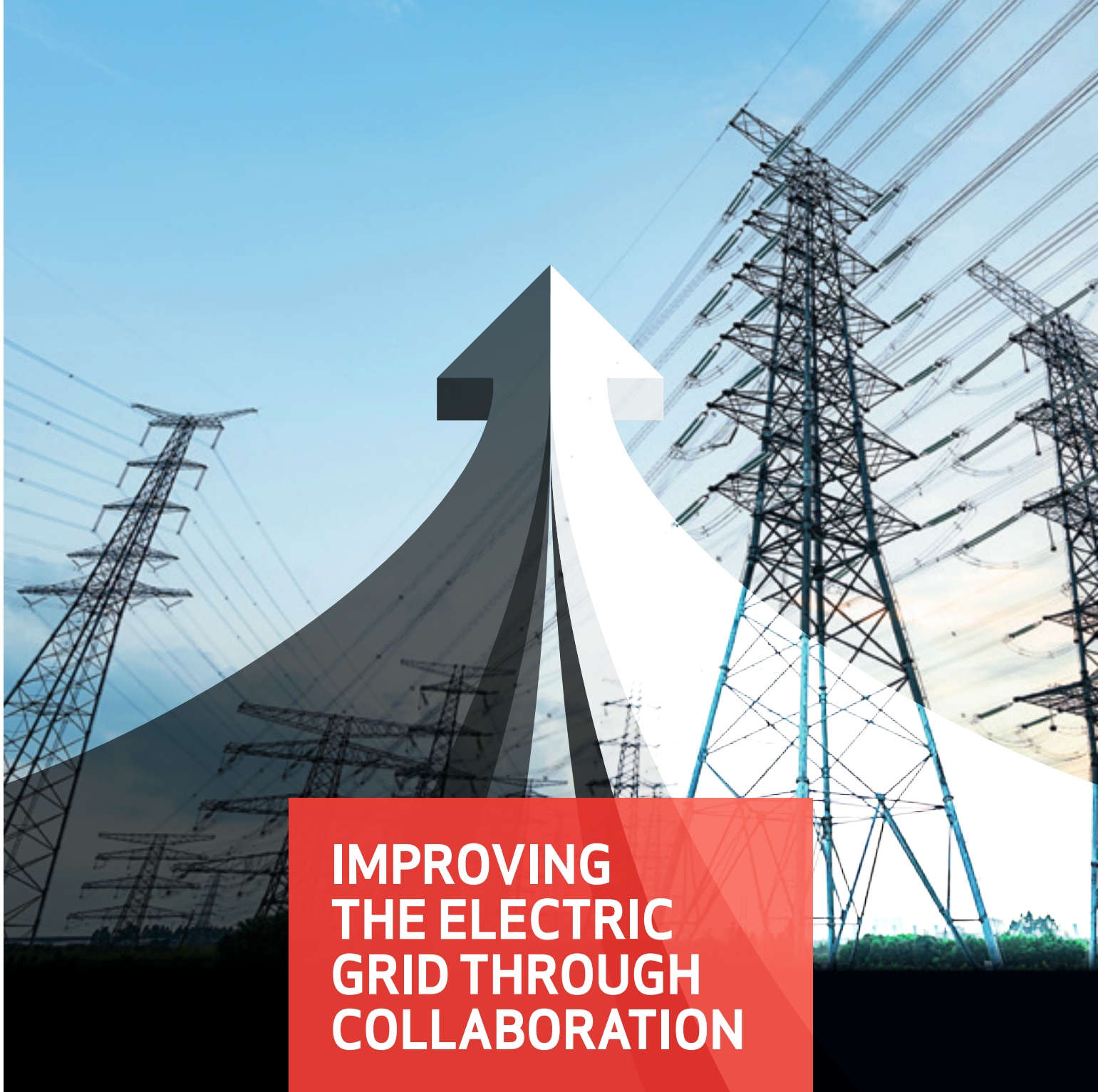


EET&D

MAGAZINE

Quarterly Issue 3, 2021 – Volume 24



**IMPROVING
THE ELECTRIC
GRID THROUGH
COLLABORATION**



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POWER POINTS

EMPOWERING UTILITY WORKERS

Elisabeth Monaghan, Editor in Chief

This issue of *EET&D* offers insight into a variety of challenges that have become commonplace in our industry – partly because of the pandemic, and partly because ours is an industry of constant change where electric power providers must always be ready to respond in the event of power outages or any other time the electric grid is disrupted.

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THE GRID TRANSFORMATION FORUM

IMPROVING THE ELECTRIC GRID THROUGH COLLABORATION

Andrew Phillips, NERC and Mark Lauby, EPRI

Recently, the North American Electric Reliability Corporation (NERC) and the Electric Power Research Institute (EPRI) announced a collaboration to “enable improved resiliency and reliability of the North American electric grid.” For the *Q3 Grid Transformation Forum*, we asked Andrew Phillips, vice president of EPRI’s Transmission and Distribution Infrastructure sector and Mark Lauby, senior vice president and chief engineer with NERC, to talk about the agreement and how they see the collaboration unfolding.

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GREEN OVATIONS

AUTOMATED THERMAL MONITORING FOR WIND TURBINES

Richard Harada, Systems with Intelligence

The number of wind farm installations has been growing steadily for the past several years, with more and more countries pledging green generation and having goals to reach zero CO2 emissions status. In 2020, there was more than 93 GW of new wind generation capacity installed, representing a growth of 53% over the previous year.

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OUR ‘GREEN’ FUTURE DEPENDS ON GRID RELIABILITY

Brian Levite, S&C Electric

The electric grid is entering an era of transition: power generation technology is getting greener and more distributed, energy loads are denser in some areas and are more reliant on high-quality power, and customer expectations for more reliable power are rising. These changes are placing a lot of pressure on the grid and utilities all at one time.

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WEATHER THE STORM WITH THE RIGHT DATA: TWO UTILITIES SHARE STRATEGIC STORM RESPONSE

Mike McGann, Sensus

It’s a warm September day in Fayetteville, N.C. Residents scurry around checking for batteries, flashlights and bottled water. Those living within a mile of the region’s main river, the Cape Fear, are urged to evacuate. Business owners prepare their property for flooding and wind damage. None are certain of exactly what damage the storm will bring, but most are content to over-prepare.

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QUANTUM COMPUTING: GAME-CHANGING, DISRUPTIVE AND NECESSARY

Amin Khodaei, University of Denver, IEEE PES

Safety, leisure, work and now more than ever, education, heavily depend on a power grid that can reliably supply and deliver electricity to customers while supporting other critical lifeline systems. The power grid, however, is becoming increasingly complex to the point that traditional grid control and decision-making built on classical computing methods may fail to address its emerging needs.

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FOR FAST RECOVERY, PLAN FOR THE WORST: EMERGENCY CHECKLIST FOR DATA CENTER MANAGERS

Kate Fulkert, Vertiv Company

It’s impossible to anticipate every threat that could jeopardize a data center, but organizations can and should plan for emergencies. A robust business continuity and disaster recovery plan eliminates one common cause of data center downtime: human error. A well-curated checklist reduces the risk of mistakes and oversights in the heat of the moment and ensures an organization is prepared for any eventuality.

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GUEST EDITORIAL

CONNECTED HOME TECHNOLOGY LEVELS THE PLAYING FIELD IN ENERGY MANAGEMENT

Juliet Shavit, SmartMark Communications

There have been a number of smart home pilots in the United States that explore different technologies and use cases. A common theme among them is the impact of these devices on energy efficiency. For utilities, this is the obvious bottom line. This benchmark has safely steered energy efficiency investments for decades and continues to be the key driver for utility smart technology programs.



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GUEST EDITORIAL

MOBILIZING THE MODERN WORKFORCE

Joe Boyle, Truce Software

The transmission and distribution of electricity grows more complex with each passing year, but the effects of COVID-19 proved especially challenging. Within weeks of the start of the pandemic, as many workers shifted to remote working and others simply sheltered in their homes, average home electrical use in the U.S. increased more than 22% over the previous year's levels, driven by a 35% increase in mid-day demand.

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GUEST EDITORIAL

YOUR NEW LIGHT SWITCH MIGHT BE THE BEST GIFT YOU CAN GIVE YOUR NEIGHBOR

David O'Reilly, Schneider Electric

For some, smart technology can be distracting and even stressful to use. The introduction of new technology to the market often comes with a learning curve. But for others, smart technology can make their lives easier, by offering ease, simplicity and streamlined processes.

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THE BIGGER PICTURE

FROM THE BIG SHORT TO THE BIG FREEZE: UNDIFFERENTIATED DATA WOES

Siddhartha Sachdeva, Innowatts

The blackouts that rocked Texas earlier this year are the result of unexpectedly cold temperatures. While a lot of scrutiny was placed on the generation outage, on a deeper level, just like the mortgage crisis of 2007-2010, this is the result of using undifferentiated data to guide decision-making.

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SECURITY SESSIONS

OT REMOTE OPERATIONS INTRODUCE NEW RISKS TO TODAY'S UTILITIES

Bill Moore, Xona

The recent pandemic radically reoriented public utilities as they empowered remote and hybrid teams to maintain operational continuity in any environment. Moving forward, it's clear that hybrid teams composed of remote and on-site employees will become more common among utilities.

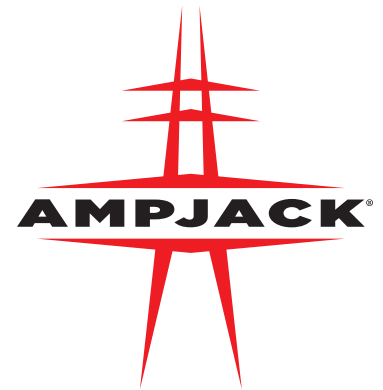
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POWERFUL FORCES

NOOSHIN BEHORYAN, PAXON ENERGY & INFRASTRUCTURE

Elisabeth Monaghan, Editor in Chief

We launched *Powerful Forces* to shed light on the fact that even though the electric power industry is dominated by men, there are plenty of female executives who have the education, intelligence and professional experience necessary to participate in propelling our industry forward. Nooshin Behroyan is no exception.



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DOE SETS 2025 COMMUNITY SOLAR TARGET TO POWER 5 MILLION HOMES

2025 Milestone Will Play a Key Role in Achieving Justice40 Goals and Create \$1 Billion in Energy Savings

October 2021

The U.S. Department of Energy (DOE) today (Oct 8) announced a new National Community Solar Partnership (NCSP) target: to enable community solar systems to power the equivalent of five million households by 2025 and create \$1 billion in energy bill savings. Reaching these milestones will help achieve the Biden-Harris Administration's goals of achieving 100% clean electricity by 2035 and ensure that all Americans can reap the benefits of renewable energy while building community wealth and resiliency.

“Community solar is one of the most powerful tools we have to provide affordable solar energy to all American households, regardless of whether they own a home or have a roof suitable for solar panels,” said Secretary Jennifer M. Granholm. “Achieving these ambitious targets will lead to meaningful energy cost savings, create jobs in these communities, and make our clean energy transition more equitable.”

There is enough solar installed to power 19 million households across the United States. Despite this unprecedented deployment, many Americans still lack access to affordable solar electricity, including many renters, homeowners who lack affordable financing options, and those without suitable roof conditions. Community solar is a form of energy generation where members subscribe to a portion of a solar array, usually located near their community. As the solar array produces energy, subscribers receive a portion of the revenue from the energy produced, typically as savings on their monthly electric bill -- a critical factor for low-income and disadvantaged communities whose energy burden is three times higher than for non-low-income households.

There is enough community solar installed in the U.S. today to power 600,000 households achieving DOE's new NSCP target would mean an increase of more than 700% in the next four years. The recently released Solar Futures Study report from DOE and National Renewable Energy Laboratory shows how solar can play a major role in a decarbonized grid.

The NCSP is a DOE initiative led by the Solar Energy Technologies Office, in collaboration with the NREL and Lawrence Berkeley National Laboratory. The partnership includes a coalition of community solar stakeholders, such as State, local and Tribal governments, solar developers, and community-based organizations, working to expand access to affordable community solar to every American household. Partners leverage peer networks as well as technical assistance funding and resources to overcome the persistent barriers to expanding community solar access with a focus on those in underserved communities. As of September 2021, NCSP had over 650 members from over 440 partner organizations.

The Sharing the Sun report released by NREL in collaboration with NCSP shows that community solar can lead to substantial bill savings from 5 to 25%. Achieving \$1 billion in cost savings would mean that, on average, community solar projects would provide a 20% bill savings. This target, along with other potential solutions for equitable community solar deployment, was informed by NCSP stakeholders in a recent request for information.

To achieve these new targets, DOE is offering free, on-demand technical assistance to NCSP partnership members. Technical assistance provides personalized support to organizations deploying community solar to help them accelerate implementation, improve the performance of their program or project, and build capacity for future community solar development. NCSP has already distributed \$1 million for technical assistance and hopes to provide \$2 million in the next year.

Learn more about NCSP and join the partnership.

ATLANTIC CITY ELECTRIC'S TARGETED GRID MODERNIZATION IMPROVEMENTS FURTHER ENHANCING SERVICE RELIABILITY AND SYSTEM RESILIENCY

October 2021

Each year, Atlantic City Electric identifies a set of electric distribution circuits to prioritize for upgrade to enhance service for thousands of its residential and business customers. These circuits, which the company calls priority feeders, receive targeted upgrades that are intended to help fortify the local energy grid against ever increasing severe weather and powerful storms and improve service reliability for customers.

Through data-driven analysis, company engineers identify and prioritize energy distribution circuits within the Atlantic City Electric service area that have experienced elevated levels of interruption during the past three years and are not performing at the level Atlantic City Electric expects. Over the past three years, crews have upgraded nearly 80 distribution circuits within approximately 50 different municipalities in each of the eight counties the company serves, including Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Ocean, and Salem counties.

To further modernize the local energy grid, Atlantic City Electric is installing new advanced electric equipment including switches, reclosers, fuses, animal guards, and several miles of new aerial wire, as part of this initiative to help minimize the number of affected customers if an outage does occur. Crews are also installing innovative technologies to improve system reliability, such as specialized equipment that can automatically restore service or isolate damage, leading to faster restoration.

Additional reliability enhancement work Atlantic City Electric performs year-round includes trimming trees, installing steel utility poles, placing animal protection devices on equipment, building new substations, and installing new equipment at existing substations, building new underground equipment, and installing stronger, tree-resistant aerial cable.

These energy grid enhancements are part of Atlantic City Electric's broader strategic effort to modernize and strengthen the local energy grid, making it smarter, stronger and cleaner for customers. These upgrades continue to improve reliability for customers by reducing the frequency and duration of outages. Atlantic City Electric customers experienced the lowest frequency of electric outages ever in 2020. Over the past ten years, energy system upgrades and new innovative technologies have reduced the frequency of electric outages by 53 percent for Atlantic City Electric customers and communities.

To learn more about Atlantic City Electric's ongoing reliability projects, visit atlanticcityelectric.com/Reliability.

Readers are encouraged to visit The Source, Atlantic City Electric's online newsroom. For more information about Atlantic City Electric, visit atlanticcityelectric.com. Follow the company on Facebook at facebook.com/atlanticcityelectric and on Twitter at twitter.com/aceleconnect. Our mobile app is available at atlanticcityelectric.com/mobileapp.

Atlantic City Electric is a unit of Exelon Corporation (Nasdaq: EXC), the nation's leading energy provider, with approximately 10 million customers. Atlantic City Electric provides safe and reliable energy service to approximately 560,000 customers in southern New Jersey.



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BPA ON PATH TO JOIN WESTERN ENERGY IMBALANCE MARKET IN MARCH 2022

October 2021

After more than three years of rigorous review and analysis, the Bonneville Power Administration has decided to join the Western Energy Imbalance Market in March 2022. Western EIM participation is expected to further enhance the value of the Northwest's federal power and transmission system.

