerard.winstanley@nema.org](mailto:gerard.winstanley@nema.org) or 703.841.3231. ☺

**Gerard Winstanley, Program Manager, NEMA**



## NIST Advances Grid Modernization

Smart grid devices, systems, and applications require extensive data exchange, necessitating well-defined interfaces to transfer and translate this data from point to point across the grid. Clarifying the communications protocol and data model performance requirements is essential to the National Institute of Standards and Technology (NIST) and its ongoing update of the Framework and Roadmap for Smart Grid Interoperability Standards (see infographic on page 11).

NIST has published three framework and roadmap versions to date. Version 1.0, published in 2010, identified gaps in Standards. Versions 2.0 and 3.0, published in 2012 and 2014, respectively, were progress updates for these Standards gaps. With the assistance of NEMA and other industry leaders, NIST is developing Version 4.0 to advance grid modernization. One of the drivers for the update is to incorporate technology advancements.

The primary mechanism for developing new content for Version 4.0 is a series of regional workshops,<sup>1</sup> each of which will examine a conceptual model relevant to that region. The NIST Smart Grid Conceptual Model describes the overall composition of electrical grid systems and applications. Originally introduced in the first NIST framework, the model is updated with each revision. The model update in Version 4.0 reflects large increases in the number and types of distributed energy resources used throughout the grid, the increasing importance and automation of distribution systems, and the role of service providers in the distribution system. An example of the conceptual model can be found on the NIST site.<sup>2</sup>

Stakeholders attending these workshops will have an opportunity to provide input that will affect the content of Version 4.0. In addition, a draft of Version 4.0 is expected to be released in early 2019, and a formal public comment period will follow. NEMA will coordinate Member comments. ☎

**Brian Marchionini, PMP,**  
Senior Program Manager, NEMA



Vince Baclawski, Senior Technical Director of Codes and Standards, and Pat Walsh, Editor in Chief of *electroindustry* magazine, retired from NEMA in January 2019. Mr. Baclawski began his work with NEMA in 1994 as Technical Director. Ms. Walsh began her work in 2007 as Standards Editor. Photo by Jena Passut

## Book-a-Speaker



**Steve Griffith, PMP,** NEMA Industry Director, will moderate a panel on how to Navigate Regional and Global Policies for IoT Consumer Markets at the 2019 Consumer Electronics Show (CES) in Las Vegas, Nevada, January 10. Learn more at <https://www.ces.tech>.



**Donald R. Leavens, PhD,** NEMA Vice President and Chief Economist, will present a keynote address at the Independent Electrical Contractors (IEC) Business Summit, January 29, in Ft. Lauderdale, Florida. In his *Electroindustry Economic Outlook*, Dr. Leavens will provide forecasts and analyses of key macroeconomic variables. Learn more at <https://www.ieci.org/business-summit>. ☎

**Need a speaker?** Book a speaker at [www.nema.org/book-a-speaker](http://www.nema.org/book-a-speaker).

<sup>1</sup> More information on the workshops is available at <https://www.nist.gov/engineering-laboratory/smart-grid/smart-grid-interoperability-framework-workshops>.

<sup>2</sup> [https://www.nist.gov/sites/default/files/documents/2018/06/06/webinar\\_slides.pdf](https://www.nist.gov/sites/default/files/documents/2018/06/06/webinar_slides.pdf)

# Outlook for 116<sup>th</sup> Congress: Infrastructure, Climate, and Trade

Philip Squair

Vice President of Government  
Relations, NEMA

When the 116<sup>th</sup> Congress convenes on January 3, 2019, NEMA Members will face a two-party federal legislature for the first time since 2013 when Democrats held a majority in the U.S. Senate. Democrats' new majority in the House of Representatives, coupled with Republicans' majority in the Senate, presents exciting challenges and opportunities as we work to achieve advocacy objectives of the Association as well as specific product groups.

We expect the House Democratic majority to spend significant amounts of time in 2019 in three areas of concern to NEMA: trade policy, climate change, and infrastructure.

