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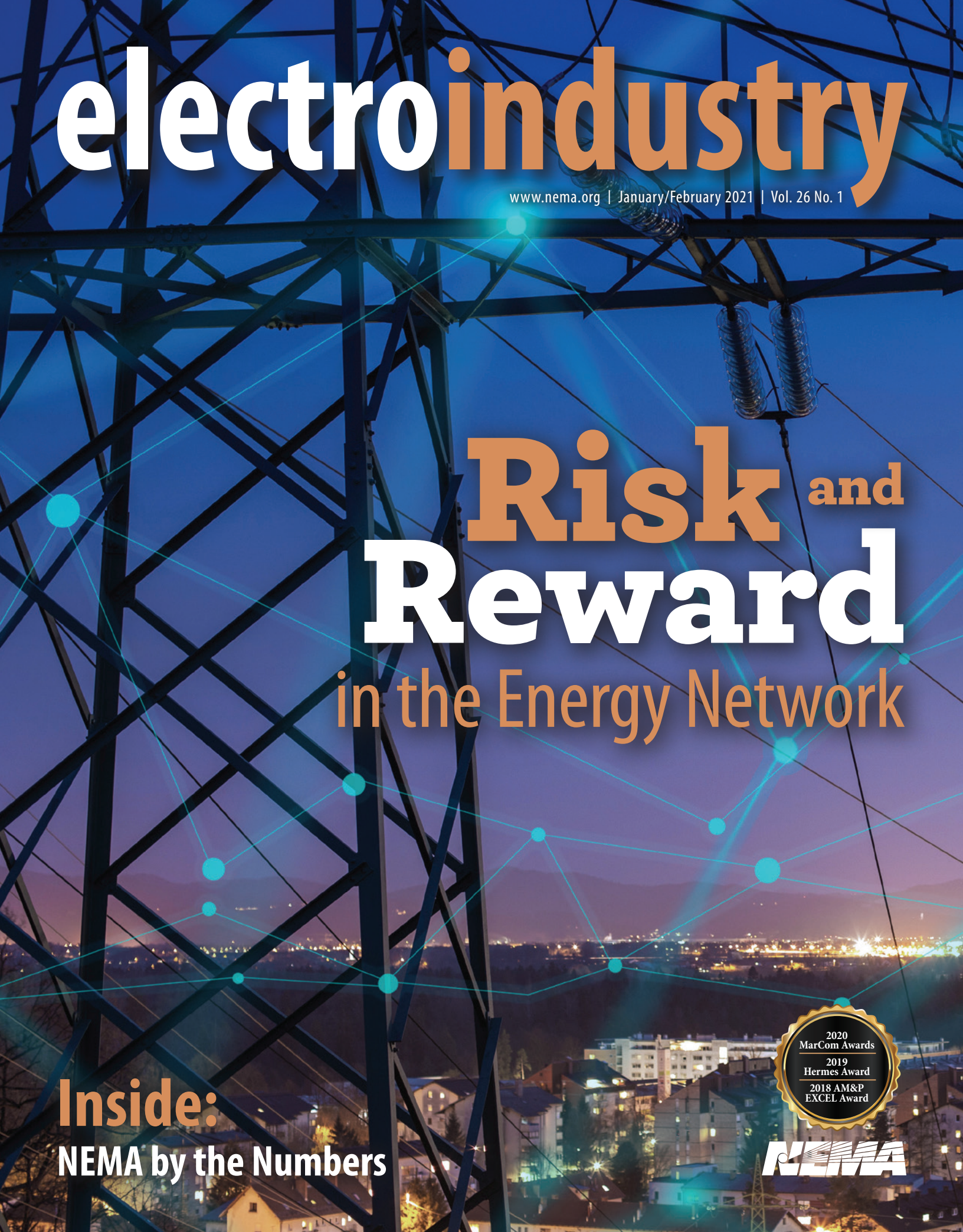
Risk and Reward in the Energy Network



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2019 Hermes Award
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Inside:

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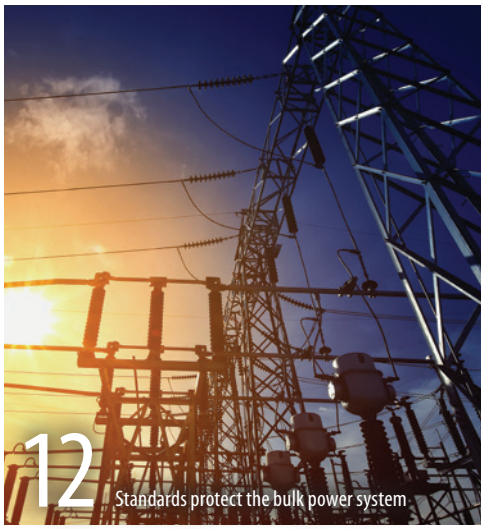

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FROM THE **CHAIR**

Last year undoubtedly brought many changes to our lives and habits, and how we think about energy use in the home is no exception. Many of the trends that have developed over the last few years have only accelerated, resulting in an opportunity to drive change in how we think the overall electrical grid operates, how it adapts and the role that homeowners will play in contributing to its efficiency and reliability.

When offices began closing in early 2020 in response to the coronavirus's arrival, most States saw an immediate and sustained increase in home energy use as many employees began to work from home and children transitioned to remote learning. In states as varied as California, Texas, Ohio, and Massachusetts, we observed mid-day consumption of in-home energy increase anywhere from 20 to 40 percent vs. previous years. Beginning in March, this held steady through much of the year. During the summer, western states also suffered from rolling blackouts driven by grid operators' increased caution during high wind conditions. Even with these preventive measures, wildfires continued to flare up throughout the year, resulting in a loss of power for many Americans.

When the home has become a *de facto* place for business and/or schooling, ensuring that home energy is reliable, stable and resilient has become a growing concern for many homeowners. Simultaneously, with solar and home-battery-system adoption increasing throughout the country, the mass availability of alternate energy sources is finally becoming a reality. Consumers want to understand how these new technologies can help to guarantee continuity of service and energy security for their families.

Increasingly, the answer can be found in the numerous smart devices and communication systems in the modern home. It is not unusual to find connected thermostats, lighting, plugs, and home energy monitors present in a newer or remodeled home today. The key to helping provide reliable (and, if needed, long duration backup) power capability, reducing stress on the overall grid, and assuring mass grid stability will be in harnessing these millions of "smart" devices to respond to signals both from the local utility and established consumer use preferences.

By marrying historical data on how people live and consume energy in their residences with the ability to receive and act on grid stability and home battery capacity data, we can begin to envision a future where Americans have more stable and reliable electricity. And, we can achieve this future state with zero loss of comfort or productivity. Imagine the ability to shift a megawatt of load by dimming the lighting in a million homes by just 10 percent for 30 minutes or extending the length of your battery back-up for hours by simply adjusting your thermostat by a few degrees.

The technology is increasingly available, and the intelligent networks required to be the backbone of this infrastructure are being deployed today. By combining in-home connected devices with grid-level data, realizing true grid-to-plug intelligence is visible on the horizon. The benefits to both homeowners and grid operators have the potential to improve our lives immeasurably. What an optimistic way to begin 2021.

Annette Clayton
Chair, NEMA Board of Governors

Phil Squair
Vice President, Government Relations, NEMA

NEMA Looks Ahead to New Administration

Election Day is over. Now, the electroindustry must take stock of the results to anticipate what might be headed our way this year and beyond. My short answer: things are looking up!

For starters, Joe Biden will be inaugurated on Jan. 20 as the 46th President of the United States. He has already started announcing his choices for key cabinet posts and other advisory positions.

The House of Representatives will remain in Democratic hands, albeit with a narrower majority. But while a majority of only one vote is needed to maintain control, House Democratic leaders will have their work cut out for them to make sure their caucus sticks together in the debates to come.

Notably, the U.S. Senate's control is still up for grabs. We'll know more after the two run-off elections in Georgia on Jan. 5. Democrats need to win both of these elections if they are to take control of the Senate.

Even with these caveats, we can draw some important conclusions about the elections' impact on our priority issues.

A Biden Administration will come to power with big ideas about infrastructure, emissions reductions, trade policy, cybersecurity, and workforce protections. The President has significant authority to implement new policies either through the normal regulatory process or via Executive Orders. President-Elect Biden has already stated his intentions to use his prerogatives vigorously.

We can expect a shift away from the previous go-it-alone approach to prioritize re-engagement with allies and global organizations in the trade area. However, this does not necessarily signal a reversal of the previous administration's tariff policy, particularly considering Biden's statements about globalization's effects on American workers and manufacturing.

A key indicator of the new administration's trajectory will relate to the U.S.-Mexico-Canada Agreement (USMCA). It should remain a cornerstone for trade in North America since it passed Congress with bipartisan support. Still, pressure for vigorous enforcement of labor and environmental provisions will intensify even as the agreement continues to operate.

A significant decision that should come very soon after Inauguration Day will be to have the U.S. rejoin the Paris Agreement leading to plans laying out future U.S. emissions reduction targets and associated regulatory requirements.

Federal action in this area should spur significant activity for the electroindustry in every NEMA Division. Grid modernization, electric vehicle infrastructure, building technologies and controls, lighting, and advanced manufacturing could all experience a surge of interest as policymakers implement programs to help meet U.S. commitments to reduce emissions.

