EET&D
MAGAZINE
Quarterly Issue 2, 2025 – Volume 31

INNOVATION THROUGH COLLABORATION:

ESTABLISHING A MODEL FOR UTILITIES TO MANAGE PCB WASTE

HASTINGS
A WORLDWIDE SUPPLIER OF
Hot Line Tools & Equipment

hfgp.com • 269.945.9541

Dedicated to the education of future lineworkers.

ONLY HASTINGS

Boyne City High School Energy Fundamentals Lineworker Program

EET&D MAGAZINE

Quarterly Issue 2, 2025 – Volume 31

04
INDUSTRY NEWS

08
POWER POINTS

POWERING PROGRESS: COLLABORATION IS DRIVING GRID MODERNIZATION | Elisabeth Monaghan, Editor in Chief

When it comes to grid modernization, utilities that have partnered with technology companies have a better chance of succeeding. It is that partnership between utilities and industry partners that drives innovation.

10
THE GRID TRANSFORMATION FORUM

INNOVATION THROUGH COLLABORATION: ESTABLISHING A MODEL FOR UTILITIES TO MANAGE PCB WASTE | Charles Johnson and Christopher Johnson, Amidyne Solutions, Elisabeth Monaghan, Editor in Chief

For our Q2 Grid Transformation Forum, it is our pleasure to introduce Charles Johnson and Christopher Johnson with Ontario-based Amidyne Solutions. Here, we share a case study about Amidyne's innovative approach that is changing the way utilities manage PCB testing and tranformer inspections.

16
GREEN OVATIONS

MODERNIZING THE GRID: HOW DIGITALIZATION AND AUTOMATION ARE TRANSFORMING UTILITIES | Luigi Montana, envelio Inc.

We are in an era of load growth – data centers, manufacturing and electrification are driving electricity demand. On the other side of the equation, DERs and storage are also entering the system. All these resources share one need – to be interconnected to the grid.

22
ENERGIZING THE NEXT ERA OF POWER: HOW TO ADVANCE THE U.S. POWER GRID | Maria Lamorey, PPG and Nelson Squires, Wesco

America's power grid is stable today, but a surge in demand is on the horizon. As innovations in AI, cloud computing and advanced technologies accelerate, energy capacity will increase, pushing the grid to new limits. Preparing for this shift is critical to meet the future demands of our connected, data-driven world.

28
SMARTER RESILIENCE PLANNING FOR MUNICIPAL AND COOPERATIVE UTILITIES | Cyril Brunner, Vermont Electric Cooperative and Mishal Thadani, Rhizome

From ice storms in Vermont and hurricanes in Louisiana to wildfires in California and snowstorms in Texas, the effects of climate change are playing out regionally in distinct and increasingly disruptive ways. Grid operators are no longer asking if extreme weather will hit – they're asking when, where and how bad.

34
KEEPING THE UK'S MOST AMBITIOUS ENERGY PROJECT AFLOAT: HOW RESISTORS ENSURE RELIABILITY IN TIDAL PROJECTS | Mike Torbitt, Cressall

This article explores how resistors can help stabilise the grid and extend the component lifespan to ensure the long-term success of tidal projects.

38
HOW ENERGY MANUFACTURERS CAN OFFSET MARKET SHIFTS WITH SMARTER INCENTIVES | Nichole Gunn, Extu

If there's one thing you can count on in renewable energy, it's change. Regulations shift, subsidies come and go and customer demand can flip on a dime. Losing key federal and state incentives has forced solar manufacturers to rethink how they connect with contractors, dealers and distributors.

42
GUEST EDITORIAL

BRIDGING THE GAP: HOW SMART CITY TECH CREATES POWERFUL UTILITY-MUNICIPAL PARTNERSHIPS | Dan Evans, Itron

Not long ago, it wasn't uncommon for a city's water department to dig up a street only to find that the electric utility had done the same thing just weeks earlier, with neither party aware of the other's plans.

50

GUEST EDITORIAL

MICROSECOND DATA ON AMI 2.0 METERS ALLOWS UTILITIES AND CUSTOMERS TO WORK TOGETHER IN A COMPLEX GRID LANDSCAPE | Mike Phillips, Sense

We can no longer afford to operate under the status quo user-and-supplier framework that's existed for so long. It's vital and urgent that we rethink the relationship between utilities, their customers and the grid they share. It must become a more flexible, responsive and efficient system.

56

GUEST EDITORIAL

TURNING DATA INTO DECISIONS: AI'S ROLE IN NEXT-GEN UTILITY ASSET MANAGEMENT | Kristy McDermott, Sharper Shape

Utilities face significant challenges with aging infrastructure, extreme weather, rising operational costs and increased demands for reliability. AI offers a promising solution, but it's time to move beyond theoretical discussions, the "what ifs," to embrace the practical benefits, the "what now?"

60

GUEST EDITORIAL

UTILITIES CAN UNLOCK THE FULL POTENTIAL OF BATTERY STORAGE WITH ANALYTICS | Lennart Hinrichs, TWAICE

Battery energy storage systems are a critical part of the modern grid. Energy storage is ideal for the integration of new resources necessary to meet rising power demands, enabling intermittent renewables to meet a utility's power needs when there is no sun or wind, while keeping the grid stable at times of high generation.

66

THE BIGGER PICTURE

KEY TRENDS RESHAPING THE ENERGY LANDSCAPE: INTRODUCING THE OPENADR ALLIANCE AND OPENADR STANDARD | Rolf Bienert, OpenADR

For anyone unfamiliar with OpenADR, the concept was conceived during the 2000/2001 energy crisis in California. California's energy needs exceeded the available resources on several occasions during this period. At the time, the only fast and reliable response available to grid operators was to completely shut down parts of cities and counties for periods of time.

72

POWHERFUL FORCES

FORGING THE FUTURE AT THE EDGE

Sasah Wang, Durabook | Elisabeth Monaghan, Editor in Chief

This issue's Powherful Forces profile is of Sasha Wang, who talks about her role as CEO of Durabook Americas, what innovative technology she thinks will have the greatest impact on the industry over the next few years and what she and her team have done to ensure their customers can understand and embrace this technology.

PUBLISHER

Steven Desrochers
steven@electricenergyonline.com

EDITOR IN CHIEF

Elisabeth Monaghan
elisabeth@electricenergyonline.com

ART DESIGNER

Z communications
r.poitras@zcommunications.ca

ELECTRIC ENERGY MAGAZINE IS PUBLISHED 4 TIMES A YEAR BY:

JAGUAR EXPO INC

PO Box 50514, Carrefour-Pelletier, Brossard, QC Canada J4X 2V7

Tel.: 888 332.3749 | info@electricenergyonline.com
electricenergyonline.com

C2
HASTINGS FIBERGLASS PRODUCTS

03
AMIDYNE SOLUTIONS

05
IEEE PES

07
RTDS TECHNOLOGIES, INC.

21
HASTINGS FIBERGLASS PRODUCTS

C4
HASTINGS FIBERGLASS PRODUCTS

Amidyne Solutions

APEX
Asset Project Execution

THE LEADING UTILITY DATA SOLUTION

INTRODUCING THE APEX APP

- A digital solution that allows linesmen to input equipment data quickly and efficiently.

CRITICAL FOR STORM REPAIRS

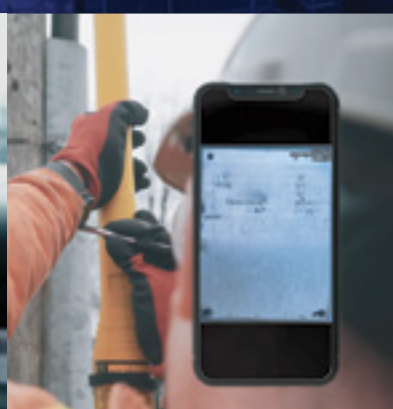
APEX plays a vital role in emergency response and restoration, enabling utilities to:

- Rapidly assess damage and deploy resources.
- Provide real-time updates to utility managers.
- Ensure accurate documentation for regulatory and insurance purposes

KEY BENEFITS

The APEX App is used by linesmen to input equipment information in minutes. This allows utility project managers to:

- Receive Standardized Equipment Reports With Photos
- Easily Import Accurate Data to GIS Systems
- Manage 3rd Party Contractors
- Improve On-Site Efficiency
- Capture “As-Built” Changes



Hydro Québec

REDRESSING THE PAST AND BUILDING FOR THE FUTURE: INNU NATION AND HYDRO-QUÉBEC COME TO A RECONCILIATION AND COLLABORATION AGREEMENT

June, 2025

Negotiators for the Innu Nation of Labrador and Hydro-Québec have signed an historic agreement-in-principle to settle past grievances and a legal challenge by Innu Nation related to the construction, operation and maintenance of the Churchill Falls Hydro-Electric complex, and to set out core elements and principles as the foundations of a new relationship.

> ***"On behalf of the Innu of Labrador, I am pleased that we have taken this major step towards settling our lawsuit against Hydro-Québec, out of court. Innu negotiators were able to reach a fair agreement to address the damage this project has done to our culture, our way of life and our lands and we will be pleased to bring this to our members. I want to personally acknowledge Michael Sabia for his leadership and for fulfilling Hydro-Québec's mandate to seeking a resolution-based approach to fairly address Indigenous concerns." said Grand Chief Simon Pokue, Innu Nation.***

Under the terms of this agreement, Hydro-Québec will contribute an amount of 87 million dollars to the Innu of Labrador in the form of annual payments to a Reconciliation Fund over a 16-year period.

This milestone agreement confirms Innu Nation and Hydro-Québec's intention to forge a long-term relationship based on openness and mutual respect. In addition to the annual payments, it will also provide the Innu of Labrador (comprised of Sheshatshiu Innu First Nation and Mushuau Innu First Nation) with 3 per cent of the dividends which Hydro Québec receives from Churchill Falls (Labrador) Corporation for as long as Churchill Falls produces power, which they can use according to their own priorities. This is consistent with terms under the existing agreement between Innu Nation, Newfoundland and Labrador Hydro and the province of Newfoundland and Labrador.

> ***"Building more respectful relationships with Indigenous communities is a fundamental priority for Hydro-Québec. This agreement is a strong demonstration of how we can work together to build a more equitable and sustainable future. It opens the door to building new power generation facilities to the benefit of all our communities." said Michael Sabia, President and CEO, Hydro-Québec.***

The agreement in principle also sets out terms for Hydro-Québec's collaboration with Innu Nation in the development of future facilities in the region, such as the Gull Island Power Generating Station.

Next steps

The Innu Nation will first present this agreement in principle to its members in the Innu communities of Sheshatshiu and Natuashish. Following this, all terms of the agreement in principle will then be made public.

Negotiations will continue to finalize the terms of a formal agreement by the fall of 2025. Once a final agreement is reached, Innu Nation will present it to its members for ratification.

European Commission

EU CLIMATE LAW: NEW WAY TO REACH 2040 TARGETS

June, 2025

The Commission has proposed an amendment to the EU Climate Law, setting a 2040 EU climate target of **90% reduction in net greenhouse gas emissions**, compared to 1990 levels. It will give certainty to investors and innovation, strengthen industrial leadership of EU businesses, and increase Europe's energy security.

85% of Europeans believe climate change is a serious problem and 81% support the EU's goal of reaching climate neutrality by 2050, according to a recent survey. The EU is currently on track to meet its next target of a 55% reduction by 2030. The new proposal builds on this legally binding goal and sets out a **more pragmatic** and **flexible** way to reach the 2040 target.

The proposed 2040 climate target takes into account the current economic, security and geopolitical landscape. It emphasises the importance of **accelerating** and **strengthening the right enabling conditions** to achieve the target and is

- aligned with the EU Competitiveness Compass, Clean Industrial Deal and Affordable Energy Action Plan
- based on an in-depth impact assessment and advice from the Intergovernmental Panel on Climate Change and the European Scientific Advisory Board on Climate Change.

The Commission has also published a Communication on delivering the first proposals on the Clean Industrial Deal. It provides an overview of the first actions delivered, progress made and remaining measures. Its **implementation is crucial towards the 2040 climate target**.

The Commission's proposal will now be submitted to the European Parliament and the Council for discussion and adoption under the ordinary legislative procedure. A future agreed EU climate target will also serve as a benchmark for the post-2030 EU policy framework.

The EU Climate Law entered into force in July 2021. It enshrines in legislation the EU's commitment to reach climate neutrality by 2050.

Pacific Gas and Electric Company®

PG&E'S 2025 INNOVATION PITCH FEST SEEKS BREAKTHROUGH TECHNOLOGIES TO SHAPE THE ENERGY FUTURE

July, 2025

Pacific Gas and Electric Company (PG&E) is calling for inventors, entrepreneurs, and tech experts to help shape the future of energy in California by applying to its 2025 Innovation Pitch Fest.

The Innovation Pitch Fest will take place over three days from September 23-25, 2025, at PG&E's Oakland headquarters. It aims to identify breakthrough technologies where solutions are still emerging and where collaboration with external innovators is critical.

> ***"We're not just looking for ideas we're looking for partners who are ready to roll up their sleeves and help us build the energy system of the future, now," said Jason Glickman, Executive Vice President, Engineering, Planning and Strategy, PG&E. "Over the past several years, PG&E has strengthened and streamlined our innovation practices, building clearer pathways for procurement, piloting, and deployment. For entrepreneurs, this means we are building upon the promise that PG&E is where innovation goes to scale."***

As a precursor to the Innovation Pitch Fest, PG&E refreshed its research and development R&D Strategy Report in November 2024 with updated problem statements, noting areas where progress has been made, and emphasizing opportunities for integrating Artificial Intelligence (AI) solutions. PG&E also held its second Innovation Summit in November 2024, demonstrating how PG&E is becoming an AI-enabled energy company.

For the 2025 Innovation Pitch Fest, PG&E is further narrowing its focus to 10 problem statements where bold ideas for rapidly scalable solutions are urgently needed. PG&E wants to work side-by-side with innovators on new solutions including:

- Accelerating load growth, including the increasing energy needs of AI data centers
- Equitably and efficiently advancing neighborhood electrification projects (known as "zonal electrification")
- Reducing wildfire risk through enhanced technologies and community resilience
- Using AI to improve safety, affordability, reliability, and customer service
- Improving operations to help lower energy costs for PG&E customers

UP TO
$25
MILLION
IN FUNDING
AVAILABLE

Potential participants with real-world solutions for these targeted challenges are encouraged to review the detailed problem statements and apply by July 26, 2025. Selected applicants will be invited to present and discuss their solutions with key PG&E decisionmakers at the Innovation Pitch Fest in September.

With up to $25 million in funding available to be allocated to new projects by the end of the year, PG&E plans to work closely with selected vendors emerging from the Innovation Pitch Fest to define projects and co-develop and integrate solutions directly into its systems, ensuring a fast, reliable path from concept to scaled impact.

The funding is available through PG&E's electric R&D budget under the public purpose program Electric Program Investment Charge (EPIC).

EPIC enables California investor-owned utilities to demonstrate new technologies and evaluate how they support safety, reliability, and affordability, environmental sustainability and equity objectives for the benefit of all California electric customers. Additional funding sources may also be available, depending on project scope and alignment through other PG&E innovation initiatives outside of EPIC.

For more information about PG&E's updated key R&D challenges and to apply for 2025 Pitch Fest, visit https://www.pge.com/en/about/pge-systems/research-and-development.html.

POWERING PROGRESS: COLLABORATION IS DRIVING GRID MODERNIZATION

ELISABETH MONAGHAN
Editor in Chief

Since the Department of Energy first introduced the Grid Modernization Initiative, there has been a lot of talk about how utilities and other industry partners are approaching a modernized grid. After attending Distributech 2024, I wrote in my editor's column for the Q2 2024 issue about the different ways industry experts I met with at the event interpreted grid modernization. I explained in that column how their responses depended on what role each company played in the electric energy sector. Although some utilities have made significant strides towards grid modernization, others continue to lag. However, industry partners around the globe recognize that to ensure successful results, collaboration between utilities and manufacturers or software developers is essential.

When it comes to grid modernization, utilities that partner with technology companies have a better chance of succeeding. It is those partnerships that drive innovation. With this in mind, I asked subject matter experts I met at Distributech this year how they are working with utilities. These conversations inspired many of the articles in this issue.

Piloting vegetation management: Sense & Georgia Power

Among the contributors to this issue that I met with at Distributech is Sense, a Massachusetts-based company that describes itself as a leader in grid intelligence. In his article on microsecond data on AMI 2.0 meters, Mike Phillips, who is the CEO and co-founder of Sense, presents a case study of a pilot project they conducted with Georgia Power. Phillips walks our readers through Sense's collaboration with Georgia Power on their program to enhance vegetation management. As Phillips explains, Georgia Power is installing Sense retrofit monitors into the homes of participating Atlanta-area customers. Installing these AMI 2.0 devices will provide a clearer picture of the local power grid to better understand when and where problems – like tree slaps – happen.

Georgia Power plans to use this detailed data to spot vegetation issues early and deal with them before they cause significant damage. They'll also use what they learn from this test project to improve how they handle similar problems in the future. We will keep our eye on Sense to see how other utilities might adopt their pilot project for vegetation management.

Streamlining interconnection: envelio & Clean Power Research

Another organization I met at Distributech 2025 was envelio, a company that provides a software as a service solution to assist grid operators with energy transitions. In his article, "Modernizing the Grid: How Digitalization and Automation Are Transforming Utilities," envelio CEO Luigi Montana lays out some of the challenges utilities face as electricity demand continues to grow.

