

# EET&D

## MAGAZINE

Quarterly Issue 4, 2022 – Volume 25



# EXAMINING THE EUROPEAN GRID'S READINESS FOR RENEWABLE POWER



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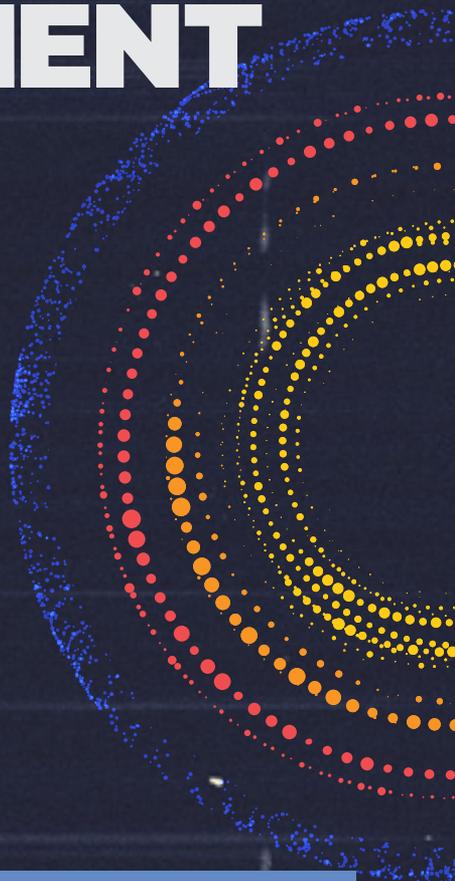
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Elisabeth Monaghan, Editor in Chief

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### **EXAMINING THE EUROPEAN GRID'S READINESS FOR RENEWABLE POWER**

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### **FINDING A SECOND LIFE FOR ELECTRIC VEHICLE BATTERIES: WHAT THE U.S. CAN LEARN FROM EV LEADERS**

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EVs are typically powered by lithium-ion batteries, which have a lifespan between 10 to 15 years, depending on environmental conditions and how they're maintained. EV manufacturers typically offer an 8-year warranty, meaning most EV owners will be responsible for battery replacement once it reaches its end of life for powering vehicles.

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Luis Duran, ABB

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### **SEEING WHAT'S NEXT: GRID MODERNIZATION IS JUST THE BEGINNING OF THE STORY**

Brandon Raso, Locana

This is the second in a series of three articles by Brandon Raso about the impact that location intelligence is having across the operations of electrical utilities. Location intelligence uses next-generation GIS technology and analytics to deliver actionable insights that utilities could not previously access.

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GUEST EDITORIAL

### CAN ELECTRIFICATION HELP US MOVE FORWARD WITH OUR DECARBONIZATION GOALS?

Christopher Roman, C.E.M., Conservant Systems

Electrification is the practice of designing or changing machinery to use electricity as a fuel source. This practice is also commonly referred to as "fuel switching." Cars converting their combustion engines to use batteries charged with electricity is the most common example of electrification today. When considering electrifying the equipment in your facility, we need to work through the following checklist: Energy Auditing, Work Conversion, Prices, Incentives, & Project Funding.

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### EMISSIONS MONITORING | Steve Lindsay, Honeywell Process Solutions

According to the U.S. EPA, methane is 25 times as effective as carbon dioxide at trapping heat within the Earth's atmosphere. Over the last two centuries, atmospheric concentrations of methane have more than doubled. Greenhouse gas (GHG) is estimated to be responsible for approximately a quarter of the historic levels of warming in the world today.

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### OUTSMARTING VEGETATION-RELATED POWER OUTAGES

Brian Hoff, GE Digital

According to FERC, vegetation management is the single largest cause of electric power outages. The agency also says that tree and power line conflicts have caused significant wildland fires in both the U.S. and Canada. Two key recommendations presented by FERC are to 1) improve current systems for managing utility vegetation management (UVM) workload and schedules, and 2) adopt consistent and industry-accepted best practices for UVM.

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THE BIGGER PICTURE

### DER REVOLUTION: TURNING THE ELECTRIFICATION CHALLENGE INTO OPPORTUNITY | Abhay Gupta, Bidgely

The U.S. Department of Energy estimates that there will be in excess of \$110 billion in DERs deployed nationwide by 2025, not including the billions in infrastructure spending that will also be required to integrate distributed resources with the grid.