“This decision aligns with Bonneville's strategic plan and opens up an opportunity to increase revenues through additional sales of surplus power and to reduce costs through greater efficiencies,” said BPA Administrator John Hairston. “As the West moves rapidly to decarbonize the grid, Western EIM participation will help us navigate future challenges and leverage opportunities to benefit our customers and the Northwest.”

BPA will now sign a Western EIM Entity Agreement as well as the remaining participation agreements with the California Independent System Operator. The California ISO will file the signed agreements with the Federal Energy Regulatory Commission for approval. BPA plans to begin its final testing stage - parallel operations - on Dec. 1, 2021.

“I would like to thank and congratulate the Bonneville Power Administration for reaching this important milestone,” said Mark Rothleder, chief operating officer at the California ISO. “Bonneville and its public power customers are highly valued partners for the ISO, and we look forward to further strengthening our working relationships.”

BPA is currently completing the work to implement new systems and processes to enable participation in the Western EIM beginning March 2022. The internal preparations are on-track and testing with the ISO has already begun.

Beginning in fall of 2021, BPA will continue to hold implementation workshops to work through changes for customers, which will include informal and formal settlements training, and provide updates on BPA's implementation efforts.

“Western EIM participation is a great introduction to emerging markets in the west,” said Hairston. “We hope to build on this experience to assess future market-based opportunities.”

As BPA assessed participation in the Western EIM, discussions about other industry improvements and market opportunities also emerged. BPA plans to take part in the development of other markets and opportunities and will make decisions about its participation in these efforts through additional public processes.

One such opportunity is the Western Resource Adequacy Program organized by the Northwest Power Pool. Bonneville proposed in a draft decision posted August 20 to participate in the next non-binding phase of this effort, Phase 3A, in which parties will test the design concepts, determine the program's viability and shape its final design.

This is a first step at establishing common resource adequacy measurements and definitions

In addition to participating in the Western Resource Adequacy Program, BPA is closely monitoring the potential formation of day-ahead markets in the West. Both the California ISO and Southwest Power Pool have presented initial concepts that could provide additional opportunities and benefits for BPA and its customers.

Information on BPA's decision to join the Western EIM can be found at www.bpa.gov/goto/eim.

INTERIOR DEPARTMENT RELEASES CLIMATE ADAPTATION AND RESILIENCE PLAN

October 2021

Today (Oct 7), as part of President Biden's whole-of-government approach to confronting the climate crisis, the Department of the Interior released its climate adaptation and resilience plan, which outlines how the Department will use science as the foundation for planning and decision-making related to climate change risks, impacts and vulnerabilities.

"The Interior Department is committed to meeting the Biden-Harris administration's ambitious climate and infrastructure goals," said Secretary Deb Haaland. "As the climate crisis disproportionately affects underserved communities, Interior will center environmental justice, build resilient communities and invest in a clean energy future that can create millions of good-paying union jobs, while protecting the communities, natural and cultural resources on which Americans rely."

The Department and its bureaus face a multitude of risks caused by climate change, including rising costs to maintain and repair damaged infrastructure from more frequent and extreme weather events, reduced program effectiveness and health and safety challenges to federal employees. Taking climate risk management actions now will mitigate disruptions to federal operations, assets and programs, and will create safer worker conditions.

As part of these efforts, the Department's Plan outlines how it will embed adaptation and resilience planning and implementation throughout its operations and programs. The Plan commits the Department to the following major categories of adaptation actions:

1. Promoting Climate-Resilient Lands, Waters and Cultural Resources;
2. Advancing Climate Equity;
3. Transitioning to a Resilient Clean Energy Economy;
4. Supporting Tribal and Insular Community Resilience;
5. Empowering the Next Generation of Conservation and Resilience Workers;
6. Enhancing Climate Literacy; and
7. Bolstering Climate Resilience in the Management of Sites, Facilities and Supply of Products and Services.

The Plan also identifies the institutional approaches the Department will use to tackle the climate crisis, as well as climate-related vulnerabilities to the Department's mission, and strategies to secure climate-ready sites, facilities, products and services. The Department will undertake all of its planning and preparations by engaging with federal agencies, Tribes, Insular areas, Native Hawaiian people, states, local communities and other public and private partners, domestically and abroad.

Today's actions supplement President Biden's Build Back Better Agenda and the Bipartisan Infrastructure Deal, which include bold, historic and transformational investments to strengthen our nation's resilience to climate change and extreme weather events.



ENEL UNVEILS GRIDSPERTISE, THE COMPANY DEDICATED TO THE DIGITAL TRANSFORMATION OF POWER GRIDS

HIGHLIGHTS

- Gridspertise, fully owned by Enel through its subsidiary Enel Global Infrastructure and Networks, will leverage on Enel's expertise in testing, assessing and scaling up the best technologies to operate smart grids all over the world, to provide field proven solutions to Distribution System Operators (DSOs) of any size or geography
- Gridspertise will provide access to cutting-edge sustainable solutions for the transformation of electricity distribution networks in three main areas: metering and grid edge digitalization, networks infrastructure digitalization, field operations digitalization
- Target markets include Europe and Latin America, starting with the countries where the Enel Group already has a strong presence, and expanding towards North America and Asia-Pacific where the investment in smart grids will drive infrastructure upgrade projects in the near future

October 2021

The new company of the Enel Group was presented today (Sept 23) in a digital event. Gridspertise is a new subsidiary fully dedicated to supporting DSOs in the delivery of a new era of sustainable and reliable smart grids for all.

"We are proud to launch Gridspertise, entrusting it with our strong legacy of transforming distribution networks across the world into smart grids," said Francesco Starace, CEO and General Manager of Enel. "The energy transition must rely on renewable electricity efficiently distributed by smart grids, open to all energy players willing to contribute to a fully electric future. Reliable and flexible smart grids are the primary enabler and contributor to the decarbonization and deep electrification targets, paving the way towards our net-zero objectives."

"The new venture gathers the unique expertise of Enel in progressively digitalizing its grids around the world, made up of more than 2.2 million kilometers of power lines monitored by hundreds of thousands of remote-control points. Enel's twenty years of experience in the smart meters field through massive roll-out projects for a total of more than 44 million active devices connected to its grids, as well as an efficient digital management of more than 30 million field operations executed every year in 13 distribution companies across 8 countries ensure that all solutions Gridspertise will offer are reliable and field-tested at scale," said Antonio Cammisecra, Head of the Enel Global Infrastructure and Networks business line.

2.2 million KILOMETERS OF POWER LINES

“Gridspertise’s mission is to become a trusted partner for DSOs all over the world. The company will help electricity distribution companies of any size and geography to roll-out integrated smart grid solutions in order to meet the evolving needs of grid users and electricity end-customers,” stated Robert Denda, CEO of Gridspertise.

Gridspertise’s portfolio of products and services highlights the company’s commitment to deliver innovative, circular-by-design, robust solutions that have been field-tested at large scale as well as designed to create value. In order to achieve sustainable and reliable smart grids, while promoting more efficient energy usage and enabling new services, the offer is structured around three main domains of DSOs’ digitalization needs across the entire value chain:

- **Metering and Grid Edge digitalization**, focused on increasing customer engagement and stakeholder participation through smart metering and grid edge technologies that also enable the electricity prosumers’ involvement in the markets;
- **Network infrastructure digitalization**, aimed at boosting intelligence and flexibility of power grids, in order to accelerate digitalization across-the-board, increasing efficiency, reliability and quality of service and supporting DSOs to tackle the challenges that network operations are facing;
- **Field Operations digitalization**, aimed at increasing operational efficiency through innovative solutions for planning and operation processes, while enhancing safety for both in-house and contractors’ field workers.

The solutions and services delivered by Gridspertise provide benefits for the entire electric ecosystem. DSOs can increase their quality of service, reduce operational costs, optimize investments in new infrastructure and enhance field operation safety, productivity and sustainability. Grid stakeholders, or those who access the infrastructure to develop electricity-related business models, can benefit from the transformation of grids into platforms open to distributed energy resources and facilitate the development of energy services market, including flexibility, and electrification of end uses. End customers of the DSOs, on the other hand, benefit from a more reliable electricity supply, facilitating the full electrification of their energy consumptions, fostering energy efficiency through better control of data, and allowing them to participate in the energy markets by making it easier to become a prosumer, integrating individual stationary storage or participating in aggregation schemes with their electric vehicles.

Gridspertise will primarily target markets in Europe and Latin America, where the Enel Group already has a strong presence, and will aim to expand towards North America and Asia-Pacific where the investments in smart grids will drive infrastructure upgrade projects in the near future.

At the event, the Gridspertise logo and corporate identity were also unveiled in a move that intends to visually embody the company’s vision, mission and personality through a dynamic, fresh and digital native brand. The company’s website and its social media channels were also inaugurated to serve customers and prospects with immediate effect.

For more information on Gridspertise, please visit www.gridspertise.com.

EMPOWERING UTILITY WORKERS



ELISABETH MONAGHAN
Editor in Chief

In a few months, we will hit the two-year mark since most of us first heard of COVID-19. Early on, when cities in the U.S. were shut down, many of us weren't sure how serious the pandemic was or the indiscriminate impact it would have on us or those in our social and professional circles. Was this something that would unite all of us, or would we see a further division between those who called the virus a hoax and those who took it seriously?

This issue of *EET&D* offers insight into a variety of challenges that have become commonplace in our industry – partly because of the pandemic, and partly because ours is an industry of constant change where electric power providers must always be ready to respond in the event of power outages or any other time the electric grid is disrupted.

In his article, “Weather the Storm with the Right Data,” Mike McGann, vice president of Sensus Americas Global Engineering and Assessment Services, likens utility workers to disaster heroes in the communities they serve. The comparison makes sense because when a storm or other catastrophe strikes, utility workers are among the first responders. They may not arrive on the scene of a disaster with medical equipment, but they are among the first to show up and immediately get to work, troubleshooting how best to protect or restore the grid. By working non-stop in their pursuit of stabilizing the grid, utilities make it possible for people to attend to basic needs like staying warm or cooling off, heating, refrigerating and preserving food or having access to running water.

McGann points out that the heroic endeavors of utility workers often mean that while those workers are safeguarding or restoring our power, their families and homes are among those being impacted by whatever natural or human-caused disaster has affected the grid.

As TRUCE Software CEO Joe Boyle touches on in his article on how utilities can empower their workforce, service providers today encounter more natural disasters, and those disasters are hitting more frequently. He goes on to explain that utilities must figure out how to “manage distributed generation and maintain service while integrating diverse, often sporadic input from renewable sources.” This only compounds the demands placed on electric industry workers.

Facing ongoing extreme weather events like hurricanes and other natural disasters, frontline workers in the electric power industry must be ready to jump into action at any time. Given the increase in extreme weather and other incidents that can take out the power grid, utility workers are working more hours than ever before. Longer hours on the job mean the workers have less time to tend to personal business.



For utility workers to “save the day” and bring the grid back online, they need the proper skills and tools. When it comes to restoring the power grid, one of the most important tools for utility workers is access to mobile technology. A national workforce survey that TRUCE conducted in January of this year found that 36% of respondents use their mobile devices more now than they did a year ago, and these devices have helped make the workers more productive.

With workers spending more time in the field, they may not have time during “normal business hours” to pay bills, communicate with family members or call customer support with questions like returning a retail item or contesting a charge they don’t recognize on an invoice. Boyle discusses how utilities can empower their workers with mobile technology that would allow them to do their work, while also being able to tend to personal tasks. To accomplish this, utilities must change their archaic mobile device policies.

Boyle addresses some of the obstacles utilities face when establishing policies for how and when their workers can use their mobile devices for both personal and job-related communications. He also explains that the days of strict policies banning employees from using their mobile devices to access the internet or specific applications are over. Today, utilities must implement an effective mobile device policy, but Boyle emphasizes that first, utilities must see their workers as “dynamic rather than static, and then adapt their mobile device policies to uphold that principle.”

Increasing diversity

If the work-life balance was difficult to find pre-pandemic, it is even more so today, and that can leave everyone from C-level executives to the administrative support staff feeling depleted. But, despite this being an era, where more demands are placed on those who work in electric energy, some believe this is a promising time for our industry.

For this issue’s “Powerful Forces” column, we profiled Nooshin Behroyan, founder and CEO of Paxon Engineering and Infrastructure. As she told me about how she got into the energy sector, Behroyan did not spend time rehashing the challenges she has had to overcome because she’s a woman or a Person of Color, who immigrated to this country and established a consulting firm in a male-dominated industry. Instead, she spoke enthusiastically about her career. She also shared her optimism about the shift that employers throughout the U.S. are making towards a more diverse workforce, and why that shift is necessary.

“I think that this is a great time for the country,” Behroyan said. “I applaud the utilities who are making an effort to be more inclusive, but a lot of that comes with the changes happening at the executive level, and if you don’t make those changes, your company’s going to stay behind.”

Behroyan is not one to sit by passively or accept the status quo. She also knows how to pick her battles. For example, early in her career and armed with a bachelor’s degree in architecture, Behroyan was at a construction site for her firm, where she did not agree with the structural engineer about his approach. Rather than letting the disagreement intimidate her or leave her feeling powerless and resentful, Behroyan went back to school and received a master’s in environmental and structural engineering.

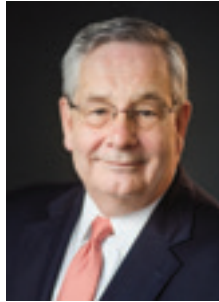
As we move closer to 2022, the future of the power industry and the individuals who work in electric energy will remain uncertain, but Behroyan is right. This is an exciting time for our country and our industry – as long as we recognize the enormous amounts of time and effort workers are putting into power restoration while ensuring they have the emotional, technological and financial support they deserve for continuously safeguarding the electric grid from any impending disasters.

If you would like to contribute an article or if you have an idea about interesting technology, solutions, or suggestions, please email me at:

Elisabeth@ElectricEnergyOnline.com

Elisabeth

IMPROVING THE ELECTRIC GRID THROUGH COLLABORATION



Recently, the North American Electric Reliability Corporation (NERC) and the Electric Power Research Institute (EPRI) announced a collaboration to “enable improved resiliency and reliability of the North American electric grid.” For the Q3 Grid Transformation Forum, we asked Andrew Phillips, vice president of EPRI’s Transmission and Distribution Infrastructure sector, and Mark Lauby, senior vice president and chief engineer with NERC, to talk about the agreement and how they see the collaboration unfolding.

EET&D: What do you consider to be the most significant impact this agreement will have on the electric power sector? How will the electric power sector benefit?

Andrew Phillips, EPRI: This agreement is about bringing together both our organizations – which have unique roles and relationships within the power industry – to better serve the electric power sector and, ultimately, society. Our collective knowledge is stronger than our individual work. This partnership will allow us to more effectively and efficiently respond to the current and future challenges facing the electric power industry. Bringing our organizations closer together through regular meetings and collaboration on key issues and research activities will accelerate innovation, solve reliability challenges and help build a more resilient bulk power system (BPS).

Mark Lauby, NERC: Our two organizations each have access to an exceptional set of employees who are subject matter experts and industry participants. This combined level of experience and expertise is significant and will be highly effective in addressing the current and emerging resiliency, security and reliability issues facing the BPS. In addition, through NERC’s committee structure, many risks and trends are identified early. Our agreement enables NERC and EPRI to jointly develop tools and initiatives that effectively mitigate existing and emerging risks to BPS reliability.