Recognizing that all players in the electric energy space share the need to be interconnected to the grid, Montana points out that companies must automate, while also providing their end customers with increased information.

Montana focuses on a partnership envelio recently formed with Clean Power Research, a company that provides software, consulting and research services focused on clean energy solutions. The collaboration between both companies integrates envelio's Intelligent Grid Platform with Clean Power Research's PowerClerk,® which is CPR's workflow management solution. This partnership between envelio and CPR will enable utilities to more extensively automate interconnection workflows, reduce project approval times and enhance grid transparency. As Clean Power Research CEO Jeff Ressler points out in the article, the collaboration helps utilities better manage the rapid growth of distributed energy resources like solar, storage and wind.

Tackling legacy challenges: Amidyne Solutions & Powertech Labs

One of the most interesting conversations I had at Distributech was with Amidyne Solution's CEO Charles Johnson and Chief Operating Officer Christopher Johnson. Upon hearing them talk about the successful project that Amidyne took on to enhance Powertech's PCB remediation process, it was clear that this was a story we needed to share with our readers.

The Grid Transformation Forum in this issue features a case study detailing the collaboration between Amidyne and Powertech Labs to help utilities comply with federal Polychlorinated Biphenyl (PCB) regulations

Introduced in the early 1900s, PCBs were added to the oil in transformers as a coolant. Made out of synthetic chemicals, PCBs were used due to their non-flammability, chemical stability and insulating properties. However, over the years, PCBs have been found to be toxic to humans, animals and vegetation.

For those who need a refresher on PCBs, and how they went from being considered a viable coolant for transmission oil, to being recognized as harmful, the Amidyne case study begins with a short explanation.

Utilities are already juggling priorities like aging infrastructure, rising energy demands, regulatory compliance and the need for digital transformation, so issues like PCB remediation compound the challenges utilities are facing.

As the case study explains, Amidyne partnered with Powertech Labs on a pilot project to simplify sampling, testing and managing PCB regulation for energized pole-top and pad-mount transformers. While Powertech had already developed a system for testing and sampling transformers, Amidyne presented a solution to enhance that system.

After licensing Powertech's live-line testing technology, Amidyne developed a proprietary mobile app, which creates a seamless process by providing back-office support teams and real-time site data acquisition. This process allows field workers to quickly inspect, locate, sample and replace transformers containing a high PCB content, saving significant time and costs.

Teaming up for a modernized grid

As the energy landscape rapidly evolves, one thing is clear: no single utility or technology provider can modernize the grid alone. The case studies and collaborative efforts highlighted in this issue reinforce the idea that successful grid transformation depends on strategic partnerships that bring together innovation, expertise and practical solutions. Whether it's leveraging real-time data to improve vegetation management, streamlining interconnection processes through automation or tackling long-standing compliance challenges with smarter tools, these collaborations are paving the way for a more resilient, efficient and intelligent grid. The road to modernization may look different for each utility, but it's the shared commitment to partnership that will ultimately drive progress.

As always, if you would like to contribute an article on an interesting project, please email me:

Elisabeth@ElectricEnergyOnline.com

Elisabeth

INNOVATION THROUGH COLLABORATION:

ESTABLISHING A MODEL FOR UTILITIES TO MANAGE PCB WASTE

CHARLES JOHNSON, CHRIS JOHNSON, ELISABETH MONAGHAN

For our Q2 Grid Transformation Forum, it is our pleasure to introduce Charles Johnson and Christopher Johnson with Ontario-based Amidyne Solutions. Here, we share a case study about Amidyne's innovative approach that is changing the way utilities manage PCB testing and inspecting transformers.

Introduction (A brief history of PCBs)

Beginning in the early 1900s, polychlorinated biphenyls, or PCBs, were added to the oil in transformers across the globe because of their insulating and coolant properties. Comprised of man-made materials, PCBs were widely used due to their non-flammability, chemical stability and insulating properties. However, widespread realization that PCBs were harmful emerged in the late 1960s and early 1970s, with significant incidents like the Yusho poisoning in Japan and the discovery of PCBs in birds in Sweden sparking public and scientific concern. By 1972, scientific evidence indicated that PCBs posed a serious threat to the environment and human health.

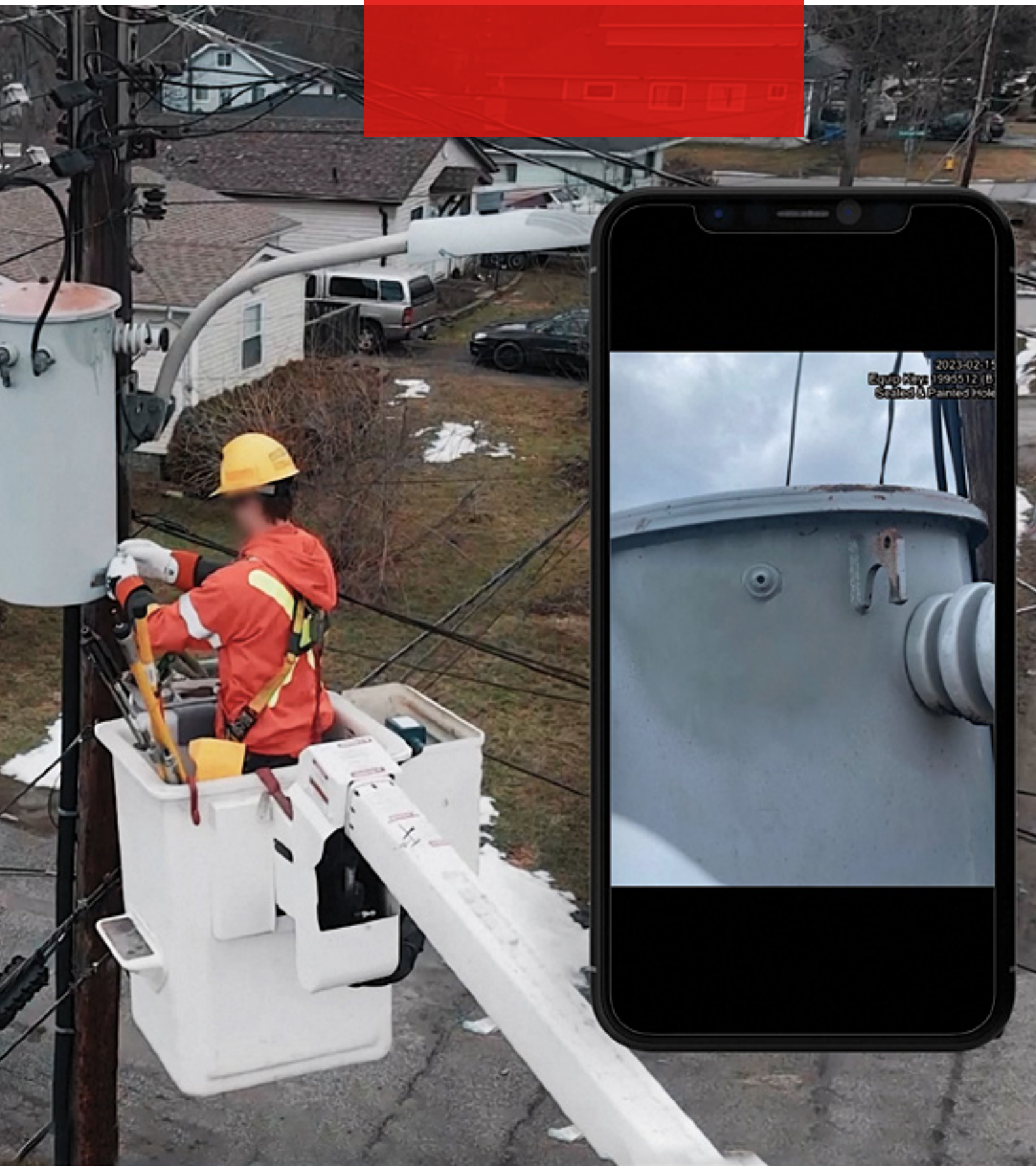
In 2001, 152 countries joined forces to sign the Stockholm Convention, which is a treaty requiring countries to eliminate concentrations of PCBs above 50 ppm in equipment by January 1, 2026, and manage contaminated waste by 2028. While Canada, Europe, South America and most of Asia/Africa adopted this convention, the United States never ratified its commitment in Congress.

Despite transformers being changed out over time, PCBs in high concentrations still exist in approximately 2-4% of transformers, where utilities have not completed a full sampling program for their removal. In the United States and other countries, PCBs remain a serious concern.

The challenge

The traditional process of sampling transformers for PCB contamination involves de-energizing transformers for three to four hours, removing the lid from the container and taking an oil sample. Not only is this costly, labor-intensive and time-consuming, but it also means that utilities' customers will be without power during that time. It is also difficult to manage administratively, especially where several transformers are in scope, and many customers will need to be notified of power interruptions.

Faced with these constraints and the approaching 2025 compliance deadline, utilities like Hydro One required a testing methodology that was safe, accurate and scalable without interrupting operations with volumes exceeding 180,000 transformers. →



Sampling - seal and paint. Source: Amidyne Solutions

Innovation through collaboration

Ontario-based Amidyne Solutions has long been a leading utility and nuclear services provider focused on end-to-end project management, engineering, design, testing and software solutions. In 2019, the company began looking for a testing laboratory partner. Known for its technical expertise and reputable work in utility testing, Powertech Labs was a natural choice for Amidyne to approach.

Powertech Labs Inc. is one of the largest testing and research laboratories in North America, situated in British Columbia, Canada. Powertech engineered an innovative solution to support Canadian utilities' mandate to comply with the Canadian Environmental Protection Act to stop using any electrical equipment containing more than 50 ppm by 2025. Powertech developed a tried and tested transformer oil sampling solution through extensive laboratory testing and collaboration with Canadian utilities to develop the methods and equipment for reliably and safely sampling pole top and pad-mount transformers.

The turnkey solution consists of live line tools, sample seal kits and oil analysis. Powertech tests and reports all oil samples for PCB levels per ASTM D4059 at Powertech's ISO 17025 accredited laboratory.

Powertech found the ideal partner in Amidyne to expand the use of its transformer oil sampling and analysis solution beyond its current client base.

During a series of discussions, the Powertech team demonstrated several of their technologies to Amidyne, including one innovation that immediately stood out: a live-line PCB sampling method using hot sticks.

"Once we started analyzing the technology, we realized we could help them improve their tools.," said Amidyne Solutions CEO Charles Johnson.

Evan Waugh, project engineer with Powertech's Transmission and Distribution Mechanical Lab, agreed with Johnson's assessment. "Amidyne's app was a significant improvement to the field operation process by providing a streamlined platform for compiling transformer data," Waugh explained. "The real-time data review and GPS-based mapping system were excellent features and complimented Powertech's tools and oil analysis."

PCB sampling tools. Source: Amedyne Solutions

Sampling - Loading the tools. Source: Amidyne Solutions

Amidyne then licensed Powertech Labs' live-line testing technology and enhanced it by integrating digital tools and making improvements to the tools. This included:

- An inspection process using a custom-designed 40' phone mount, which removed 68% of transformers from requiring sample – a significant savings in cost
- Real-time data review and program management
- Improved data management, including integration into Hydro One's database
- PCB Sampling tool refinements and improvements.
- GPS-based mapping system with scannable barcodes for quick transformer identification
- Real-time image sharing to enable instant quality control and remote feedback
- Color-coded visual mapping tool to show site access difficulty and operational tracking

Using the app, fieldworkers could instantly verify transformer sites, scan barcodes and record inspection and testing data. Reviewers could monitor progress remotely, suggest immediate corrections and ensure data accuracy in real time significantly reducing the processes involved with inspections and testing.

Even more impressively, Amidyne's solution was up and running within just three months of their initial collaboration with Powertech Labs.

From trial to expansion

Initially, Amidyne Solutions introduced its enhanced live-line testing technology to a member of Hydro One's environmental team, who agreed to test the system.

The initial trial using Hydro One's transformers ran from May 2022 to March 2023, pausing briefly and resuming in January 2024. For the first phase, Amidyne was provided with 1,000 units to test, which the utility immediately increased to 6,000, due to the speed and efficiency of Amidyne's system. Within a few months, the trial eventually scaled to close to 180,000 units.

The work was completed on time, with zero safety incidents and at a significantly lower cost than the traditional sampling method.

As the testing progressed, Amidyne began using the mobile app for different projects, including pole and transformer replacements, switch installations, feeder quality improvements and post-storm assessments. →

Sampling - Rivet Gun. Source: Amidyne Solutions

Sampling - Extraction. Source: Amidyne Solutions

Barcode used to identify transformers. Source: Amidyne Solutions

Looking at the future

Amidyne's solution has not only transformed how utilities can manage PCB testing and transformer inspections but the solution is now being expanded internationally. As a result of its success with Hydro One, Amidyne has initiated discussions with utility providers in the United Kingdom, Brazil, Costa Rica and other Canadian utilities. The company is also expanding its U.S. presence through industry events and strategic partnerships.

The project illustrates how collaborative innovation, driven by regulatory compliance and operational necessity, can result in scalable, effective solutions. The live-line PCB testing system now serves as a model for utility modernization under environmental constraints

Conclusion

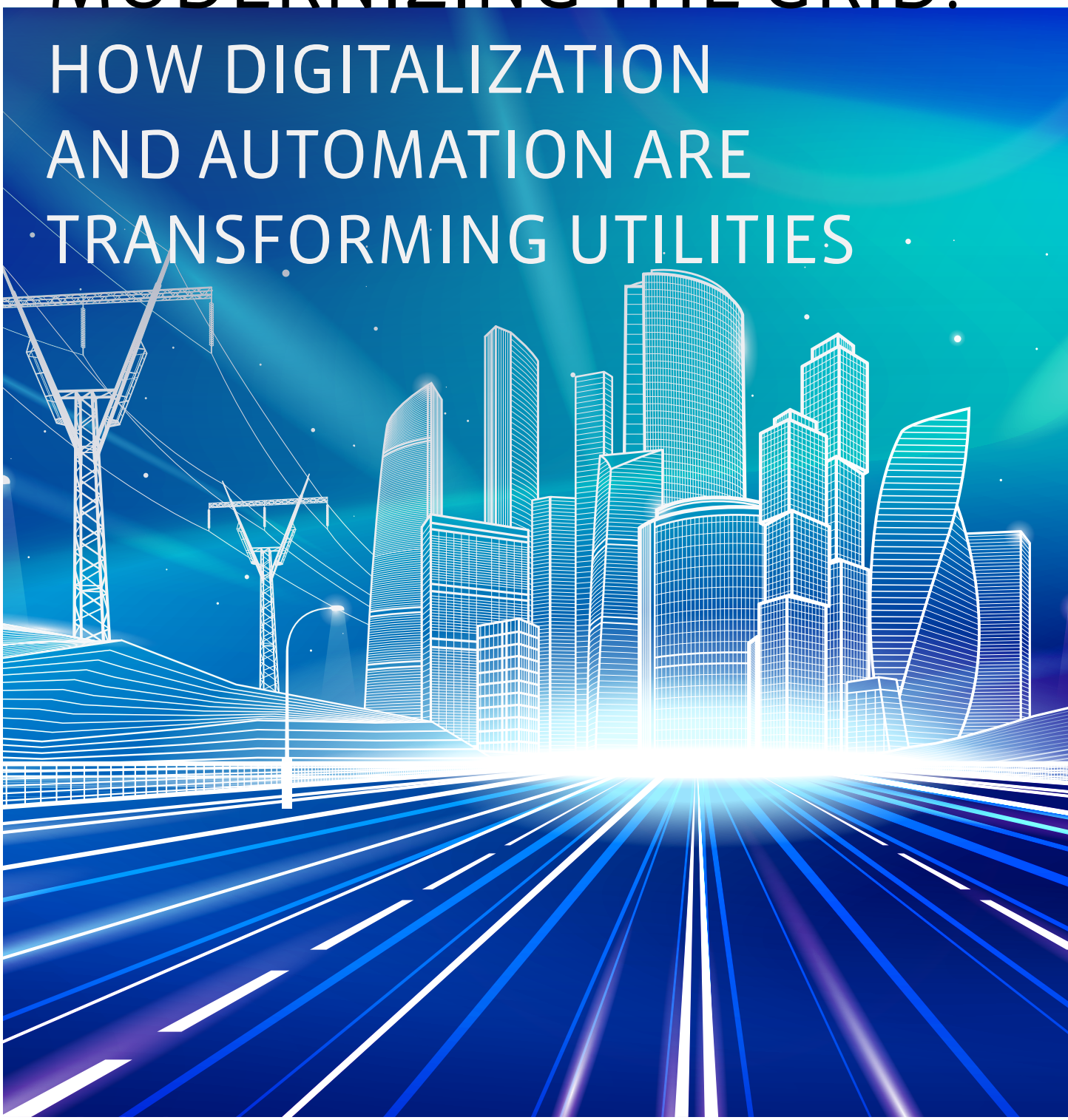
The partnership between Amidyne Solutions and Powertech Labs, with operational input from Hydro One and Valard Construction, demonstrates the potential of industry collaboration to address complex environmental challenges. By reimagining how PCB testing is conducted in the field, the project achieved regulatory compliance without compromising operational continuity–marking a significant step forward in utility asset management and environmental responsibility.