## TRADE POLICY

Once the U.S.–Mexico–Canada Agreement (USMCA) was signed by President Trump and his Mexican and Canadian counterparts on November 30, attention shifted to Congress and whether legislation to implement the agreement would be approved. Adding pressure to an already charged political atmosphere on trade, President Trump signaled a willingness to withdraw the U.S. from the North American Free Trade Agreement (NAFTA) by the summer, in part to compel Congress to act quickly on USMCA. NEMA believes the USMCA is a legitimate successor to NAFTA and should be supported, so Congress should approve it expeditiously.

## CLIMATE CHANGE

In the area of climate change, House Democrats have been vocal about their intention to accelerate consideration of proposals to address the issue, perhaps by recreating the Select Committee on Energy Independence and Global Warming. Whether such a committee is established or not, concerns about climate change will almost certainly receive a higher level of attention in 2019 than in the 115<sup>th</sup> Congress. In this area and others, Democrats may also use their House majority to conduct vigorous oversight of Administration officials.

## INFRASTRUCTURE

Thirdly, and perhaps most significantly for NEMA Members, the topic of America's infrastructure has been and will continue to be top of mind for many in Congress. Democrats, Republicans, and President Trump have all floated their ideas, but none has made it past the starting gate up to now. NEMA intends to be particularly bold and aggressive in offering the electroindustry's recommendations in physical, digital, and human/workforce areas to build an infrastructure that is worthy of the 21<sup>st</sup> century and supports NEMA Members' global competitiveness.

NEMA does not envision significant changes to the priorities pursued by the expanded Senate Republican majority during the 116<sup>th</sup> Congress. Majority Leader Mitch McConnell should continue to reserve time for the consideration of judicial and Administration nominees, while pursuing typical Republican approaches in the areas of tax, trade, and infrastructure.

## LOOKING AHEAD TO 2020

Finally, the 116<sup>th</sup> Congress will be hampered by the fact that the 2020 presidential elections are right around the corner. All of the 435 representatives and 33 senators up for re-election will be searching for ways to position themselves favorably with their constituents. This can help the prospects for legislation, because pressure exists for incumbents to prove their governance skills and abilities to "get things done." On the other hand, though, elections can bring out the worst in some legislators who see advantages in slowing down the legislative process or opposing constructive proposals for ideological reasons.

Regardless, NEMA will be at the forefront of the debates over proposals affecting the electroindustry. ☺

## NEMA and Western Utilities Collaborate

In the Western United States, approximately 80 utilities collaborated with the Electric Utility Service Equipment Requirements Committee (EUSERC), which was formed in 1983 by the merger of two different groups in Southern and Northern California that had been active since the 1940s. There are 14 Western states that have utility members represented in EUSERC. The NEMA West Coast Field Representative and an Underwriters Laboratories (UL) representative attend quarterly meetings to represent their organizations' interests. Both UL and NEMA are associate members of EUSERC.

The EUSERC goals include the development of consistent safety Standards for the manufacture and installation of service equipment and metering equipment. To this end, each year EUSERC publishes an Electric Service Requirements (ESR) Manual that provides drawings and design criteria for all types of residential and commercial/ industrial service equipment. Member utilities use the EUSERC ESR Manual as the basis for their own ESRs and often make revisions to accommodate local requirements. Any deviations from the manual are indicated in the Acceptability Pages so that manufacturers know in advance if they need

to make modifications to their equipment for a particular utility. Recent changes to the ESR have included new drawings for solar photovoltaics, energy storage, and electric vehicle service equipment installations.

NEMA has worked with EUSERC and its predecessor organizations for many years. These NEMA Member groups that were organized in the 1960s eventually evolved into one group, now called the Western Electrical and Energy Regulations Advisory Committee (WEERAC). WEERAC is composed of representatives from seven NEMA Member companies that manufacture service equipment. They are a subcommittee of the NEMA Codes and Standards Committee and meet annually in conjunction with a EUSERC quarterly meeting. Their concerns encompass the 14 Western states that EUSERC covers.