In the lead-up to Election Day, NEMA published an *Open Letter to All Candidates for President and the 117th Congress*. The letter urged candidates to embrace pro-growth policies to reduce emissions, modernize and secure the electric grid, implement reasonable data-driven regulations, foster a future-focused workforce, and increase access to life-improving medical technology.

These will be the essential ingredients of any successful body of work from the Administration and Congress over the coming years, and NEMA will be right there to help them achieve these goals.

Phil Squair

A Biden Administration will come to power with big ideas about infrastructure, emissions reductions, trade policy, cybersecurity, and workforce protections.

Commission Order Opens U.S. Markets to Distributed Energy Resources

Keith Bradley, Partner, Squire Patton Boggs

Investment in distributed resources has increased in recent years, and forecasters expect the trend to accelerate. Some estimates suggest the combined worldwide capacity of distributed resources will be more than 300 gigawatts by 2025[1]. In its recent Order No. 2222, the Federal Energy Regulatory Commission (FERC) has taken a significant step to open U.S. markets to distributed resources.

Particular types of distributed resources have been operating at scale for years by this point. Rooftop solar has become commonplace in many parts of the country, so much so that in California it is approaching 10 percent of net summer generation[2]. Demand response programs are increasingly popular, with more than 20 GW of enrolled capacity in 2019[3]. More varieties are on their way; distributed solar owners are adding on-site storage, two-way electric vehicle chargers, distributed solar thermal, and more.

The regulatory system and the wholesale market are racing to keep pace with these developments. State utility commissions have handled rooftop solar since FERC determined that net metering programs would not constitute FERC-jurisdictional sales.[4] The net

1 Jeff St. John, "5 Major Trends Driving the $110B US Distributed Energy Resources Market Through 2025," Greentech Media, June 22, 2020, https://www.greentechmedia.com/articles/read/5-takeaways-on-the-future-of-the-u.s-distributed-energy-resources-market

2 *Q1/Q2 2020 Solar Industry Update,* National Renewable Energy Laboratory

3 *2019 Utility Demand Response Market Snapshot,* Smart Electric Power Alliance, Pg. 7, September 2019, https://sepapower.org/resource/2019-utility-demand-response-market-snapshot

4 Sun Edison LLC, 129 FERC ¶ 61,146 (2009), reh'g granted on other grounds, 131 FERC ¶ 61,213 (2010); MidAmerican Energy Co., 94 FERC ¶ 61,340 (2001)

metering programs that many states and utilities have developed for these systems have been successful but also controversial as utilities, regulators, and customers debate how to allocate the costs. Multiple state utility commissions have engaged in study projects to explore how to bring distributed resources into the market.

Order No. 2222 cuts through many of these developments. FERC demands that aggregators of distributed resources must generally be able to sell into wholesale markets. There are many details to work out, such as eligibility requirements, the terms of participation, technical details about metering and telemetry, and process matters about applying for market access.

Regional Transmission Organizations (RTOs), Independent System Operators (ISOs) and state regulators will make decisions on these matters in the coming years. But FERC mandates that however those details play out for specific situations, distributed resources should be allowed to deliver energy to the bulk grid as a fundamental matter. This is a major change from net metering, in which a rooftop solar generator gets credit for delivering energy to the customer's distribution utility. Under Order No. 2222, distribution networks will change from one-way streets to two-way boulevards, delivering energy to end customers and transmiting it, at scale, from those endpoints to wholesale markets.

This information is not wholly new, of course. There are already facilities interconnecting to the grid through distribution systems, such as industrial cogeneration facilities selling under *Public Utility Regulatory Policies Act* (PURPA). The FERC order contemplates a major expansion of "two-way distribution," precisely because FERC is clearing the path for micro-scale resources to participate. The key concept is a distributed resource "aggregator," which is a business that combines and manages a collection of distributed resources and sells them into the wholesale markets as an aggregate. The aggregate would be over 100 kW, the typical minimum size for a market participant in many existing tariffs, though the individual resources could be much smaller.

The FERC definition of a distributed resource further expands the scope of this wholesale opportunity. It covers any resource located on the distribution system: whether behind a customer meter or in front of it, and whether the resource is generation or some other form. Storage resources, unsurprisingly, are covered; combined assets, like a generator paired with a storage system, can also qualify.

Demand Response

Perhaps more controversially, distributed resources covered by the order may be able to include demand response. FERC determined years ago in Order No. 719 that RTOs/ISOs must enable demand response aggregations to participate in wholesale markets when state or local regulatory authorities allow that.

In the new order, FERC says the existing rules about demand response remain in place, such as the requirement that the relevant regulator permit participation and the technical requirements that RTOs/ISOs are allowed to impose. At the same time, a distributed resource aggregator will be able to include demand response assets in aggregation and bid them into wholesale markets through the new distribution resource channel.

FERC also says the pricing rule established a decade ago, in Order No. 745, for compensating demand response will still apply; at the same time it distinguishes Order No. 2222 participation from existing demand response programs and says RTOs/ISOs may develop restrictions to keep a given asset from being compensated in both channels. How to handle demand response is likely to be a source of some confusion and debate in the coming tariff filings.

Role of Distribution Utilities

Distribution utilities will play a critical role in making this all work, but most of the details remain to be worked out. Distributed resources will need to interconnect through their distribution utilities to inject electricity into the bulk system, but FERC is declining to exercise jurisdiction over that interconnection process. State regulators will be responsible for overseeing distribution interconnections, much as they are for net metering programs but now for a broader range of transactions that could include substantial energy injections. Distribution utilities will have technical concerns, but FERC has not said much about how those will be addressed. It calls for a "review" process, in which a distribution utility will get a specified period of time to review participation by a given distributed resource aggregation before it begins sales. But FERC distinctly refuses to let the distribution utility decide whether the distributed resources can sell; at best, it appears, the utility can ask the RTO/ISO to remove a distributed resource from an aggregation or restrict its participation. The review processes are to be another feature of the forthcoming tariff filings.

To give a flavor of what FERC is expecting, the order suggests that perhaps an RTO/ISO should require that a utility's request for restriction be supported by an affidavit saying that sales from the distributed resource would pose a significant risk to safe and reliable operations.

Critically, all of this applies only to distributed resources connected to larger distribution utilities. Utilities that distribute less than 4 million megawatt-hours a year are not required to facilitate sales by distributed resources per se, though state regulators can decide to include smaller utilities in the Order No. 2222 system. Absent such an opt-in from the relevant regulator, a distributed resource aggregator will need to have only assets connected to larger utilities—those over 4 million MWh—and an RTO/ISO must not accept bids from an aggregation that includes customers of smaller utilities.

Questions and Challenges

The regulatory system is going to become more complex. Distribution systems are, of course, ordinarily regulated by state utility commissions, and distribution is beyond FERC authority. But Order No. 2222 says not just that FERC has authority to regulate wholesale transactions by distributed resources if those occur. FERC is also asserting that it has authority to clear the path for distributed resources to come into the market. This assertion is not uncontroversial, and Commissioner James Danly dissented. We may well see litigation focused on this point.

At any rate, if the order stands, at least in its basic framework, distribution networks will be subject to two regulatory regimes. To go back to the analogy of a two-way street: It is as though the local police department watches traffic one way, and state troopers cover the traffic in the other direction. (And, of course, it's even more complicated than that, because for the reverse traffic, FERC will regulate the transactions while not regulating the interconnections.)

Many questions remain unanswered, and the compliance filings that RTOs and ISOs must now handle will be complex and contentious. Questions include:

- How will distributed resource aggregators bid geographically dispersed resources into the markets, and how will distributed resources be dispatched?
- What technical requirements will distributed resources have to satisfy, particularly about metering and telemetry?
- Can a resource aggregator swap individual assets in or out of a resource aggregation, and how should that be coordinated with the RTO/ISO?
- How will distribution utilities upgrade their systems to handle distributed resource interconnections, and how will the costs be allocated?

Many of these questions will be answered by RTO/ISO tariff filings that FERC has now ordered. Many of them will remain for state regulators to work out with distribution utilities.

Tariff filings in response to Order No. 2222 are due October 2021. This is the start of a fascinating journey for distributed resources regulation.

Mr. Bradley served as Senior Advisor to the General Counsel of the U.S. Department of Energy (DOE) from 2014 to 2017.

Innovative Interoperability and Security Possible for Distributed Energy Resources

Ronald Farquharson, DNP Users Group, Mount Victoria Consulting

Grant Gilchrist, DNP Users Group, Tesco Automation

As the pace of renewable energy deployments continues to grow, the importance of optimizing the interoperability and security of associated measurement and control equipment is also increasing. Larger deployments of Distributed Energy Resources (DERs) create a greater need for interoperability, increase the size of cybersecurity-related attack surfaces, and expand the probability of overall vulnerabilities. In response, the Distributed Network Protocol (DNP) Users Group, the MESA Standards Alliance (MESA), the Electric Power Research Institute (EPRI), and The Institute of Electrical and Electronics Engineers (IEEE) have developed new Standards solutions and extended existing Standards to address these new concerns.