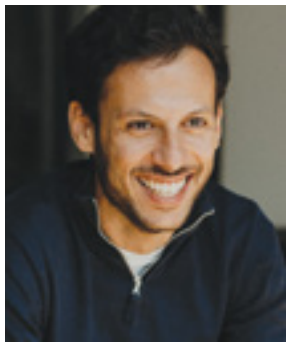
ABOUT THE AUTHORS:

Charles Johnson is the co-founder and president of Amidyne Solutions Inc. His three-decadelong career as an entrepreneur has focused on cleantech industries, including owning companies manufacturing innovative insulation products; leading-edge electronics and chemical solutions for drinking water; as well as services and products for the power generation, transmission and distribution industries worldwide.

Chris Johnson has more than 20 years of experience leading teams specializing in innovative technologies and project management. He has a degree in electrical engineering and an MBA. Before joining Amidyne, Johnson led a technical services team of more than 200 people.

MODERNIZING THE GRID: HOW DIGITALIZATION AND AUTOMATION ARE TRANSFORMING UTILITIES





LUIGI MONTANA

We are in an era of load growth – data centers, manufacturing and electrification are driving electricity demand. On the other side of the equation, DERs and storage are also entering the system. All these resources share one need – to be interconnected to the grid. This puts utilities at the front and center of that development. Yet today's interconnection process wasn't designed to scale. The result? Exploding queues, extended lead times and growing pressure on utility workforces. In addition, developers' uncertainty and concern about their applications and project delays put more strain on the overall system. To unlock interconnection queues, we need to automate and provide end-customers with increased information. Utilities are seeing that with the correct tools and insight, they can greatly reduce the pressure on their grid and operations and boost efficiencies. →

Seven challenges facing electric utilities:

1. **Manual processes:** Most of the processes to handle and assess interconnections are manual and require skilled engineers to perform. Handling a single interconnection application – from building a grid model to running the required impact analysis – can take days or even weeks.

2. **Customer demands:** Commercial customers require transparency and information to be able to assess the business case for a project to interconnect. While hosting capacity maps are a first step, they do not provide all the information required. The results are time-consuming requests to utility DER teams and speculative applications that lead to an even heavier (and avoidable) workload.

3. **Resource constraints:** Although faced with more workload and requirements, utilities are resource-constrained, particularly as regulators push to keep rates flat. This means that hiring additional staff is often not a viable option and utilities must do more with less.

4. **Data-management complexities:** While utilities generate massive amounts of data, many struggle with siloed systems, inconsistent data quality, difficulty easily accessing the data and the inability to leverage the data. Effective data collection, integration and analysis are essential for informed decision-making and operational efficiency.

5. **Workforce transition:** The industry faces the dual challenge of an aging workforce approaching retirement and a shortage of skilled personnel to replace them. This gap affects maintenance, operations and technology adoption – highlighting the urgent need for knowledge transfer and workforce development initiatives.

6. **External uncertainties:** Utilities must navigate unpredictable variables, including increasing regulatory requirements. Extreme weather events and fluctuating energy demands also cause strain. Building resilience and adaptability into core operations has become critical to managing these uncertainties.

7. **Rapid interconnection demand:** Utilities often struggle to process the growing demand for interconnection requests, largely driven by renewable energy projects (i.e. solar and battery storage) and data centers. Wait times can be over three years.

Why digitalization is no longer optional

Modernizing grid infrastructure has transitioned from a strategic advantage to a fundamental necessity. For decades, utilities have managed vast amounts of data using legacy systems that can trap information in inaccessible silos. As demand and complexity in projects increase, grid operators face overwhelming interconnection requests. The root cause? Outdated data management methods and limited automation capabilities.

To unlock their full operational potential, utilities must integrate fragmented data sources and make data more accessible – internally and externally. Only through this digital transformation can the pathway to automation be realized – driving efficiency and eliminating bottlenecks that impede progress. You can't automate if you don't have access to the data. We partner with utilities to co-build the right solution by uncovering current data, workflow and business operations.

How to leverage existing data

To help utilities tackle interconnection and long-term grid investment, we created the envelio Intelligent Grid Platform (IGP). We leverage a utility's existing data, create a digital twin of its entire grid and enable stakeholders to more easily access data. The result is automation and efficiency across the system.

The envelio IGP streamlines interconnection processes, allows utilities of all sizes to scale the modular platform and enhance grid planning and transparency for real-time insights. Utilities now have a much more efficient and less complicated way to address grid vulnerabilities, visualize and plan hosting capacity, and automate grid connections. Over 70 utilities worldwide, including half the German grid, use the envelio IGP.

Strategic U.S. expansion and key partnerships

Last fall, we secured our first U.S. client – Eversource, an energy provider serving customers in Connecticut, Massachusetts and New Hampshire. Central to our U.S. strategy is growing our partnership ecosystem. Earlier this year, envelio announced a partnership with a key player, Clean Power Research©. This collaboration integrates envelio's Intelligent Grid Platform with Clean Power Research's PowerClerk® – Clean Power Research's leading workflow management solution. PowerClerk® has processed over two million interconnection projects to date. The company's expertise in streamlining and automating Distributed Energy Resources (DER) interconnection processes has enabled utilities to achieve faster turnaround times, reduce backlogs and enhance stakeholder satisfaction across the board. With this combined solution, utilities are able to scale DERs efficiently while strengthening grid planning and operations.

"By integrating key elements of envelio's Intelligent Grid Platform with PowerClerk®, we're enabling utilities to more extensively automate interconnection workflows, reduce project approval times and enhance grid transparency," stated Clean Power Research CEO Jeff Ressler. "Our collaboration helps utilities better manage the rapid growth of distributed energy resources like solar, storage and wind."

European success stories: Proven results

Following are examples of three European utilities who have successfully automated:

Helen Electricity Network (Finland) – Tasked with preparing Helsinki's power grid for carbon neutrality by 2030, Helen Electricity Network implemented the envelio Intelligent Grid Platform to optimize planning and future-proof its infrastructure. Advanced grid modeling and scenario-based planning allowed Helen to identify critical bottlenecks and design targeted investment strategies that support Helsinki's ambitious climate goals.

FairNetz GmbH (Germany) – As the distribution system operator for Reutlingen, FairNetz faced mounting challenges with grid connection requests for photovoltaic systems and electric vehicle charging stations. By implementing the envelio IGP, they successfully automated 60% of all connection requests, dramatically improving approval times and enhancing grid visibility.

Syna GmbH (Germany) – Operating one of Germany's largest grid networks, Syna GmbH adopted envelio's IGP to modernize its approach to grid compatibility testing. Previously, manual processes meant evaluations took up to eight hours to complete. With IGP implementation, this evaluation time was reduced to just 15 minutes – dramatically improving both data quality and operational efficiency.

Assessing your automation potential

A utility is well suited to benefit from automation and modernization if it can answer "yes" to most of these questions or statements. (The fact is, regardless of a utility's digital progress or readiness, it is already positioned to greatly benefit from automation.)

Data accessibility and quality

- Is your team frustrated with having to access disburse systems for data? Afterwards, will they have to build one-off models with potentially outdated data?

Integration of distributed energy resources (DERs)

- Are you experiencing increased interconnection requests for DERs such as solar systems and EV charging stations?
- Can you effectively assess the real-time impact of DERs on your grid?

Process efficiency

- Are your current processes for managing interconnection requests and grid planning time-intensive and labor-dependent?
- Have you identified operational bottlenecks that could be addressed through automation?

Growth in data center and AI

- Do you see increased demand from data centers and other digital infrastructure plans in your region?

Advanced planning and simulation

- Are you leveraging scenario-based planning tools to forecast future grid demands and potential constraints?
- Are you simulating various grid conditions to guide investment and operational decisions?

Regulatory and strategic alignment

- You want to abide by regulatory mandates for grid modernization and carbon reduction but are not sure of the most efficient path.
- You could benefit from an integrated technology roadmap for addressing these challenges.

Building resilience and future readiness

The push toward renewable energy adoption extends beyond sustainability – it's becoming essential for long-term viability. Utilities need to plan future capacity with precision and leverage predictive analytics to strengthen networks against extreme weather events and rising energy demands. This is exactly what our platform enables.

Through comprehensive digitalization and automation, utilities can keep pace with change…and even lead it. By modernizing their operations, grid operators can prioritize sustainability, accelerate clean energy adoption and build resilient networks prepared for tomorrow's challenges.

ABOUT THE AUTHOR:

Luigi Montana serves as CEO of envelio Inc., leading the organization's North American operations and strategy. Before relocating to the United States to lead U.S. expansion, Montana held various leadership positions at envelio and other European companies, managing large-scale IT projects, complex investment planning, financial decision-making and organizational transformation initiatives. Montana holds a Master's degree from HHL Leipzig Graduate School of Management in Germany and a Bachelor's degree from Bocconi University in Milan, Italy.

Founded in Germany in 2017, envelio GmbH (the parent company) is an award-winning energy software company providing advanced automation, interconnection and grid planning solutions to more than 70 utilities worldwide.

ENERGIZING THE NEXT ERA OF POWER:

HOW TO ADVANCE THE U.S. POWER GRID

MARIA LAMOREY AND NELSON SQUIRES

America's power grid is stable today, but a surge in demand is on the horizon. As innovations in AI (artificial intelligence), cloud computing and advanced technologies accelerate, energy capacity will increase, pushing the grid to new limits. Preparing for this shift is critical to meet the future demands of our connected, data-driven world.

In fact, cloud computing and generative AI consume 5% of the grid today. By the end of the decade, that number is projected to be as high as 12%. This is a big challenge for the power industry, but it also presents a new opportunity.

Managing this demand will require a coordinated effort across industries with innovations in energy storage, transmission and infrastructure all playing important roles.

Up and-coming energy sources

Extreme weather events such as last September's Hurricane Helene, which caused widespread devastation and the loss of power for millions in Virginia and North Carolina, January's Palisades wildfire near Los Angeles that destroyed thousands of structures and the growing severity of winter snow and ice storms all serve as powerful reminders of the need to upgrade, modernize and protect the power grid.

There is growing concern that there are not enough green energy sources to keep up with energy demands, particularly with the proliferation of power-hungry AI data centers. This concern is driving renewed interest in nuclear and natural gas, sources that appear to align with the interests of the new administration.

Nuclear energy is making a comeback. Initiatives such as the potential restart of the Three Mile Island plant in Harrisburg, Pennsylvania, as well as innovative startup companies exploring smaller-scale nuclear facilities positioned closer to data centers, may be harbingers of things to come. In theory, these nuclear power plants would serve as a local source to feed the data centers, which are expected to continue to pop up across the country.

Powering the future of our nation will require more than a single energy source, but a diverse mix working together to meet our anticipated energy demands for work and home. →


IA

Challenges and risks

Two of the biggest risks to a vulnerable power grid are wildfires and brownouts – temporary power outages implemented when electricity demand exceeds supply. These challenges are interconnected because wildfires in California have triggered rolling brownouts.

One of the main risks that puts the grid in a vulnerable state is reliance on a single power source, which is often too limiting and fails to meet the growing demands. Future solutions must consider anticipated growth plus our current electricity requirements. It also needs to account for forecasted computing and AI demands and any other long-term, evolving requirements of power infrastructure.

For example, the reshoring of manufacturing over the past several years has added pressure to the grid, emphasizing the need for a more resilient system to meet current and future demand, as well as protect national and economic security by reducing dependence on equipment suppliers outside of the U.S. To safeguard existing resources, the industry must ensure smart investments in newer, more sustainable options that diversify the nation's power sources.

Modernizing the grid

To effectively modernize the nation's aging power grid and address current challenges, several key initiatives must be considered.

One method of making the infrastructure less susceptible to wildfires is to bury the power lines. The grid is not equipped to handle the growing frequency and destruction of wildfires as temperatures continue to rise and droughts become more common. Buried lines also increase overall power line safety and reduce outages due to downed wires.

In addition to reducing fire hazards, much of the country's infrastructure dates back to the 1950s and 1960s, and energy consumption looks very different than it did 75 years ago. Consequently, the grid requires extensive retrofitting and modernization to meet today's demands. This means not only replacing older equipment with modern, efficient alternatives but also introducing protective coatings developed with cutting-edge technologies to improve durability and extend the lifespan of existing components. These measures would allow critical infrastructure to continue serving the nation's needs in a much more sustainable manner without an all-out replacement of existing equipment.

High-performance powder and liquid coatings can help reinforce and protect aging transformers, power lines and metal frameworks against extreme weather con ditions, corrosion and wear over time. By applying specialized coatings engineered for years of outdoor exposure, the grid infrastructure can better withstand the elements, significantly extending the time needed before full equipment replacements become necessary.

Durable, long-lasting coatings are even more important today because lead times for the manufacturing of transformers are no longer a matter of weeks, but years. When manufacturers, municipalities and utility organizations can tap into the power of high-performance paints and coatings, they can effectively and collectively extend the lifespan of critical infrastructure elements such as switchgear, transformers, power breakers, generators and more. Coatings engineered with the latest technologies offer a clear benefit in the manufacturing of electric-generating equipment, and from a retrofitting perspective, re-coating with high-performance solutions can renew equipment for another lifetime of use. This adds to the overall sustainability of the equipment and the grid.

In addition, anti-corrosion coatings applied to grid-support structures (such as steel towers and substations) provide additional protection against rust and degradation. This helps to preserve structural integrity and durability.

Thinking ahead, the best solution for modernizing the grid might be a middle-ground approach that blends replacing equipment with modern machines, while retrofitting much of the existing equipment with safety, reliability and sustainability in mind.

Because it is not feasible to modernize and replace all equipment (because the capacity to manufacture new equipment does not currently exist), retrofitting electrical equipment with high-performance coatings must be part of the equation.

Trending: smart grids and microgrids

Microgrids and smart grids represent a shift in how energy is produced, stored distributed, paving the way for increased renewable energy integration. Unlike conventional grids, smart grids allow for decentralized power generation, where individual sources such as solar panels on a homeowner's roof feed energy back into the grid. Smart grids take on more of a community-based approach.

In addition, smart grids now incorporate battery storage, which was not possible five years ago. When battery storage capabilities are tied to the grid, it enables excess energy generated during sunny or windy periods to be stored and redistributed when demand is high or conditions are not ideal. The rapid advancements in battery technology over the past five years have made large-scale energy storage more viable and affordable. →

Furthermore, microgrids will play a key role in the future of our electricity infrastructure. These are small-scale electrical networks that can operate independently or together with the larger grid. From a cost perspective, when owned privately, they allow users to sell power back to the grid, making their operation more affordable.

Overall, microgrids enhance the reliability and resiliency of electric supplies in areas prone to outages or high demand. This setup reduces dependency on traditional power sources, such as gas turbines, which were previously essential when renewable sources failed to meet demand. Therefore, microgrids will play an increasingly important role, especially when sunlight and wind are limited.

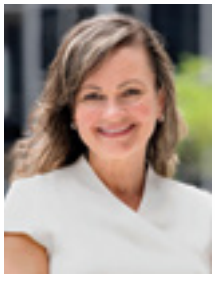
With the ability to leverage supplemental battery storage capabilities, microgrids can harness stored energy and release it as needed. This will help keep the grid running smoothly, making it more dependable while reducing reliance on fossil fuel backup systems. In essence, instead of relying on gas-powered turbines when demand rises or renewable energy drops, the nation can access stored clean energy as needed.

As AI and cloud computing grow in adoption and become even smarter, these technologies will consume even more energy. Therefore, microgrids and smart grids will play a critical role in meeting future energy needs, supporting sustainable growth and enabling grid expansion across the nation.

Securing the next era of power

As the U.S. faces rapidly growing energy demands, grid modernization is an imperative next step. While many already are, municipalities, utilities and government agencies must prioritize grid hardening, reliability and capacity expansion to meet this surge in demand. Adoption of the latest technologies and bolstering the durability of electrical equipment through extra measures such as the proper coatings will prove imperative in the coming decades. A combination of strategies that includes embracing multiple energy sources, retrofitting and re-coating existing infrastructure with advanced solutions and installing new equipment, will be essential for creating a grid that can reliably sustain the 24/7 access that modern life requires.

By enhancing the reliability of its electricity supply, the U.S. can remain a pioneer in power innovation and investment, charting a course for an energy infrastructure network that is fit for the future.



ABOUT THE AUTHORS:

Maria Lamorey is the commercial strategy manager – Americas for PPG. With more than 20 years of industry experience, Lamorey plays a leading role in PPG's commitment to delivering high-performance coatings products across a variety of general industrial applications. Lamorey is a certified instructor for a nationally PDH-accredited course on material science in electrical equipment design and has been an active member of the IEEE Transformer Committee and NEMA (National Electrical Manufacturers Association).

Nelson Squires is executive vice president and general manager, Electrical and Electronics Solutions (EES) at Wesco. Prior to this appointment in June 2020, Squires held several previous roles, including senior vice president and Chief Operating Officer, group vice president and general manager for Canada and international and group vice president and general manager of Wesco's Canadian operations. Before joining Wesco, Squires was vice president and general manager of North American Gases and president of Air Products Canada Limited for Air Products and Chemicals, Inc. Squires served as a Captain in the U.S. Army and holds a Bachelor of Science degree from Wake Forest University.

SMARTER RESILIENCE PLANNING

FOR MUNICIPAL AND COOPERATIVE UTILITIES

MISHAL THADANI AND CYRIL BRUNNER

Data-driven insights to guide informed, proactive investments and upgrades matter as outages caused by extreme weather increase

Across the United States, utility trucks rumble down washed-out roads and snow-covered switchbacks, racing to restore power after yet another "once-in-a-generation" weather event. But these events are no longer once in a generation, they're seasonal, expected and increasingly severe.

From ice storms in Vermont and hurricanes in Louisiana to wildfires in California and snowstorms in Texas, the effects of climate change are playing out regionally in distinct and increasingly disruptive ways. Grid operators are no longer asking if extreme weather will hit – they're asking when, where and how bad. The scale of disruption has shifted, and so must the scale and speed of our response.