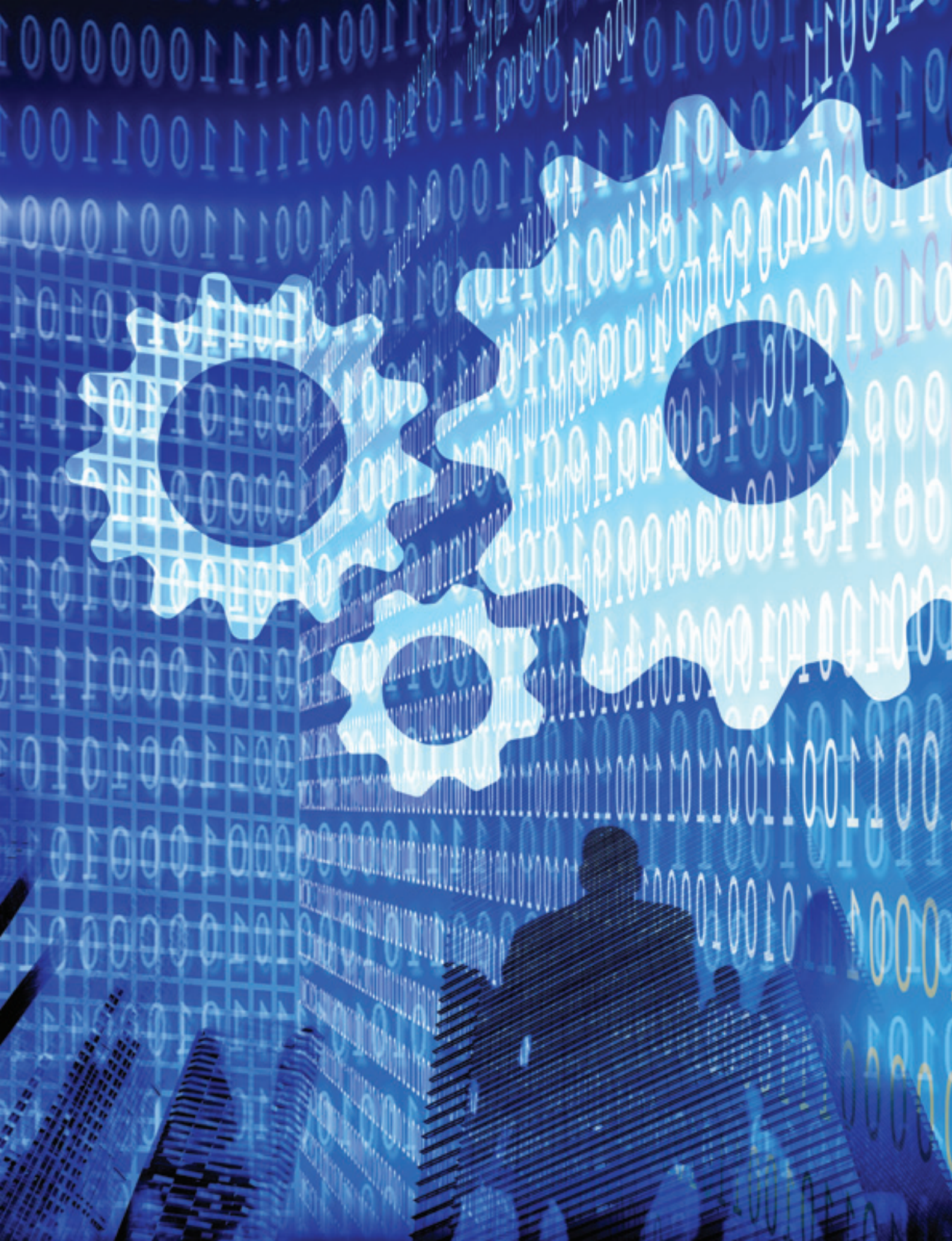
EET&D: What are the strengths each organization brings to this collaboration?

AP: EPRI draws on the strength and technical expertise of our scientists and engineers, as well as experts from academia and industry, to produce research and science-based information to enhance the generation, delivery, and use of electricity.

EPRI’s labs were designed and developed over decades with unique capabilities going beyond standard testing to address some of the most relevant and difficult issues facing the industry. These test capabilities enable the confirmation and development of models and theories used to address some of the most complex problems in improving reliability and resiliency of the BPS.

EPRI’s outdoor, high-voltage laboratory in Lenox, MA can simulate up to 1,200-kV full-scale AC transmission line or 1,500-kV DC., as well as lightning impulses up to 5 MV. Our lab in Charlotte, NC focuses on developing and evaluating new underground cable concepts, as well as asset monitoring technologies such as sensors for transformers or conductors. In Charlotte and Knoxville, EPRI uses some of the largest privately-owned EMP generators to simulate the electromagnetic effects of a high-altitude nuclear blast on electronic equipment. →





ML: NERC's greatest commodities are its people and its structure. Similar to EPRI, NERC employees are largely drawn from within the industry (e.g. government, research and engineering) and bring, operational, technical and policymaking expertise to the collaboration. In addition, through its governance structure, which supports several stakeholder-populated technical committees, NERC also brings a wide-ranging perspective from the industry and stakeholders in North America. NERC's technical committees, such as the Reliability Issues Steering and Reliability Security Technical Committees, work to identify current and emerging threats to reliability thereby highlighting issues that may be investigated through this collaboration. NERC also has an 11-member Board, who act impartially on behalf of a broad and diverse range of stakeholders.

EET&D: Why now?

ML: A highly reliable, resilient, and secure BPS is at the core of NERC's mission, and we are focused on proactively addressing the risks to the reliable operations of the BPS. The transforming grid creates challenges and opportunities to support this mission. For example, the ability to deliver energy is becoming increasingly hampered during certain common widespread, long-duration conditions such as extreme hot or cold temperatures. The electricity sector is undergoing significant changes that are unprecedented in both transformational nature and rapid pace. Initiatives are underway to address these risks, the management of reliability, resilience and security requiring increased focus right now and our collaboration with EPRI is part of that effort.

AP: Two of the main pillars of a decarbonized future are the generation of electricity from renewable resources and the conversion of fossil-fueled systems to electricity. This makes for a future where society is more dependent on electricity, which is generated from a different mix of resources in different locations. As a result, enhancing the reliability and resiliency of the BPS is more important than ever. There will be many new unknowns and future challenges to navigate. The whole industry has a role to play in rising to the challenge, with NERC and EPRI playing vital roles.

Through the clean energy transition, electrification will continue to expand in countries, industries and businesses across the globe. Our partnership will help ensure power companies and stakeholders are prepared and equipped to deliver electricity efficiently, reliably and resiliently.

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The electricity sector is undergoing significant changes that are unprecedented in both transformational nature and rapid pace.
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Jim Robb, President and CEO, NERC and Arshad Mansoor, President and CEO, EPRI sign MOU.

EET&D: What are some of the greatest challenges the industry must overcome for your effort to succeed?

AP: Ensuring resilience and reliability as electrification grows is one – if not the most important issue at hand. Success involves accounting for present and future challenges, including extreme weather events. We also must factor in changes in the resource mix, evolving technology and emerging threats such as cybersecurity, physical security, geomagnetic storms and electromagnetic pulse (EMP).

At EPRI, we know that science holds the solution to these challenges. And advancing science is what we do best. Our partnership with NERC will help us identify the most urgent and relevant topics to work on, as well as increase the application of our findings to more stakeholders. We believe this will amplify the value of innovation and accelerate building a more reliable and resilient industry.

ML: The industry is facing many challenges such as grid transformation; cyber and physical security threats; increased vulnerability due to extreme weather events, especially those related to extreme temperatures; and critical infrastructure interdependencies such as the ability to deliver natural gas to generating units. This transformation must be understood and planned for to preserve and improve reliability. At NERC, we are observing three major trends that are changing the reliability ecosystem.

First, the BPS is decarbonizing rapidly as policies, economics and customer preferences drive the retirement of traditional baseload generation. This evolution is altering the operational characteristics of the grid. Second, the grid is becoming more distributed. The improved economics of solar is a key driver of this dynamic. Grid operators need more control and visibility into many of these resources. And third, the system is becoming increasingly digitized through smart meters and advanced control systems. These investments greatly enhance operational awareness and efficiency but increase our exposure to cybersecurity risk. Managing this pace of change is the central challenge for reliability. →



EET&D: To what extent will NERC and EPRI's next steps require buy-in from utility providers?

ML: NERC and EPRI have collaborated closely and successfully for many years. It is a highly complementary and beneficial relationship that combines NERC's ability to identify issues that may compromise the reliability and resilience of the BPS and EPRI's scientific and technological expertise. The industry has already benefited from our previous collaboration and we believe our strong track record continues to engender support from our stakeholders.

AP: EPRI and NERC have been working together for decades, with EPRI research results being used as the technical basis for numerous NERC standards, such as the minimum distance from a tree to a transmission line, how to address solar storms from the sun or how to design a substation to make it resilient to an electromagnetic pulse from a nuclear weapon exploded in outer space. We hope the reaffirmation of our partnership is seen as a win for the power sector and the public. By working together with a shared vision to serve the electric power sector, we believe all stakeholders will quickly see the value and benefit of our combined efforts.

EET&D: How will the collaboration between you ensure improved grid resiliency or fewer grid failures like what we saw in Texas this past winter?

AP: As a result of Texas and other recent events, EPRI has launched research into how to ensure resource adequacy during future extreme weather events while accounting for a changing resource mix. NERC is being engaged in this effort and we expect the results to inform the future management of the grid.

Improving grid technology while ensuring reliability and resiliency is a priority for both of our organizations. As such, we expect our partnership may identify new or expanded research opportunities to help overcome current and future challenges related to grid operations.

ML: Through our assessments that identify and quantify emerging reliability issues, NERC can provide risk-informed recommendations and support a learning environment for the industry to pursue improved reliability performance. These recommendations, along with the associated technical analysis, provide the basis for actionable enhancements to resource and transmission planning methods, planning and operating guidelines and NERC Reliability Standards. Our partnership with EPRI brings the appropriate scientific and technological expertise to the development of potential solutions.

EET&D: How will you measure the effectiveness of your collaboration?

AP: For EPRI, effectiveness will be measured by working on the key issues and risks that NERC and its stakeholders have identified as being important for BPS. Success means that EPRI research and results continue serving as the technical basis used in the NERC process when developing or revising standards.

We expect this to be a mutually beneficial collaboration where EPRI and NERC provide input to each other. This ensures we're jointly identifying the most important BPS issues and providing the most relevant and helpful research to support these challenges.

ML: At NERC, effectiveness will be measured through the feedback obtained from our stakeholders, the level to which reliability and reliance have been enhanced, and the issues that may impact the BPS can be mitigated.

ABOUT ANDREW PHILLIPS:

Andrew Phillips is vice president of transmission and distribution infrastructure. He provides executive oversight and direction for research, development and demonstration programs addressing asset management, operations, planning and integration. During his career at EPRI, Phillips has led the industry in developing advanced approaches and technologies to manage a range of T&D assets. Since joining EPRI in 1998, he has led various research programs and initiatives covering transmission and distribution infrastructure and systems.

Phillips earned a Bachelor of Science, Master of Science, and Doctor of Philosophy in electrical and electronics engineering from University of the Witwatersrand, in Johannesburg, South Africa.

He holds 16 U.S. patents and is the author of more than 60 journal and conference publications. He is a member of IEEE and CIGRE and is a registered professional engineer.

ABOUT MARK LAUBY:

Mark G. Lauby is senior vice president and chief engineer at NERC in January 2007 and has held a number of positions, including vice president and director of Standards and vice president and director of Reliability Assessments and Performance Analysis.

In 2012, Lauby was elected to the North American Energy Standards Board and was appointed to the Department of Energy's Electric Advisory Committee by the Secretary of Energy from 2013–2017. He has been recognized for his achievements by many technical associations, including the 1992 IEEE Walter Fee Young Engineer of the Year Award. He was named a Fellow by IEEE in November 2011 for "leadership in the development and application of techniques for bulk power system reliability," and in 2014, he was awarded the IEEE Power and Energy Society's Roy Billinton Power System Reliability Award. In 2020, the National Academy of Engineering (NAE) elected Lauby as a member, citing his development and application of techniques for electric grid reliability analysis.

Prior to joining NERC, Lauby worked for the Electric Power Research Institute (EPRI) for 20 years, holding a number of senior positions, including: director, Power Delivery and Markets; managing director, Asia, EPRI International; and manager, Power System Engineering in the Power System Planning and Operations Program. Lauby attended the London Business School Accelerated Development Program as well as the Executive Leadership Program at Harvard Business School.

AUTOMATED THERMAL MONITORING FOR WIND TURBINES

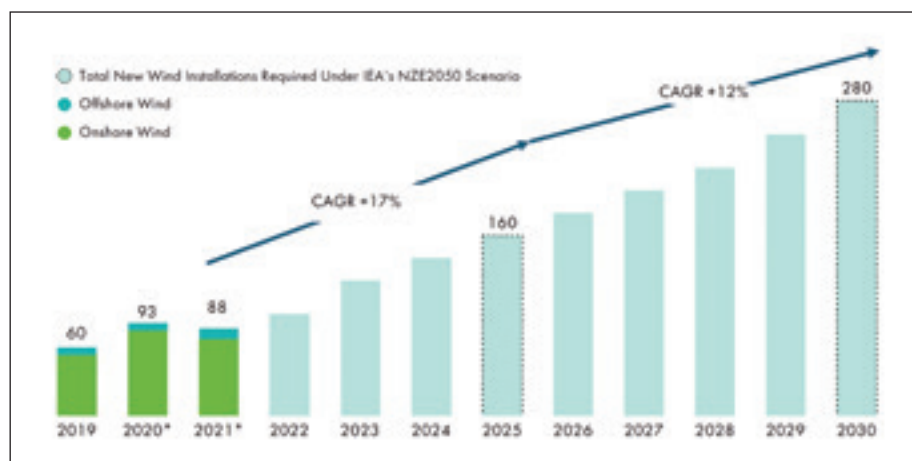




RICHARD HARADA

The growth in wind energy

The number of wind farm installations has been growing steadily for the past several years with more and more countries pledging green generation and having goals to reach zero CO₂ emissions status. In 2020, there was more than 93 GW of new wind generation capacity installed, representing a growth of 53% over the previous year.^[1] New installations are expected to continue to grow over the next several years, with growth in offshore windfarms predicted to gain momentum and increase in the percentage of wind generation. →



Source: GWEC Market Intelligence; IEA World Energy Outlook (2020s)

As wind farms continue to be rolled out, the maintenance challenges will continue to grow as larger and more powerful turbines are deployed in more difficult-to-reach locations. Whereas an average wind turbine produces 2-3 MW, the newest, most powerful wind turbines stand more than 250 m tall, with 100 m long blades and produce 15 MW of power. With the growth of wind energy, the complexity of the technology and the criticality of maintaining reliable operation grows with it. The future of wind farms is changing from being an add-on to conventional power generation to being the primary source of power generation.

Maintenance challenges

As the percentage of power generation increases in wind power, the level of importance in maintaining these systems grows with it. The conventional methods of thermal power generation are decades old, and therefore, the reliability and maintenance methods for these generation systems has matured. Wind generation technology is relatively young, and there are new developments in wind technology happening regularly. Many of the conventional equipment concepts – such as generators, transformers and breakers – are used for wind applications but on a different scale, and to complicate things, these pieces of equipment are located in a moving nacelle, on a tower, 100m off the ground. The maintenance techniques for wind generation are new and evolving as the technology matures.

Wind turbine technicians

A wind turbine technician, or wind tech, installs, inspects, maintains, operates and repairs wind turbines. The demand for qualified wind turbine technicians is growing with the increasing number of installations; in 2016 it was the fastest-growing occupation of the decade,^[2] with strong demand for the foreseeable future. The wind tech must be physically fit enough to climb inside the tower while carrying parts and tools and have no fear of

heights or enclosed spaces. Most of the maintenance and inspection work is done inside the nacelle that houses the major equipment. The wind tech must be knowledgeable in many areas to maintain the mechanical and hydraulic equipment that controls the positioning system and gearbox as well as the electrical equipment such as the generator, transformer, breakers and switches. The specialized training that wind techs must receive also has a focus on safety and first aid.

Challenging locations

Wind farms are usually in remote locations requiring extra time and logistics to get to sites with the proper equipment. Offshore wind farms are even more challenging and require more planning, training and transportation to reach the site. Once at a wind farm, it takes additional time and physical exertion just to access the equipment inside the nacelle. Wind turbine inspections are much more complicated when compared to the inspection of land-based substation equipment. In the U.S., a medium-sized wind farm will have 50 – 100 turbines per site so it can take days or weeks to inspect each turbine manually. In addition, the wind turbines are shut down during the inspection so electrical issues that occur under load will not be detected during a manual inspection.