Role of DNP3 in DER Communications

At the center of recent DER communications developments is the Distributed Network Protocol (DNP3), formally referred to as IEEE Std 1815™. It is implemented in millions of existing utility devices and used by the vast majority of North America's utility control centers. Furthermore, IEEE Std 1815 is specified in IEEE Std 1547-2018™, the IEEE Standard for interconnecting DERs, as one of the protocol options to be used for communicating with DERs. The DNP Users Group (DNP-UG), comprised mostly of expert volunteers from industry, controls the evolution of the Standard, and works with other groups such as EPRI, MESA, the IEEE, and the International Electrotechnical Commission (IEC) to improve its functionality, security, and interoperability. The DNP-UG currently has several active programs in place or underway to maximize interoperability (e.g., the Conformance Certification Program and updated test procedures) and cybersecurity (e.g., DNP Secure Authentication and the next generation Authorization Management Protocol). The DNP-UG also recently completed a profile document for communicating with DERs.

IEEE Std 1815 (DNP3) in IEEE Std 1547-2018

The IEEE 1547-*Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces* was updated in 2018 to include essential new requirements for reactive power support, voltage, and frequency "ride-through." It addresses a notable shift toward optimizing Bulk Power System (BPS) dynamic and transient stability. The IEEE Std 1547-2018 Standard also specifies three communication protocols: DNP3, IEEE Std 2030.5™ and SunSpec Modbus™.

MESA and EPRI

To maximize interoperability between DERs and utilities, the DNP-UG, MESA, and EPRI collaborated to develop a detailed protocol profile, including a standardized points list. The profile did not change the protocol, but it detailed directions on how to use the protocol for a particular application—in this case, DERs. The document's purpose is to integrate DERs simply by requiring each device to provide the same data for monitoring and control at the same predictable locations, in the same expected formats, using the same protocol options. The DNP-UG refers to the resulting work as the *DNP3 Profile for Communications with DERs* (AN2018-001), while the MESA version is called the *MESA-DER Specification*. Both the DNP-UG and MESA provide access to the documents to their Members.

Introducing the DNP3 DER Profile

With the increasing deployments of DERs on the grid, new and extended communications methods are becoming essential to enable utilities and the public to maximize the operational functionality and financial value of distributed energy and other assets.

The DNP3 DER Profile was based on pioneering industry work by EPRI developing the *EPRI Common Functions for Smart Inverters*, and the specifications that have made use of it, including; IEC 61850-7-420,

Mr. Farquharson has more than 30 years of experience in transmission and distribution automation technologies and Standards, focusing on data communications, intelligent devices, gateways, synchrophasor measurement, precision time, and equipment-condition monitoring.

Mr. Gilchrist, P. Eng., is a Member of several utility data communications Standards groups, including the IEC working groups for SCADA, substation automation, protocol security, and interoperability.

IEEE 61850-90-7, IEEE Std 1547-2018, California's Utility DER Electric Rule 21 Interconnection, and the European ENTSO-E DER interconnection requirements (2016). The profile also references IEEE Std 1815.1™ for mapping between DNP3 and IEC 61850 and previous versions of DNP3 profiles for Advanced Photovoltaic Generation and Storage. Key to the DNP3 DER Profile is its design based on the structured data models for DERs specified in IEC 61850-7-420 Edition 2.0 (under development), which is part of the International Electrotechnical Commission (IEC) 61850 protocol Standards family. This approach brings many benefits for long-term interoperability because it aligns the specification with work on DERs across the world.

The DNP3 DER Profile defines a comprehensive set of point definitions for DER units, inverters, batteries, and meters based on the operational modes described in IEEE Std 1547, the *Common Functions for Smart Inverters,* and a suite of other functions and modes including schedules and settings groups for islanding and commissioning.

The MESA-DER Specification dictates a subset of the DNP3 DER Profile and includes additional functions of particular interest to Energy Storage Systems.

Work with DNP3 DER Profile

States such as California and Hawaii are continuing to revise their DER regulations and will require independent conformance certification testing of DER communications interfaces. These requirements are critical for optimal interoperability in large systems with equipment from multiple vendors. The DNP-UG has implemented and currently operates a conformance certification program for Standard DNP3 and is working with MESA and other organizations to extend the program to include the MESA-DER Specification and the DNP3 DER Profile. Additional developments include new test specifications, updated XML configuration definitions, and new test tools.

Cyber Security Developments for DER Communications

As stated above, unless strict controls are in place, larger deployments of DER devices tend to expand the power system's attack surfaces and result in greater overall vulnerability. This vulnerability arises from third-party service providers' deployment of communications networks, communications with devices owned and controlled by others, and permitted functions such as remote access and control to third parties. These factors combine to raise the importance of cybersecurity requirements for DER systems. The IEEE has recognized this need and has started work on what will become the IEEE Std 1547.3 for securing DERs.

Fortunately, there is an overlap of security requirements for DERs and other parts of the power utility, which enabled the use of previously standardized cybersecurity specifications such as DNP Secure Authentication. The DNP-UG developed that specification as part of a defense-in-depth design. The current version of this Standard is Secure Authentication Version 5 (DNP3-SAv5) and is in IEEE Std 1815-2012. The DNP-UG is now developing SAv6 and a new communication authorization mechanism called Authorization Management Protocol (AMP). Authors may include these technologies in IEEE Std P1547.3.

Defining New Profiles

NEMA and the DNP-UG have identified a potential need for additional interoperability profiles (and associated other documents) based on the example of the DNP3 DER Profile. These new profiles would address other devices, such as distribution feeder reclosers, due to the high numbers of these devices on our power systems. NEMA and the DNP-UG are currently investigating the level of interest in the industry for additional profiles.

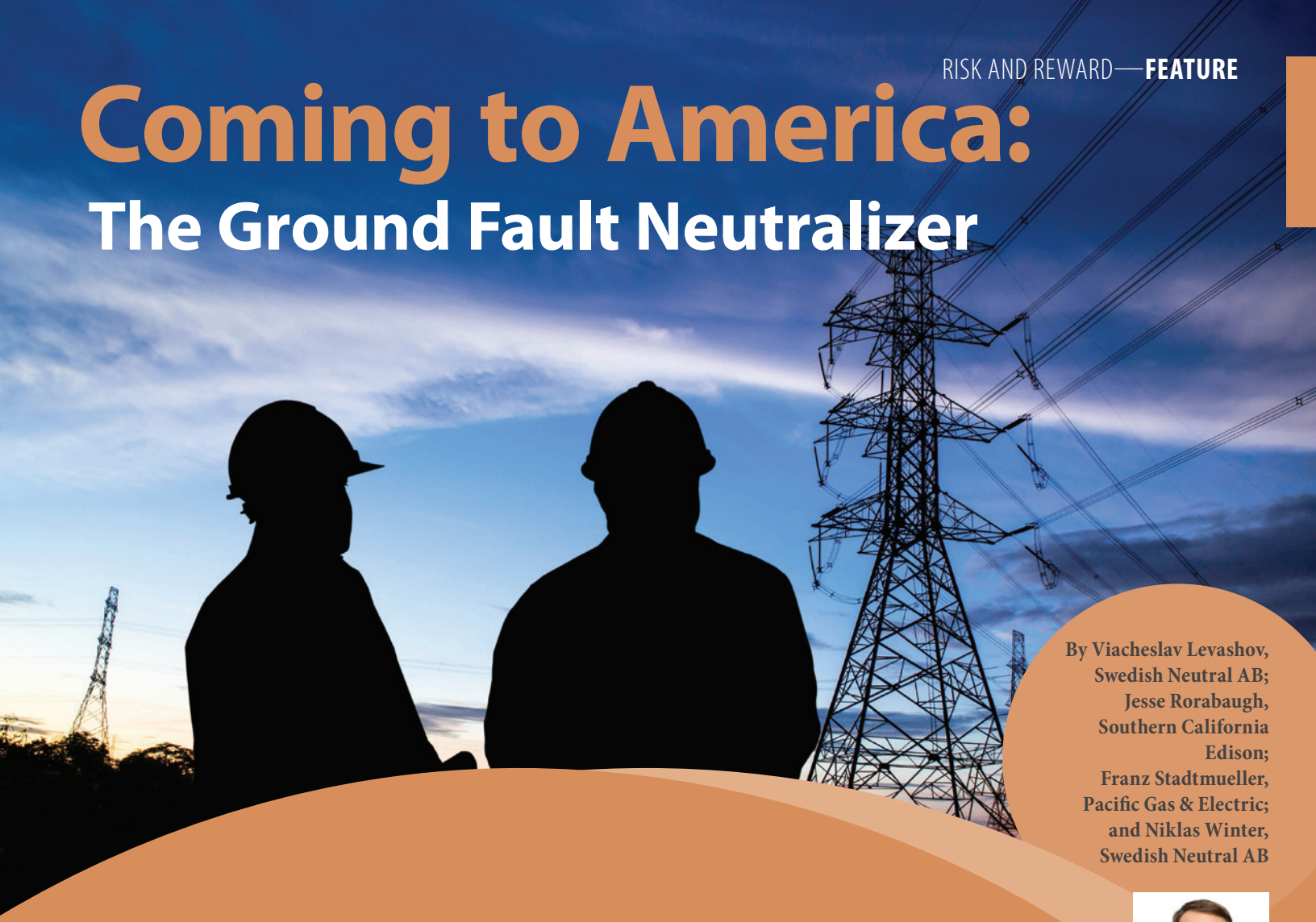
The DNP-UG is Member Supported

Several development programs are supportive of, if not crucial to, interoperable and secure communications for DERs. Our dedicated volunteers --many of them experts --continue to provide more than 4,000 hours of volunteer time each year. We develop and make available a wide range of specifications, guides, application notes, and technical bulletins to our Members. The UG also operates our conformance certification program. However, our Members sustain the DNP-UG. If you or your company are not already Members of the DNP-UG, please consider joining us. New memberships are available here. Membership renewals are available here. For assistance and more information, please contact us at admin@dnp.org.