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### POWERFUL FORCES

Elisabeth Monaghan, Editor in Chief

For our final Powerful Forces column of 2022, we are pleased to introduce Claire Gotham, VP, Utilities for Capgemini. Gotham talks about the changes she's witnessed in her time with the electric energy sector and the important role mentorship has played throughout her career.



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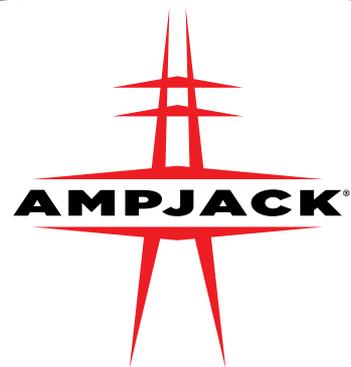
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# THE WORLD'S COAL CONSUMPTION IS SET TO REACH A NEW HIGH IN 2022 AS THE ENERGY CRISIS SHAKES MARKETS

December, 2022

Global coal demand is set to increase only marginally in 2022 but enough to push it to an all-time high amid the energy crisis, according to a new IEA report, which forecasts the world's coal consumption will remain at similar levels in the following years in the absence of stronger efforts to accelerate the transition to clean energy.

Global coal use is set to rise by 1.2% in 2022, surpassing 8 billion tonnes in a single year for the first time and eclipsing the previous record set in 2013, according to Coal 2022, the IEA's latest annual market report on the sector. Based on current market trends, the report forecasts that coal consumption will then remain flat at that level through 2025 as declines in mature markets are offset by continued robust demand in emerging Asian economies. This means coal will continue to be the global energy system's largest single source of carbon dioxide emissions by far.

Expected coal demand in 2022 is very close to the IEA forecast published a year ago in Coal 2021, even if coal markets have been shaken by a range of conflicting forces since then. Higher natural gas prices amid the global energy crisis have led to increased reliance on coal for generating power, but slowing economic growth has at the same time reduced electricity demand and industrial output - and power generation from renewables has risen to a new record. In China, the world's largest coal consumer, a heat wave and drought pushed up coal power generation during the summer, even as strict Covid-19 restrictions slowed down demand.

"The world is close to a peak in fossil fuel use, with coal set to be the first to decline, but we are not there yet," said Keisuke Sadamori, the IEA's Director of Energy Markets and Security. "Coal demand is stubborn and will likely reach an all-time high this year, pushing up global emissions. At the same time, there are many signs that today's crisis is accelerating the deployment of renewables, energy efficiency and heat pumps - and this will moderate coal demand in the coming years. Government policies will be key to ensuring a secure and sustainable path forward."

The international coal market remained tight in 2022, with coal demand for power generation set to hit a new record. Coal prices rose to unprecedented levels in March and then again in June, pushed higher by the strains caused by the global energy crisis, especially the spikes in natural gas prices, as well as adverse weather conditions in Australia, a key international supplier. Europe, which has been heavily impacted by Russia's sharp reductions of natural gas flows, is on course to increase its coal consumption for the second year in a row. However, by 2025, European coal demand is expected to decline below 2020 levels.

The world's three largest coal producers - China, India and Indonesia - will all hit production records in 2022. However, the report notes that despite high prices and comfortable margins for coal producers, there is no sign of surging investment in export-driven coal projects. This reflects caution among investors and mining companies about the medium- and longer-term prospects for coal.

Coal demand is forecast to fall in advanced economies in the coming years as renewables increasingly displace it for electricity generation. However, emerging and developing economies in Asia are set to increase coal use to help power their economic growth, even as they add more renewables. Developments in China, the world's largest coal consumer, will have the biggest impact on global coal demand in the coming years, but India will also be significant.

The IEA's special report on Coal in Net Zero Transitions, published on 15 November, provides the most comprehensive analysis to date of what it would take to bring down global coal emissions rapidly enough to meet international climate goals while supporting energy security and economic growth, and addressing the social and employment consequences of the changes involved.

Increase in coal use in Europe is expected to be temporary, with demand falling in advanced economies in the coming years but remaining robust in emerging Asia.