The numbers tell a sobering story. In 2024 alone, the U.S. faced 27 billion-dollar weather and climate disasters, totaling over $182 billion in damages. According to NOAA, the 1980-2020 annual average was just nine such disasters. In the last five years, the average has surged to 23 per year – a near-tripling in just a generation.

As the climate changes, so do the consequences for electric reliability. From 2000 to 2023, 80% of major U.S. power outages were caused by extreme weather. In 2022, the average American experienced 16% more disruptions than in 2013. Even as utilities invest more capital than ever before, the threats are outpacing traditional planning.

These outages come with a steep price: not just in dollars lost, but in lives, livelihoods and trust. In heat waves and winter storms, socially and economically vulnerable populations bear the brunt. When power is lost, so is access to refrigerated medicine, dialysis machines and life-saving HVAC. As a result, grid reliability isn't only a technical issue – it's a matter of public health, environmental justice and economic equity.

That's why planning for grid resilience in a climate-uncertain future with clear, data-driven insights is more important than ever before. We can't afford to miss on resilience investments. This is especially true for municipal utilities and electric cooperatives, the small but mighty providers serving 1 in 7 Americans. The decisions these utilities make today will determine whether their communities can withstand the climate impacts of tomorrow. →

Source: Vermont Electric Cooperative

Source: Vermont Electric Cooperative

Resilience on the front lines of municipal and cooperative utilities

In Vermont, climate change has meant more than warmer winters. It has meant ice, wind and back-to-back storms that devastate rural infrastructure. For Vermont Electric Cooperative (VEC), a not-for-profit cooperative utility serving over 43,000 meters across eight counties, these events have become more intense and more frequent.

VEC owns and operates approximately 2,500 miles of overhead distribution lines, many running through off-road, heavily forested terrain. These conditions create persistent challenges for line maintenance, asset visibility and storm response. In the past five years alone, outages from wind and ice have surged. Trees and weather-related events now account for nearly 50% of all outage hours and roughly 30% of all outage events.

In 2024, storms Finn and Gerri dealt a one-two punch to VEC's system. Hundreds of trees fell, and more than 60 poles were snapped, requiring specialized equipment and nearly a week of coordinated recovery. Events like these are no longer anomalies – they are the new normal. And for utilities like VEC, adapting to this reality means rethinking every aspect of resilience planning.

One of the most urgent lessons? Major storm events require two to four times the typical resource mobilization. Managing response with legacy systems, like Excel spreadsheets, is no longer feasible. That's why VEC is building a comprehensive resilience strategy, one that blends cutting-edge technology with community-focused innovation

As part of this strategy, VEC partnered with Rhizome, a climate resilience planning platform, to bring greater visibility and intelligence into its planning workflows. Rhizome's gridCAVA (Climate and Asset Vulnerability Assessment) platform, built specifically for municipal and cooperative utilities, provides affordable, high-resolution climate vulnerability modeling. It's helping VEC prioritize limited investment capacity and stretch every dollar for maximum community value.

This partnership is just one piece of VEC's forward-thinking approach. The cooperative is also embracing drone-based asset inspections through Firmatek and participating in the SOLVER project, a collaboration with Vermont Electric Power Company (VELCO) and the University of Vermont. Using LiDAR and new analytics, SOLVER helps identify vegetation risks, which is one of the largest outage drivers in the state. Coupled with gridCAVA, VEC will have unprecedented visibility into the current and future compounding risks present in their geography.

VEC is also preparing to launch its Income-Qualified Battery Program in 2025. Supported by a state grant, the program will deploy batteries in approximately 55 low- and moderate-income households, offering backup power for essential services and contributing to peak load reduction. This is resilience with equity in mind.

From modernizing its AMI systems to reducing outage reporting delays, VEC's work reflects a larger shift across public utilities: a move from reactive recovery to proactive planning.

Smarter planning

You can't manage what you can't measure. That's the core premise behind gridCAVA, Rhizome's flagship climate vulnerability assessment platform tailored to the needs of municipal and cooperative utilities.

gridCAVA brings together weather and climate models, utility infrastructure data and social vulnerability metrics into a single, interactive planning environment. With this unified view, utilities can zoom into specific feeder lines, simulate future weather scenarios and evaluate how targeted investments – such as undergrounding or vegetation management – could improve system resilience over time.

Critically, gridCAVA doesn't just show where systems are vulnerable, it helps determine why. By bringing asset vulnerability characteristics with geospatial climate threats, utilities can identify the most impactful upgrades. Should a line be reinforced? Buried? Paired with distributed energy resources or backup storage? These questions, once difficult to answer without costly consulting studies, can now be inexpensively explored in-house. →

Source: Vermont Electric Cooperative

Source: Vermont Electric Cooperative

The platform also supports multi-hazard planning. Rather than isolating each risk – flooding, wildfire, ice – gridCAVA allows users to see how compound events could interact. For example, a heat wave might simultaneously increase demand, wildfire risk and equipment failure rates. Understanding these overlaps is critical for resilience investments.

Because it's built on Rhizome's Aspen platform, gridCAVA is a living system. It updates as new data is ingested, allowing utilities to iterate their plans in real time. This is especially helpful for grant applications and regulatory filings – utilities can generate visual reports and "what-if" scenarios to demonstrate the cost-benefit of proposed upgrades, without outsourcing every step.

Most importantly, gridCAVA is designed to be affordable and accessible. Many smaller utilities have historically been priced out of resilience studies. Rhizome is changing that. By streamlining and automating complex models into user-friendly interfaces and pricing them within reach, gridCAVA makes high-quality planning possible for the very organizations that need it most.

For utilities like VEC, the benefits are tangible: smarter capital planning, clearer regulatory communication and stronger trust with members.

Leading the way in a climate-uncertain future

Targeted resilience investments, guided by clear data and intelligent planning, are no longer optional – they're essential. For municipal and cooperative utilities, the stakes are high: the future reliability of their systems, the trust of their communities and the protection of the most vulnerable among us.

Tools like gridCAVA allow utilities to move from uncertainty to action. They help leaders prepare, not just react. And by integrating equity considerations into every investment decision, these tools also help ensure that no community is left behind.

Climate change is not a distant threat. It's here, reshaping the grid and redefining our expectations of reliability. The work being done by VEC and Rhizome shows that, with the right tools and partnerships, even small utilities can lead the way in building a smarter, stronger and more equitable energy future.

ABOUT THE AUTHORS:

Cyril Brunner is innovation and technology leader at Vermont Electric Cooperative, a rural 43,000-meter electric cooperative in Vermont. Brunner is focused on linking electric cooperative challenges and individuals with technology solutions. He has more than a decade of experience in the utility industry and holds a degree in electrical engineering from the University of Vermont.

Mishal Thadani is the co-founder and CEO of Rhizome, a climate resilience software platform for electric utilities. Thadani has more than a decade of experience in climate resilience and regulation, and is a recipient of the Public Utilities Fortnightly 40 Under 40 and is a Clean Energy Leadership Institute Fellow.

KEEPING THE UK'S MOST AMBITIOUS ENERGY PROJECT AFLOAT

HOW RESISTORS ENSURE RELIABILITY IN TIDAL PROJECTS LIKE MERSEY TIDAL POWER

MIKE TORBITT

The UK's clean energy transition is set to take a major leap forward with the Mersey Tidal Power project, a proposed development that could become one of the largest in the world. But what challenges does a project of this scale present for electrical infrastructure? This article explores how resistors can help stabilise the grid and extend the component lifespan to ensure the long-term success of tidal projects.

The Mersey Tidal Power project is one of the UK's most ambitious renewable energy projects to date. Inspired by successful tidal range developments such as La Rance in France and Sihwa Lake in South Korea, it aims to replicate the long-term viability of tidal power on an even larger scale. Using a barrage-style turbine array to harness the immense power of the River Mersey's tides, the development could generate up to one gigawatt (GW) of clean energy. However, despite its promise, the scale and ambition of the project raise several challenges that require careful consideration.

Stability and reliability demands

Unlike other renewable sources, tidal power generation follows a predictable pattern, being governed by the lunar cycle. However, tidal energy still experiences variations in output due to the changing intensity of tidal flows. Managing these fluctuations, particularly at such a scale, requires highly efficient electrical infrastructure.

Any variation in energy production needs to be carefully managed to prevent fluctuations from causing inefficiencies or disruptions in power transmission. Without this precise control, power surges or dips could destabilize the grid, undermining the reliability of the entire energy network. →

The Mersey Tidal Power project's sheer scale also introduces technical demands beyond standard renewable installations. With an expected operational lifespan of over 120 years, all components – especially electrical systems – must be designed to withstand extreme marine conditions. Saltwater corrosion and high mechanical stresses from strong tidal currents place exceptional demands on electrical equipment. Ensuring system longevity requires components that are not only resilient but also capable of maintaining performance over decades of operation.

Anchoring tidal power

The success of large-scale tidal energy projects depends on a responsive and reliable electrical system. Dynamic braking resistors (DBRs) play a key role by absorbing excess energy during peak tidal flow. When tidal currents are at their strongest, turbines can generate more electricity than the grid can immediately use. DBRs convert this surplus electrical energy into heat, safely dissipating it to prevent voltage spikes or overloading transformers. By smoothing out power delivery, they help maintain a consistent and reliable supply of electricity, ensuring that tidal energy can integrate seamlessly with the wider grid.

Beyond grid stability, resistors also protect the physical infrastructure of the turbines. Rapid changes in water flow, such as shifts between ebb and flood tides, can create sudden torque variations on turbine blades and drive systems. DBRs help regulate these mechanical stresses by slowing the turbine's rotational speed in a controlled manner, reducing wear on bearings, shafts and other moving parts.

Given the vital role that resistors play in tidal power generation, their durability in harsh seawater is essential. High-quality marine braking resistors are engineered to withstand the extreme conditions of tidal power systems, including corrosion, heat and mechanical wear. Designs often incorporate sheathed mineral-insulated elements to protect against physical damage and environmental degradation, alongside marine-grade stainless steel to resist saltwater corrosion. These durable materials allow resistors to maintain peak performance for decades, even in the demanding conditions of tidal power projects.

While the scale of the Mersey Tidal Power project raises technical challenges, the proposed development is a bold testament to the UK's commitment to clean energy. As the government increasingly supports tidal power as part of its long-term energy strategy, this project could pave the way for widespread adoption of tidal infrastructure. Throughout this transition, resistor technologies are expected to play an important role in ensuring the stability of the grid and the longevity of power generation systems.

ABOUT THE AUTHOR:

Mike Torbitt is the managing director of Cressall. He has more than 20 years of experience in key finance and leadership roles in the engineering and manufacturing sectors.

HOW ENERGY MANUFACTURERS CAN OFFSET MARKET SHIFTS

WITH SMARTER INCENTIVES

NICHOLE GUNN

If there's one thing you can count on in renewable energy, it's change. Regulations shift, subsidies come and go and customer demand can flip on a dime. Losing key federal and state incentives has forced solar manufacturers to rethink how they connect with contractors, dealers and distributors.

Loyalty isn't automatic. It's something you have to earn and protect. The smartest manufacturers turn to sales incentive programs to stay ahead, get real-time insights and strengthen those crucial relationships across their sales channels.

Here's what investing in incentives can do for solar and energy brands:

- Keep you top of mind with contractors and installers who have plenty of options.
- Encourage upselling and cross-selling of your best or newest products.
- Maintain sales momentum even when funding or policies get shaky.
- Capture valuable sales data to guide smarter marketing and forecasting.

And this isn't just theory. On average, companies using well-designed incentive programs see sales jump about 30%, even in tough or shifting markets.

What are sales incentive programs?

Sales incentive programs are structured reward systems designed to motivate contractors, dealers and distributors to promote and sell your products more effectively. These programs typically offer rewards, such as cash bonuses, gift cards, travel incentives or exclusive recognition, based on achieving specific sales goals or behaviors. By aligning rewards with desired actions, incentive programs help build stronger partnerships, boost sales performance and provide valuable data on what drives success. →

Solar energy's future depends on strong partnerships and smart strategies to navigate a shifting market.

What makes an incentive program work?

There's no universal template, but the most effective programs share key attributes:

- **Clear goals and structure:** Participants need to know precisely which behaviors or outcomes will earn rewards. To drive performance, tailor goals to your program's unique objectives; whether boosting sales in a specific channel, increasing product knowledge or improving customer retention. Make sure goals are specific, measurable and achievable, and track progress using KPIs like revenue growth, deal registrations, product upsell rates or training completions. Clear, relevant goals keep participants focused and motivated.
- **Tiered rewards:** Not all participants start at the same level or are motivated by the same incentives. By using tiered, performance-based rewards, such as the 20-60-20 rule, you can effectively engage partners across the spectrum. This approach rewards the top 20% of performers with premium incentives that recognize their exceptional results, while the middle 60% receive scalable rewards designed to encourage steady improvement. The remaining 20% may receive motivational rewards or support to help them grow. This diverse reward structure creates clear growth opportunities, meets partners where they are and keeps more participants motivated and engaged, avoiding the pitfall where only top performers benefit and others lose interest.
- **Digital accessibility:** Your incentive program must be easy to access and use anytime, anywhere – especially on mobile devices. Contractors, dealers and distributors should be able to quickly upload photos of invoices, sales claims or warranty registrations right from their phones to instantly submit them for rewards. This seamless mobile process removes the need for a desktop and helps participants earn incentives on the spot. With tools that enable fast submissions and immediate reward eligibility, engagement stays high. A mobile-friendly platform or app also lets users track progress, redeem rewards and get support without hassle, making participation effortless and driving better program results.
- **Real-time reporting:** Live dashboards that show participants their current standings create a friendly, healthy competition that fuels ongoing effort. On the brand side, real-time data lets you spot trends, troubleshoot issues and adjust incentives on the fly to maximize impact. And with AI-driven analytics becoming more common, energy companies can now get predictive insights to anticipate behavior and tailor programs dynamically.
- **Dedicated support:** Never underestimate the power of human connection. Even the best tech can fall flat without personalized guidance. Having program managers or support teams who understand the industry and the unique challenges participants face helps drive adoption and resolve issues quickly. This is especially important in industries like energy, where digital skills and resources can vary widely across contractors and dealers.

Recognition fuels retention

Here's something people don't always think about: the psychology of incentives is based on feeling valued. Contractors and dealers get bombarded with offers all day, but few brands actually say "thank you" in a meaningful way. A good incentive program says, "We see you. We appreciate you. We're invested in your success." In a competitive, high-pressure market like renewable energy, that kind of connection matters a lot.

Incentives build transparency

If you sell through multiple layers – dealers, distributors, contractors – it can be hard to know who's really driving sales and why. Smart incentive programs shine a light on that. They help you spot top performers, identify gaps and see opportunities or risks before they become problems. A well-run incentive program is a tool for better decision-making.

Why it matters now

With federal renewable incentives rolling back, solar manufacturers and installers have to do more with less. The phase-out of the solar Investment Tax Credit and other subsidies reshaped the financial landscape, making it more important than ever to incentivize your dealers and contractors to champion your products instead of your competitors.

A real-world result

Take Siemens, a global energy and technology leader with a fast-growing solar division. Facing a complex incentive rollout with multiple product lines, tight deadlines and technical requirements, the company decided to partner with Extu.

"We knew there were complexities to navigate and we needed to move quickly," said a representative from Siemens. "We put a challenging 30-day set-up goal in place and were able to meet every milestone with Nichole's philosophy."

Sales incentives are a powerful tool helping energy manufacturers boost performance and deepen channel loyalty. Source: Extu

The program not only launched on time but also helped drive a 32% increase in sales across key electrical products, including assembled panel boards, switchboards and modular metering, while laying the groundwork for ongoing partner engagement.

Don't wait for the market to bounce back

In uncertain markets, it's tempting to pull back. But the brands that lean in and find smarter ways to maintain sales without over-relying on discounts or ads are the ones that gain ground.

Sales incentives offer an efficient, strategic way to protect share and build momentum. They're also a long-term investment in the people who ultimately make your product successful: the contractors, distributors and dealers on the front lines of every sale.

ABOUT THE AUTHOR:

Nichole Gunn is the global chief marketing officer at Extu, bringing over 20 years of marketing expertise in the B2B sector. With a passion for data-driven strategies and innovative leadership, she excels in demand generation, brand development, and customer experience. Gunn earned her bachelor's degree in marketing and design from American Intercontinental University. She is certified in areas and skills ranging from SEO to Google with various leadership training certifications as well. She's also been named a Titan 100 and received the Gold MarCom Award for Extu's rebrand.

BRIDGING THE GAP:

HOW SMART CITY TECH CREATES POWERFUL UTILITY-MUNICIPAL PARTNERSHIPS

Source: Google

DAN EVANS

Imagine the chaos that follows a major storm. It doesn't just knock out power lines – it floods streets, damages buildings and disrupts entire communities. Both utilities and city departments scramble to respond, often with little coordination. Not long ago, it wasn't uncommon for a city's water department to dig up a street only to find that the electric utility had done the same thing just weeks earlier, with neither party aware of the other's plans.

Those days are quickly becoming outdated. Today, many urban centers are experiencing a significant technological transformation as innovative smart city platforms bridge the traditional divide between utility providers and city departments. Unified data ecosystems are enabling real-time collaboration between utilities and municipalities, breaking down silos and forging new models of partnership. This ensures better resource management, more sustainable operations and significantly better public services to residents. →

Source: Google

Shared challenges, common customers

At the foundation of effective utility-municipality collaboration lies a simple but powerful insight: these entities serve the same constituents and face many of the same challenges. Residents and businesses within a city are simultaneously customers of both the utility and the municipality. This shared customer base 01creates a natural alignment of interests that, when properly leveraged, can transform traditionally separate operations into coordinated efforts.