Addressing New Requirements

The growing presence of DER systems and devices on our power systems is driving the need for new or extended mechanisms to optimize interoperability and security for DER communications and enable utilities and the public to maximize the operational functionality and financial value of distributed energy and other assets. Innovative new solutions and improvements to existing ones are on their way. ei

Coming to America:
The Ground Fault Neutralizer



By Viacheslav Levashov, Swedish Neutral AB; Jesse Rorabaugh, Southern California Edison; Franz Stadtmueller, Pacific Gas & Electric; and Niklas Winter, Swedish Neutral AB

One of the most critical components of electrical infrastructure is protection. On the power grid, the grounding and protection system must properly function when lines come in contact with vegetation, wildlife, or other lines, that could trigger faults. Without adequate protection on the lines, the results could be catastrophic.

"What keeps us up at night," explains Matthew Pender, Director of the PG&E Community Wildfire Safety Program, "is the exposure—how many miles, how many things could go wrong. It only takes one tree."

Some commonly employed grounding/protection technologies might not always detect certain kinds of faults in the network or might not sufficiently reduce the fault's energy, leading to ignition. A relatively new technology to the North American market—the Ground Fault Neutralizer (GFN)—seeks to remedy this. GFN technology detects faults that traditional protection cannot by being roughly 25 times more sensitive. Then it neutralizes the fault ultra-fast, preventing a fire before one can even begin. This is achieved by combining hardware (a passive Petersen coil and an active residual current compensating inverter) to neutralize the fault current with advanced software (differential zero sequence admittance) to detect the faults.

Though new to North America, GFN technology was developed in the 1980s in Sweden and first demonstrated in field applications in the early '90s. At the time, Swedish regulators had begun requiring the state-owned utility to cut power supply immediately following an earth fault, eliminating any residual current on the line. Regulators also required increasing fault detection sensitivity to be able to detect all earth faults of up to 5kOhm. Recognizing that earth fault current on ungrounded systems consists of two components—capacitive (charging) current and residual current—engineers developed GFN to eliminate both.


Viacheslav Levashov

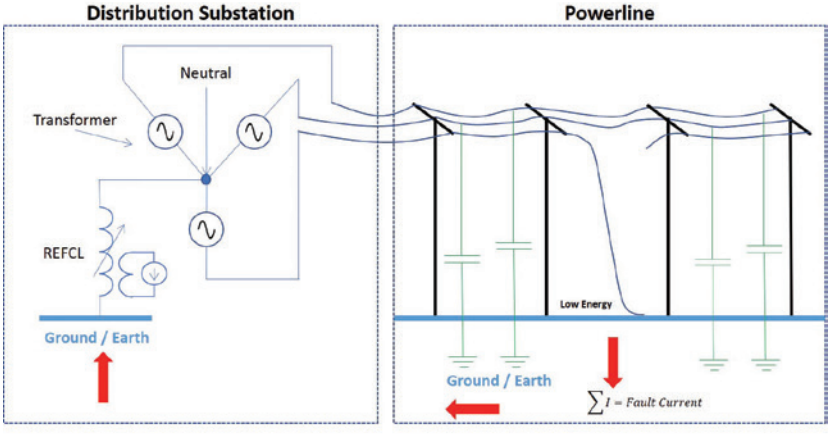

Jesse Rorabaugh


Franz Stadtmueller


Niklas Winter

Today's GFN systems are installed and controlled from the substation, protecting the entire network from a single point. The technology connects to the neutral of a power transformer and is comprised of three major components: 1) an arc suppression coil (aka Peterson coil) that compensates for the capacitive part of the fault current; 2) a residual current compensating Inverter that compensates for the residual part of the fault current; and 3) a computer controller that detects ultra-high impedance faults and controls the two other components to neutralize the fault current ultra-fast. Mathematically, this could be expressed as follows:

Total Fault Current = (capacitive fault current – arc suppression coil current) + (residual fault current – inverter current) = 0



Configuration of a GFN system (referred to here as Rapid Earth Fault Current Limiter, or REFCL)

Until somewhat recently, use of the technology was largely limited to Sweden and nearby European countries. That all began to change in 2009 when the Victorian Government (Australia) implemented the Rapid Earth Fault Current Limiter Program across the state in response to the Black Saturday bush fires which led to 173 deaths. An extensive test program of available technologies showed that the Ground Fault Neutralizer was the most effective at preventing ignition. The Victorian utilities were mandated to install them to protect a total of 31,000 km of circuitry by 2023. Conversions have already been completed on 15,000 km of circuitry. These conversions included testing to demonstrate that every single circuit can detect a 25.4kOhm earth fault.

The Ground Fault Neutralizer appears to have been extremely effective in its first years of use. In the 2019-20 bushfire season—the worst ever in Australia—the technology performed well, protecting the lines against 57 faults including 33 permanent faults. None of these faults resulted in an ignition.

Well aware of the success in Victoria, two major investor-owned utilities in California have both begun Ground Fault Neutralizer pilot projects: Southern California Edison and Pacific Gas & Electric.

Southern California Edison

The small city of Neenach, California, lies about 100 miles north of Los Angeles and is home to one of Southern California Edison's distribution substations. The substation covers about 180 miles of 12kV circuity, 70 of which run through geography designated as "high fire risk areas" by the state of California.

"We chose this area for the pilot," explains Jesse Rorabaugh, Senior Engineer and Project Lead "because it closely resembled the system design, ratings and application parameters of what was done in Australia. We hope to replicate their success as we familiarize ourselves with the technology, then scale it to other parts of our system, where it makes sense to do so."

In February, SCE will begin installation of a GFN into the Neenach substation, just as was done through Victoria, to protect the entire length of circuitry originating from that substation. The project timeline allows for field testing in time for the 2021 fire season.

Pacific Gas & Electric

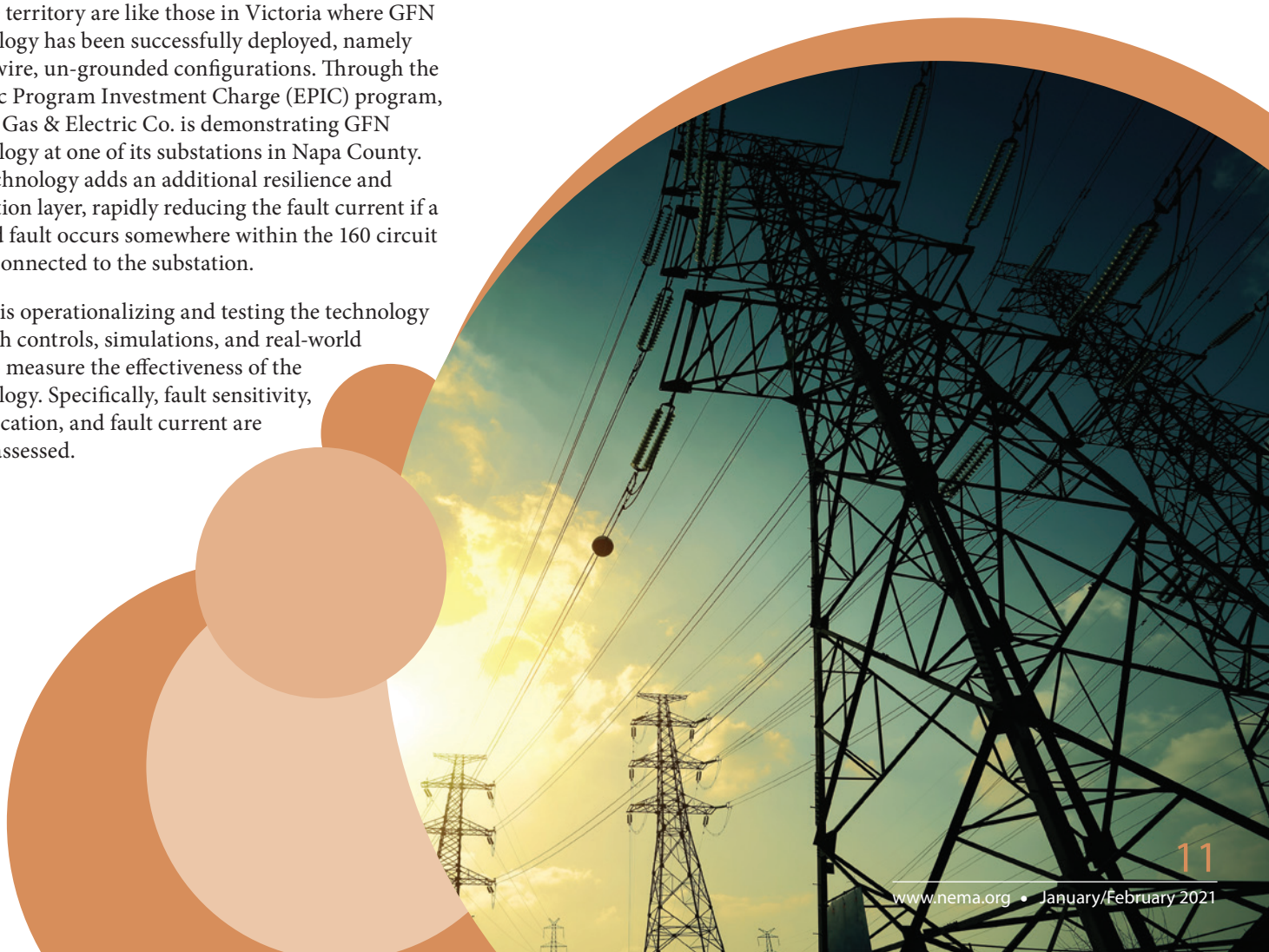
Many of the electric distribution circuits in the PG&E service territory are like those in Victoria where GFN technology has been successfully deployed, namely three-wire, un-grounded configurations. Through the Electric Program Investment Charge (EPIC) program, Pacific Gas & Electric Co. is demonstrating GFN technology at one of its substations in Napa County. The technology adds an additional resilience and protection layer, rapidly reducing the fault current if a ground fault occurs somewhere within the 160 circuit miles connected to the substation.