With the knowledge that maintaining the equipment inside the wind turbine is labor-intensive and physically challenging, wind farm operators are recognizing the value of online condition monitoring.^[3] Through automated and early detection of faults, more serious failures can be prevented through condition-based maintenance that allows operators to optimize resources and reduce repair costs. There are several condition monitoring systems for wind turbines to monitor both electrical and mechanical systems that operators can consider for their site. Many of these systems will be turning to new technology to help reduce the number of manual inspections.

Technology to overcome challenges

Energy 4.0 technology will help with maintenance and inspections

Some utilities have started to implement in their operations, the same emerging technologies that are driving the fourth industrial revolution in the manufacturing sector. The Industrial Internet of Things, (IIoT), machine learning and cloud computing are among the new technologies that are already being used by a few electric companies around the globe for asset monitoring^[3] predictive maintenance^[4] and the operations of distributed energy resources (DER)^[5]. Some industry experts have started calling this trend Energy 4.0 to highlight the magnitude of the transformation they expect it will bring to the electric industry.



Figure 1: Access to the nacelle requires special training and equipment.

Emerging technologies like the Industrial Internet of Things (IIoT), Artificial Intelligence (AI), machine learning, cloud computing, etc. can provide the tools utilities need to adapt to this new industry environment and provide arguments in favor of full adoption of these technologies by the electric industry^[3]. These emerging technologies are part of what now is known as the fourth industrial revolution, or Industry 4.0, which is why some people refer to the use of these technologies in the electric industry as Energy 4.0.

Monitoring the wind turbine with thermal imaging

Thermal imaging sensors can measure the infrared radiation from an object and convert it into a temperature value. An important feature of thermal imaging is that it is 'non-invasive,' it uses a sensor that can measure temperature values without physically touching the object; therefore, it is not required to power down equipment to install the sensor or to make the temperature measurements.

Thermal imaging measures and detects overheating in any electrical component that has current running through it. Thermal imaging is commonly used in electrical applications to detect faults in connection points, switches, bushings, transformers, generators and motors. If there is current flowing through a path with resistance it will cause heat to be generated that will be detected by the thermal sensor. Thermal sensors can also detect excessive heat due to friction in the bearings of the generator, gearbox or motors that control the positioning of the turbine components.

A typical thermal sensor has a field of view allowing it to capture a scene with multiple areas of interest in it. As an example, the sensor may be able to view the whole transformer and its bushings and connection points. The

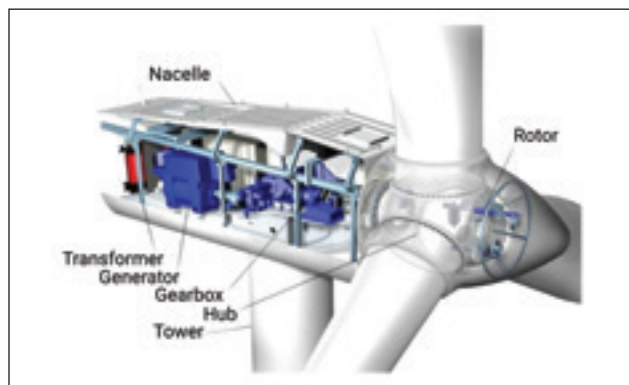


Figure 2: Electrical and mechanical systems inside the nacelle can be monitored with infrared sensors.

sensor can then pick out the areas of interest within the scene and capture the temperature values and store them as data points. Some thermal sensors are mounted on a pan and tilt base that allows them to cycle through a series of different views and areas of interest. An advantage of thermal imaging is that a single sensor can monitor a variety of different pieces of equipment instead of having separate, specialized sensors for each. Thermal asset monitoring can be used to track temperature fluctuation over the course of the day, week and seasonally to monitor if there is a trend in the asset temperature that could be an indicator of an impending problem.

Portable infrared cameras have been typically used by thermographers in the electric power industry to periodically inspect substations and other key areas of the grid. While periodic scanning is useful, automated and continuous thermal monitoring has many advantages such as being able to provide measurements during changing environmental and load conditions, as well as being able to provide the data directly to operators, SCADA, and asset management systems.

With the advancement of IoT and infrared technology, the two are now able to be combined into a single sensor. This brings thermal imaging into the IoT world and makes the technology and associated data much more accessible and cost-effective.

Practical application

In this application, the wind farm operator wanted an online monitoring system that could detect faults to allow them to schedule maintenance before more serious problems developed. Time-based maintenance was often performed on healthy systems and was costing the operator valuable resources that could be deployed for more urgent issues. The operator was familiar with infrared technology and how it could be used to detect potential problems in electrical systems. Infrared sensors detect the excess heat emitted through arcing in failing insulation or poor electrical connections. Infrared technology is a proven technology that has long been used by utilities for inspections of transformers, busbars, breakers, switches and other primary and secondary substation equipment. →



The solution

The device used was an IoT sensor with onboard thermal and visual imagers and built-in wireless communications. The sensor takes temperature readings on live systems and will detect overheating bushings, cables, joints and insulators – even in enclosed and confined spaces. Due to its small size and low power requirement, the sensor can be installed quickly using high-powered magnetic mounts to keep the unit in place.

The sensors are pre-programmed to take snapshots that give operators a visual and thermal view of the system. The thermal data is collected, stored, and analyzed continuously. The cloud-based dashboard provides a comprehensive view of the data with graphs of the temperature points along with visual and thermal images. Alarm thresholds can be set in the dashboard, so operators are alerted instantly if pre-set temperatures are exceeded. The data and alarms can be sent to SCADA or PI systems through an IoT Sensor Gateway, allowing the utility to trend the data and use it in a condition-based maintenance program.

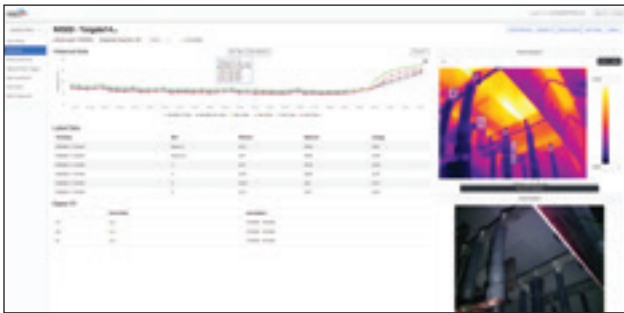


Figure 3: Comprehensive dashboard provides status, trending and visualization information

Summary

Using IoT and thermal sensing technology will allow wind farm operators to perform remote inspections, with 24/7 monitoring on sites and equipment that would otherwise be difficult, costly and time-consuming to inspect. The sensors provide visual and thermal imaging of equipment inside the nacelle without having to send personnel to the site. The IoT sensors can be installed quickly and easily due to their small and lightweight form factor, low voltage requirements and built-in communications. Temperature data is sent to SCADA or PI applications for further analysis, trending and input to asset management applications. Continuous thermal monitoring ultimately improves safety and reliability while reducing operating costs.

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ABOUT THE AUTHOR:

Richard Harada has more than 20 years of experience in industrial networking communications and applications. Prior to joining Systems With Intelligence, Harada worked at Rugged.Com and Siemens Canada, where he focused on product management and business development for industrial communications in the electric power market. Harada is an electronic engineering technologist with a Bachelor of Science degree in computer science from York University in Toronto.

OUR ‘GREEN’ FUTURE DEPENDS ON GRID RELIABILITY

BRIAN LEVITE

The electric grid is entering an era of transition: power-generation technology is getting greener and more distributed, energy loads are denser in some areas and are more reliant on high-quality power, and customer expectations for more reliable power are rising. These changes are placing a lot of pressure on the grid and utilities all at one time.

But most power users don't consider the complexity of the electric grid system. While the accelerated use of consumer technology has increased the density of some power loads, it has highlighted the need for improved power reliability across all loads. Consumers are no longer willing to wait for the power to come back on; in fact, they expect it never to turn off. At the same time, there is increasing pressure from the public and policymakers to reduce the harmful climate impacts of our energy systems.

These simultaneous pressures of an increasingly complex system with higher customer expectations and the need to reduce carbon footprints are now joined by our need to focus on economic recovery from the COVID-19 pandemic crisis. Businesses globally are attempting to claw their way back to productivity, and reliable energy is going to be an important ingredient for success. Utilities and regulators alike are trying to be creative in how they solve these challenges.

There is good news, though. There are expectations that the lights must stay on, and distributed energy resources (DERs) can help ensure that happens. There is also growing consensus in the industry that we need a cleaner grid and that a reliable grid is going to be absolutely critical to deliver cleaner energy.

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With so many organizations increasing
their focus on corporate sustainability efforts,
having green energy generation is becoming
increasingly important.

Increased use in green generation is changing the grid

Some of the most common DERs being integrated into the grid are “green” generation sources such as solar panels and wind turbines. The addition of these carbon-free generation sources can provide immense benefits to the grid, but they come with their own set of challenges.

DERs can help diversify a utility's total energy supply, thereby building up a utility's overall resilience. The use of DERs also provides an alternative to fossil fuels, reducing greenhouse gas emissions to achieve carbon-footprint goals outlined by governments and businesses. With so many organizations increasing their focus on corporate sustainability efforts, having green energy generation is becoming increasingly important.

From a financial perspective, DERs make sense for a utility's bottom line. When compared to developing a traditional generation plant or substation to support increased demand, DER integration is often much more affordable for utilities and their customers. →





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When done correctly, the installation of DERs
can improve a grid’s reliance and reliability.”

It’s hard to argue with the benefits of green generation: help save the planet while saving money. But the actual installation of these DERs isn’t as simple as plugging in a solar panel. It’s important to remember the grid wasn’t designed for this. For the last century, the grid has operated as a one-way power-delivery system. Power plants were located at one end of the grid, and customers were at the other. Today, DERs enable power to enter the grid at a variety of locations, which is changing the architecture of the grid. Most green generation is being added directly to the distribution system, which isn’t designed to optimize these distributed sources, and it is delivering electricity to the parts of the distribution grid where it’s needed most.

The grid is changing from a one-way power-delivery system to a distributed electricity network, facilitating generation and loads in any direction. When left unchecked, this shift in power flow can pose significant risks for existing grid equipment and line crews. Before utilities can fully embrace DERs to help support generation needs and customer demand, other aspects of the grid and overall utility operations must be updated to better accommodate this change. When done correctly, the installation of DERs can improve a grid’s reliance and reliability.

Areas of consideration before integrating green generation sources

Technical grid solutions

A critical area of consideration for any utility before adding DERs to its system is to evaluate and modernize the existing distribution grid. As the future home of new DERs, distribution systems require advanced grid solutions to help ensure all aspects of the system are protected and ready to accommodate these new generation assets.

One way to bolster lateral lines in preparation for DER integration is to increase grid segmentation. Adding more protective switching devices throughout the system and segmenting lateral lines into smaller pieces allows utilities to achieve higher levels of configuration. This enables utilities to integrate more DERs safely and effectively into the system while simultaneously reducing unnecessary outages. When segmentation is paired with smarter controls serving both the transmission and distribution grids, it allows utilities to efficiently balance loads and resources across their service territories.

Changes to regulation policy

Modernizing an existing distribution system requires a significant utility financial commitment, and sweeping changes are often not possible without the support of state regulators. To encourage utilities to make these grid changes to support DER growth, a shift in how regulatory bodies and policies measure a utility's overall performance will likely be required.

For decades, utilities have navigated a cost-of-service model, which rewards utilities with a rate of return for their investments. The safest way utilities can get those returns approved has been to stick with traditional, well-known technologies that essentially involve rebuilding the grid of the past. The single-year rate cases and risk-averse investment methodology has meant transformative investments in the grid were almost impossible. Given all the changes discussed earlier, this kind of regulation isn't likely to result in the green, reliable grid of the future.

A solution some states and several other countries are trying is performance-based regulation (PBR). PBR helps utilities to invest in changes they need for an advanced grid by allowing for longer rate periods and financial benefits tied to outcomes instead of earning a simple rate of return on legacy investments.

PBR can also incorporate more advanced reliability metrics. All of this allows regulators to better understand company performance to incentivize outcomes that are truly in the public interest. Many states are exploring PBR business models, and those using them are seeing great improvements throughout their local grids. The more effort a utility puts into improving its performance, the greater the reward.

The use of new metrics

Also important is for utilities to begin expanding their measurement tactics to include more than System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI). These average systemwide performance metrics are where many utilities focus their attention, but they create a disconnect between what a utility's perceived reliability is and what utility customers are actually experiencing. The increasing complexity of the energy grid may make acute problems on the grid worse if the right solutions aren't in place. As DER integration grows, utilities must consider reliability metrics that better capture customer experience.

DER performance is not captured in traditional utility metrics to gauge performance, but for DERs to be impactful the grid must be reliable. Without a bedrock of grid reliability, utilities will find it challenging to effectively integrate DERs as supplemental generation options. The inclusion of more customer-centric metrics can provide a more complete picture of overall reliability. Metrics such as Customers Experiencing Multiple Interruptions (CEMI) and Customers Experiencing Multiple Momentaries (CEMM) help paint a more complete picture.

During the transition with DER integration, ensuring grid performance is meeting customers' expectations will be crucial to overall utility success. It may also be necessary for the electric utility industry to develop new performance metrics more focused on resilience and stability to help better gauge overall performance and areas for improvement.

The frequency of DER deployment on the grid will continue to grow, but to make this transition to greener generation sources as smooth as possible, the grid must be in a position to support these new resources. We can't have a green grid unless we are willing to invest in a reliable one.



ABOUT THE AUTHOR:

Brian Levite is the regulatory affairs director at S&C Electric Company. He joined S&C from Hitachi, where he helped develop the company's microgrid offering. Prior to Hitachi, Levite worked at the National Renewable Energy Lab, the Department of Energy and the Environmental Protection Agency, developing and implementing government programs focused on energy efficiency and renewable energy. Levite earned a master's in public policy at American University and is a Certified Energy Manager. He is the author of the book *Energy Resilient Buildings and Communities: A Practical Guide*.

WEATHER THE STORM WITH THE RIGHT DATA: TWO UTILITIES SHARE STRATEGIC STORM RESPONSE

MIKE MCGANN

Utilities are the disaster response heroes in every community they serve. They quite literally have the power. The power to turn on the lights after a gut-wrenching storm. The power to return their customers' ability to cook and prepare hot meals for their families.

But this responsibility doesn't come easily. It often means utility workers report to emergency command centers while their families wait out the storm. It also requires utilities to plan constantly to prepare and then reevaluate their disaster response strategy. But utilities can also learn from each other. Following are two powerful examples – and what we can learn from them.

One town, one unprecedented storm

It's a warm September day in Fayetteville, N.C. Residents scurry around checking for batteries, flashlights and bottled water. Those living within a mile of the region's main river, the Cape Fear, are urged to evacuate. Business owners prepare their property for flooding and wind damage. None are certain of exactly what damage the storm will bring, but most are content to over-prepare.

This scenario is not unusual for the military community 60 miles south of the state's capital, Raleigh. The town is no stranger to adverse weather events. A tropical cyclone makes landfall in North Carolina approximately every two years. More than two storms per year affect the state without making direct landfall.

But this storm, Hurricane Florence, turned out to be different. After crossing the North Carolina coast, the storm hovered for days producing record-breaking rainfall across eastern North Carolina. By the time the hurricane reached Fayetteville, residents were in for four days of unprecedented rainfall. The storm's persistence made it a new type of menace. By the time the rain stopped, more than \$24 billion in damage was done.

"What made Florence such a menace was its longevity," said Mark Brown, senior customer programs officer, Fayetteville Public Works Commission (PWC). "We had up to 20 inches of rain in certain parts of our area and damage that left more than 50,000 customers without power."