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# NEW YORK POWER AUTHORITY ANNOUNCES NEW FIVE-YEAR CONTRACT AGREEMENT WITH INTERNATIONAL BROTHERHOOD OF ELECTRICAL WORKERS

December, 2022

The Trustees of the New York Power Authority (NYPA) on Dec. 13 approved a new five-year contract agreement with the International Brotherhood of Electrical Workers (IBEW), a labor union representing more than 570 electricians, line persons, and other skilled craft employees at NYPA, the nation's largest state public power entity providing nearly a quarter of New York's electricity. Union representatives and NYPA leadership gathered Dec.14 for a ceremonial signing of the contract at NYPA's Niagara Power Project in Lewiston, N.Y.

*"We are very pleased to have arrived at this contract with the IBEW and to ensure the continuation of good wages and medical benefits for a vitally important arm of NYPA's workforce," said NYPA Interim President and CEO Justin E. Driscoll. "New York State relies on NYPA's talented craft labor force more than ever to help advance its ambitious clean energy goals and to ensure the continued efficient, secure and reliable operation of New York's energy system."*

The IBEW collective bargaining agreement includes wage increases that are retroactive and amount to a 17% increase over the term of the agreement which expires in 2027. Other negotiated terms include changes to time off provisions, retiree health care and the prescription drug plan for members who retire under this contract.

"The membership of IBEW 2104 continues to partner with the New York Power Authority in providing clean hydropower that helps fuel the economic development of this state. Having reached this new agreement, led by our new interim president and CEO Justin Driscoll, we look forward to doing our part to support Governor Hochul's zero-emission goals," said Lou Fazzolari, business manager, IBEW LOCAL 2104.

"Members of the IBEW are highly trained, dedicated professionals who have made tremendous contributions to support the production of clean, low-cost power throughout New York State. I am proud of our members and the many accomplishments and sacrifices they have made during unprecedented times. This new agreement will protect benefits and provide stability for the next five years as we work to support New York's ambitious energy goals," said William Brown, Jr. business manager, IBEW Local 2032.

The contract extension covers NYPA employees who work at NYPA's Niagara Power Project in Lewiston, its St. Lawrence-FDR Power Project in Massena, and its Blenheim-Gilboa Pumped Storage Power Project in Schoharie County, and its small hydropower facilities in Albany, Saratoga, Schenectady, Oneida and Herkimer counties.



December 14, 2022-- Lewiston, NY--- New York Power Authority Interim President & CEO Justin E. Driscoll (center) joins with Lou Fazzolari, Business Manager of IBEW Local 2104 (right) and William Brown, Jr. Business Manager of IBEW Local 2032, at a ceremonial signing of the new NYPA/IBEW five-year labor agreement.

Credit: New York Power Authority



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# ITRON SIGNS CONTRACT TO MODERNIZE ELECTRICITY, GAS AND WATER INFRASTRUCTURE IN GAINESVILLE, FLORIDA

December, 2022

Itron, Inc. (NASDAQ: ITRI), which is innovating the way utilities and cities manage energy and water, today (Dec 13) announced that they signed a contract with Gainesville Regional Utilities (GRU), a multi-service utility owned by the City of Gainesville, to modernize the utility's infrastructure with Itron's multi-purpose industrial IIoT network solution, including smart Gen 5 500W water and Gen 5 500G gas communication modules and Gen 5 Riva Distributed Intelligence enabled electric smart meters. The utility will also take advantage of Itron Enterprise Edition Meter Data Management as a Software-as-a-Service to manage meter and sensor data. These solutions will allow GRU to improve operational efficiency, data collection accuracy and enhance customer service. The utility plans to deploy Itron's solutions across Gainesville and surrounding areas.

Itron's flexible, extensible solution will enable GRU to execute its data management vision and strategy as it undergoes digital transformation and upgrades its metering infrastructure. Upon completion, GRU's electric, gas and water operations will leverage Itron's multi-purpose communications network to receive more accurate data, enabling the utility to act on insights that will help improve service reliability and reduce operational costs.

Through Itron's solutions, data is collected electronically daily as opposed to manually every month. This eliminates the need and costs associated with physically accessing the homes and businesses of customers to collect read meters. In addition, Itron's solutions can help GRU's customers lower their utility bills since they can now monitor usage from an online account.

"Our core business principle at GRU is to seek ways to enhance our customer's experience and reduce the impact of our operations on the environment," said Chad Parker, Energy Measurement and Regulation Manager at GRU. "Modernizing our infrastructure with Itron's IIoT network solution gives us the opportunity to streamline meter reading and improve services to our customers such as providing accurate and reliable billing. With Itron's solution, it lays the foundation for future applications like Distribution Automation, Street Lighting Controls and other Smart City advanced capabilities.