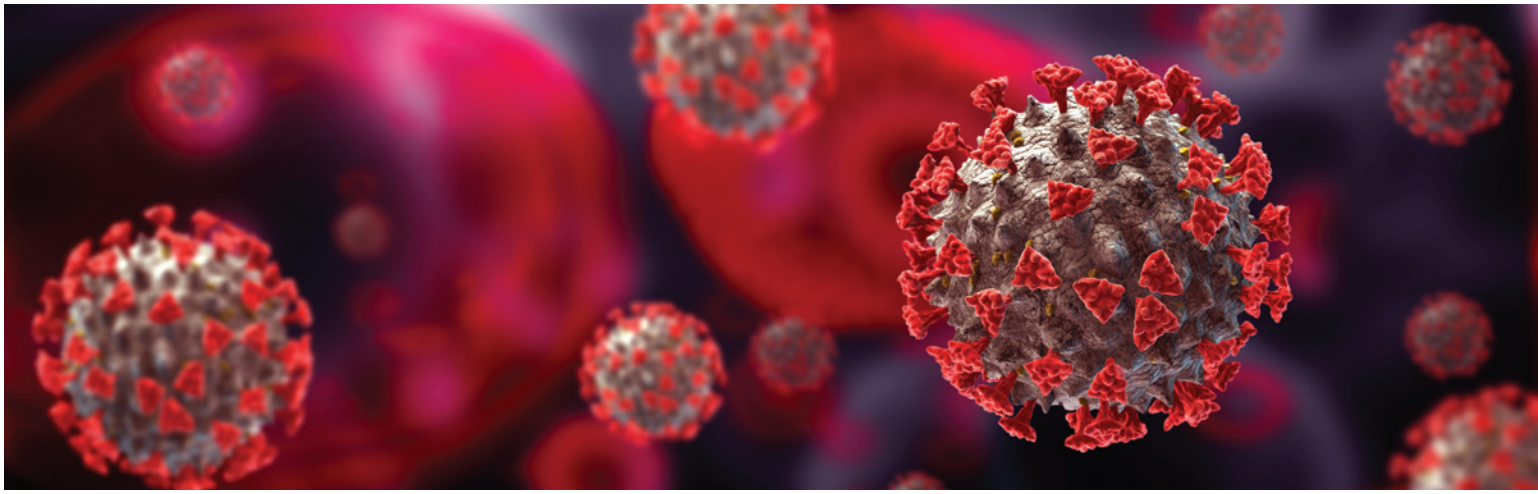
PG&E is operationalizing and testing the technology through controls, simulations, and real-world tests to measure the effectiveness of the technology. Specifically, fault sensitivity, fault location, and fault current are being assessed.

"Deploying GFN technology is not plug and play," confides Franz Stadtmueller of PG&E. "A detailed engineering design of the supporting substation and distribution equipment is required. All of the primary connected equipment needs to be fully rated for phase-phase voltage to ground for example."

To maximize the greatest level of sensitivity, the PG&E demonstration involves balancing the capacitive (charging) currents from each of the phases at the substation. Long single-phase tap lines or single-phase underground cables cause unbalance, so PG&E is installing capacitive balancing units to maintain balance and high sensitivity to ground faults. The demonstration project is scheduled for completion in June 2021.

Mr. Levashov is a software department manager at Swedish Neutral; Mr. Rorabaugh is a senior engineer at Southern California Edison; Mr. Stadtmueller is an electrical engineer at Pacific Gas & Electric; and Mr. Winter is executive vice president at Swedish Neutral.





Captive Insurance for Critical Exposures

Kyle Seymour, S&C Electric, and Rich Stinson, President and CEO, Southwire

If you've recently asked an attorney to review your business disruption insurance policy to ascertain whether it covers a pandemic, you're not alone. If the answer was a resounding, "maybe," you're not alone in that regard either.

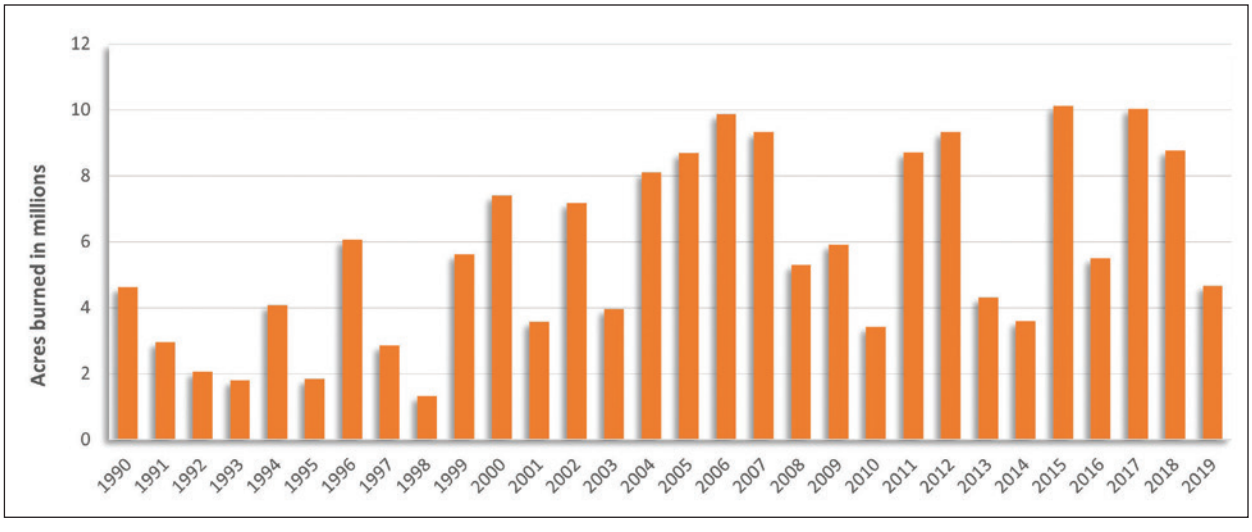
Kyle Seymour

Rich Stinson

Unfortunately, whether your insurer agrees with coverage is another issue entirely, and courts around the country (and the world) continue to sort it all out. The pandemic coverage fight is just the latest in a broader trend of liability insurance issues that have resulted from catastrophic losses occurring in the past few years, mostly due to weather events such as hurricanes, tornadoes, floods, and wildfires. Many companies have experienced a tightening market for general liability coverage with premiums accelerating or added coverage exclusions.

A particularly acute example of this phenomenon relates to liability coverage for electrical equipment manufacturers serving the California energy market. Wildfires there have caused deaths and substantial economic losses in recent years. Of the past 30 years, 24 have seen at least 1 million acres burned in wildfires. And all of the 10 years that have seen more than 8 million acres burned have occurred since 2004.

Though wildfires are not exclusively in California, the state represents the most wildfires and damage sustained by them over that time. A variety of issues can cause these fires in California, commonly including weather and wildlife. But under a legal doctrine known as "inverse condemnation," when equipment on the power grid malfunctions or is otherwise deemed to have caused a wildfire, the state's law attributes automatic liability to the electric utility that owns that equipment.



Source: National Interagency Fire Center

How often are California utilities stuck with a bill for damages resulting from wildfires caused by their equipment? A January 2019 Los Angeles Times article reported that equipment owned by the state's three largest utilities—Pacific Gas and Electric, Southern California Edison, and San Diego Gas & Electric—ignited more than 2,000 fires in a 3.5-year period. Due to the liability it faced for the private property these fires destroyed, PG&E (the largest of the three) filed for bankruptcy in 2019.

Electrical equipment doesn't cause all wildfires. Among those that do, not all of those fires destroy private property, fortunately. But when they do, financial liability for the responsible utility can quickly soar into the billions-of-dollars range. Even with the large investor-owned utilities in California, there is no guarantee that they will have funds or insurance coverage to compensate the plaintiffs (usually the property insurers). The magnitude of the losses involved drives plaintiffs and utility companies alike to seek remuneration from other parties, such as equipment suppliers.