Both utilities and municipalities face shared challenges around environmental impacts that frequently damage utility infrastructure while simultaneously disrupting city operations. Yet, they still need to deliver reliable services to their communities. Utilities are racing to harden their infrastructure against increasingly severe weather, while city governments are trying to protect residents from flooding, heat waves and other climate hazards.

By adopting a unified approach to these challenges, utilities and municipalities can create win-win scenarios that benefit all stakeholders. That's exactly what's happening in forward-thinking cities across the country. By sharing data and coordinating their efforts, utilities and municipalities are creating partnerships that make our cities more resilient, sustainable and efficient.

When they work together – sharing resources, data and planning – communities recover faster.

At the same time, sustainability goals are getting more ambitious. Cities are setting bold carbon reduction targets while utilities are transitioning to renewable energy. By coordinating their efforts through shared data platforms, they can both track progress more effectively and uncover new opportunities for collaboration.

The overlapping responsibilities and challenges faced by utilities and municipalities include:

1. **Climate resilience and adaptation** – Both entities are on the front lines of climate change impacts:
   - Utilities must harden infrastructure against extreme weather while maintaining service reliability
   - Municipalities must protect residents and businesses from flooding, heat waves and other climate hazards
   - Both must coordinate emergency response during disasters and service restoration afterwards
   - Shared data platforms enable rapid information distribution to facilitate coordinated planning and response across organizational boundaries

2. **Sustainability and environmental goals** – Cities and utilities both face increasing pressure to reduce greenhouse gas emissions:
   - Municipalities establish climate action plans with carbon reduction targets
   - Utilities transition toward renewable energy and implement efficiency programs
   - Both must monitor and report on environmental metrics to various stakeholders
   - Collaborative platforms enable integrated tracking of carbon footprints and other environmental indicators

3. **Infrastructure modernization** – Aging infrastructure presents challenges for both entities:
   - Utilities must upgrade electrical grids, water systems and gas networks while maintaining service
   - Municipalities face similar challenges with roads, bridges, buildings and other public assets
   - Both must coordinate construction activities to minimize disruption and maximize efficiency
   - Shared planning tools and data exchange reduce conflicts and enable coordinated capital improvements

4. **Financial constraints** – Both entities operate under significant budget limitations:
   - Utilities must balance infrastructure investment with affordable rates for customers and, in some cases, returns for their shareholders
   - Municipalities must provide essential services while maintaining reasonable tax burdens
   - Both face increasing costs for regulatory compliance and security requirements
   - Collaborative approaches can reduce duplicative investments and create operational efficiencies

5. **Public expectations and service quality** – Citizens expect seamless, responsive service:
   - Utilities must maintain reliable services with minimal interruptions
   - Municipalities must deliver efficient public services across diverse domains
   - Both must communicate effectively with the same constituent base
   - Unified platforms can improve service coordination and provide consistent information to residents, visitors and businesses

Data: The great connector

Central to this collaborative transformation is the emergence of unified data platforms that integrate information from diverse sources across both utility and municipal domains. These platforms bring together information from countless smart devices – everything from smart meters and streetlights to traffic sensors and environmental monitors. The real magic happens when this data becomes accessible across organizational boundaries while still maintaining appropriate security controls.

Think of it as creating a digital conversation between systems that never talked to each other before. When a severe storm is approaching, emergency managers can see real-time data from the utility about vulnerable infrastructure, while utility repair crews get immediate updates about road closures and flooding from city systems.

What makes these platforms so powerful is their ability to spot connections that humans might miss. Through sophisticated "if this, then that" logic, they can identify patterns across diverse data sets and trigger appropriate responses automatically – whether that's dimming streetlights to save energy during peak demand periods or rerouting traffic away from utility repair work.

The architectural elements that make these unified platforms so powerful include:

1. **Multi-layer data integration** – These platforms collect, normalize and integrate data across three key dimensions:
   - Vertical integration across the technology stack connecting physical devices in the field to applications
   - Horizontal integration across different departments, agencies and utilities
   - Temporal integration combining historical data with real-time inputs to enable predictive capabilities

2. **Federated security models** – Advanced security architectures maintain appropriate access controls while enabling collaboration, including:
   - Data-level security defining which specific data elements can be accessed by which users
   - Role-based access control mapping organizational responsibilities to data access privileges
   - Contextual security adapting access rights based on circumstances
   - Audit trails tracking all data access and system interactions for compliance and security monitoring →

Source: Google

3. **Scalable data processing** – These platforms implement sophisticated data handling capabilities:
   - Edge processing that filters and pre-processes data near its source to reduce bandwidth requirements
   - Stream processing for real-time analysis of data flows from thousands or millions of endpoints
   - Batch processing for deeper analytical workloads across historical datasets
   - Distributed storage architectures that balance performance, cost and data retention requirements

Real-world success: Chicago smart streetlights

Chicago provides a perfect example of what's possible. The city deployed roughly 280,000 LED streetlights equipped with smart controllers that communicate over a dedicated network. For decades, streetlight billing was based on rough estimates such as how many lights were installed, multiplied by assumed hours of operation and energy rates. With smart controllers, the city now pays for exactly what it uses, including when lights are dimmed to save energy.

The results speak for themselves: Chicago projected $100 million in savings over ten years – about $10 million annually – from reduced energy costs and more efficient maintenance. When a light fails, the system immediately reports the exact location and problem, so repair crews arrive prepared with the right equipment. But the benefits go far beyond just saving money. City operators can adjust lighting levels in specific areas based on safety concerns or citizen feedback about light pollution. And the network infrastructure supporting these smart lights creates a foundation for other applications.

The Chicago implementation illustrates several key aspects of successful utility-city collaboration:

1. **Data-driven operations** – The smart controllers collect granular data on each streetlight's performance, enabling each organization to optimize its operations based on shared, accurate information rather than estimates or assumptions.

2. **Dynamic control capabilities** – Beyond simple on/off functionality, the system enables precise control of lighting levels. City operators can adjust brightness levels in response to citizen concerns about light pollution or to address specific safety issues in targeted areas.

3. **Maintenance transformation** – The deployment has fundamentally changed how streetlight maintenance operates, transitioning from reactive to proactive maintenance with automated alerts about specific issues at specific locations, including diagnostic information about the nature of the problem.

4. **Infrastructure for additional applications** – While streetlighting served as the anchor application, the network infrastructure deployed to support the lighting controllers creates a foundation for additional smart city applications.

5. **Financial model innovation** – The project demonstrates how technology can enable new financial arrangements between utilities and cities through more accurate billing models that benefit both parties.

San Antonio's united utilities

In San Antonio, TX, a different kind of collaboration emerged when CPS Energy (the local utility) installed smart electric and gas meters throughout the metropolitan area. Rather than building separate infrastructure, the San Antonio Water System (SAWS) integrated its water meters into the same system.

This partnership saved substantial money by sharing network costs across multiple utilities. Though both organizations operate under the municipal umbrella, they function as separate entities with distinct priorities while servicing a common customer base. The unified platform gives each utility access only to its relevant data while sharing infrastructure costs.

This creates economies of scale that benefit everyone, from the utilities themselves to the residents they serve. This implementation highlights several important dimensions of cross-utility collaboration:

1. **Shared infrastructure economics** – By leveraging the existing network infrastructure established for electric and gas metering, the water utility avoided substantial capital expenditure, creating economies of scale that benefit all parties.

2. **Multi-tenant security model** – The platform implements sophisticated role-based access controls that maintain appropriate separation between different utilities' data while enabling the infrastructure sharing that makes the collaboration economically attractive.

3. **Phased deployment approach** – The San Antonio example demonstrates how collaborative platforms can evolve over time, with water metering added after the initial deployment of electric and gas metering.

4. **Cross-utility innovation opportunities** – By bringing multiple utility data streams into a common platform, new opportunities emerge for cross-utility analytics and service improvements, such as correlating water usage patterns with electricity consumption to identify potential leaks.

Making it work: Practical implementation strategies

So how do cities and utilities build these collaborative systems? It typically starts with an "anchor application" – a specific use case that drives the initial investment. In recent years, this has been streetlighting as they were converted to LED technology. This is especially true outside the United States where cities frequently own and operate lighting infrastructure.

The most successful implementations follow several key principles:

- Start with a high-value use case: It's sensible to start with something concrete and valuable, with applications that deliver clear, measurable benefits to build momentum and demonstrate return on investment. Smart streetlighting often works well because it delivers quantifiable energy savings while creating visible improvements in public spaces.
- Design for scalability and scope: It's good practice to choose network technologies with appropriate bandwidth, coverage and security capabilities and select software platforms with open APIs and standards-based interfaces.
- Engage stakeholders early and often: Establishing formal governance mechanisms that bring together stakeholders from multiple departments and organizations requires both leadership commitment and operational coordination. Creating a roadmap for growth and developing multi-year plans that outline how the platform will evolve from initial applications to broader capabilities is a sound strategy. This should align with capital planning cycles and establish clear metrics for measuring success at each phase.
- Prioritize people alongside technology: Investing in workforce development to ensure staff have the skills to use these systems effectively enhances employee value and can increase job satisfaction. This includes technical training on specific tools and broader education on data-driven decision-making. →

Source: Google

Keeping it open

One of the biggest pitfalls in smart city implementation is the creation of closed, proprietary systems that can't talk to each other. To avoid this, forward-thinking cities and utilities embrace an open framework approach that supports standardized connectivity and data models. This means implementing well-defined interfaces between different system layers, using established standards rather than proprietary protocols wherever possible and creating common data models. For instance, core concepts like "streetlight" or "air quality measurement" should have consistent definitions across platforms and departments.

Equally important is embedding security from the ground up. Security must be built into every layer of the architecture rather than bolted on as an afterthought to protect sensitive data and ensure system integrity. As these platforms evolve from basic data collection to more sophisticated analytics, they also require scalable tools for analytics and decision-making. That includes extensible capabilities for data processing, user-friendly visualization tools and mechanisms to translate raw information into actionable insights.

The benefits are real

The collaborative platforms emerging in smart cities deliver multiple benefits:

- Unified ecosystems: By integrating data from diverse IoT devices into a single platform governed by predefined access rules, these systems eliminate the need for multiple parallel networks and create economies of scale.
- Cross-domain intelligence: When information is correlated across departments and domains, patterns emerge that siloed systems can't detect. This enables more effective planning and coordination between utility recovery teams and city emergency services.
- Responsive public services: They enable more responsive public services with near real-time adjustments based on current conditions rather than fixed schedules. This creates more efficient resource utilization while improving service delivery to residents.
- Sustainable insights: With detailed visibility into how resources are consumed across systems, cities can launch more precise and impactful conservation and environmental programs, tracking progress and adjusting strategies in real time.

- Operational efficiency: Beyond simple energy efficiency, these platforms unlock new efficiencies through predictive maintenance capabilities, resource optimization and automation across multiple city departments and utility operations.

Looking ahead

As these collaborative platforms mature, several exciting possibilities are emerging. Electrification and distributed energy integration will become increasingly important as cities and utilities work to decarbonize. Collaborative platforms will play a crucial role in managing the transition to electric vehicles and integrating distributed energy resources, optimizing charging infrastructure based on grid capacity and traffic patterns.

Advanced analytics and machine learning applications will flourish with the vast datasets generated by unified platforms. Predictive models will help both utilities and municipalities optimize operations in ways we're just beginning to imagine.

Citizen engagement and transparency will transform how people interact with utilities and municipal services. While respecting privacy concerns, these platforms can provide personalized dashboards and real-time information about service disruptions or planned maintenance. In a world where everyone expects instant, real-time information seamlessly delivered through smartphones and apps like Amazon and Uber, it is even more important to have a unified system that can present the latest data as quickly as possible.

Regional coordination and resilience planning will extend beyond city boundaries, with collaborative models connecting multiple municipalities and utilities. This creates even greater efficiencies and resilience for disaster response and infrastructure planning.

The big picture

As cities face mounting challenges from climate change, resource constraints and growing expectations, these collaborative smart city platforms aren't just nice to have – they're becoming essential infrastructure.

The shift from siloed operations to integrated, data-driven collaboration represents the most significant transformation in urban management of the digital era. By bringing utilities and municipalities together around shared data and common goals, smart city technology is helping create more livable, sustainable and resilient communities for all of us.

The walls between traditionally separate operations are coming down, and in their place, we're building bridges – digital connections that help our cities and utilities work together more effectively than ever before. The future of our cities depends on it.

ABOUT THE AUTHOR:

Dan Evans is senior director of product management at Itron, where he defines the product roadmap for the Smart Cities and Smart Lighting business unit. Evans joined Itron through their recent acquisition of Silver Spring Networks. Before joining Silver Spring Networks in 2007, Evans had more than 30 years of experience in the networking space at SkyPilot Networks, Excite@Home and NASA. He has a Bachelor of Science degree in computer science from San Jose State University in California.

MICROSECOND DATA ON AMI 2.0 METERS

ALLOWS UTILITIES AND CUSTOMERS TO WORK TOGETHER IN A COMPLEX GRID LANDSCAPE

MIKE PHILLIPS

Utilities are under pressure.

The grid is becoming increasingly strained and complex. Demand is soaring; forecasts call for a 200% to 300% increase from current levels by 2050. Home and vehicle electrification and renewables integration are simultaneously creating new decarbonization wins and varied intricacy. The need to measure, manage and balance all of this – while remaining affordable and resilient – weighs heavily.

There's no doubt about it: the grid must be made more intelligent and more connected to support this transition. We can no longer afford to operate under the status quo user-and-supplier framework that's existed for so long. It's vital and urgent that we rethink the relationship between utilities, their customers and the grid they share. It must become a more flexible, responsive and efficient system. And utilities and customers must become more connected and responsive themselves – through the grid. Otherwise, we'll all fall short of capacity needs and Net Zero goals.

The good news? It can be done. We just need to give a makeover to one of the most critical technologies at the forefront of the energy transition: the humble home energy meter. →

Meters are key

Utility meters have traditionally been thought of as simply data collection devices. The first smart meters served a fairly small range of functions when they were installed in the early 2000s. They eliminated the need for manual meter reading, but weren't much more than just that; basic reading and billing devices that operated on 15-minute interval data. That's not nearly enough resolution to support today's energy system needs. And it most certainly won't be enough to support the grid of the 5, 10 and 20 years.

AMI 1.0 meters are hitting the end of their 20-year lifecycles now, too. It's estimated that 25% of home energy meters will need to be replaced by 2030. The need to replace meters and the rapidly changing energy demands of the future meet at an opportunistic and timely intersection.

Enter the next wave of next-gen smart meters. AMI 2.0 devices, equipped with embedded intelligence and the ability to process microsecond-level data, are multi-purpose solutions for electric utilities and their customers. They turn meters from static devices into the distributed sensing, compute and control platform for the modern grid. By living in the intersection of homes and buildings and the grid, these next-gen meters can provide a real-time view of the entire distribution system. This insight is deep and nuanced, carrying all the way down to the device level.

So, what will it take?

To make this quantum leap in visibility and control all AMI 2.0 meters need three things:

- **High-resolution data**: Meters have recently been announced that can continuously sample voltage and current waveforms up to one million times per second. That's 50 million times more data processing than first-generation smart meters. It's useful, too. This level of resolution turns data from incomplete and siloed, into comprehensive and decision-informing. This drives proactivity across multiple planes; from the present moment to the long-term, with learnings that prioritize targeted upgrades and investments.

High-resolution data lets utilities and grid operators track device-level consumption behind the meter and detect minute anomalies across the grid. Subtle variations in voltage and current waveforms can be used to detect and localize issues before they cause outages or damage equipment. These issues can be as granular as seeing singular transformer arcs or vegetation brushes on lines–in real time.

To deliver these capabilities, AMI 2.0 meters should be equipped with:

- Continuous and synchronous sampling of voltage and current waveforms at a minimum of 15,000 samples per second
- Linear quantization with at least 16-bit resolution for current and at least 14-bit for voltage
- Raw energy data accessible to the application processor – beyond just summarized information

- **Local computation, memory and storage:** With 50 million times more data, transmitting everything to a centralized cloud location to then make these decisions is not possible. Instead, AMI 2.0 places powerful computation on the grid edge. Embedded processing creates insights and automated operational efficiency adjustments. Advancements in the mobile phone industry have made this possible. This level of computation is now energy-efficient and cost-efficient as well. And it has opened doors in the utility space. Hardware accelerators on next-gen smart meters can run AI models locally and process high-resolution data rates in real time on a per-needs basis.

The latest AMI 2.0 meters leverage these processors by using a distributed software model. Much of the processing happens locally on the meter–combined with real-time networking and cloud-side processing as needed.

To deliver these capabilities, AMI 2.0 meters should be equipped with:

- 1000 DMIPS CPU processing power
- 256MB RAM
- 1GB Flash storage or other storage

- **Real-time networking:** A distributed computing model reduces the strain on utility networks, but realizing the full potential of a responsive smart grid still relies on reliable connectivity.

While many applications can function with modest bandwidth, others require rapid, low-latency communications. This includes some of the most vital flexibility and resilience functions–like real-time DER coordination, voltage optimization and outage detection.