The collaboration over the years between EUSERC and NEMA has proven to be beneficial for all parties involved. Manufacturers are able to provide input on the development of service equipment Standards, and utilities have a forum to provide feedback to the manufacturers on field and installation issues. ☺

### Ann Brandstadter

Manager, Standards Publications and  
Marketing, NEMA

## Reports Summarize Strategic Initiatives Findings

**NEMA GMOD 1-2018** *Reviewing the Business Case and Cost Recovery for Grid Modernization* covers grid modernization investments, summarizes the benefits of grid technologies, and documents cost recovery mechanisms and business cases. It is available at no charge to NEMA Members and to the general public in hard copy and electronic download for \$100 at [www.nema.org/grid-modernization-report](http://www.nema.org/grid-modernization-report).

**NEMA BE P1-2018** *Building System Efficiency Modeling—Improving the Accuracy of Building Energy Modeling* analyzes the sources of discrepancy in the modeled energy use of selected building systems. It is available at [www.nema.org/building-energy-modeling](http://www.nema.org/building-energy-modeling).

### OTHER RECENTLY PUBLISHED DOCUMENTS

**NEMA 250-2018** *Enclosures for Electrical Equipment (1,000 Volts Maximum)* is updated with new enclosure types, pressure wash

ancillary ratings, a high-pressure power wash test, and revised outdoor corrosion protection requirements. It is available in hard copy and electronic download for \$134.

**ANSI C136.2-2018** *American National Standard for Roadway and Area Lighting Equipment—Dielectric Withstand and Electrical Transient Immunity Requirements* is available in hard copy and electronic download for \$44.

**ANSI C136.18-2018** *American National Standard for Roadway and Area Lighting Equipment—High-Mast Side-Mounted Luminaires* is available in hard copy and electronic download for \$41.

**ANSI C136.48-2018** *American National Standard for Roadway and Area Lighting Equipment—Wireless Networked Lighting Controllers* is available in hard copy and electronic download for \$63. ☺

## Considering USMCA and Other Trade Developments

As noted in “Outlook for 116th Congress” (page 16), Congress is expected in 2019 to consider the new U.S.–Mexico–Canada Agreement (USMCA), intended as a modernization of and replacement for the 1994 North American Free Trade Agreement (NAFTA). At present, the prospects are colored by competing priorities: on one hand, demands for changes in the compromise agreement from members of Congress from both sides of the aisle, including the presumptive incoming speaker of the House of Representatives; on the other, the prospect that the Administration could give a six-month notice of U.S. withdrawal from NAFTA, effectively presenting Congress with a choice between USMCA and nothing.

USMCA contains many positive provisions for the electroindustry but also some elements that effectively shrink opportunities for cross-border trade and investment. NEMA will work with Member companies to ensure that Congress understands the value of the trade agreement for electrical manufacturing in North America.

### PAUSING U.S.–CHINA TARIFF ESCALATION

NEMA Members that import 82 types of Chinese-made items subject to additional U.S. tariffs were afforded a reprieve from a planned January 1 tariff increase from 10 to 25 percent. While the U.S. and China did not resolve their differences over trade, industrial, or intellectual property policy during a December 1 meeting, the leaders did agree to drop plans for further trade-restrictive measures, including tariffs, during a 90-day period for further negotiations. According to the Administration, the aforementioned policy areas are joined on the proverbial “table” until March 1 by imprecise pledges by Beijing to purchase more U.S. goods to address a large and continually growing bilateral trade imbalance.

### NEMA SEEKS ACCESS IN JAPAN AND EU

NEMA provided advice to the Office of the U.S. Trade Representative (USTR) on priorities for trade agreement negotiations with Japan and the European Union. USTR Robert Lighthizer notified Congress in October 2018 of the President’s intent to enter into new trade negotiations with Japan, the EU, and the United Kingdom. NEMA called for trade agreements of the highest standard possible, building on trade liberalization achieved

in previous pacts, to ensure U.S. electroindustry exporters gain new market access opportunities.

### WTO REPORT CITES BLOCKCHAIN POTENTIAL

A November 2018 paper published by the World Trade Organization cited numerous potential benefits to international traders and governments of distributed ledger technology, popularly known as blockchain. The paper concludes that the main value of blockchain in trade lies in potential cost reductions linked to digitalization.

According to author Emmanuelle Ganne, “By increasing transparency and making it possible to automate processes and payments, Blockchain [sic] has the potential to reduce trade costs significantly, including verification, networking, processing, coordination, transportation and logistics, as well as financial intermediation and exchange rate costs.” The full paper is available at [www.wto.org/publications](http://www.wto.org/publications).