Wildfire liability insurance has historically been available and cost-effective for equipment manufacturers. But given the increasing risk level and the sums of money currently at stake, this coverage is becoming more expensive and less available at each renewal period. When combined with other catastrophic losses, it points to a general concern about continuity and cost of liability insurance coverage that the electroindustry may well face in coming years.

With few jurisdictional (state) regulations limiting which exposures can and cannot be covered, new ideas often emerge from corporations in need. NEMA is investigating one such idea as part of its 2020–21 Industry Defense Strategic Initiative: General Liability Captive Insurance.

A captive insurer is an insurance company wholly owned, operated, and controlled by the company or companies it insures. As a response to a hardening insurance market (one where premiums for specific exposures are increasing, or the level of coverage for those exposures is decreasing or is no longer available), captives can offer a viable alternative. The owners/insureds define the covered exposures and establish premium levels and payouts, all of which are tailored specifically to their respective tolerances for risk.

According to a recent *Wall Street Journal* article citing A.M. Best, the number of U.S.-based captives more than doubled from 2007 to 2019. Today, more than 3,100 captive insurers have been created to address hardening markets for liabilities ranging from workers compensation to product liability to errors and omissions.

And what of business disruption coverage for a pandemic? Michael Serricchio, Managing Director at Marsh Captive Solutions and a risk management expert, sees a growing demand. "When the pandemic started, we took a look at our captive base, and we found that over 30 captives had pandemic coverage in the captive already. We see pandemic in captives, and I think that number's going to grow."

The Industry Defense Strategic Initiative Task Force will convene a NEMA-wide call this spring. If you are interested in learning more about how such a mechanism can insure or re-insure your critical exposures, please contact Jonathan Stewart (jonathan.stewart@nema.org) for an invitation.

Like the traditional/commercial insurance market, the principles of economies of scale apply just as readily to captive insurance. To keep the price of premiums reasonable, traditional insurers must build sufficient reserves to cover would-be pay-outs. The same naturally holds for captives. But commercial insurers benefit dozens, if not hundreds of premium payers, to create these reserves. Likewise, to keep premiums at acceptable levels for the owners/insureds, a captive must also have a sufficient number of premium payers. Otherwise, the premiums will be too high and cost-prohibitive, or the coverage will be insufficient.

To date, the group of NEMA Members interested in a captive solution to provide coverage for general liability related exposures has been insufficient to make the economics work. This could be due primarily to two factors:

1) lack of awareness among the NEMA membership, and
2) a perception that the efforts within NEMA are limited only to wildfire risk.

I am hopeful that this article will, at least in part, address the first factor. Regarding the second, it is true that wildfire risk has been the driving issue. But, as mentioned above, we can establish captives to cover a range of liability exposures. Creating a single captive insurer to cover multiple exposures appears to be the most viable way forward if any exist. Risk managers among the NEMA Membership should consider captive insurance as an alternative risk transfer method in the face of a hardening market of traditional insurance.

Mr. Seymour recently retired from S&C Electric. Mr. Stinson has more than 30 years experience in the electric industry.

Steve Griffith
Industry Director, NEMA

How Standards Protect the Bulk Power System

Among the many North American Electric Reliability Corporation (NERC) Standards, few get as much attention as those for critical infrastructure protection (CIP).

NERC is the Federal entity responsible for overseeing the bulk electric system (BES) for North America. NERC developed the CIP Standards to apply specifically to the cybersecurity aspects of the BES. These Standards define the reliability requirements for planning, operating, and protecting the North American bulk power supply system.

There are 10 fundamental requirements within the NERC CIP Standards:

1. **Identification and Classification**: BES are identified, categorized, and defined as a grouped set of cyber assets. Cyber assets are programmable electronic devices also capable of holding data.
2. **Security Controls**: Clear accountability is needed to protect BES cyber systems.
3. **Background Checks and Training**: Train staff and contractors appropriately to reduce BES cyber systems' exposure to associated cyber risks.
4. **Electronic Security**: Create electronic security perimeters around cyber assets.
5. **Physical Security**: Define operational and physical controls in a physical security plan, a visitor control program, and a maintenance and testing program.
6. **System Security**: Apply specific technical, operational, and procedural elements such as security patch management, malicious code prevention, and system access controls.
7. **Incident Management**: Have a clear and planned incident response plan to help mitigate the risk to a BES cyber system's efficient and reliable functioning.
8. **Recovery Plan**: Define requirements in support of the recovery phase from a cybersecurity incident that has affected the BES cyber systems' reliable functioning.
9. **Configuration and Vulnerabilities**: Set clear requirements for preventing and detecting any unauthorized changes and achieve this through system configuration controls and active testing for system vulnerabilities.
10. **Information Protection**: Identify specific types of information that could affect the reliable functioning of the BES if misused.

The NERC CIP Standards also contain numerous sub-Standards that give detailed information and direction on which appropriate methods to use for proper compliance and aspects of enforcement.

SUPPLY CHAIN RISK MANAGEMENT

CIP-013-1, one of the more recent NERC CIP Standards, focuses on mitigating reliable operation risks by implementing security controls for supply chain risk management of BES cyber systems. The CIP-013-1 Standard covers, at a minimum, the following four objectives:

1. **Software Integrity/Authenticity**: Example controls include patch procedures that ensure they are from the original source and server-side encryption keys with validation processes.
2. **Vendor Remote Access**: Example controls include operator-controlled, time-limited access; and changing default passwords.
3. **Information System Planning**: Example controls include a screening criterion to identify high-risk systems or changes, and new system design processes that incorporate layered protections.
4. **Vendor Risk Management**: Example controls include incorporating risk assessment information in requests for proposals (RFPs) and the establishment of procurement review teams that include CIP personnel.

While the NERC CIP 013-1 Standard is meant to address what is needed in these objectives, it does not describe how to achieve them.

There are several industry Standards and best practices that manufacturers already utilize to mitigate the cyber risks in the supply chain. One of them is the *NEMA Supply Chain Best Practices* document originally published back in 2015. That document is currently undergoing a revision that includes new sections on market expectations, cyber insurance, and vendor dependencies. It is expected to be published Q1 2021.

Stacy Tatman
Senior Manager, Government Affairs, NEMA

Summit Shines Light on Grid

The nation's electrical infrastructure is evolving to meet the fast-changing demands of a competitive modern economy. Co-sponsored by NEMA and the Macro Grid Initiative (MGI), the third annual Grid Modernization Summit held four 90-minute sessions in November. Similar to last year's event (except virtual) this year's summit covered key aspects of grid modernization, including interregional transmission, electric vehicles, microgrids, and cybersecurity. The event showcased how expansion and renovation of our nation's electrical transmission network will make the power system more clean, reliable, resilient, and secure while bringing costs down for consumers.

Grid Innovation Caucus (GIC) Co-Chairs Representatives Bob Latta (R-OH) and Jerry McNerney (D-CA) kicked off the virtual summit. After the introductory remarks, the first 90-minute session covered issues related to the Executive Order on Securing the United States Bulk-Power System. The panel, moderated by NEMA VP of Government Relations, Phil Squair, addressed how industry manufacturers are already mitigating cybersecurity risks in the supply chain by following industry Standards and best practices. The panel also explored opportunities for government–industry collaboration on securing the U.S. grid.

The second session focused on the recent Federal Energy Regulatory Commission (FERC) Order 2222, thought to be a game-changer for the distributed energy resources (DER) market. FERC has told bulk power system operators to remove all barriers that prevent technologies like rooftop solar, microgrids, and even EV charging from participating in bulk power auctions. Consequently, market operators must now write their own participation rules, and the session participants discussed how the DER market might respond.

The third session examined the energy and transportation industries that are being aggressively disrupted by converging exponential technologies. As we move toward a future where clean tech renewable sources will meet our energy needs, the new transportation revolution sets the stage for a future of seamlessly efficient travel at lower economic and environmental costs. The speakers for this session explored how the interconnection of energy and transportation is already occurring.

Congressman Scott Peters (D-CA) launched the final event, which looked at the transmission requirements for our nation's vast wind and solar resources. These energy supplies cannot be developed without upgrading and expanding the transmission network to deliver the power to population centers where it's needed. Since U.S. investment in a robust transmission grid lags behind other nations, this panel discussed the challenges facing expanding and upgrading high-voltage inter-regional transmission across the country. Grid experts looked at the reliability, consumer, and environmental benefits of high-voltage transmission connecting states and regions.

NEMA President and CEO Kevin Cosgriff and the American Council on Renewable Energy (ACORE) President and CEO Gregory Wetstone provided closing remarks.

"Achieving a truly connected 21st century-worthy national Macro Grid represents enormous economic, social, and security benefits for our country," Cosgriff said during the summit's closing remarks. "But when contemplating what may be the most complex system yet built by humankind, we know its systematic modernization will not be easy, fast, or inexpensive."

"We need the regulatory framework that will allow the market to sort out the economics, better-permitting laws to facilitate interconnection and grid stability and policies that allow for cost recovery for modern grid investments. NEMA Members are made up of people eager to work constructively with the government to build a better, electrified future for America," Cosgriff added.