To deliver these capabilities, AMI 2.0 meters should support:

- 30-1000MB/day of non-real-time data transfer, from meter to cloud
- Low latency (less than 750ms round trip) for real-time applications requiring rapid control signals
- Local home network access (WiFi or Ethernet) to enable seamless smart home devices

Benefits on both sides of the meter

More data enables new capabilities. Just as data made possible advancements in larger language models and AI, grid-edge processing of high-resolution data enables the next cohort of real-time intelligence needed to manage the largest and most complex single project that humanity has ever undertaken.

More data also breeds adaptation. By embedding edge-computing software, AMI 2.0 meters can adapt over time and accommodate the consumer-driven transition to smart homes, all without needing to replace hardware. This approach facilitates whole-home electrification. On the utility side, consistent software updates can be made without hardware upgrades and future-proofing equipment for an evolving energy landscape.

Real-time visibility is not new at the generation and transmission levels. However, the progression of visibility into last-mile feeder networks, distribution transformers and behind-the-meter is a strong evolution. A better understanding of what is happening on the grid is the result. And that allows utilities and grid operators to take targeted, prioritized action.

With the ability to granularly identify without delay comes the ability to influence. Automation and efficiency via meter-hosted machine learning allow utilities to exert demand flexibility not only for overall load and demand but also to avoid system peaks throughout the grid. This peak avoidance runs deep, to the service feed into homes and buildings. A view of real-time data across a vast number of DERs can also help utilities adapt to new load profiles.

1MHz sampling also opens a new chapter in dynamic rate management. Dynamic energy pricing models can accurately reflect real-time energy usage and grid operations.

Consumers benefit as well.

Again, this oncoming wave of AMI 2.0 meters is primed to transform the relationship between homes and the grid. These devices even give utility customers a similar POV as grid operators. They can see their assets (for example, a microwave) across their system (behind their meter) and use energy with their command control center (an app on their phone) in real time. It's precise enough for consumers to see the wattage used on a per-lightbulb basis. →

With real-time access to this data, consumers can make informed decisions about energy efficiency and even automate their energy management. This shift towards greater control empowers consumers to play an active, engaged role in optimizing their energy consumption and contributing to the shared grid's overall efficiency.

A case study on resilience

Grid resilience is at the top of all utility stakeholders' minds. Grids must withstand extreme weather events that are rapidly increasing in frequency and intensity. In just the past year, wildfires in Southern California left hundreds of thousands of residents powerless and Hurricane Helene caused outages that impacted more than five million customers. Outages threaten lives, particularly in service areas with elderly and disadvantaged populations.

Effective vegetation management is crucial for safety, reliability and expense reduction. Southern Company's Georgia Power has collaborated with Sense, a leader in grid edge intelligence, on a pilot program to enhance vegetation management.

Between 80 to 90% of outages within the distribution grid are caused by object-on-wire faults. These faults are notoriously difficult to detect. They're typically uncovered through line-by-line segment inspections carried out by field teams. Bucket trucks good, old-fashioned manpower and visual inspections are the preeminent tactics in this critical work.

Georgia Power uses predictive technologies, like LiDAR, to measure the proximity of limbs and lines. They've supplemented this with Sense's high-resolution data to determine if better grid visibility can be leveraged to identify the occurrence of disruptions.

The hope underpinning Georgia Power and Sense's pilot program is that response times can be improved, thus enhancing safety and reliability for customers. Georgia Power is installing Sense retrofit monitors into the homes of participating Atlanta-area customers. The installation of these AMI 2.0 devices, using ultra-high resolution data and embedded AI, will generate an improved view of the local distribution system and a better understanding of when and where grid anomalies like tree slaps occur.

Georgia Power intends to use this disaggregated data to detect vegetation issues earlier than before and manage them proactively. That tightens and prioritizes vegetation management efforts while also removing the aforementioned manual detection process. It also produces smoother, stronger regulatory compliance. Most importantly, it creates a safer, more resilient distribution system for all involved.

Georgia Power will also be able to unlock learnings that can help refine its response to future disruptive vegetation events. This is an in-progress, customer-impacting example of the quantum leap provided by AMI 2.0 meters with microsecond data rates. It's also a great example of rethinking the relationship between utilities, customers and the grid they share. It takes innovation and proactivity, both directed towards shared values and goals.

Real-time visibility builds a cleaner, more flexible and resilient grid

The adage "you can't manage what you can't measure" holds true in the energy transition. Next-generation meters equipped to process 1MHz data and locally host AI computation are giving utilities the tools they need to proactively measure AND manage, in real time. By enabling deep and responsive insights and offering management automation, these meters foster a new, more collaborative relationship between utilities and their customers.

As we create a future powered by clean energy, now is the time to embrace high-resolution data at the grid edge. Over the next five years, we have a unique opportunity to accelerate grid-edge intelligence and maximize the capabilities and performance of existing infrastructure. By transforming home energy meters into smart, proactive, automated devices capable of sensing, processing and controlling energy usage, we can build a cleaner, more flexible and more resilient shared grid.

ABOUT THE AUTHOR:

Co-founder and CEO of Sense since 2013, **Mike Phillips** brings decades of expertise to achieve Sense's mission to transform the relationship between people, homes and the grid. Previously CTO and founder of a start-up with the first voice-enabled virtual assistants on mobile phones, Phillips is a pioneer in machine learning, bringing his capabilities to tackle the climate crisis.

TURNING DATA INTO DECISIONS:

AI'S ROLE IN NEXT-GEN UTILITY ASSET MANAGEMENT

KRISTY MCDERMOTT

In an era flooded with AI buzzwords, the utility sector faces a critical question: are we maximizing AI's potential or merely discussing it?

Utilities face significant challenges with aging infrastructure, extreme weather, rising operational costs and increased demands for reliability. AI offers a promising solution, but it's time to move beyond theoretical discussions, the "what ifs," to embrace the practical benefits, the "what now?"

AI tools like ChatGPT have already laid foundations as household names, receiving both good and bad reviews for varying applications and being used for everyday tasks. But the world is also abuzz with what feels like everyone pushing their latest and greatest AI solution that promises the world. This can bring AI fatigue. Without real, meaningful use cases of the benefits artificial intelligence can bring, we risk talking the talk but not walking the walk.

Recent advancements show how AI can revolutionize asset management for utilities. Automated systems can now accurately identify and assess components on utility poles, streamlining inspections and minimizing human error. These systems not only detect defects with high precision but also enhance maintenance efficiency, reduce downtime and extend the lifespan of critical assets.

This shift from talk to action signals the next step toward the future of utility management. After all, actions speak louder than words. →

AI in action

To turn the theoretical into the practical, we can examine how AI technologies are already impacting the utility sector through innovative applications. For utilities especially, AI technology is no longer merely an experimental tool, but a proven solution. Companies that have embedded in automating asset management for utilities for over a decade, honing what AI can look like and what it can provide for businesses with hundreds of miles of powerlines in the most remote locations are rising to the top of their field. And of course, the industry has come a long way in the past ten years. Comparably, think of the smartphone you carried with you in 2014 versus Apple's latest iPhone 16.

The most advanced software goes far beyond the machine learning that your summer intern could train in a couple of hours. And that's not to undermine the work of interns, but today we're deploying highly sophisticated tools that organize huge quantities of reality data into useable workflows. In recent years, many utilities have already made the first step to limit reliance on outdated physical maps and instead found themselves relying on a digital equivalent – vast volumes of unorganized, siloed data which is unmanageable and expensive to store.

The next stage is truly AI-optimized systems which work through the entire inspection process from planning through to reporting, combining and interconnecting data as it does so, providing a clear and actionable plan and giving utilities more oversight than ever before.

One such platform is our Asset Insights module. By automating the detection and assessment of infrastructure components and employing advanced machine learning algorithms to scan utility poles and other assets AI solutions provide exceptional accuracy. This technology not only identifies defects such as cracks or corrosion but also assesses overall asset health, allowing utilities to prioritize maintenance and repair tasks effectively.

The real-world application of such technologies is already showing promising results. For example, utilities using AI-driven systems report a substantial reduction in both the time and cost associated with routine inspections. By automating these processes, AI helps utilities redirect valuable human resources toward more complex issues that require human insight.

Addressing the challenges

While AI offers substantial improvements, adopting it in utility asset management is not without its challenges. Integrating advanced AI systems into existing operational frameworks often presents hurdles in the form of employee training and data compatibility and system integration.

Utilities and AI service providers must address these technical challenges head-on, ensuring that their existing processes can seamlessly connect with AI technologies to fully leverage their capabilities.

Merging AI technology with legacy systems poses a significant challenge. Many utility companies operate on outdated platforms that are not readily compatible with the latest AI software, requiring extensive customization and sometimes complete system overhauls. This integration process demands not only technical expertise but also a strategic approach to ensure that new and old systems communicate effectively without disrupting ongoing operations.

Additionally, for AI to be effective, it requires high-quality, structured data. Utilities often have vast stores of unstructured or inconsistent data, making it difficult to leverage AI effectively. Establishing robust data governance and quality control is essential to prepare for AI integration. The process of cleaning and organizing data can be resource-intensive but is critical for maximizing the benefits of AI.

Training and change management also play crucial roles in the successful implementation of AI. Utility workers must be trained not only on how to use new systems but also on how to interpret AI-generated insights effectively. In an industry with an experienced workforce, the cultural shift towards data-driven decision-making can be substantial and requires careful management to align staff with new technological processes.

Furthermore, the upfront cost of implementing AI can be a barrier, particularly for smaller utilities or regional cooperatives. However, the long-term cost savings, increased efficiency and improved asset management performance justify the investment. To mitigate these costs, some utilities opt for phased implementation strategies, starting with the most critical assets to generate quick wins and establish the value of further investment.

Overcoming these challenges requires a proactive coordinated effort between AI solution providers and utility companies, focusing on seamless integration, comprehensive training and strategic investment to ensure that AI tools deliver on their promise to transform utility asset management while remaining flexible and scalable to best suit the utility's needs. Such strategic integrations will enable early adopters to enhance their operational efficiencies without overhauling their entire systems.

Looking ahead

Looking ahead, the role of AI in utility management is set to grow exponentially. Emerging trends such as the Internet of Things and smarter grids are expected to further enhance the capabilities of AI systems. These technologies will allow utilities to not only monitor but also automatically adjust their operations in real time to optimize energy distribution and respond to potential disruptions before they escalate.

Moreover, as utilities continue to face the challenge of extreme weather AI will allow them to stay one step ahead of the status of surrounding vegetation that could fall onto powerlines or catch fire. Advanced data analytics powered by AI will provide enhanced decision-making, as AI algorithms analyze vast amounts of data to predict potential failures before they occur.

From discussion to action

In 2024, AI is already transforming utility asset management from a reactive to a proactive discipline. By harnessing the power of AI, utilities are not only improving their operational efficiencies but are also setting the stage for a future where digital resilience defines utility industry leaders.

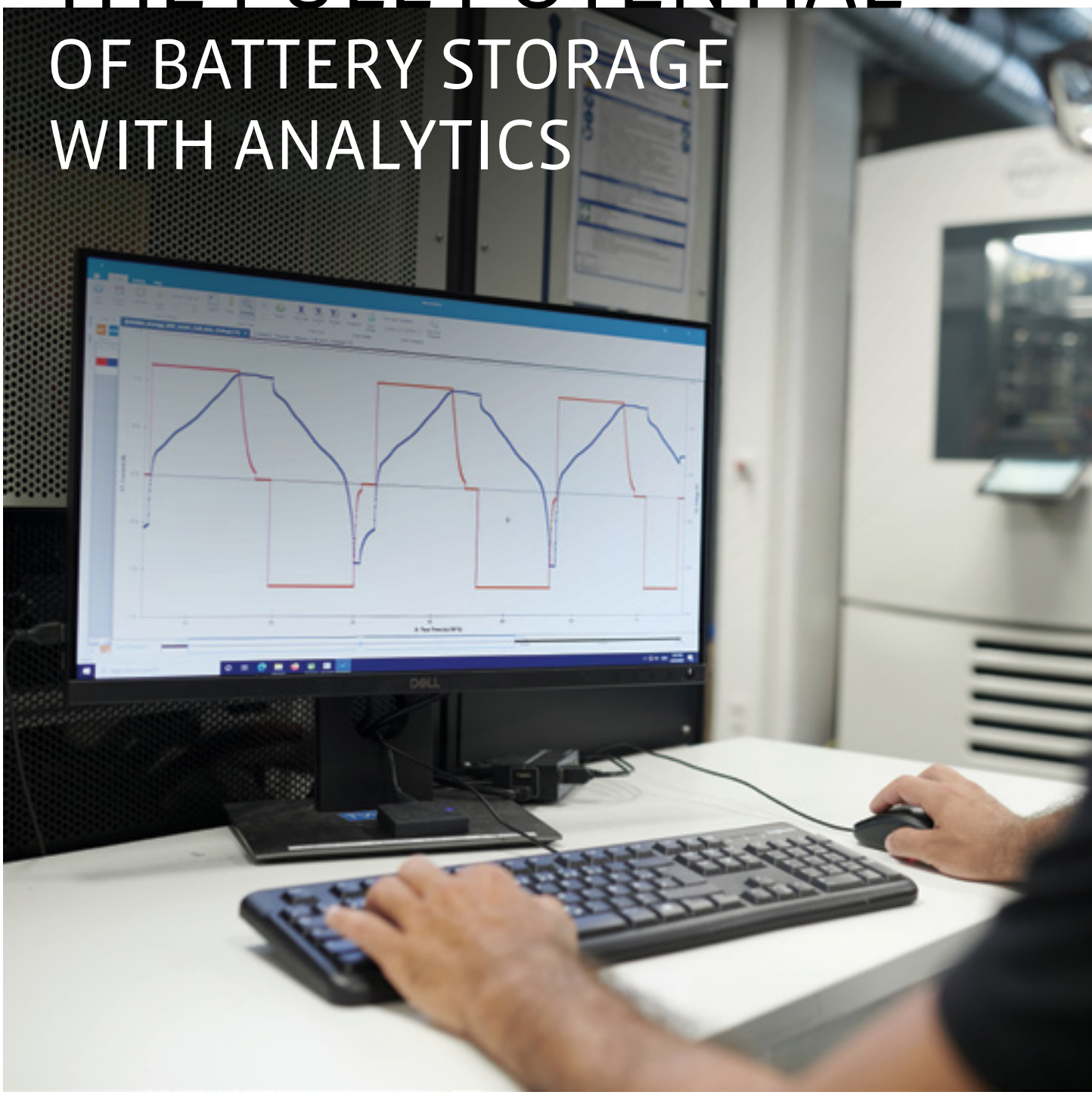
The journey from theoretical AI applications to practical, impactful implementations is complex but achievable with strategic planning, robust partnerships and a clear focus on long-term goals.

As we move beyond the hype, it becomes clear that AI is not just a tool for innovation but a necessity for the sustainable, efficient and resilient utility operations of today and tomorrow.

ABOUT THE AUTHOR:

Kristy McDermott has more than 30 years of experience in leadership roles with technology and utility companies. She has extensive experience in working with electric and telecommunications utilities, having held roles in operations, product, sales and regulatory compliance. Before joining Sharper Shape, McDermott led product teams to build and maintain fiber optic networks and manage the products and services offered on those networks to serve telecommunications and electric utilities. McDermott holds a bachelor's degree in business administration, majoring in accounting from the University of Iowa.

UTILITIES CAN UNLOCK THE FULL POTENTIAL OF BATTERY STORAGE WITH ANALYTICS



Source: TWAICE

LENNART HINRICHS

Battery energy storage systems (BESS) are a critical part of the modern grid. Energy storage is ideal for the integration of new resources necessary to meet rising power demands, enabling intermittent renewables to meet a utility's power needs when there is no sun or wind while keeping the grid stable at times of high generation. The suitability of BESS for the modern grid has led utilities to make it a key part of their long-term strategy.

However, battery storage can also be a stressor for utilities. There are dozens of BESS suppliers to choose from, all using a wide range of different batteries and inverters, and utilities need to right-size their systems to ensure they are not investing in more or less storage than they need. BESS resources are complex assets that require regular monitoring and maintenance to ensure safe and reliable operation, while operators must also make sure those operations are within the bounds of manufacturer warranties. There is also a diverse set of revenue opportunities for utility BESS assets to participate in, but as this differs for each ISO/RTO, navigating it can be daunting.

All of this means battery storage has the potential to add to utility challenges, even as the technology represents a critical element in the power mix. Through this article, I will explain how having the right software can give utility operators a powerful tool that enables them to fully harness the capabilities of a BESS. An advanced battery analytics platform provides utilities with full access to and control of the wealth of data offered by a BESS, becoming a valuable tool for all stages of a BESS lifecycle – deployment, operations, augmentation and end-of-life (EoL). Analytics software also ensures that battery systems remain a safe and reliable asset while unlocking revenue-generating opportunities for utilities. →

Source: TWAICE

From cradle to grave, a tool for the entire life of battery storage

Battery storage includes a manufacturer-provided energy management system (EMS), and utilities may think this is enough for BESS operation. While a basic EMS generally confirms safe battery performance, the software is largely limited to identifying immediate safety concerns over long-term concerns and is susceptible to failure itself. More advanced analytics software, which operators can use in concert with the provided EMS, offers greater capabilities. Indeed, in a recent industry survey[1], only 55% of respondents noted satisfaction with their current software stack and indicated that their primary concerns had shifted from immediate safety worries to operational issues. These are the sort of everyday concerns typical of a maturing technology – one that requires the deeper integration of a robust analytics platform.