One Midwest region, one widespread windstorm

It's another warm, summer day, and Alliant Energy prepares to face a powerful, widespread windstorm. There's no shortage of severe weather events that cause power outages from intense summer heatwaves and winter storms to tornados and floods. But this windstorm, called a derecho, caused one of the biggest outages in Alliant's 100+ year history. The massive wind gusts took down trees, ripped apart corn silos and peeled the roof off an apartment complex. The storm passed, but not before it knocked out power for 260,000 people in Iowa. Among the affected areas was Cedar Rapids, Iowa's second-largest city. →





There was no calm after the storm for Alliant. As soon as the dangerous winds passed, their team sprang into action.

“It was all-hands-on-deck to get power restored as quickly as possible,” said Randy Bauer, Alliant Energy’s director of operational resources. “Thankfully, the technology investments we made previously helped provide a roadmap for where we needed to go and what we needed to do.” As the intense winds began to die down, an Alliant team used data from a utility solutions provider’s smart network to execute the outage management and restoration process.

“Data from our system let us know who was with or without power,” said Bauer. “We could also identify transformers that had been damaged, so we knew where to dispatch technicians to make immediate repairs.”

Alliant Energy relied on the near real-time data from their smart utility network to make informed decisions swiftly and restored power for the majority of customers in just a few days. Dedicated crews continued working through the harder-hit areas, and power became available to all customers within 16 days.

What these stories teach us about disaster preparedness

There are three things that these utilities have in common:

1. They planned and deployed the right technology.

The utility leaders knew it was only a matter of time before the next natural disaster hit. They planned for this unexpected certainty and deployed technology that supported a more efficient disaster response.

2. They made data-based decisions. The utilities were nimble after the winds and rains calmed. They acted swiftly and decisively based on the data at their fingertips.

3. They helped their communities. Thanks to the forward-thinking individuals and hard-working restoration crews, the communities were able to recover more swiftly after the storm. Preparedness helped the people of these communities.



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Dedicated crews continued working through the harder-hit areas, and power became available to all customers within 16 days.

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What we can learn from these utilities

The demand for disaster preparedness is clear, but the path to get there is not. Utilities must ensure investments are sound and technology upgrades scale to meet evolving needs. Following are key technologies you should consider for your disaster response toolkit.

Start with remote management through an Advanced Metering Infrastructure (AMI) system. AMI was the foundation of both Fayetteville and Alliant’s disaster response. Think of it as the railroad tracks for remote management. A smart infrastructure keeps you connected to the information you need before, during and after a storm. It ensures that you can provide the best possible service no matter where you are, or where your customers are. Consider features and software that extend AMI’s benefit to your disaster response plan such as:

- **Outage and restoration management:** Remote monitoring capabilities automate the outage notification process so crews can be dispatched before the customer calls. This helps save time and costs associated with identifying outages and restoring power for the customer. It also minimizes safety risks to employees investigating the extent of the outage.
- **Remote connect/disconnect:** Utilities once viewed remote disconnect as a nice-to-have ability in certain service territories. This mindset shifted due to the pandemic as access to customer homes became significantly more challenging. In parallel, some utilities faced smaller work crews because of illness or family issues caused by the pandemic. In either case, remote connect/disconnect empowers utilities to spend more time addressing an outage, and less time at the meter turning service off or on. This is especially beneficial following a natural disaster and widespread outages.
- **Customer portals:** Provide your customers with a way to check their usage and conserve energy. It is also a disaster preparedness tool to inform customers of their status and provide transparency into the outage restoration process. →



Data informs decisions

The right data at the right time means your utility can point crews and resources towards hardest-hit areas first – maximizing the number of customers you can return service to promptly.

Take Fayetteville, for example. The communication network acted as a compass during and after the storm. Their team hunkered down in Fayetteville PWC's Emergency Response Center when Hurricane Florence arrived. Every department within the utility supported storm response efforts and each employee had an assignment, whether answering phones or updating social media. As the storm slowly made its way through the region, utility staff used their network to stay on top of the situation.

After the storm, the network guided Fayetteville's crew and the mutual aid workers from Alabama, Georgia and Tennessee that offered additional help with downed powerlines and trees toppled on homes. The utility communicated regularly with emergency responders to help people in need and clear major roads.

“As the storm slowly made its way through the region, utility staff used their network to stay on top of the situation.”

“We were able to act quickly because our system let us know exactly where to put boots on the ground,” said Brown. “We had 97% of customers who had lost power back up and running within 96 hours.”

The utility's efforts to communicate proactively with customers during and after the prolonged hurricane didn't go unnoticed. Fayetteville PWC was honored with a North Carolina City & County Communicators' (NC3C) Excellence in Communications Award for their social media communications during the storm. Their social media messages reached nearly half a million people and the team had over 1,300 private message conversations with customers during the storm and the week-long recovery efforts.

Data empowered Alliant's response to the derecho as well. They put their technology to work for meter mapping to prepare for the next adverse event.

The utility was using geographic information system (GIS) mapping to help understand the topography of their service area, but they found inconsistency in the data. "Maps can get messy when you're focused on getting the lights back on quickly for so many customers," said Bauer. "The only thing you can be sure of with GIS mapping is that it's going to get out of date really fast."

This led them to conduct a pilot program with the phase detection across 600 electricity meters in the town of DeWitt, Iowa. This extension of the utility's smart network proved capable of detecting the correct phase with 100% accuracy.

"We went out and field-verified those results, and it turned out we had 240 mismatched meters," said Bauer. "Resolving these types of inaccuracies moving forward will help us serve our customers better."

The Alliant team was so impressed with the results of the pilot program that they plan to extend the capability across their entire service area.

Essential services for the community

Natural disasters don't wait for you to be prepared. In fact, these tragedies are on the rise due to climate change, their impact intensified by pressures like population growth and coastal development. The 2020 Atlantic hurricane season is historical for several reasons. According to the National Oceanic and Atmospheric Administration, this past season included:

- A record-breaking 30 named storms – the most storms on record
- 12 storms that made landfall in the continental United States
- Six major hurricanes

This data only accounts for one type of natural disaster. Wildfires, flooding and drought impact communities every single year.

Don't let these numbers intimidate you. Utilities are uniquely positioned to help their communities weather the storm. Plan, deploy smart technology and follow the lead of community-focused utilities like Alliant Energy and Fayetteville PWC. Utilities have the power to restore service, save lives and support their communities no matter what lies ahead.



ABOUT THE AUTHOR:

Mike McGann is vice president of Sensus Americas, Global Engineering and Assessment Services at Xylem. He leads teams solving tomorrow's biggest challenges for water, gas and electric utilities, today.

As a Lean Six Sigma Master Black Belt and a United States Marine Corps Veteran, he is skilled in applying continuous improvement methodology and process control to help individuals and teams do their best work and serve their customers and communities.

QUANTUM COMPUTING: GAME-CHANGING, DISRUPTIVE AND NECESSARY

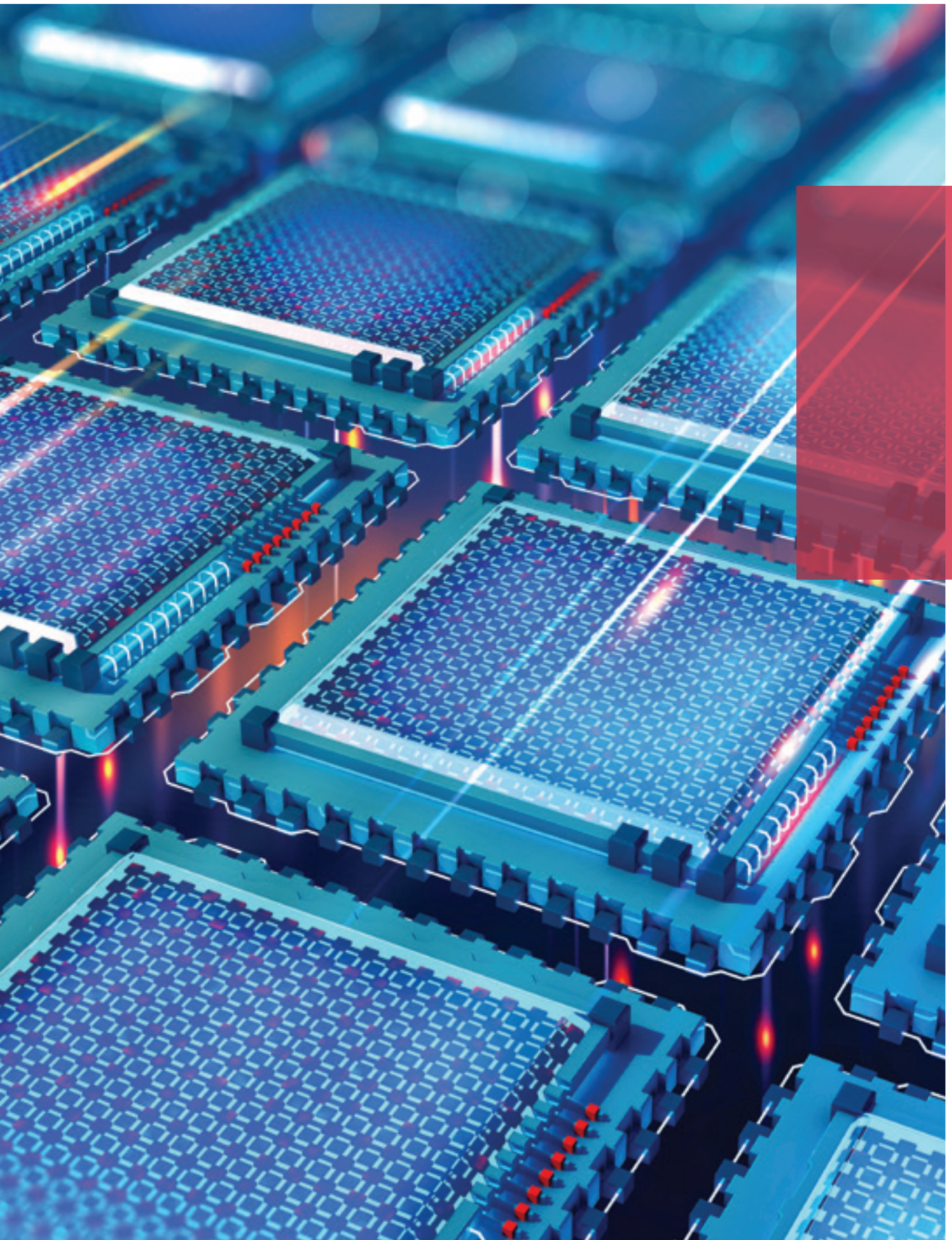
TECHNOLOGY POISED TO
REVOLUTIONIZE DECISION
MAKING IN COMPLEX SYSTEMS

AMIN KHODAEI

Safety, leisure, work and now more than ever, education, heavily depend on a power grid that can reliably supply and deliver electricity to customers while supporting other critical lifeline systems. The power grid, however, is becoming increasingly complex to the point that traditional grid control and decision-making built on classical computing methods may fail to address its emerging needs. The growing proliferation of intermittent renewable generation resources, increased frequency and intensity of natural disasters and weather events due to climate change, a rapidly electrifying transportation sector and cyber vulnerability are just some of the complicating factors. Luckily, there is an emerging solution to this and many other challenges across industries—quantum computing. As a broad range of use cases and pilots ramp up, quantum computing is set to complement, and in some instances, even replace classical computing over the coming years.

Unleashing the power

Quantum computing is developed based on quantum mechanical phenomena that describe the nature and conduct of energy and matter at the level of fundamental subatomic particles. Quantum computers process information differently than classical computers (using qubits that could be either 0 or 1 or any combination of 0 and 1). The potential power of quantum computing is in the superposition and entanglement of states, allowing the execution of exponentially many computations in parallel. Given its promise of disrupting traditional practices in many sectors, investment in quantum technologies is booming. Tech giants, such as Google and IBM, are developing quantum computers. Many others, including Intel and Microsoft, are following suit by focusing on the software to support hardware developments. Governments are investing billions of dollars in research and development of this technology. →



Many quantum applications are expected to have significant disruptive implications for industries and businesses – currently there are extensive ongoing efforts in the areas of finance, cybersecurity and cryptography, forecasting, drug design, molecular modeling, aerospace and weather services. Among these noteworthy pilots is an investigation of the quantum computing potential in managing critical infrastructure that we heavily depend on: the electric power grid.

Managing a lifeline system

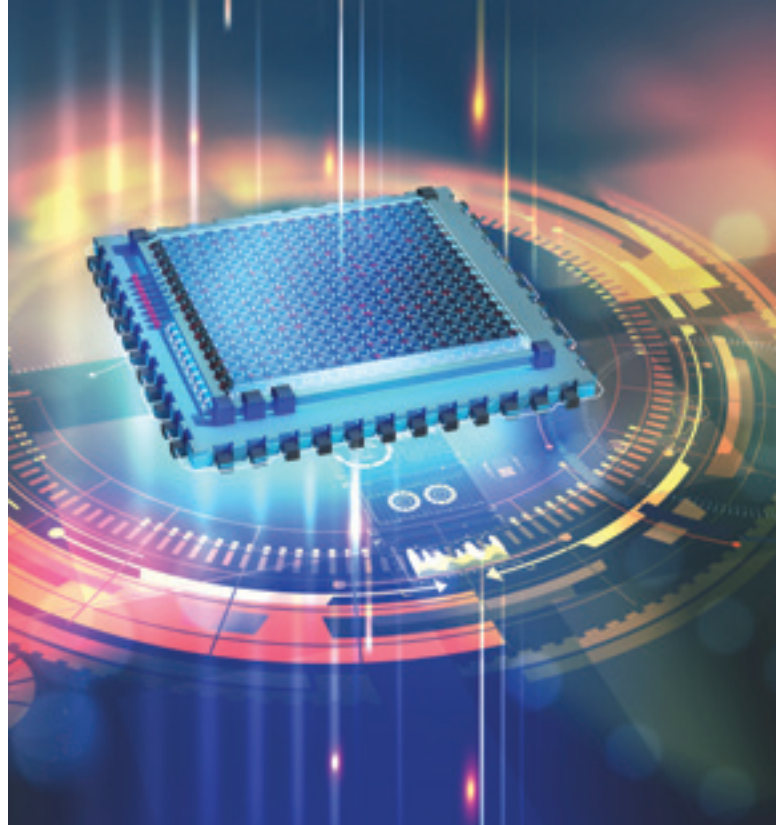
Computation has been central to electric power grid management for decades. As these grids become more complex, there is significantly more data to process. Using existing mathematics on more powerful computers is not a practical approach to address these broad complexities, hence requiring new classes of models, algorithms and solutions. Electric utilities, as the responsible party to ensure service reliability, are at the forefront of this transformation and are keenly aware of the looming challenge.

ComEd, the electric utility serving four million customers in northern Illinois and Chicago and a pioneer of electric power grid transformation, gathered multiple leading experts to discuss this topic and initiate a multi-year collaborative effort. Participants including multiple universities, national laboratories and quantum hardware and software developers participated in a day-long workshop in Chicago. The goal: to investigate how quantum computing can empower electric utilities to build the smart grid of the future. The following summarizes the pilot study we undertook.

Tackling a fundamental grid problem: power flow

Our team, representing the University of Denver, worked closely with ComEd and a Colorado-based R&D company (focusing on quantum-grid technology and software solutions) to model and solve one of the most fundamental power system problems – the power flow – using quantum computing. Power flow is a numerical analysis based on the physics of the grid, and its solution determines the amount of flow of electricity on various transmission and distribution lines. Power flow is the keystone of electric utilities' decision-making in grid operation, control and planning. However, it is a daunting task to solve this problem efficiently due to intricacies induced by the laws of physics.

Many critical electric utility decisions rely on the solution of the power flow. Turning on a power plant, rerouting power to prevent power outages, de-energizing part of the grid to reduce chances of wildfires, mobilizing repair crew to respond to hurricane damages and building a new high-voltage transmission line, are just a few. Besides



its importance in grid operation, power flow is a unique candidate for quantum applications, as it offers near-term technical feasibility on available quantum hardware, and the existing quantum algorithms to solve this problem guarantee a speedup.