Time Running Out on Transformer Steel Trade Investigation

Stacy Tatman
Senior Manager, Government Affairs, NEMA

Last May, the U.S. Department of Commerce initiated a Section 232 investigation to determine whether imports of electrical transformers and certain components could represent a threat to national security. Section 232 investigations are conducted under the authority of the *Trade Expansion Act of 1962* and are used to determine the effect of imports on national security.

Section 232 investigations had been a seldom-used procedural tool, but the Trump Administration used these inquiries frequently to scrutinize imports of steel, aluminum, automobiles (and parts), titanium sponge, and uranium, resulting in tariffs on steel and aluminum.

From the initial announcement of the investigation, NEMA was active in its advocacy, strenuously asserting that the investigation should not lead to tariffs or other policies that disrupt the supply chain for these important products. NEMA Members are part of the U.S. transformer manufacturing sector composed of over two dozen companies directly employing over 15,000 workers in seven states. We consistently asserted that continued importation of products within the scope of this investigation would *not* threaten national security and was in fact *necessary* to maintain it and protect the existing U.S. transformer manufacturing base.

Throughout the summer, NEMA submitted several sets of comments to Commerce and met directly with Mr. Cordell A. Hull, Commerce Acting Undersecretary for Industry and Security. During that meeting NEMA Members provided additional commentary on product manufacturing and voiced concerns about the investigation and potential resulting regulatory actions.

On October 22, 2020, rumors of the investigation's conclusion began circulating. Several reputable sources reported that Commerce had delivered its report to the White House ahead of the December 2021 deadline. As of mid-November, NEMA has not obtained confirmation that the report was delivered nor whether the White House had made any decisions. If the report has been delivered to the White House, the administration has 90 days to take action.

Interestingly, on Nov. 5, the Office of the United States Trade Representative (USTR) released a statement reporting the successful conclusion of steel negotiations with Mexico. These consultations were held pursuant to a 2019 Joint Statement to address "the transshipment of grain-oriented electrical steel (GOES) from outside the North American region into the United States through GOES-containing downstream products." Starting later this year, Mexico will be tasked with monitoring exports of electrical transformer laminations and cores made of non-North American GOES.

This agreement sets up a potential policy conflict within two major offices within the Administration—USTR and the Commerce Department. Should the White House impose tariffs on GOES imports because of the Commerce Section 232 investigation report, it would call into question the commitment of the U.S. to the newly-reached agreement with Mexico negotiated by USTR.

Ann Brandstadter
Standards Manager, NEMA

New Standard Covers Specifications for Portable Lithium Batteries

American National Standard for Portable Lithium Rechargeable Cells and Batteries—General and Specifications is a new Standard that applies to portable rechargeable, or secondary, lithium cells and batteries. It covers secondary lithium cells and batteries with a range of chemistries.

Users can establish the viability of commercially available cells and batteries based on the specifications in this Standard to select the cell or battery best suited for their intended application.

The primary users of this Standard are testing labs, toy manufacturers, and consumer electronics manufacturers.

ANSI C18.5M Part 1 is available for $90.

OTHER RECENTLY PUBLISHED STANDARDS:

5G Best Practices Technical Guidance Report **NEMA 5G 1-2020** is available for $500.

American National Standard for Aerospace and Industrial Electrical Cable **ANSI/NEMA WC 27500-2020** is available for $139. *American National Standard For Roadway and Area Lighting Equipment—Concrete Lighting Poles* **ANSI C136.46-2020** is available for $69.

Solid-State Lighting Annex: Visual Perception under Energy-Efficient Light Sources—Detection of the Stroboscopic Effect under Low Levels of SVM **NEMA LSD T 83-2020** is available as an electronic download at no cost.

The Value of Rail Electrification **NEMA RC P1-2020** is available as an electronic download at no cost.

American National Standard for Composite Insulators—Station Post Type **ANSI/NEMA C29.19-2020** is available for $74 in hard copy and as an electronic download at no cost.

Bryan P. Holland

MCP. CStd., Senior Field Representative, Southern Region, NEMA

Building Resiliency in the National Electrical Grid

The national electrical grid is an engineering marvel. Electricity, sometimes generated thousands of miles away from a community, provides the electrical energy used in homes and businesses at this very moment. However, the electrical grid is susceptible to natural disasters, human-made disasters, societal changes, and other hazards and challenges such as a global pandemic.

The most practical solution to build resiliency into the electrical grid is technology. Existing technologies that provide resiliency to the electrical grid include distributed energy resources, such as renewable energy supply systems, ac and dc microgrids, and electrical energy storage systems. New and emerging technologies like artificial intelligence, machine learning, internet connectivity, and novel sensor technology can provide additional resiliency to the grid. Strong building, electrical, and energy codes and code enforcement will ensure this technology is implemented safely and effectively at the facility and community level. And while technology can be a solution for resiliency, the technology itself will need to incorporate self-resilient measures to ensure that it remains effective over time.

There are three layers of electrical energy resiliency: standby and backup, protective measures, and efficiency. For standby and backup, individual appliances and equipment can use portable storage devices, spare batteries, or uninterruptible power systems. Building-level energy demands may require onsite energy sources such as solar photovoltaic (PV) systems, wind systems, or electric generators. Including electrical energy storage systems will ensure that an on-site backup is always available when utility demand is at its highest and peak energy rates are in effect. For community-scale energy resiliency, a public-private partnership between the serving utility and community citizens can use microgrids or large-scale solar PV systems.

For protective measures, communities should consider building-scale and communitywide techniques such as relocating power lines underground, establishing a tree-trimming program for aboveground distribution systems, and elevating transformers and other electrical infrastructure above the design flood elevation indicated on the community's flood insurance rate map. They should also consider installing surge-protective devices at the building level for power systems and surge protectors for data and communication equipment, limiting the impacts of lightning or other disturbances on the electrical grid that may compromise energy delivery.

To ensure that homes and businesses are as electrically efficient as possible, use high-efficacy lighting, ultra-efficient appliances, and automatic control features. In short, the lower the amount of energy a building needs to operate on the electrical grid, the smaller and more reliable the backup and resiliency strategies will need to be.

A community can implement resiliency strategies through developing, adopting, and enforcing codes and Standards. The National Institute of Building Sciences' *Natural Hazard Mitigation Saves Report*, published in 2019, found that adopting the latest building codes generated a benefit of $11 for every $1 invested. Also, product Standards can incorporate resiliency features to enhance user safety, energy efficiency, and reliability. More importantly, these performance features are measurable and trackable over the life of the product.

The nation needs a robust and resilient electrical grid through the entire electrical supply chain, from generation to end-consumer use. Codes and Standards are the keys to building resiliency in the electrical grid.

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Gustavo Dominguez Poo
Director, Latin America, NEMA

Mexico's Energy Sector: Will Generation Be Public or Private?

Mexico's 2015 Energy Transition Law stipulates that by 2021, 30 percent of the country's electricity must come from low-emission sources; 35 percent by 2024; 45 percent by 2036; and 60 percent by 2050. To meet these goals and promote electricity generation from clean and renewable sources, government institutions granted incentives to encourage the private sector to develop needed electricity infrastructure.

Among the most critical incentives are:

- permitting the private sector to use or sell their "energy bank," which allows the accumulation of surplus energy to producers under a self-supply scheme;
- offering a preferential rate for energy transmission; and
- setting a net measurement scheme for small-scale residential and industrial projects that consists of offsetting the cost of electricity used with the national grid's energy.

However, President Andrés Manuel López Obrador (AMLO), elected in 2018, has a different energy outlook. AMLO based his energy policy on strengthening the government energy sector, investing in the rehabilitation of aging thermoelectric and hydroelectric power plants, and stopping the privatization of electricity production in favor of state-owned resources. In particular, his policies impose rules and tariffs on alternative energy companies, requiring them to meet minimum standards and cover fees for using the electricity distribution network.

The president's plans fly in the face of former president Enrique Peña Nieto's policies, which he designed to incentivize private investment in renewable generation, and have led to tense disagreements between the Federal government and the private sector. State governments, which also stood to gain indirectly from the incentives, have gotten involved, raising questions about the constitutionality of the current president's policies. These disagreements have found their way into the courts. In November, at the request of the governments of Colima, Jalisco, and Tamaulipas, Mexico's Supreme Court issued a stay against the Ministry of Energy's efforts to thwart privatization and impose tariffs until the Court decides on the constitutional issues involved.

AMLO reacted to the court's decision by discussing the possibility of reforming the Constitution to make the State the leading participant in the national energy market.

"We will find another chance to defend the public interest, if necessary proposing constitutional reform so that the national ownership of natural resources prevails and so that the general interest is above personal interests or that of groups, however legitimate," AMLO said.