### “BREXIT” TIMELINE DEFERS U.S. TRADE DEAL

Prospects for a trade agreement between the U.S. and the United Kingdom receded in late 2018, shortly after U.S. Trade Representative Robert Lighthizer notified Congress in October of his intent to initiate negotiations. Under a deal reached in November on the UK’s planned withdrawal from the 28-member European Union on March 29, 2019, a trade agreement with the U.S. could not take effect until 2022 or 2023.

Although Prime Minister Theresa May had not secured approval in Parliament at the time of this writing, the departure agreement would have the UK remain within the EU customs union until a UK-EU trade agreement could be negotiated, thereby meeting the UK business priority to maintain preferential access to its closest commercial partner. If Parliament rejects the November deal in January 2019, however, business and political uncertainty would increase. By remaining in the EU customs union, the UK would not have full authority to negotiate and implement its own trade agreement with the U.S. Officials in both countries could deepen their current dialogue on facilitating bilateral trade, especially between small and medium-sized enterprises, to prepare for a future deal. ☺

## MITA Staff Reflects on Radiology Convention

Upon returning from attending their first annual meeting of the Radiological Society of North America (RSNA), new staff with the Medical Imaging & Technology Alliance (MITA), a division of NEMA, shared their experiences.



### ZACK HORNBERGER

#### DIRECTOR, CYBERSECURITY & INFORMATICS, MITA

RSNA touts itself as the biggest medical imaging event in the United States, and it lives up to that hype in spades. It was an excellent opportunity to learn more about the devices we talk about every day.

### CAROLYN HULL

#### MANAGER, GLOBAL REGULATORY STANDARDS, MITA

While preparing for and attending the conference involved much work, it was helpful to remember why MITA exists, and why we attend RSNA: the patients. MITA works to keep patients safe, through Standards development and conversations with FDA.



### HOLLY GROSHOLZ

#### MANAGER, GOVERNMENT RELATIONS, MITA

Seeing new medical imaging technologies reinforced the importance of our work: reducing regulatory barriers, establishing Standards, and advocating for the medical imaging industry so that these innovative and life-changing technologies can be shared more swiftly with the world. 🌐

## Utility Products & Systems

- Capacitor
- Distribution Automation
- Electrical Connector
- Electrical Measuring Equipment
- Energy Storage Systems
- High Voltage Insulator
- Surge Arrester
- Switchgear
- Transformers

Learn more at [www.nema.org/utility-products-and-systems](http://www.nema.org/utility-products-and-systems). 🌐

## I Am NEMA



Jonathan Stewart, Industry Director, Utility Products & Systems Division

While I am far from an expert on the historical evolution of the United States power grid, I can't imagine there has ever been a more exciting time to be a part of this industry. Electricity is generated, transmitted, distributed, consumed, stored, controlled, bought, and sold today at scales and in ways not achievable five years ago and not even imagined ten years ago. It's a safe wager that the same will be true five years from now.

As Industry Director for the NEMA Utility Products & Systems Division, I view it as my job to make sure the industry is prepared for the changes of today and preparing for the changes of tomorrow. But how?

As I look across the Division including 11 Product Sections and 57 different companies, I see an array of profiles. Some have been with NEMA for decades and others for only days. Some are Leviathans and others Lilliputians. From Switzerland to St. Louis, from Mexico to Mather, my division has it all. Yet each Member has one thing in common: each has found a way to innovate in this industry. So how do we prepare for change together? By bringing that innovation—that creative technical know-how—to NEMA.