Results underscore need for disruptive technology

The results: Our power flow studies on a test system showed a speedup of more than 30 times compared to that of a classical computer. This is a significant milestone, as it shows great promise in solving a wide range of critical electric power grid problems such as the ones mentioned above more rapidly and efficiently. In simple terms, this 30x speedup means that, for example, if planning for grid repair and recovery after a natural disaster takes one hour using classical methods, the quantum computer would solve this problem in less than two minutes. This in turn ensures a faster grid recovery and shorter power outages for residents in disaster areas. Imagine the effect this would have on helping to save lives, restore power and ensure communication within the community, among many other benefits.

The obtained quantum speedup holds tremendous potential for grid operators in revolutionizing traditional decision-making practices. While there are multiple challenges yet to be overcome with large-scale implementations of quantum computing, these challenges are expected to be solved in the near future as technology progresses. In the meantime, utilities and other industries should forge ahead with small-scale pilots that co-exist with classical computers.

How to get started now

Although we are still a few years away from commercialized universal quantum computers, now is the time to investigate the benefits of quantum computing as viable solutions across many applications and industries and gain a competitive advantage. Below are recommendations on how to get started:

- Identify areas in need of computational and analytical improvement in the business. Look into the complex problems that are currently solved using approximations or simplifications. Also, consider the areas with a growing volume of collected data.
- Research the feasibility and application of quantum computing to solve those identified problems. Near-term technical feasibility and proven algorithmic solutions to guarantee a speedup are the main points to consider.
- Run pilots. Collaboration is key in successful pilots. Universities are well-positioned and equipped to both conduct research and lead pilot studies.
- Make investments now, so when existing hardware and software limitations are removed, your applications and use cases are ready to move forward.

Conclusion

Legacy grid decision-making using classical computing is hard-pressed to address the growing complexity of today's electric power grid. Quantum computing models, frameworks and pilots today can exist alongside classical computing to provide practical solutions in a fraction of time — not only for utilities but for many other industries and applications. As quantum technology becomes commercially viable, companies that today evaluate and invest in applications and use cases will be poised for game-changing business transformation once quantum computing technology is ready for widespread use.



ABOUT THE AUTHOR:

Dr. Amin Khodaei is a professor of electrical and computer engineering, the director of KLab and the executive director of industry-university consortium on quantum-upgraded electric system of tomorrow (QUEST) at the University of Denver. His research is focused on the climate crisis, the grid of the future, and advanced technologies to modernize the grid, including artificial intelligence, blockchain, and quantum computing. He has authored/co-authored more than 190 peer-reviewed technical papers. As an active member of the IEEE Power & Energy Society (PES), he has served on multiple editorial boards and also as the technical chair of the 2016 and 2018 IEEE PES T&D conferences.

FOR FAST RECOVERY, PLAN FOR THE WORST

EMERGENCY CHECKLIST FOR DATA CENTER MANAGERS

KATE FULKERT

Try as we might, there is a limit to what we can do to anticipate the unexpected. But when it comes to the electric grid in the modern era of severe weather events, we can rely on one thing: unreliability. For data center operators, this puts basic and essential business functions in harm's way.

The devastating California fires over the last few years have shown us all just how exposed data centers can be in the face of a natural disaster. Consider the 2018 Camp Fire in California. As the fire itself abated, the utility giant PG&E announced it would start pre-emptively interrupting service to fire-prone regions that hadn't been burned in that cycle. Moreover, those planned outages appear to be an unpleasant fact of life for California residents and businesses, because the utility company has indicated that it could take a decade to upgrade and harden its systems. Until then, the outages are likely to continue.

This problem has been looming for some time. A 2017 infrastructure report card, an analysis conducted every four years by the American Society of Civil Engineers, gave America's energy system a low-performing D+, in large part because the country's power lines were built more than 70 years ago.

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A robust business continuity and disaster
recovery plan eliminates one common cause
of data center downtime: human error.
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Extreme weather, be it climate-fueled fires, floods, winter storms or hurricanes, has gotten worse while America's grid ages. That harsh reality means data center managers would be wise to develop plans to help their facilities and networks survive the various kinds of disruption. Especially for places where you may have a customer.

It's impossible to anticipate every threat that could jeopardize a data center, but organizations can and should plan for emergencies. A robust business continuity and disaster recovery plan eliminates one common cause of data center downtime: human error. A well-curated checklist reduces the risk of mistakes and oversights in the heat of the moment and ensures an organization is prepared for any eventuality.



The following are a few suggestions specific to the data center.

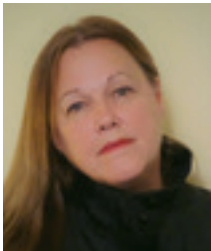
1. **Risk Assessment:** This should be the first step for any organization in developing a disaster recovery plan. What types of threats are relevant to your area? Hurricanes, flooding, tornadoes, fires, earthquakes, volcanoes are examples of natural disasters that require planning, but are any of your facilities located near areas where radiation exposure, toxic waste or explosives are a consideration? A good data center services provider can help with the assessment and the ensuing emergency plan.
2. **Evacuation Plan:** Human safety always comes first, so you should have a plan to evacuate any personnel potentially at risk. This should include a detailed plan for communication with staff to confirm their safety.
3. **Check the Generator:** There is a tendency to set and forget a generator, but that piece of machinery requires maintenance and upkeep to ensure it performs as expected when needed. Is it full of clean fuel? Are the fuel line and air filter free of contaminants? Test the generator regularly and ahead of any anticipated weather events. Line up at least three vendors to deliver fuel in the event of an extended outage. Remember, fuel often is at a premium after a disaster, and yours will not be the only organization requiring delivery.
4. **Communicate with Utilities:** Consider the ramifications of loss of power, water, phone or internet. Communicate early with utility providers to set up contingency plans. Create a contact list and have a plan for communicating if traditional channels are compromised.
5. **Weatherproof the Data Center:** If the threat is a hurricane or flooding or something weather-related, take the necessary steps to harden your facility. Secure or store loose items and make sure servers are secured in their racks. Check gutters and storm drains to make sure they're clear. Make sure doors can be sealed against high winds and blowing rain. Water is the enemy of the data center, so do everything necessary to ensure no water enters the server rooms.
6. **Backup Data:** Many data centers conduct routine data backups once a week. If you know severe weather is coming, increase the frequency of those backups. We can't always know when a disaster is going to strike, so organizations should consider making daily backups a regular practice. Consider where data is being backed up. It should go offsite, but make sure the offsite location is secure and safe from potential disaster.
7. **Emergency Staffing:** In the event of a significant disaster, local employees may be unavailable to work. They may have evacuated with their families, be dealing with urgent damages to their homes or vehicles or be unable to reach the data center due to impassable roads. Consider bringing in emergency crews and establishing crisis housing near the data center to ensure you have on-site personnel.
8. **Contact Vendors:** Establish a list of vendors and prioritize those requiring communication in the event of an emergency. Reach out to them early and make the necessary arrangements so you can be free to focus on more immediate needs during the crisis.
9. **Trust Your Team:** Bring together all parties – IT, Facilities, Security, HR, Communications, Legal, Logistics, Information Security, as well as Business Continuity – and make sure everyone understands their responsibilities throughout the crisis. Have a plan for communicating with that team in the event regular communications are down. Consider that the more your teams can do to generate a sense of calm and well-managed order, the more this will help customers and business partners to weather this virtual storm and be grateful for the cooler heads that prevailed on their behalf.



10. **Confirm Insurance Coverage:** This starts with insurance on the facility itself, but additional coverage may be warranted on the infrastructure or for continuity of business. If the data center is down for a week, continuity of business insurance can compensate the organization for lost revenue.
11. **Remember the Edge:** Today, the enterprise data center is just one piece in a distributed network. Many organizations manage multiple edge sites, those sites are more critical than ever before, and they must be considered in disaster planning. In many cases, the core data center may be safe from a specific event, but one or more edge sites could be at risk. Prioritize by criticality and have a plan for those facilities and the personnel at those sites.
12. **Mind the Cloud:** Just because some of your data and applications are housed in the cloud does not mean they are always safe from emergency events. Those cloud servers are in a data center somewhere, and you should know how your cloud provider will handle a potential disaster. How often are they backing up data? Do they have redundant sites? Ask these questions before a crisis, because once disaster strikes, it's too late.
13. **Consider the Opportunists:** Hackers see natural disasters or similar emergency events as an opportunity to access networks while attention is focused elsewhere. Make sure your information security and physical security teams are prepared for bad actors.

Don't forget that teams facing these tricky situations in developing countries must develop contingency plans as unique as their locale. In some parts of the world, the electric grid is under the control of the government. As civil unrest increases, these basic elements of the modern economy can be revoked suddenly, leaving businesses to find alternate means of power and staffing.

Finally, keep in mind that an emergency preparedness plan is a living document, one that you should be prepared to alter as new information comes to light or as circumstances change. It is a guide for ongoing planning, exercises, and updates. Circumstances and personnel change, equipment ages and is refreshed, replaced or added, and risks evolve over time. Work across your organization and with your data center service provider to ensure your plan is up to date and the relevant personnel are prepared for the worst.



ABOUT THE AUTHOR:

As global business continuity and disaster recovery manager for Vertiv, **Kate Fulkert** is responsible for developing strategies and solutions to minimize business disruptions related to crises or disasters experienced around the globe. Fulkert joined Vertiv in 2018, bringing with her more than 19 years of experience in business continuity, disaster recovery and crisis management. She holds a master's degree in emergency and disaster management from Georgetown University and is a Master Business Continuity Professional (MBCP), which is the highest level of certification offered from DRI International. Fulkert also holds a crisis management certification from the Massachusetts Institute of Technology and has completed Certified Information Systems Security Professional (CISSP) training.

CONNECTED HOME TECHNOLOGY LEVELS THE PLAYING FIELD IN ENERGY MANAGEMENT





JULIET SHAVIT

There have been a number of smart home pilots in the United States that explore different technologies and use cases. A common and obvious theme among them is the impact of these devices on energy efficiency. For utilities, this is, of course, the obvious bottom line.

This benchmark has safely steered energy efficiency investments for decades and continues to be the key driver for utility smart technology programs (e.g., smart thermostats).



SmartMark Communications is working with BGE and the City of Annapolis on the Connected Home and Small Business Demonstration, which offers low income customers smart home devices to lower energy use and evaluate the benefits to quality of life.



Yet, the current Department of Energy, under the direction of the Biden Administration, has been tasked with building a roadmap for energy equity, arguably shifting the industry conversation from energy reduction to equitable access to affordable energy solutions. As utilities move steadily down the path of designing and implementing dynamic pricing and Time of Use programs, now most noticeable in the State of California, the current model is likely to benefit wealthier individuals with access to smart devices and appliances. Higher-end refrigerators and washer dryers are decked out with mobile applications and energy efficiency settings. Considered luxury items, these smart appliances are noticeably expensive. The likelihood of low-income customers selecting these things for their homes is zero. Their purchases will always be governed by cost, and that unfortunately can dictate less efficient products.

Thanks to Energy Star rebates and discounts, low-income customers have more access to energy-efficient appliances than ever before. Yet, despite that, research suggests that low-income customers are more likely to hold onto older, less efficient appliances. If you add in the economic pressures caused by the pandemic, then the likelihood of replacing appliances in the home now becomes even less probable.

That means that approaching smart and connected devices for kWh reduction is not enough, and, with the onset of time-based pricing, a perfect storm is brewing.

Energy Star appliances will not save customers significant dollars when they run during peak periods in dynamic pricing environments. Similarly, low-income customers are not likely to succeed in incentive-designed programs that encourage reduction during peak hours. That means that in the current world of energy efficiency program design, the cards are stacked against the people with the most to lose. That is a dangerous concept.

The time has come for the conversation to shift from energy efficiency to “leveling the playing field”. While smart refrigerators and washer dryers are expensive, a \$10 smart plug is not. In fact, it is likely to cost less than recruitment and marketing costs for average energy efficiency programs. If utilities provided low-income customers with tools to succeed on these programs rather than just a direct mail piece, they would be creating a sustainable path for successful energy efficiency that aligned with their strategies. It is even more cost-effective economically for utilities to provide tools for success than offer bill protection in many cases.



The likelihood of low-income customers selecting these things for their homes is zero. Their purchases will always be governed by cost, and that unfortunately can dictate less efficient products.



Today’s regulators, policymakers and advocates must be aware of the role “technology access” plays in energy equity. It is the most obvious and overlooked opportunity for utilities as they seek to address issues of equality. A close friend of mine who works for a low-income advocacy group warned me that it is a myth that low-income customers do not have access to mobile phones or know how to use technology the same way as their wealthier peers. In a survey conducted by Pew Research, teenagers who came from homes, where income was less than \$30,000 annually, were less likely to have access to a desktop or PC (75%) but were likely to have a smartphone (93%).

A smartphone and a smart plug are all you need to reduce energy use during peak hours if you are away from home. When you couple technology with education, there is nothing more powerful in the roadmap to energy efficiency and energy equity. It is the most obvious and most overlooked path forward for sustainable and equitable energy management in the industry.

ABOUT THE AUTHOR:

Juliet Shavit is the president and CEO of SmartMark Communications, LLC a global leader in strategic communications and customer experience. For more than two decades, she has been at the forefront of conversation around technology innovation and the impact of those decisions on industry transformation.

Shavit has been widely recognized for her contributions to the energy industry. She was instrumental in founding the DOE smart grid customer education working group and is the founder of the Smart Grid Customer Education Symposium. Today, she works with utilities to optimize their AMI investments and build customer centric programs around technology adoption.

MOBILIZING THE MODERN WORKFORCE

HOW UTILITIES CAN EMPOWER THEIR
WORKERS THROUGH TECHNOLOGY





JOE BOYLE

The transmission and distribution of electricity grows more complex with each passing year, but the effects of COVID-19 proved especially challenging. Within weeks of the start of the pandemic, as many workers shifted to remote working and others simply sheltered in their homes, average home electrical use in the U.S. increased more than 22% over the previous year's levels, driven by a 35% increase in mid-day demand, according to Sense home data.

Electrical utilities have had to adjust to changing usage patterns and heightened residential demand while dealing with their COVID-related safety and staffing challenges. Aside from the pandemic and the regular workload of responding to accidents and outages, it seems that providers today deal with ever more frequent natural disasters, from raging fires to hurricanes and uncharacteristically severe winter storms that strain circuits, whip transmission wires, or weigh them down under heavy layers of ice. Add in the increasing sophistication required to manage distributed generation and maintain service while integrating diverse, often sporadic input from renewable sources, and the need to draw maximum efficiency and productivity from each worker has never been higher.

These factors beg the question: How can operators empower their workforce to not only meet these escalating challenges as they're moving from job to job, but also drive efficiency and productivity that deliver positive business outcomes? →

Empowering the dynamic workforce

Utility providers are realizing that empowering employees with mobile technology is a key to achieving greater performance, much like their counterparts in other essential industries that rely heavily on frontline workers. As control room operators, field engineers, linemen and other specialists execute a multitude of critical services and repairs, they rely on mobile devices to stay updated on work orders, report progress on tasks and provide field documentation, all while moving throughout and in between job sites.

In a national workforce survey conducted by a mobile device management software company in January 2021, employees across categories surveyed (essential, deskless, remote and office-based) said they believe mobility plays an increasingly important role in enabling them to do their jobs. With the majority having said they believe mobile phones or tablets play a key role in helping them be productive at work, respondents also noted they're using their devices more heavily while on the job than they were a year ago. Over a third (about 36%) said their mobile device usage at work had increased more or significantly more than it was a year earlier. Only about 7% said it had decreased significantly.