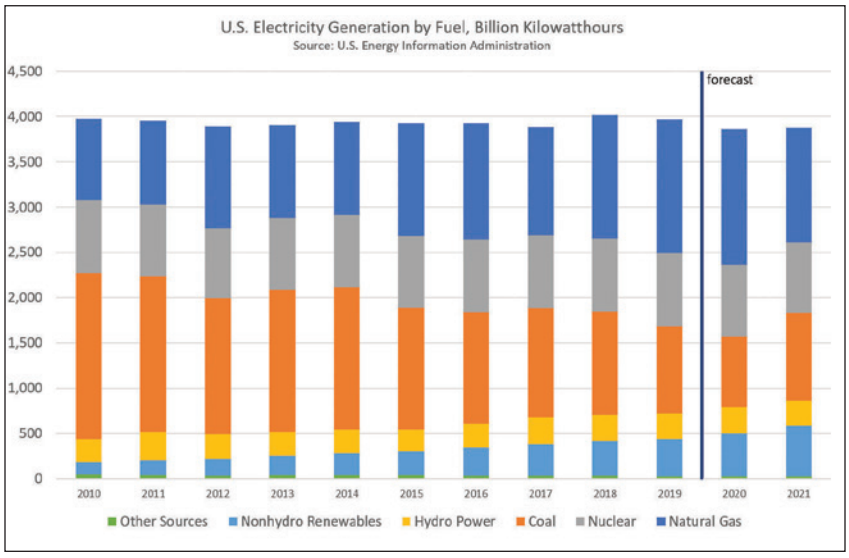
While AMLO is trying to defend the control of the energy sector in Mexico by executing public policies, many experts believe that his efforts will ultimately fail because of the low performance/productivity of the Comisión Federal de Electricidad (Federal Electrical Commission, or CFE) and PEMEX, Mexico's national oil company. They also think it will be impossible to keep Mexico's power running and affordable without private sector development.

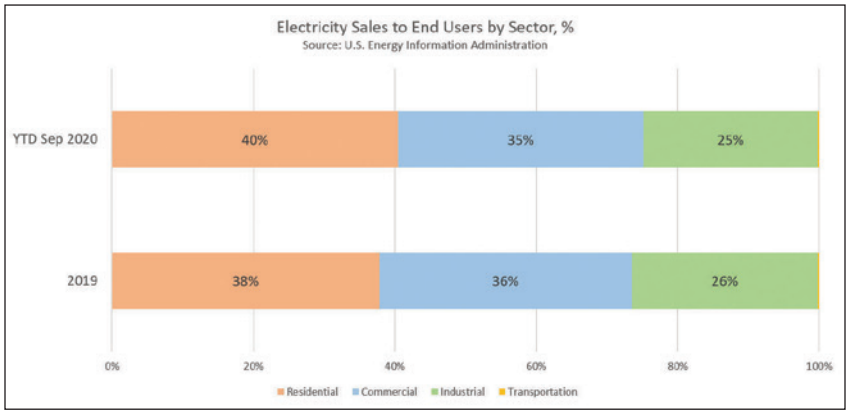
COVID-19 Containment Efforts Dampened Electricity Consumption and Generation

Fred Ashton
Economist, NEMA

The COVID-19 pandemic has transformed how we work, how we learn, and how we participate in the broader economy. No sector was spared from the disruption, including utilities.

As depicted in the nearby graph, the residential sector end user accounted for 38 percent of electricity sales, the commercial sector 36 percent, industrials 26 percent, and the transportation sector less than 1 percent in 2019, according to data from the U.S. Energy Information Administration.[1] As businesses were forced to close and many began working from home, the end market for electricity shifted. Year-to-date through September 2020, the share of electricity sales rose to 40 percent for the residential sector and dipped to 35 percent and 25 percent for the commercial and industrial sectors, respectively.





The distribution of electricity sales was not the only noticeable change for the utility sector. The amount of electricity sold also changed. Overall sales fell 4.1 percent year-to-date through September as sales to the commercial sector dropped 6.6 percent, industrials sank 9.3 percent, and sales to the transportation sector plunged 16.6 percent. As expected, the increase in working from home yielded a gain of 1.7 percent in sales to the residential market. The U.S. EIA expects that for calendar year 2020 retail sales of electricity will drop 3.6 percent.[2] On the production side, EIA projects electricity generation to slide 2.7 percent in 2020 to 3.859 trillion kilowatt hours before rebounding 0.5 percent in 2021.

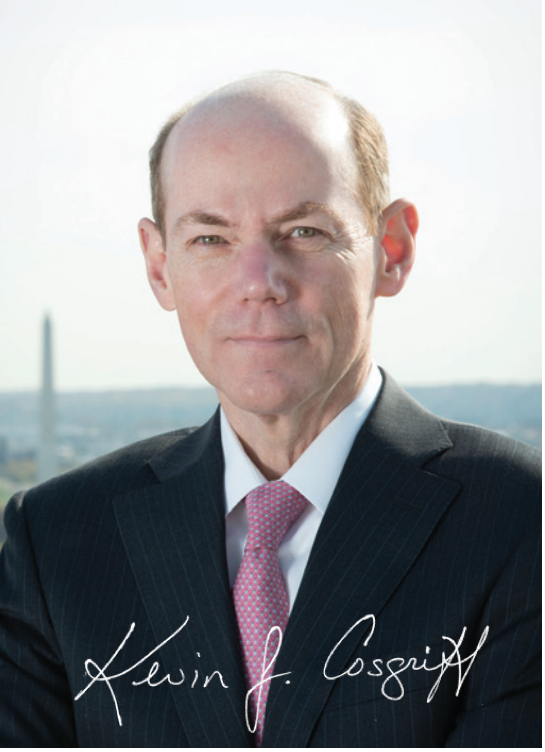
The drop in electricity production and consumption have not been limited to the United States. According to report from the International Energy Agency, electricity demand was "depressed by 20 percent or more during periods of full lockdown in several countries, as upticks for residential demand [were] far outweighed by reductions in commercial and industrial operations." IEA likened the shape of demand to "that of a prolonged Sunday." By their estimates, global demand for electricity could fall by 5 percent with 10 percent declines in some regions.[3]

The drop in sales of electricity will likely result in lost revenue resulting in delayed investment for new electricity infrastructure.

1 https://www.eia.gov/todayinenergy/detail.php?id=43636

2 https://www.eia.gov/outlooks/steo/report/electricity.php#:~:text=EIA%20forecasts%20that%20the%20consumption,increase%20by%202.5%25%20in%202020.

3 https://www.iea.org/reports/global-energy-review-2020



Coming This Year

March/April

Lighting Systems
Smart, Seamless, Imperceptible

Smart cities are all about connectivity, easier communications, public safety, decreased traffic congestion, and energy optimization. We'll explore those themes in the next issue!

May/June

Transportation Systems
Shifting Gears: Transportation Innovation

July/August

Building Systems
Redesigning and Repurposing Buildings for the Next Normal

September/October

Industrial Products & Systems
What Will the Global Economy Look Like in 2025?

November/December

Building Infrastructure
Backbone of Our Connected Future

ENDNOTES FROM THE **PRESIDENT**

Like many of you, I own a car powered by an internal combustion engine. Also, like many of you, my next car is likely to be an electric vehicle (EV) of some sort. My reasons are simple: cost of ownership, performance, and ready access to NEMA Member-made charging stations.

Notably absent from my list of reasons above is anything related to the environment. That matters to me, but much of the conventional wisdom suggests that reduced carbon emissions from an EV, coupled with (assumed) use of carbon-less renewable generation, makes the transition to EVs a *de facto* win for the environment. Yet, at least one major consideration to the contrary exists: battery waste.

All batteries, including those used in EVs, have a lifespan associated with the number of "cycles" (a discharge coupled with subsequent charging) that the battery is capable of performing before it deteriorates. Eight to 10 years of life is the e-automobile industry average, after which the owner needs a new battery (or a new car). So, what happens to the old batteries? The International Energy Agency estimates that fewer than 5 percent of them are recycled. By 2030, 11 million tons of EV batteries are expected to reach their end of life.

The NEMA Energy Storage Section recognized the need for a battery recycling market and is taking steps to catalyze its development with a Standard for assessing the recyclability of lithium ion batteries (from both vehicle and stationary sources). Such a Standard is a microcosm of a much broader topic: the circular economy.

As described by the Ellen MacArthur Foundation, the concept of a circular economy "… entails gradually decoupling economic activity from the consumption of finite resources and designing waste out of the system." Circular business models increase utilization of an asset by extending the length of time that it creates value, and/or by fostering product re-use through collection, repair, and refurbishment. This is in contrast to a "linear" business model, which employs utilization of a finite resource until that resource is exhausted, cost-prohibitive, or no longer needed.

The environmental benefits of a circular economy are apparent, but we must expect they will be evolutionary. That being the case, manufacturers can explore the use of circularity now to derive economic benefits, including increased margins from waste reduction and supply chain efficiencies and increased sales from product design innovation and new outside investment.

It comes as no surprise that many NEMA Members are moving toward a circular business model. In a 2019 survey to NEMA Members, almost half of respondents stated that circular concepts are "somewhat" or "mostly" integrated into their companies. Of that group, approximately three quarters have included or intend to make them part of their company's corporate strategy.

The NEMA position on the circular economy concept is simple and aligns directly with our mission to help our Members reduce costs and expand profitability. NEMA is committed to supporting our Members' efforts to move toward more sustainable business practices, whatever the underlying motive, to the extent doing so does not lessen product safety or performance. For example, this includes promoting public-private partnerships to establish the logistical infrastructure to collect and transport waste electrical equipment, with manufacturers and users/consumers sharing the responsibility for environmental stewardship.

So, when I see you at the EV dealership in a few years, we can both acknowledge the myriad benefits of going electric and take comfort knowing that NEMA Members are leading the way to a responsible, more circular future.

Kevin J. Cosgriff, NEMA President and CEO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