If I can help the 57 Members of the Division to be unsatisfied with the status quo, constantly assessing whether legacy activities continue to be of value, and constantly searching for new value propositions, then I've done my job. 🇺🇸

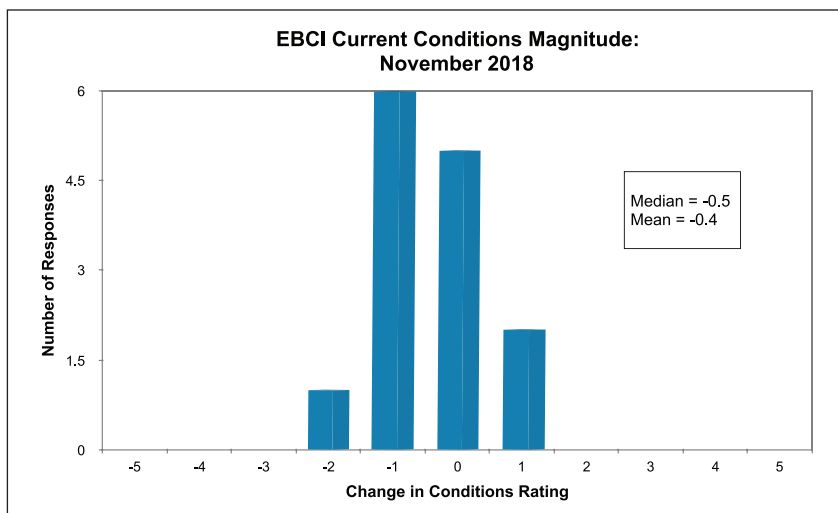
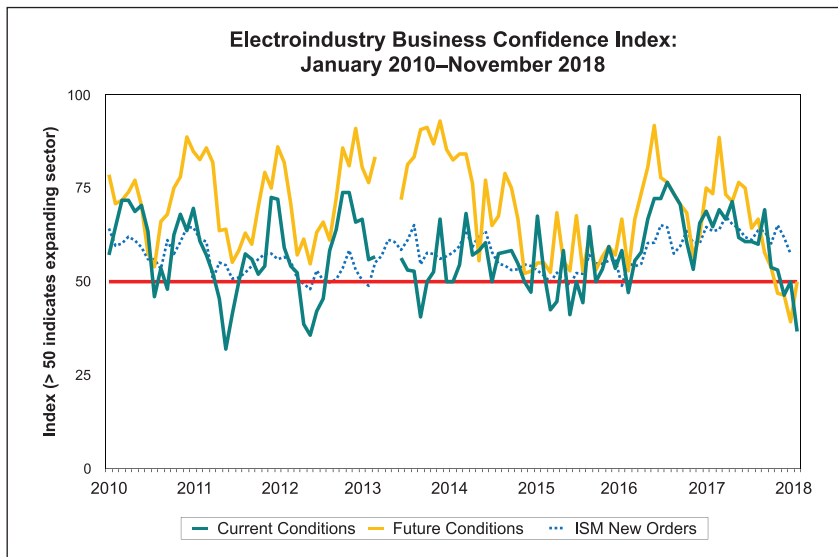
# Current Conditions Suggest Softening Environment

	Current Conditions (Compared to Previous Month)	Conditions Six Months From Now (Compared to Current Conditions)
EBCI	36.7 ▼	50.0 ▲
% Better	7% ▼	33% ▲
% Worse	33% ▲	33% ▼
% Unchanged	60% ▲	33% ▼

Number of Respondents: 15

Values reflect the percentage of respondents expecting "Better" conditions, plus one-half of the percentage of respondents expecting "Unchanged" conditions.

A score of 50 or higher suggests conditions appropriate to an expanding economy.



For the second time in three months, the current conditions component of the Electroindustry Business Confidence Index (EBCI) dropped below 50, giving up more than 13 points from October to a reading of 36.7 in November. This marks the lowest point in the series since August 2012.

Although the share of respondents that reported worse conditions increased to 33 percent, a solid majority, 60 percent, noted unchanged conditions. The mix of responses is perhaps more telling than the headline number, likely signaling that the extent to which conditions are improving compared to the prior period may have peaked.

The mean value of the reported intensity of change in electroindustry business conditions slid from  $-0.1$  last month to  $-0.4$  in November, and the median value moved into negative territory,  $-0.5$ , for the first time since early 2009, in line with the growing share of respondents reporting worse conditions. Panelists are asked to report intensity of change on a scale ranging from  $-5$  (deteriorated significantly) through  $0$  (unchanged) to  $+5$  (improved significantly).

By contrast, the future conditions component returned to expansionary territory, albeit just barely, following a three-month string of sub-50 readings. With responses about expectations for six months ahead split evenly between better, worse, and unchanged, the November score calculated to exactly 50 points. Panel member comments evinced ambivalence, along with a nod to continued strength in the industrial sector and some concerns about trade and inflationary pressures in the months ahead.