The study also looked at how working hours have evolved over the past year and found the pandemic has ushered in heavier workloads. Over 40% of survey respondents said

they are working more than they were a year ago. Coupled with working longer hours and increased use of mobile while at work, it should come as no surprise that most people surveyed noted they believe the lines between work and personal life are being blurred. Forty-six percent acknowledged this to be the case, with 23% stating they wish they could find a better balance.

As those blurred lines claim more of a worker's time, both on the job site, and often, at home or elsewhere, mobile technology has become an increasingly essential means of taking care of personal business throughout the day. During an authorized break from their work duties, for example, an employee with a smartphone may pay their water bill online, order their family's groceries for delivery, confirm that their child has arrived home from school safely, or catch up on personal emails, all without leaving the workplace. Back on the clock, the same employee may use that same device to call up reference maps or confirm the status of a restored electrical circuit.

At the same time, few industries rival utility operations for the number and frequency of safety risks that their workers must mitigate daily. Enabling frontline workers to access the full range of applications and resources they need via a smartphone or tablet is a powerful advantage that can help them to address dangerous situations safely. If not properly managed, however, the same volume of mobile input can vie for a worker's attention when absolute concentration is required.



Maximizing mobility

Many organizations struggle with what they view as potentially conflicting goals of embracing mobile devices at work and maintaining safety. Some employers may regulate mobility in the workplace through overarching policies designed to restrict usage. Others may try to provide company-issued, single-use devices in the hopes of providing mobile tools while prohibiting the use of personal technology. Both approaches suffer from inherent difficulties that limit their success.

These stances have become even less tenable since consumers have taken the lead in driving IT innovation in the enterprise. Today's worker expects the devices they use on the job to provide the same functionality as their personal phones and other devices. However, corporate-issued equipment often does not perform at the same level as the device a user has personally selected and outfitted with the applications they deem most useful.

Prohibitive usage policies not only preclude the performance advantages that mobile devices can offer to the organization, but are also out of step with a modern workforce that has come to view personal technology as an essential right and a key to productivity. In the same national survey mentioned earlier, nearly 62% of respondents said they agree mobile phones or tablets play a key role in helping them be productive at work. Significantly, 56% of those polled in the survey said yes, they believe it is their right to use their mobile device during work hours. That majority holds the ability to use their phone on the job to be an inherent right rather than a workplace amenity.

Prohibitions also run counter to the advancement of increasingly mobile business practices. A steady stream of new processes and applications are emerging to serve the mobile workforce and are transforming the way jobs get done. And the revolution is far from over. The mobile worker population, already 78.5 million strong in 2020, is projected to grow to 95.5 million in 2024 when it will account for 60% of U.S. workers, according to IDC projections.

To succeed and remain competitive, utility enterprises must find ways to empower this growing portion of the workforce to safely perform at maximum productivity and efficiency. Rather than withhold access, businesses must recognize that tablets and mobile phones are productivity platforms that support efficient operations and smarter work throughout the organization. They connect workers in the field with access to the same resources available in an office, making them a powerful means of doing flexible work without compromising worker safety or business security when managed properly. →





Mobile workers need and expect to have access to the tools and functionality they wield in their personal lives. That is why features such as video chat and mobile credit card processing are replacing legacy workflows. Progressive businesses are adapting processes for mobile compatibility because the benefits of today's advanced mobile capabilities far exceed the difficulties of incorporating their use. To limit employees' mobile device functionality and access is to constrain their ability to meet the challenges of performing their jobs. For example, one utility employer might view mobile devices on a worksite as a safety risk – moving from job site to job site, distracted drivers can cause potentially fatal accidents. However, that same driver needs to be able to access directions and work orders to fulfill the job they've been scheduled to do. That's why mobility should fundamentally be viewed and deployed contextually. That way, a worker isn't hindered by a lack of technology and information, but also isn't a danger to themselves and others.

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To limit employees' mobile device functionality and access is to constrain their ability to meet the challenges of performing their jobs.

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The question of whether it is a utility employee's right to mobility on the job depends on their organization's mobile device policy, regardless of if it's via a personal phone or tablet or a company device. But if that employer chooses to maximize mobility for its workforce, there is a safe way to keep devices in the hands of employees while also enforcing appropriate use.

A new model

Employers in the demanding field of electrical utilities need a better alternative to failed traditional approaches if they are to fully unlock the full benefits that mobile technology can bring to their workforce. Previously, employers might have worked with a paper-based system or enforced a mobile device policy that was completely cut off from the internet or banned any apps that were deemed personal. However, this establishes a lack of trust between employer and employee and ultimately creates more risks as workers work around technology instead of with it. These providers need a reliable system that will ensure workers are using their devices correctly and contextually to not only remain productive, but safe as well. This connotes managing device functionality based on a worker's environment, from where they are and what they are doing, to the equipment they are using or working near, proximity to vehicular traffic when servicing transmission lines, or other conditions that influence the risk of their work.

The ideal device management strategy will provide access to exactly the right applications and functions at the right time, in the right place, to the right user. In practice, the way to put this degree of contextual access into practice, consistently, is with a technology platform. This gives an employer the ability to apply situational awareness to mobility usage by each employee by taking into account who is using the device, where, when and how. That contextualization is what we refer to as the human aspect of mobility, and as a worker's environment changes throughout a shift, so too do their device permissions – automatically and in real-time.

In designing or selecting a platform, flexibility or dynamic responsiveness is an essential attribute. Workforce mobility is more effective when the acceptable use of a device and allowed contexts match the employee's evolving situation throughout their day. And in addition to meeting the employee's nuanced mobile computing needs and privacy, the management platform must equally address and protect the company's network and data. Permissions must adjust dynamically to provide the functionality and flexibility workers need to do their jobs.

Situationally managed mobility

How will mobile devices ultimately serve workers and their employers? And how will business best practices and processes change to make the most of mobile technologies? We are only scratching the surface in these areas. Without a doubt, mobile devices will continue to push the enterprise forward in delivering a new model for the modern workforce, and that evolution has already advanced considerably. Utility providers cannot afford to ignore the opportunities that mobile technology has to offer or swim against the strengthening tide by denying their employees access to these advantages that have cemented their place in the daily life experience.

Electrical utilities will only bring advanced workforce mobility to life when they acknowledge that workers are dynamic rather than static, and then adapt their mobile device policies to uphold that principle. More and more organizations that choose to follow this path are adopting systems to manage mobile devices situationally, thinking about how mobility is used in the workplace and then handling those devices dynamically to provide access to exactly the right applications and functions for the task at hand. When a worker's environment changes, so does what they can do on their mobile device.

This enlightened approach gives employers the improved ability to manage not just what's being used and by whom, but also where and how, while still maintaining complete respect for employee privacy. This makes it easy to transform how mobile devices are used by the workforce and to do so in a way that increases productivity, rather than inhibits it.

ABOUT THE AUTHOR:

For more than 20 years, Joe Boyle has led high-performance teams in technology companies, creating a proven track record of success in both SaaS and software business models. Over the course of his career, Boyle has achieved successful outcomes in leading integration activities for these companies. As chief executive officer at TRUCE Software, Boyle brings a passion for enhancing companies' safety standards and improving their overall productivity through contextual mobile device management.

YOUR NEW LIGHT
SWITCH MIGHT
BE THE BEST GIFT
YOU GIVE YOUR
NEIGHBOR





DAVID O'REILLY

Smart technology is at the forefront of everything we do. From newly expanded curbside pickup facilitated by online grocery shopping, to virtual visits to the doctor, smart technology touches nearly every facet of our lives.

For some, smart technology can be distracting and even stressful to use. The introduction of new technology to the market often comes with a learning curve. But for others, smart technology can make their lives easier, by offering ease, simplicity and streamlined processes.

As more smart tech enters the consumer market, the decision of how individuals and/or businesses prioritize which technologies to adopt can be overwhelming. But choosing the right device doesn't have to be complicated – in fact, incorporating it into your daily life can boast significant advantages.

Canadians are increasingly adopting smart technologies, as a means to pursue more sustainable and efficient lifestyles. As economies reopen and vaccination rates rise, there is no better time to pursue smart technologies for this purpose. →



‘Smart’ technology – What is it and where does it apply?

We’ve all heard of smart technology, but what does it really mean? In layman’s terms, smart technology is defined as an interaction between the customer and the product. It goes beyond the basic traditional communication between a person and a thing, such as the physical flipping of a light switch. Instead, it offers greater interaction and control and aims to make contact easier by removing an additional step.

Smart technology comes in many shapes and sizes and can be categorized under a variety of umbrellas. Home technology, personal technology, entertainment, fitness and sustainability are just the tip of a very big (and very automated) iceberg.

Just how popular is smart tech? Fourteen percent of Canadians own at least one smart home device –and this trend is growing, especially as more people practice efficient ways to conserve energy and time. However, the initial barriers to entry with smart technology can be difficult to overcome. Not only is there typically a steep upfront cost, but when faced with the onslaught of home and personal tech options in the market, it can be difficult to narrow down your choice.

While the percentage of Canadians who own at least one piece of smart technology is small by comparison, of those who have purchased, 78% say they plan to purchase more smart technology within the next year. The most purchased smart technologies by Canadians include personal assistants, smart appliances, lighting control and security technologies. What’s stopping the other portion of Canadians from hopping on the connectivity bandwagon? Concerns of cybersecurity, price and the notion they simply don’t need it, remain at the forefront.

As more products become available at more affordable prices, early-adopting generations continue to enter the workforce, and smart tech becomes the norm in our everyday lives, it’s easy to predict that the percentage of Canadians who own smart tech devices will increase.

As Millennials and Generation Z gain expendable income and prioritize smart tech purchases, there will be a significant shift in market demand. Consumers are not just looking for smart tech that will make their lives easier, they’re looking for technology that looks as good as it performs and delivers on their investment.

Sustainability and smart technology

Smart tech can now help us achieve a more sustainable life at home – whether it's upgrading existing facilities, building a new, connected home from the ground up, or simply incorporating small efforts to be more environmentally conscious in your daily life. Smart home technology can make it easy to reduce your carbon footprint. Recently, Canadians have begun to embrace smart home lighting such as lightbulbs, smart plugs, light switches and other electrical automation – this ensures your devices are only on when you need or want them to be.

Smart home technology plays a major role in sustainability, allowing for technologies and innovations that would otherwise not be possible. Available smart technologies for 'greenifying' your home include smart thermostats for precise and timed temperature control, power-saving and smart-controlled lighting, window treatments and water irrigation systems.

In addition to energy maximizing solutions like ensuring proper insulation and upgrading your doors and windows, technology-forward actions can be taken to monitor and manage how and when energy is used in your home. Monitoring your own energy reduction is easy, actionable and accessible on your monthly billing – installing new outfits and smart tech will lead to immediate results and cost savings.

Installing smart or connected breakers and upgrading the electrical paneling in your home is an effective solution that works hard behind the scenes. Available technologies enable clean wiring with faster installation and increased connectivity. While implementing these connected solutions are often easy steps to incorporate within existing home automation systems, many consumers overlook them when it comes to energy savings.

Installing an energy management system to provide a complete picture into your home's energy usage is an easy and effective first step to reducing your energy consumption and becoming more conscious of your actions. Smart home systems applications are an integral part of any smart home and drive the level of visibility and control needed to keep tabs on your home by notifying you when devices are on or off and monitoring home energy usage in real-time, for a safer and more efficient home.

These solutions help homeowners see significant savings in energy consumption in their homes, helping them do their part to make Canada and the world a better place, as we work towards achieving our net zero goals.

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With more information and technologies
available than ever before, the options and
unique personalization available to consumers
mean some solutions fit every need,
every budget and every home.
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Smart, sustainable technology and Canadians

When looking at the broader conversation surrounding sustainability, the onus often falls on emerging technologies, such as wind and solar, to help reduce our carbon emissions. While these technologies play an important role in the race to climate action, there are other, more immediate and available actions and initiatives related to our current energy consumption we can take.

Many people focus on the generation side of power as the solution to this growing issue, but it will take large actions, along with millions of small steps, to reduce our carbon emissions. The “greenification” of our homes is one way that each of us can contribute.

Canadians should consider the choices available to them and invest their time and money into smart technologies to make their homes more sustainable. With more information and technologies available than ever before, the options and unique personalization available to consumers mean some solutions fit every need, every budget and every home. Simply put, there's no time like the present.

Most homeowners are led to believe that cost is the biggest impediment to “greenifying” our homes and making them more efficient. However, through current government incentive programs like the Canada Greener Homes Grant program, which provides up to \$5,000 in incentives for homeowners to make their homes more efficient, there has never been a better time to take on this project.

When faced with subsidies and grants, as well as an endless catalog of sustainable options, the real question is why shouldn't Canadians take the plunge and upgrade? →



Future implications

Thinking of the future, especially after an unpredictable 18 months, can be difficult. Yet Canadian communities will need to become increasingly adaptive as we prepare for the climate crisis and consider how to turn the ship around. More sustainable action means better communities, better air, better drinking water and a better future for generations to come.

By monitoring our personal energy consumption and reducing the amount of energy we use in our homes, we can all make a significant impact. If we consume less now, the need to generate more power will go down.

But we all know that carbon targets will never be met with more efficient power generation solutions alone. With macro-economic drivers in our society like (1) increased urbanization and population growth, (2) manufacturing growth in developing countries, and (3) increased global demand for technology, data centers are under significant demand. We will need to be 2.5 times as efficient in our energy consumption just to hit current carbon targets, let alone stretch targets for reduction.

Essentially, all the efforts in the world mean nothing if we, the consumers, don't mitigate our consumption and become more conscious of our impact. The implications of climate change don't discriminate and if communities don't rally now to warrant the healthy future of one another, other efforts may not be enough.

One simple, actionable step forward is to reduce our home energy consumption and in doing so, we can help contribute to better and more efficient communities for today and tomorrow.

Rally your grant application skills, browse the Internet for available smart home technology options and prepare to make an impact. Your community will thank you.

ABOUT THE AUTHOR:

David O'Reilly is vice president of the Home & Distribution and Secure Power divisions at Schneider Electric Canada. O'Reilly joined Schneider Electric in April 2017. Prior to joining Schneider, O'Reilly held a variety of senior roles at organizations over his 25-year career, including roles at Telus, The Williams Group, Deloitte & Touche, Bell Canada and Netscape Communications. O'Reilly is a graduate of Wilfrid Laurier University.

FROM THE BIG SHORT TO THE BIG FREEZE: UNDIFFERENTIATED DATA WOES





SIDDHARTHA SACHDEVA

Undifferentiated data fueled the mortgage crisis. Now it's exacerbating Texas's energy woes.

The subprime mortgage crisis of 2007-2010 was, in large part, a failure of data analysis. By bundling subprime mortgage customers with different credit profiles together and monetizing their debts in bulk through mortgage-backed securities, banks and other financial players obscured homeowners' wildly differing risk profiles. The result: buyers of these securities did not fully understand the risk they were taking on until non-payment started and everything bloomed into a full-blown global economic crisis.

Earlier this year in Texas, we saw a similar crisis unfold — not in the real estate markets, but in the energy sector. The blackouts that rocked Texas are the result of unexpectedly cold weather, of course. While a lot of scrutiny was placed on the generation outage, on a deeper level, just like the mortgage crisis, this is the result of using undifferentiated data to guide decision-making. And these problems aren't unique to cold weather. As we saw this past summer, warnings on AC usage to curb electricity consumption in the warmer months too, also showcase the issue as much greater than just a snap of cold weather. Without efficient demand analysis, we can't price energy effectively. We also can't send the right signals to energy producers and ERCOT to articulate current and anticipated future energy needs. And we can't send the right signals to customers about how they should manage their energy usage during periods of high demand and systemic stress. →

Let me explain. As things stand, many energy providers today are “bundling” customers with different demand profiles to come up with load forecasts. In other words, energy consumption forecasts are based on average energy usage by average consumers. Often this works, more or less. But when you encounter unexpected events — such as a sudden plunge into Arctic temperatures — those averages aren’t as much use. Not only this, but compounding issues, like increased electrification, climate change and population growth, show that the industry has turned a blind eye to these issues for years.