One of the main benefits of analytics compared to the provided EMS is that it is a tool for the entire life of an ESS. Utilities can start using an analytics platform even before a battery storage system is in operation. Analytics software that offers modeling features lets utilities simulate how a BESS will perform based on their planned usage, which offers several benefits to utilities. Modeling helps determine how much storage utilities will need, so they can avoid spending more than necessary on an oversized installation. Modeling also helps utilities determine which system is best for their needs, as it can simulate battery degradation in different scenarios to account for services like demand response and peak shaving. Most analytics providers equip their software with a complete database of all major battery manufacturers, so the platform will be ready to model whichever ESS the utility is considering.

After construction, utilities can then employ analytics during the important step of commissioning a BESS. Commissioning is key to ensuring safe operation but can easily become a drawn-out process that delays deployment. Digital commissioning using analytics can complement on-site efforts by uncovering issues that may go unnoticed during on-site commissioning, offering deeper insight into the performance and condition of the storage system. Resolving BESS issues earlier in commissioning ensures utilities can deploy the system to the grid faster.

Once a BESS is operational, analytics continue to offer everyday support for utility operators. The software monitors battery data to immediately alert users to areas of concern, using complex algorithms to recommend the best path forward. Analytics identify issues that a standard EMS would otherwise miss, ensuring greater uptime for a BESS that will not be knocked out of commission by a defect that spirals into a larger issue. For utilities with a diverse portfolio of storage assets, analytics is also ideal as it brings together various installations into a single asset management platform with straightforward visuals.

During regular operations, the monitoring and data crunching of analytics also help utilities determine if they should alter their BESS strategy. If a utility decides to enroll its BESS in ancillary services after deployment, for example, analytics will recommend how to best adjust its operation to meet those needs. Considering the need for flexible assets in the face of a changing grid of intermittent renewables and increased demand, it's key that battery software can adjust to any changes in how a utility operates its BESS.

Another operational benefit to analytics is how it works with the various warranties from BESS suppliers. Navigating warranty restrictions can be daunting for operators and can lead to utilities running their battery storage far below capacity to avoid unplanned warranty deratings. Some analytics suites offer detailed warranty trackers that alert operators if a BESS is in danger of voiding its warranty, and the detailed information within analytics also simplifies warranty claims. The warranty features of analytics also make it possible for utilities to run BESS closer to limits operators would typically avoid out of an abundance of caution, maximizing performance.

Through the end-of-life for a BESS, analytics continues to serve a purpose. Analytics can even help postpone when EoL will occur, or at least tell operators when to expect it. With access to a wealth of data, analytics will adjust when it expects a BESS to approach EoL based on current and planned usage. The platform provides recommendations on how to adjust BESS operations to extend the system's lifecycle. A battery equipped with analytics is also well-placed for second-life potential; a BESS with a lifetime of detailed health reports and monitoring recorded by analytics is easier to repurpose – like maintaining detailed service records for a vehicle.

Calming safety worries

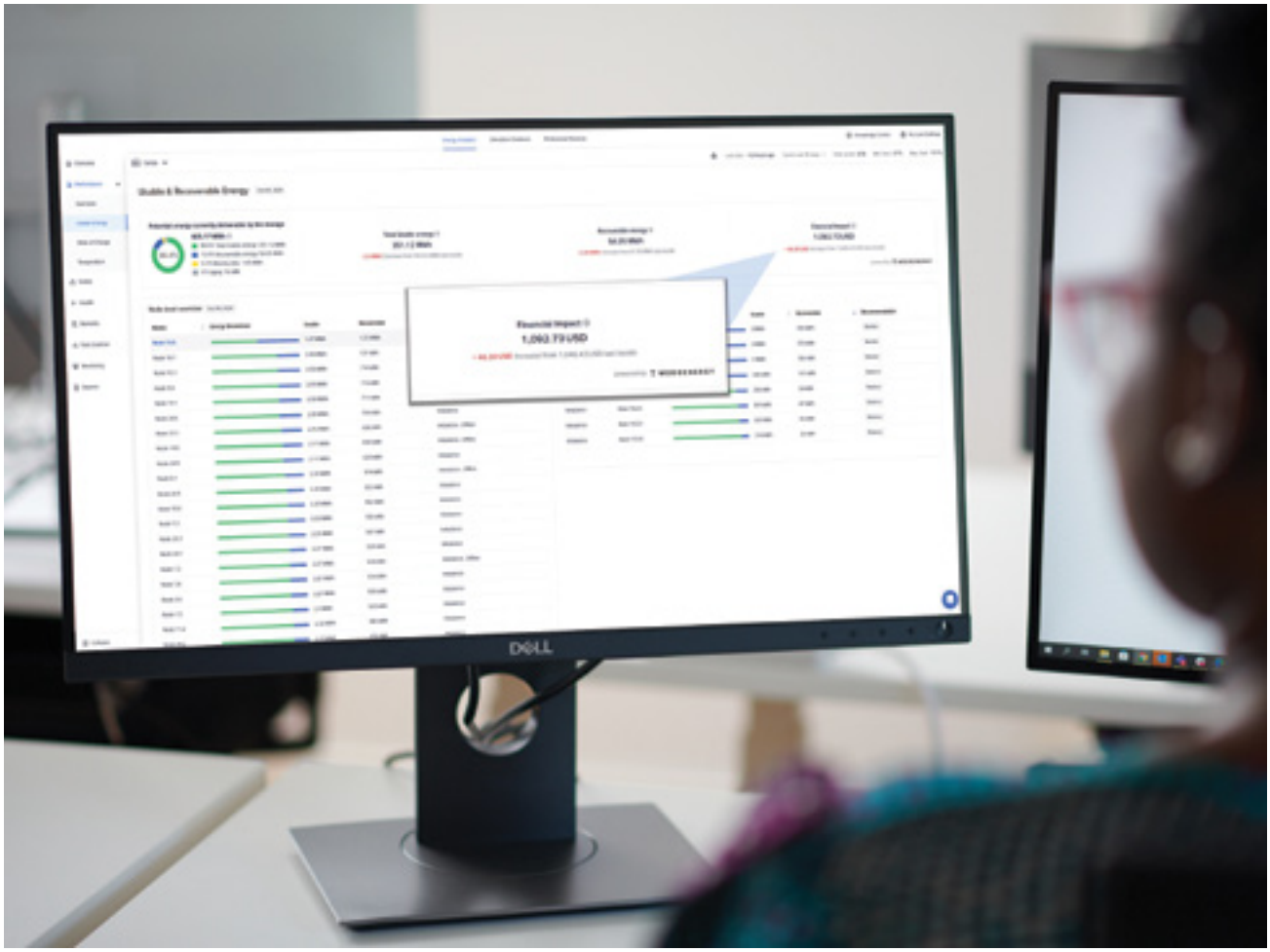
Analytics software is an ideal tool for BESS operators who are growing more concerned with operational issues, but it also enhances safety monitoring. Having better insights into safety issues is still critical for utilities, even as battery systems mature. Though the risk of battery fires is small, the danger posed by thermal runaway in lithium cells continues to make safety an overriding concern for storage operators. This is especially true for utilities, many of which have to balance community concerns of BESS safety with the need for greater storage capacity.

By providing access to advanced data collection and processing capabilities, analytics helps utilities avoid the sort of high-profile conflagrations that can swiftly put an end to BESS deployment aspirations. Algorithms within analytics software identify issues early on that could eventually lead to fires, such as manufacturing defects at an individual cell level. The safety alerts sent by analytics platforms are also granular and will direct operators to exactly where they need to focus their efforts, whether it be the cooling system or an electrochemical issue.

Just as analytics is helpful at every operational phase of a battery, the platform also assists with safety at each stage. During commissioning, analytics will alert operators to manufacturing defects before the system energizes which could lead to a fire. The software will also raise red flags around the utility's planned strategy if it threatens to push the BESS to dangerous limits. Analytics can even assist after a fire. In one instance, a storage integrator approached an analytics firm to identify the root cause of a BESS fire. The analytics company's software, in processing data provided by the integrator, was able to source the fire to a flawed cell during the manufacturing process.

Expanding BESS revenue potential

Energy storage can be a large capital expense, especially at the utility scale required for grid applications. The good news is there are many options for generating revenue from a BESS. In North America, the various ISOs/RSOs offer several energy markets for battery storage participation, but the options can be bewildering. Utilities must navigate arbitrage, frequency regulation, demand reduction, and peak shaving, as well as wholesale markets for resource adequacy and reserve capacity. →



Source: TWAICE

Analytics software helps utilities navigate all the above use cases and provides operational guidelines to ensure battery degradation does not impact long-term profitability. The different wholesale markets will each place unique stressors on BESS assets, which analytics software considers when predicting how batteries will age. Utilities can also use the single analytics dashboard to manage different market enrollments for each battery.

Beyond market enrollments, analytics will also help optimize BESS revenue during everyday operations, and even prior to deployment. Modeling provides utilities with a way to test different BESS strategies before commissioning systems, helping determine which will provide the most revenue over time. Utilities can employ analytics this way very early in the planning process, receiving guidance from the software on which BESS to purchase for maximal return on investment.

During regular operations, analytics are critical for determining the accurate state of charge (SoC) so utilities can be certain of a battery's capacity. An EMS alone cannot calculate true SoC, instead relying on temperature, voltage, and current to estimate it – an issue in any of these measurements results in an inaccurate SoC from the EMS. The accurate SoC enabled by analytics' enhanced computing power is critical to BESS profitability. For example, inaccurate SoC could mean that an asset is unable to deliver the forecasted energy or Àprovide contracted ancillary service – thereby leading to underperformance penalties.

Battery analytics also contribute to revenue generation by detecting potential issues early on, enabling operators to proactively address issues and avoid costly downtime caused by unexpected failures. The software will help operators isolate an issue without having to shut down large portions of the BESS to locate it, avoiding lost revenue for a utility, along with stopping the issue from snowballing into something that seriously damages a BESS. Even approaching EoL, analytics continues to optimize for revenue, monitoring degradation and capacity loss to determine how these factors impact a battery's market potential towards the end of its lifecycle.

Taking full advantage of BESS data with battery analytics

Battery storage systems are complex technologies with a wealth of available data, and utilities are doing themselves a disservice by not using this data to its full potential. While the standard energy management software provided by BESS suppliers is adequate to avoid serious safety issues, it is not designed for a maturing technology with everyday operational concerns.

In deploying advanced battery analytics software, utilities can make the most of their energy storage investments, from planning to end-of-life, and enhance existing safety monitoring while opening new doors for revenue. Battery storage will be a critical piece of the grid in the years to come. Analytics is just as important a piece of this puzzle for utilities.

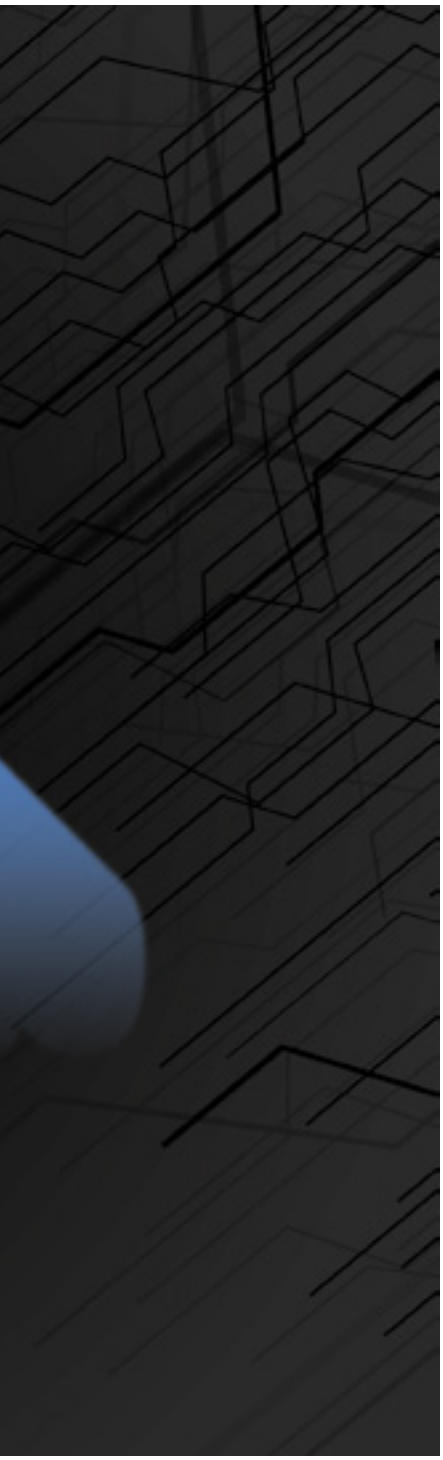
References:

1. BESS Pros Survey: What Matters Most to BESS Professionals Today." TWAICE, Feb. 2025, www.twaice.com/guides-reports/bess-pros-survey-report.

ABOUT THE AUTHOR:

Lennart Hinrichs is executive vice president & general manager Americas at TWAICE, where he oversees TWAICE's business across the Americas from the company's Chicago office. He previously served as vice president of Marketing & Strategic Partnerships and commercial director. Before joining TWAICE, Hinrichs worked in strategy consulting and other start-ups driving the business model development and go-to-market strategy in industries ranging from consumer goods to telecommunications and automotive.

KEY TRENDS RESHAPING THE ENERGY LANDSCAPE



ROLF BIENERT

For anyone unfamiliar with OpenADR, the concept was conceived during the 2000/2001 energy crisis in California. California's energy needs exceeded the available resources on several occasions during this period. At the time, the only fast and reliable response available to grid operators was to completely shut down parts of cities and counties for periods of time. The blackouts were cycled around within the affected areas, termed as rolling blackouts. As a result, the OpenADR standard was created and quickly became the key standard for demand-side management across the United States.

Since then, we have seen demand for OpenADR grow further afield, with the first requirements outside of the U.S. in Japan, followed by Korea and China. New Zealand followed in the late 2010s and most recently Europe, particularly in the United Kingdom. This rapid adoption emphasizes the importance of standards and the crucial role they play in enabling efficient demand response within energy management systems. By mandating standards, governments and regulatory bodies support the need for compliance. →

The standard is maintained by the OpenADR Alliance, a California-based non-profit organization. The Alliance now has three versions of the standard, OpenADR 2.0a, 2.0b (2012 & 2013) and 3.0, first published in 2023. We recently launched the first certified OpenADR 3.0 products into the market from member companies, EVoke Systems, E.ON Energy Networks and Universal Devices. The Alliance now has over 200 members worldwide, 300+ certified products and is working with 10 approved test facilities around the world.

Over the last 25 years, we've seen a growing number of challenges facing the energy sector, driven by more extreme weather events like wildfires and hurricanes, the rapid adoption of electric vehicles (EVs) and electric appliances and the rise of power-hungry artificial intelligence (AI) applications. As a result, the growth in energy demand and consumption continues to be a major concern.

In a fast-changing energy world, industry standards like OpenADR are the key to unlocking the grid's full energy potential. Here, we look at some of the more interesting trends taking shape in the industry:

1. Electric appliances as grid resources
2. The power of Virtual Power Plants
3. Power-hungry data centres: the role of microgrids
4. Flexibility through EV charging and vehicle-to-grid applications

Grid-interactive buildings and homes

The use of electric appliances as grid resources has been accelerated by connectivity and the use of standards. There is a need for a smart and flexible electricity system that decarbonizes economies and, most importantly, helps manage energy demand and balance the grid at peak times.

Grid-interactive buildings are one interesting trend. These solutions can help transform energy management, offering greater flexibility and efficiency by balancing and optimizing energy loads to reduce the strain on the grid. This type of intelligent building can adapt energy use dynamically, reducing demand when the grid is under stress and storing and drawing power from a range of distributed energy resources (DER) like solar and battery storage.

But can this idea be taken a step further by treating electric appliances as potential grid resources? Smart homes and smart automation are nothing new of course. But with the advances in technology, increased grid connectivity and compensation and the integration of AI for smarter automation, the market is set to explode.

Recently, Geo (Green Energy Options), a UK-based energy tech firm, has developed a groundbreaking open specification that enables OpenADR and Matter to work together, enabling mass-market, consumer-friendly grid demand response solutions. Published in March 2025, with independent input from the OpenADR Alliance and the Connectivity Standards Alliance (CSA), the specification provides a clear framework for energy flexibility.

Demand Side Response Service Providers (DSRSPs) and Energy Smart Appliance (ESA) manufacturers can use this bridging specification to unlock the inherent energy flexibility that's contained in household white goods appliances, EV charging, water heating, electric heating, solar and battery storage systems.

Utilities and energy flexibility service providers have been using the OpenADR protocol for over 20 years to connect homes and businesses to the grid. Using OpenADR, the grid understands how these ESAs can be flexed; sending incentive signals to use energy at different times and help balance the grid.

The strength of virtual power plants

Balancing energy supply and demand is critical to maintaining a reliable electricity grid. So, can Virtual Power Plants (VPPs) offer an innovative and alternative solution to traditional approaches, allowing local grid operators to use energy flexibility to ensure a more stable electricity supply?

A key driver is the emergence of falling battery storage costs, increasing the capability of VPPs as grid resources. First generation implementation for OpenADR in the VPP market was through rooftop solar and storage. Companies are now developing EV charging management systems that support flexible pricing, solar system integration and AI-based predictive load balancing.

The power industry is starting to look at aggregation of resources, even at a residential level. For this reason, VPPs are attracting attention. Drawing on the capacities of a range of energy sources, from wind turbines and PVs to home batteries and EVs, the cost of implementing VPPs can be much lower when compared to traditional power sources but offers all the potential for enhanced grid reliability and efficiency.