Visit [www.nema.org/ebci](http://www.nema.org/ebci) for the complete November 2018 report. 📄

## STOCKART

Cover, 9: ©istockphoto.com/Mlenny  
 4-8: ©istockphoto.com/Mlenny  
 12: ©istockphoto.com/ser\_igor



## ENDNOTES FROM THE **PRESIDENT**

**A**s highlighted in this issue, where and how we get our power is changing. We still rely on large power plants, but rooftop solar panels, wind farms, and other sources are emerging in the market. Members of the NEMA Utility Products & Systems Division expect that this model of more distributed generation closer to where power is consumed—along the edge of the network, rather than central power plants—is the evolving norm.

Over the past decade, several utilities and commissions across the United States invested in new grid technologies, tools, and techniques to accommodate these resources and to modernize the electrical grid. While such efforts promise substantial benefits for utilities, customers, and society as a whole in the long term, they come with a big price tag that can, at least in the short term, increase rates.

NEMA recognizes the importance of sharing the grid modernization experience gained by early-adopter utilities and jurisdictions. Throughout this issue of *electroindustry*, we have scratched the surface of grid modernization. We have defined grid modernization broadly, from technologies, tools, and techniques to applications like upgrading the existing grid and the experience of grid users.

While most utilities are enthusiastic about undertaking modernization projects, the need for cost recovery of such investments has prompted some jurisdictions to revisit their existing regulatory models and consider alternatives. For more on this, I direct you to the NEMA report *Reviewing the Business Case and Cost Recovery for Grid Modernization Investments*.

Throughout 2019, we will take a systems approach to the industry by focusing in turn on one of each of our seven Divisions. I encourage NEMA Members to submit articles related to these broad topics listed below, and I urge our supply chain partners to take advantage of our advertising opportunities. 📧

Kevin J. Cosgriff  
NEMA President and CEO

### 2019 Editorial Calendar

#### January/February

##### Utility Products & Systems

Exploring new utility models

#### March/April

##### Lighting Systems

Quality of Light = Quality of Life—Managing lighting systems

#### May/June

##### Transportation Systems

Electrifying transportation—  
Not just for cars anymore

#### July/August

##### Building Systems

Systems efficiency modeling

#### September/October

##### Industrial Products & Systems

Smart manufacturing

#### November/December

##### Building Infrastructure

The connected customer—Creating dynamic systems with passive devices

#### November/December

##### Medical Imaging

### Charley Denny Leaves Technological Legacy

Charles W. Denny, a Falk Award recipient and former Member of the NEMA Board of Governors, died in November 2018, leaving a legacy of technological and trade achievement, marketing and managerial excellence, and dedication to his family.

In presenting the Falk Award in 2001, then—NEMA Chairman Peter McIlroy called him “a hardworking leader who is committed to doing the right things for his company and for the industry.”

In 1960, Mr. Denny began his career in the electroindustry in his family-owned business, Barkelew Electric Manufacturing Company, which was acquired by Square D in 1967. In 1997, he became Chairman and CEO of Schneider Electric, focusing on major opportunities of development for the company (particularly in North America), global account management, and enhancing relationships with customers and distributors. He retired in 2000 to spend more time with his family.

While serving as chairman of the NEMA Board of Governors, Mr. Denny pushed the organization to be more global in its endeavors, leading a successful trade mission to Brazil, which later led to the opening of a NEMA office in São Paulo, followed by a second international office in Mexico City. He was also one of the first contributors to the NEMA political action committee, NEMAPAC. 📧



**SPEED. SIMPLICITY. SECURITY. EDI SERVICES. PEACE OF MIND.**

# Have It All.

IDEA Exchange<sup>SM</sup> Managed Services let you exchange eBusiness documents with your trading partners faster, easier and more securely without the complication and cost of hiring new staff or purchasing additional software. When IDEA manages your EDI services, you can relax knowing you've got the whole package.

**idea**   
**EXCHANGE**<sup>SM</sup>

→ Learn more at [idea4industry.com](http://idea4industry.com).