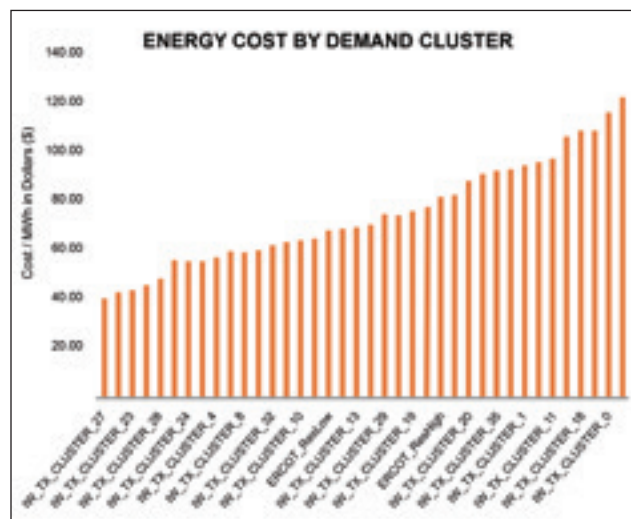


Figure 1: The above costs are derived from trailing 3-year spot market prices

To cope with tumultuous times, energy providers need to use granular data, based not on broad historical averages but rather on bottom-up insights from smart meters and other localized data sources, such as weather and socio-economic trends. Only by understanding how different kinds of customers use energy, and how that varies according to factors such as weather or time of day, can we hope to develop rigorous, effective systems for energy management and eventually energy transition.

To put this concept in context, Texas energy providers typically bucket residential customers into two broad groups: electric heat and non-electric heat (highlighted in blue in the graph – **Figure 1**). Look closer, though, and it becomes apparent that there are actually at least 36 groups of different residential demand profiles present in this market.

If you’re looking at only the electric heat and non-electric heat profiles, then the price separation between the two doesn’t seem that wide — just a 19% difference between the two groups. When you look at the full spectrum of 36 groups, though, we can see that in reality, the price spread is 107%. So, what’s the impact of these two approaches? Well, if you’re only grouping your customers into two buckets, you’ll wind up with a significant number of customers being under-priced by an average of 36%. In these cases, energy providers are not including enough risk premium, and are relying too much on ERCOT spot markets. This can lead to huge collateral calls, which ultimately result in sudden bill increases for customers and default for energy providers.



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If we don't understand demand drivers at the level of individual customers, we'll never
be able to cope with disruptions like the extreme weather that impacts Texas.”
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At the other end of the spectrum, some customer groups are overpriced by an average of 46%. When that happens, energy providers will lose these customers to smarter energy providers that have differentiated and customized pricing. That, in turn, skews the energy provider's portfolio, since they'll be left with a higher proportion of high cost-to-serve customers.

This is a simple example, but the reality is that a lack of granular data affects all aspects of energy generation and distribution. Without efficient demand analysis, we can't price energy effectively. We also can't send the right signals to energy producers and ERCOT to articulate current and anticipated future energy needs. And we can't send the right signals to customers about how they should manage their energy usage during periods of high demand and systemic stress.

If we don't understand demand drivers at the level of individual customers, we'll never be able to cope with disruptions like the extreme weather that impacts Texas. A granular understanding of customer needs can help you understand how demand patterns will change in unusual circumstances — but if you simply lump everyone together, you'll be subject to unexpected shocks and spikes, with disastrous results. Of course, the blackouts that have rocked Texas aren't solely due to poor data practices. It took a succession of errors — including subpar weatherization, incorrect pricing plans, lack of customer communication, poor maintenance and bad planning — to create the perfect storm. But better data and more granular insights into energy demand patterns will make it far easier to make the right infrastructure and maintenance investments, smooth out energy-demand peaks and make better decisions.

This isn't the first time the U.S. has faced blackouts and failures of energy infrastructure. With the world warming and extreme weather growing more common, it certainly won't be the last. Winter is again fast approaching, and we need to get to work now to build more resilient and sustainable energy systems — and that means not just tougher pipes and turbines, but also better data intelligence and analytics to help us make smarter decisions in a turbulent and rapidly changing world.

The 2008 financial crisis taught us a hard lesson about the need for granular, well-differentiated data. It's time for us to apply those lessons to the energy sector, and ensure we have the tools and data we need to effectively serve consumers.

ABOUT THE AUTHOR:

Siddhartha Sachdeva serves as the co-founder and CEO of Innowatts. Prior to founding the company in 2013, Sachdeva served as the senior director of innovation and technology at NRG Energy. Sachdeva has approximately 20 years of experience in the retail energy and power markets. At Innowatts, he oversees the overall vision and growth and also sits on the company's board of directors. Sachdeva has a degree in electrical engineering and a master's degree in business economics.

OT REMOTE OPERATIONS INTRODUCE
NEW RISKS TO TODAY'S UTILITIES:

HOW TO SECURE CRITICAL SYSTEMS FOR A HYBRID WORKFORCE



BILL MOORE

The recent pandemic radically reoriented public utilities as they empowered remote and hybrid teams to maintain operational continuity in any environment. Moving forward, it's clear that hybrid teams composed of remote and on-site employees will become more common among utilities. While this presents unique opportunities to curb expenses while boosting certain capabilities, it also presents novel cybersecurity challenges that utilities can't ignore.

Most importantly, according to a survey of 1,726 utility professionals, cybersecurity challenges are amplified as utilities connect OT assets to existing IT systems. In other words, engaging and operating infrastructure using OT resources empowers teams to work effectively from anywhere in the world. However, when not adequately protected, these systems create cybersecurity vulnerabilities that put people, profit and critical resources at great risk. In response, utilities need to secure their OT remote operations with solutions that combine resiliency, security and affordability. →



1. Resiliency in any environment

A utility's IT network is multifaceted, connecting billing departments, accounting professionals and human resources personnel. These data-heavy digital assets require IT and cybersecurity teams to direct their efforts accordingly, working with hyper-focused precision to secure company and customer data. Meanwhile, OT networks are comprised of physical control systems, where downtime can put public safety at risk or create ripple effects through the wider economy.

Increasing automation and the proliferation of Industrial Internet of Things (IIoT) technology have created interdependencies between critical IT systems and OT networks. Failure to secure these networks effectively can have significant consequences for companies and their customers. Most recently, a cyber attack on Colonial Pipeline, an essential utility providing 45% of the East Coast's fuel, cost the company more than \$4 million and resulted in long-lines and panic buying at local gas stations. Although the ransomware attack impacted the company's IT assets, it was forced to halt operations because of ineffective segmentation and cybersecurity controls.

To empower hybrid teams with OT operational capacity without undermining cybersecurity, utilities can develop resilience by pursuing usability and cybersecurity in tandem and without compromise.

2. OT-centered cybersecurity

Securing remote OT access requires a zero-trust framework that mitigates risk without significantly undermining usability. Critical zero-trust elements include:

- Multi-factor authentication
- Protocol isolation
- Mediated secure file transfer
- User-to-asset connection monitoring
- Full user access logging and recording.

Utilities relying on these components reduce their exposure to evolving cybersecurity incidents, ensuring better service availability and allowing utilities to operate confidently in an expansive threat landscape.

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**Failure to secure these networks effectively
can have significant consequences for companies
and their customers.**

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3. Affordability & effectiveness

After a pandemic year, wrought with many forms of disruption and economic uncertainty, many utilities are operating with limited financial resources to devote to a hybrid work transition and the accompanying cybersecurity concerns. To compensate, some utilities are utilizing remote access tools without proper network segmentation and cyber protection. These tools also do not meet industry compliance requirements.

Fortunately, investing in a zero-trust framework doesn't require leaders to ignore their financial reality. Rather, as a Forrester Research report notes, "IT and business leaders likely have heard myths that a zero trust architecture is too costly or complex. In reality, organizations can implement many zero trust strategies with current technology and updated policies and standards."

At the same time, companies are bringing cybersecurity resources to market that can enhance OT operational capacity, giving utilities options when it comes to securing off-site OT access.

The recent pandemic ushered in a new era for utilities, making them more nimble, agile and better prepared for the future. This path isn't paved without obstacles. It comes with novel cybersecurity risks that utilities can start addressing today.

ABOUT THE AUTHOR:

Bill Moore is the CEO and founder, XONA, providers of a unique "zero trust" user access platform especially tailored for remote Operational Technology (OT) sites. Moore is currently working with global power generation and distribution customers to reduce their remote operations costs and cyber risks. He brings more than 20 years of experience in security and the high-tech industry, including positions in sales, marketing, engineering and operations.



NOOSHIN BEHORYAN

PAXON ENGINEERING & INFRASTRUCTURE



BY ELISABETH MONAGHAN

One of the reasons we launched our Powerful Forces column was to shed light on the fact that even though the electric power industry is dominated by men, there are plenty of female executives who have the education, intelligence and professional experience necessary to participate in propelling our industry forward.

Nooshin Behroyan is no exception. After graduating from high school a year early, Behroyan went directly to college, where she earned a bachelor's degree in architecture. Working for an architectural firm, Behroyan designed mixed-use high-rises sites in California, India and the Philippines, as well as major cities around the globe. While visiting a site at one of those locations, she disagreed with the structural engineer on the job, but without an engineering degree or experience, she didn't have the credibility to override him.

So, Behroyan returned to school to pursue her Master of Science in civil and environmental engineering. For her thesis, she conducted research with the California Department of Oil and Gas, which opened the door to her career in natural gas projects. It was around that period when a natural gas pipeline in San Bruno, CA exploded. Behroyan was one of the project managers consulting for PG&E with the pipeline safety enhancement program to ensure proper testing, audit and compliance of other gas pipelines in Northern California, including the infrastructure rebuild of San Bruno. With that, Behroyan's career on the utility side of the power industry was born.

In 2016, Behroyan founded Paxon Engineering and Infrastructure, a consulting management firm focused on improving critical infrastructure in the oil, gas and utility industries. Four years later, Paxon was ranked 9th on the Inc. 5000 list of fastest-growing companies. With a staff of nearly 200 and dozens of contractors across the U.S., Paxon works with its clients from a program's initiation throughout its lifecycle, with services that include strategic planning and program management, compliance, quality management assurance and safety services for the electric utility field workers and natural gas pipeline operators.

One of the core issues that inspired Behroyan to create Paxon is the relationship between climate change and infrastructure. Earlier in her engineering career, Behroyan recognized there wasn't much being done on the natural gas side to reduce the effects of climate change. This prompted her to meet with utility executives, where she told them, "Look, you are not tracking your natural gas release into the atmosphere during the pipeline maintenance projects or anytime there is a leak on transmission or distribution."

In keeping with Behroyan's desire to mitigate climate change, Paxon was able to raise \$34m in the project budget to establish a leaks management program and began using zero-emission vacuum and compression equipment that moves gas out of the pipeline being depressurized into another section of the pipeline system.

Behroyan considers climate change to be just one factor in what she refers to as "the related risk of everything." As she explains, "It's really about looking at infrastructure in general. We need to think about how we are making key decisions about planning and building an infrastructure that is not just looking out 10 years ahead, but 50 or 100 years ahead. We need to consider how this infrastructure will affect our climate now and in the future."

On the services side of Paxon, Behroyan is excited about the work the research and development department is doing with microgrids. Currently, the R&D team is examining how to establish a critical infrastructure that will allow Paxon's utility clients to better themselves, such as implementing technology that limits the intensity and effects of power outages. The way Behroyan envisions it is if the grid is divided up appropriately, with proper automation and microgrid establishment, a public safety power shutoff doesn't have to take out a whole county, but instead, only take out the area considered high-risk.

The fact that she has made remarkable inroads in a male-dominated industry, speaks volumes about Behroyan's intelligence, vision and business acumen, but her ability to address situations from both analytical and abstract approaches factor significantly into her success.

"I do well in an abstract environment," says Behroyan. "I was trained as a classical pianist. Then, when I moved to the U.S. from Iran, I learned jazz. When you play jazz, you have to recreate the music. You may be playing the same melody, but you're always recreating, and no two pieces are the same."

Throughout her career, Behroyan has applied a similar blend of analytical and creative approaches to her work. "When you're developing architecture, you're creating," she says. "You're creating space that is ergonomically friendly because when people feel comfortable, there's a sense of trust in that space. I've always contemplated things like 'how do you make a space smart so that it generates its own energy?' so when you combine all of that analysis and expertise and bring them into an organization like Paxon, you are now looking at infrastructure with a mindset that asks, 'How is it serving the people? How will it sit in the planet, how might it scar the planet, and how can you minimize that damage?'"

Behroyan understands that many may believe infrastructure is all about analytics and numbers, but she believes that when done properly, and if it includes plans for upgrades and retrofitting, infrastructure is more of an abstract concept, in that you have to think many years ahead to be able to create an infrastructure that will continue to serve its customers. She also views proper retrofitting of existing infrastructure for the future of carbon reduction to be one of the greatest challenges the power industry faces right now. "Yes, we need alternative fuels," says Behroyan, "but all of those new fuels require new infrastructure. So much money has gone into building the infrastructure, so the challenge for the industry is not just saying no to natural gas and using only electricity or other renewable energy. Instead, we have to take a middle path and look at how we can leverage our existing infrastructure."

Behroyan draws upon both her analytical and creative sides when describing the role she and her fellow engineers will play in the future of infrastructure. "When I talk about the need to plan ahead. I'm not just talking about a few years from now, but centuries from now. We need to plan that far because it is our job is to make the planet a better place with cleaner, safer energy that we can pass on to future generations." →

COMMENTS FROM NOOSHIN BEHROYAN ON A WOMAN'S WORK IN WHAT TRADITIONALLY HAS BEEN A MAN'S INDUSTRY



ABOUT NOOSHIN BEHROYAN:

Nooshin Behroyan has 17 years of oil, gas and utilities industry experience that includes integrity management, construction management and inspection, engineer, procurement and construction (EPC) for pipeline and electric grid infrastructures. Her company, PAXON, which she founded in 2016, was named 9th fastest growing company in America on the Inc. 5000 list and the No.1 female-led company on the same list two years in a row. As a first-generation immigrant and a single mother, Behroyan brings extensive cross-cultural experience that promotes gender diversity and work-force equality by addressing barriers and driving change for positive impact for women engineers and veterans. Behroyan serves as the board president for National Association of Women Business Owners (NAWBO)- San Francisco Bay Area, as well as, chairwoman of the advisory board of IKAR Energy Group, and the advisory boards for American Gas Association (AGA). She holds a B.A. in architecture from UC Berkeley, M.S. in civil and environmental Engineering from UC Davis and is a graduate of UCLA's MDE Program. She is also a professionally trained piano player and has played for the U.C. Berkeley Jazz Ensemble.

As females, we are expected to do a whole lot more. Women have to do twice as much and only get half as far, and that's the reality of it. Quality is extremely important. Women-owned companies have to work in an environment, where we're not only consulting on next-generation tools, technologies and best practices, but we're also looking at compliance. But we have to do this with almost an error-free approach because we are given far fewer chances, with far less room for any errors. This also has been the key success to Paxon's tremendous growth.

What makes women different is the agility to be quick on our feet in our decision-making and responses to our clients. That's extremely important, and we try to run the company with as minimal bureaucracy as possible. Our clients appreciate that they can pick up the phone, knowing someone will be in the field or fly where they are needed because it is an emergency. If we have to wait a month to get back to our clients, the issue isn't going to go anywhere.

The second factor that differentiates women is the quality of the service we provide. At the end of the day, if you don't provide good services, you don't have repeat clients, and 90% of our work is repeat clients. Being a female-owned company, we have to be resilient, understanding that we will be often passed over. When we don't get a client, we assess the situation, saying, "Okay, if they said no to us, what do we need to change? Where do we need to improve? How do we need to approach this?" There are a lot of engineers out there doing good work, but what's the difference between good and great? It's small, and we really strive to be in that "great" category, so that when we present to our clients, there are no second thoughts.



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