The OpenADR Alliance is engaging with three of the top 10 manufacturers in the U.S. market by providing insight on how they can engage directly with utilities as grid resources.

A reorganization of the VPP provider market, in the wake of the compensation rule changes in California in 2023, is starting to take shape. OpenADR is part of a VPP project funded by the DOE Connected Communities program. Marin Clean Energy (MCE) will leverage its status as California's first Community Choice Aggregation (CCA), and its work as a load-serving entity (LSE), scheduling coordinator and registered Demand Response Provider (DRP), to demonstrate how CCAs can use VPPs to create new opportunities and value for the buildings they serve, while enhancing grid health and reliability.

Those entering or considering the VPP market are already focusing on the use of advanced technologies and open standards, helping to drive growth. Utilities and energy providers will need to collaborate with others including tech companies and product manufacturers to turn homes, workplaces and communities into VPPs. Governments need to facilitate change through regulation and legislation to realize the full potential for VPPs to change the way we use and optimize energy.

Power-hungry data centres and the role of microgrids

Generating enough power for the demands of AI, cryptocurrency and other power-hungry applications is one of the biggest challenges facing data centres right now. With a power grid already under pressure and in the process of trying to modernize and flex to cope with the huge demands placed on it, the industry needs to rethink the way it adapts to these challenges.

With the rise of AI and the expectation of what it can deliver, the next few years are likely to see a significant rise in the number and size of data centres, with serious consequences for the energy sector. At the same time, technology firms are under growing pressure to make data centres more energy efficient and sustainable.

Microgrids could be the answer to providing a more sustainable and efficient energy supply for data centres. While the concept of a microgrid can vary depending on how they are used, it can be defined as a small-scale, localized electrical grid that can operate independently or in conjunction with the main power grid. They can range in size from a university to a single home. From residential to large campuses like Apple in Silicon Valley, microgrids are already being used in different scenarios.

The real advantage is in helping overcome grid constraints and improving reliability by managing consumption and maintaining power during grid issues. For data centres that require uninterrupted operation, this ability to deliver resilience is critical. →

Sustainability is another key advantage. By integrating renewable energy sources, such as solar or wind power and energy storage, microgrids can reduce their footprint, while in terms of cost, they can reduce operational costs by utilizing local power generation and demand-response strategies.

The bottom line is that the data centres will need a very high continuous supply of power, and microgrids offer options for a more resilient and responsive energy infrastructure. Decentralized power through a network of microgrids could help dynamically manage power loads and optimize renewable energy sources – especially as demands on the grid grow as we head towards an AI-powered future.

Flexibility through managed EV charging

The rapid growth of the EV market has spurred cooperation between automotive OEMs and the electric utility industry. Electrification represents a once-in-a-generation transformation of both the automotive and the utility sectors. We are already seeing a significant number of charging programs using standards like OpenADR and the Open Charge Point Protocol (OCPP), an open standard communication protocol for EV charging stations.

The industry is still developing, and we are expecting more innovation to happen. Aside from the basic communication protocol, EV charging includes a number of systems. From the plug to the customer interface, these systems must become more standardized in their roles and interactions to provide a customer-friendly and scalable solution for the future.

Governments around the world are investing in EV charging infrastructure, pushing it as part of their net zero goals and climate change agendas.

With this growing demand for electrification, EVs and charge points, it means greater demand for electricity. If everyone goes electric, grid capacity is placed under huge strain, particularly when people want to charge their cars at home or work during peak hours. Forecasting peak use and balancing this extra demand for power will be critical as the rollout of charging infrastructure escalates.

Electricity suppliers will need to incentivize consumers to charge their vehicles outside of peak periods by offering lower rates and other incentives. Showing customers that they can save both money and energy will be important while communicating the benefits in a timely and convenient way is critical.

Standardized information exchange on pricing signals, energy consumption and capacity are the basis for effective load control, enabling suppliers to respond flexibly to fluctuating demand. DSOs need to communicate this information to customers, quickly and securely using open communications standards. These standards will be critical to the success of energy flexibility developments like vehicle-to-grid (V2G) and ensuring the infrastructure is fit for purpose.

There are also lifecycle implications for EV batteries that need to be addressed as bi-directional charging can lead to degradation and shortening of battery life.

The issue of power quality also needs to be addressed. With more high-powered inverters pushing power into the grid, it could raise questions about power quality that is not up to standard and may require periodic grid code adjustments.

But such initiatives will only be a success if customers want it. While the industry is looking to educate users about the benefits of these types of programs, we need everyone involved, from energy suppliers and automotive companies to the government, to help promote energy flexibility initiatives.

It will be interesting to see how these trends develop further, and particularly the role of open standards in supporting future energy flexibility developments.

ABOUT THE AUTHOR:

Rolf Bienert, technical & managing director of the OpenADR Alliance is responsible for creating and managing technical strategy, direction and activities of the Alliance. He has been involved in many international standardisation efforts and is an active member multiple other organisations driving the development of new technologies.

The OpenADR Alliance was created to standardise, automate and simplify Demand Response & Flexibility, and Distributed Energy Resources (renewable energy, energy storage, etc.) to help utilities manage growing energy demand and decentralised energy production. OpenADR is an open, secure, two-way information exchange model and smart grid standard.

FORGING THE FUTURE AT THE EDGE: WHERE LEADERSHIP, INNOVATION AND COLLABORATION CONVERGE

ELISABETH MONAGHAN

In our Q4 2024 issue of EET&D Magazine, we published an article by Durabook Americas' CEO Sasha Wang on advances in rugged mobile computing, especially in AI-ready mobile devices that have been implemented in electric energy T&D fieldwork, and the resulting benefits to the electric energy industry. For our Q2 Powherful Forces profile, Wang talks about her role as CEO of Durabook Americas, what innovative technology she thinks will have the greatest impact on the industry over the next few years and what she and her team have done to ensure their customers understand and embrace this technology.

Leading with vision and purpose

As president of Durabook Americas, Sasha Wang drives the organization's strategic direction and operational execution across North and Latin America. At the helm of a dynamic organization in an evolving market, Wang focuses on business growth and market positioning while delivering rugged computer solutions that serve mission-critical sectors.

Wang's leadership is rooted in designing and building integrated technology eco-systems in collaboration with Durabook's customers and partners. By aligning global R&D innovation with regional needs, Wang ensures that every initiative Durabook pursues delivers real-world value to frontline professionals and enterprise stake-holders alike

Fueling passion

With a background in product planning and designing commercial devices for enterprise applications, Wang quickly realized that most enterprise solutions were built primarily for in-office use, often overlooking the needs of those working in the field. "What truly resonated with me was the impact technology could have when it was developed with a deep understanding of field conditions and user realities," said Wang. That insight has fueled Wang's passion for more than 15 years.

Wang did not plan a career in rugged computing, but once she stepped into the space, she felt an instant connection with the industry. "I've always been captivated by the ways technology can tackle real-world challenges – how it empowers people to achieve more with fewer resources and more quickly, especially in high-pressure, high-stakes environments," Wang said.

Joining Durabook marked a pivotal moment in Wang's career, where she saw the potential to revitalize the brand and drive rugged computing into a new era: one defined by machine intelligence, invention and seamless connectivity.

Enabling progress

For Wang, innovation isn't just about launching new products – it's about reimagining what's possible. In her opinion, true leadership means listening with intention, making bold choices and fostering growth in others. According to Wang, the most transformative breakthroughs happen when leadership and novelty are grounded in teamwork and strengthened by trusted partnerships.

Enabling progress is what Wang considers to be the most rewarding aspect of her work. Seeing how her company's technology empowers frontline professionals to work safer, smarter and faster. Whether it's an energy technician restoring power after a hurricane or a field engineer performing predictive maintenance on critical infrastructure, Wang feels it is Durabook's purpose to make their mission more effective.

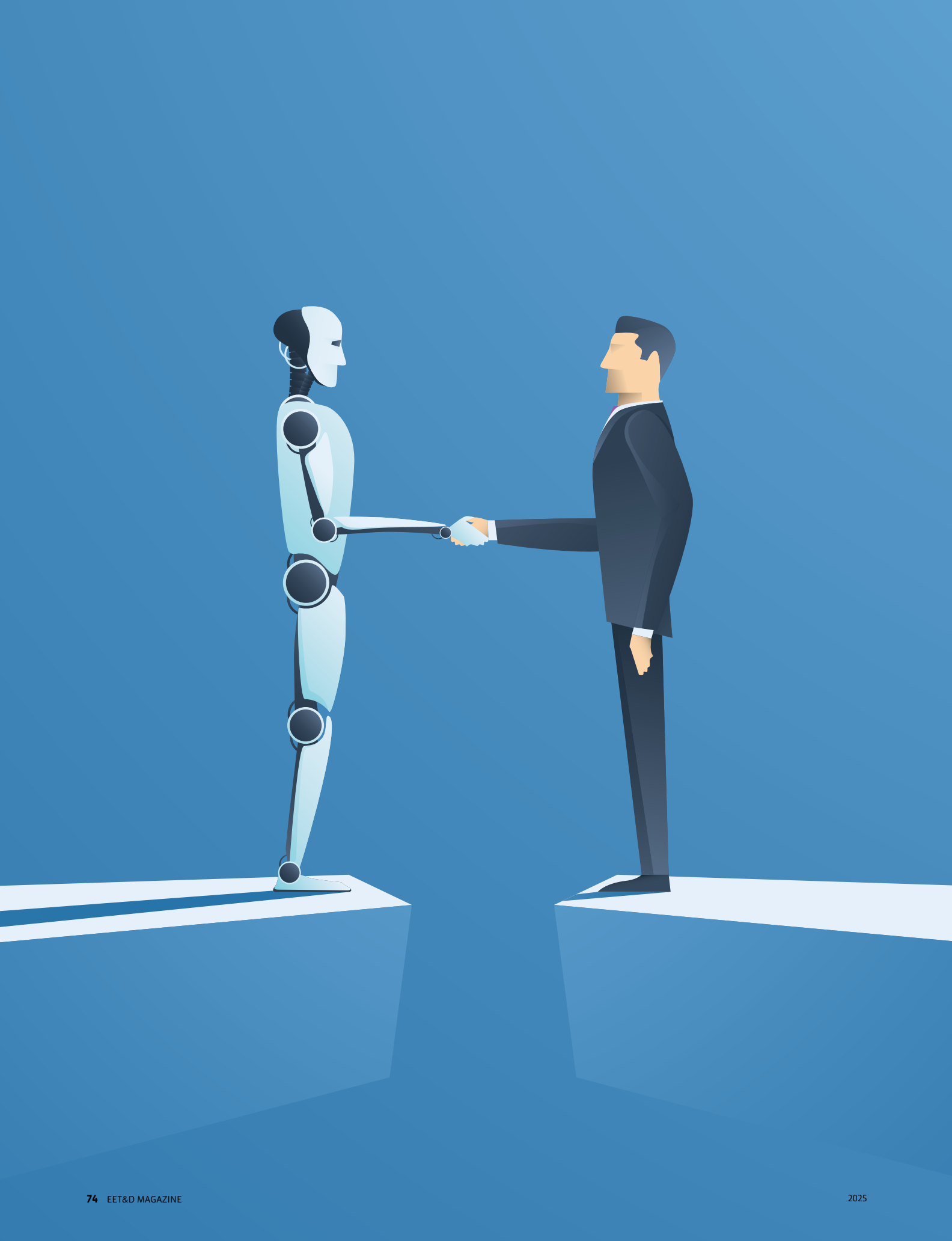
Wang finds purpose in helping others advance, but she believes that the real magic happens behind the scenes. "I deeply enjoy collaborating with our teams, engaging in open, creative brainstorming where we learn from each other's perspectives and experiences," said Wang. "Those conversations often spark the most innovative ideas and help us uncover unique solutions that truly anticipate and meet the evolving needs of our customers."

Reshaping the industry with AI

According to Wang, technology is the foundation of modern safety and security in high-risk industries, but she emphasizes that safety doesn't stop at physical threats. As operations become more connected, cybersecurity is just as critical. That's why her company's rugged solutions are built with multi-layered protection, including secure boot systems, built-in encryption and remote device management, safeguarding sensitive data and ensuring operational continuity.

Wang points to AI as the most transformative force across the energy industry – particularly when integrated into rugged field devices. Today's AI is no longer limited to centralized data centers or back-end systems; it now powers real-time decision-making directly at the edge. Whether it's through predictive maintenance, anomaly detection or intelligent automation, AI-enabled rugged devices are helping frontline workers operate smarter, more safely and with greater autonomy. AI is also reshaping how the electric energy industry approaches field operations.

However, Wang is quick to add that harnessing AI in the field isn't just about performance – it's also about reliability. Devices must not only process complex data locally but must also withstand extreme conditions, from harsh weather to shock, vibration and long duty cycles. Longevity, serviceability and consistent performance are non-negotiable. →



Wang views balancing sustainability with operational reliability as the utility industry's greatest challenge. Companies are under mounting pressure to lower carbon intensity, embrace cleaner practices and modernize aging infrastructure – all while maintaining uptime and profitability in an increasingly volatile global market. To meet these demands, Wang holds that the industry must accelerate its digital transformation to bring about intelligent, connected field solutions that blend rugged mobility with real-time data and advanced analytics. This is where she sees artificial intelligence as a game-changer – enabling predictive maintenance, automated inspections, intelligent workflows and dynamic decision-making at the edge.

By leveraging AI-powered insights, Wang believes field teams can proactively identify and address issues before they escalate, optimize asset performance and make faster, data-driven decisions – all without compromising safety or efficiency. She also believes that AI doesn't replace people – it enhances their capabilities and helps the industry move toward a more resilient and sustainable future.

Changing mindsets

Wang has experience overcoming resistance to digital transformation in traditionally change-averse environments. However, introducing rugged digital tools, data-driven workflows and AI-enhanced decision-making hasn't been just a matter of adapting to technology – it has been about changing mindsets. Wang has learned how to bridge that gap between modernization and trust, between what's possible and what feels practical on the ground.

Although it took time to engender her colleagues' acceptance of new technology, Wang understood the value of working closely with teams and partners in the field and having them participate in brainstorming solutions, was the most effective way forward for everyone involved. Through empathy, co-creation and demonstrating real-world value, Wang has successfully led efforts to modernize field operations – proving that trust and technology can evolve together.

Currently, Wang's team is working on next-gen rugged platforms that combine AI acceleration capabilities with Durabook's durability engineering. This includes incorporating AI-ready chipsets, enhanced thermal designs and modular upgrade paths to ensure future-proofing and long-term support in mission-critical environments. Additionally, Durabook is collaborating with its partners to develop domain-specific solutions that are optimized for the edge – from energy asset inspections using computer vision, to real-time environmental monitoring for safety compliance.

Customers are the heartbeat

When Wang talks about her work with Durabook, she speaks with enthusiasm, but she credits the resilience and dedication of those customers working on the front lines with driving her passion. Everyone – from linemen restoring power grids in the aftermath of a storm to engineers monitoring pressure valves in remote deserts or technicians navigating wildfires and deep freezes – relies on technology they can trust, often in life-critical situations.

> **[Our customers'] courage, adaptability and commitment to keep the world running under the toughest conditions fuel my own purpose.**

> **We strive to design and deliver tools that don't just work – but endure, perform and empower. Every challenge they face reminds me why reliability, originality and user-driven design matter. Their stories are the heartbeat behind everything we do.**

ADVICE FOR YOUNG PROS INTERESTED IN ELECTRIC ENERGY

As much as Sasha Wang talks about her passion for her work, fostering a culture rooted in purpose, creation and shared success is equally meaningful to her. To build something with the company's partners, as well as its employees, fulfills both Durabook's and Wang's mission. With that in mind, EET&D asked Wang what advice she can offer young professionals entering into the utility sector.

Sasha Wang's advice for young professionals entering into the electric energy sector:

Enter the energy sector with curiosity and a strong sense of purpose. This is a dynamic and complex industry, but within that complexity lies incredible opportunity – opportunity to innovate, impact and contribute to something bigger than yourself.

Don't be intimidated by the challenges – embrace them. Every challenge you face is also a valuable learning moment. It's through solving tough problems, adapting to change and navigating uncertainty that you grow not just professionally, but personally.

Invest time in understanding the full picture – from the office to the front lines. Field experience is essential. It grounds your ideas in reality, gives context to your strategy and shows you how innovation actually plays out where it matters most.

And always remember – success in this sector isn't achieved alone. It takes collaboration. Work closely with your team, seek out mentors and be open to diverse perspectives. Some of the best ideas come from brainstorming with others, learning from different disciplines and building solutions together. The future of energy depends on collective effort – and your voice can be part of that transformation

For women, specifically, those entering the workforce, Wang offers the following advice:

Don't shrink yourself to fit a mold – create your own path. This industry needs your perspective, your voice and your ideas. Be confident, trust yourself and know that you belong in every room where decisions are being made.

Dare to ask questions, even when you're unsure – that's how you learn, grow and lead. No one has all the answers from day one, but those who succeed are the ones who stay curious and keep learning every day.

Speak up, even when it feels uncomfortable. Your insights are valuable. Seek allies who lift you up but also be that ally for others. And remember strength and empathy are not opposites – they are powerful together.

Your authenticity is your greatest asset. Own it, evolve it and let it guide you as you rise.

ABOUT SASHA WANG:

Sasha Wang is president of Durabook Americas, the business division that specifically and exclusively serves the commercial sector of North America. She has more than 20 years' experience in the rugged-computer industry and previously served as Durabook's director of global sales and marketing.