***"Working together with GRU, the fifth largest municipal electric utility in Florida, to deploy Itron's unified IIoT solution will enable the utility to enhance the quality, safety and reliability of the services that they delivery to their customers," said John Marcolini, senior vice president of Networked Solutions at Itron. "We look forward to working together with GRU to meet the changing demands in energy and water service delivery and better manage the planet's most precious resources."***





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\* The Elastimold Tru-Break switchgear module is considered maintenance-free because it contains no oil or gas to monitor or maintain.



# HIGH VOLTAGE TRANSFORMER CONFERENCE SPARKS A FUTURE UTILITY DISCUSSION

December, 2022

Our Director Herman Vogel and Chair, Chris Root along with Co-Chair Joe Huff invite you to come join them and experience the TechCon® difference! TechCon North America holds its 28<sup>th</sup> annual conference in person January 31 - February 2, 2023. It is hosted by Duke Energy and produced by TJH2b Analytical Services. Held in Charlotte, NC, the education and training content pursued has many of the brightest subject matter experts in the high voltage transformer maintenance industry.

An overview will highlight current trends in Utilities of the Future to include how Luma Energy is reimagining the grid infrastructure in Puerto Rico. You will have front row seats for the live discussion and debate during the Panel session moderated by Wayne Bishop, Jr. and sponsored by HyVolt. The National Grid Resiliency Journey speaks on Surviving Tomorrow's Climate while Dominion Power discusses in detail their 2600 MW Chesapeake Offshore Wind Project. Both Omicron and Reinhausen Manufacturing are holding hands-on and interactive training seminars to introduce their current innovations. These seminars are always in big demand.

After the compelling Keynote Address on Dynamic Resource Planning and Bridging the Gap to a Cleaner Energy Future by Duke Energy's Senior Vice President and Fuels Strategy and Policy Director, Nelson Peeler, (*count the vowels?*) Robots and Drone topics take over the stage. Both Hydro Quebec and Duke Energy explore how both of these devices are changing the workforce landscape. Another technical Panel session discusses many possibilities of SF6 futures, moderated by John McDonald and sponsored by NETA. You will be invited to join the riveting discussions and debates all before having lunch!

There are too many specialty topics driving predictive utility management decisions to list, but there are several Tutorials and various Training Tracks before the 2-part Training on Fire Safety by Seattle Fire Department's Captain Chris Greene. Energy and Fire Safety Procedure Training is part 1 and NOT TO BE MISSED, Lithium-Ion Battery Fire Risk is part 2.

We close out on Thursday with the DePartY lunch event sponsored by NETA, who will be providing CEU's for their members who attend TechCon® and apply. Don't miss where bright minds gather!

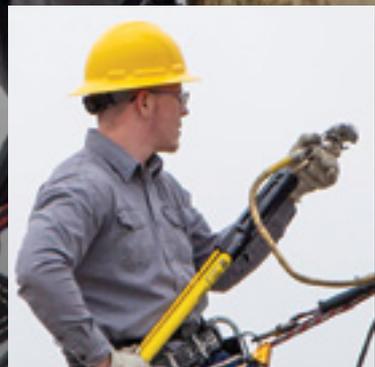
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## GOVERNOR HOCHUL ANNOUNCES \$23 MILLION IN FUNDING AND AWARDS FOR TRANSPORTATION ELECTRIFICATION INITIATIVES

*\$8 Million Available to Install Fast Chargers in Buffalo, Rochester and Syracuse, Including Underserved Communities*

December, 2022

Governor Kathy Hochul today (Dec 14) announced \$23 million in funding and awards for transportation electrification initiatives in New York State. Today's announcement includes \$8 million made available under the third round of the Direct Current Fast Charger program to install electric vehicle infrastructure in Buffalo, Rochester, and Syracuse, including underserved communities; \$7 million in awards to ChargePoint and EVGateway to improve access in upstate New York under Rounds One and Two of the Direct Current Fast Charger program; and \$8 million made available for electric school buses and paratransit buses under the New York Truck Voucher Incentive Program. These initiatives support the state's nation-leading Climate Leadership and Community Protection Act goals of reducing carbon emissions 85 percent by 2050 and that at least 35 percent, with a goal of 40 percent of the benefits of clean energy investments be directed to disadvantaged communities.

***“Reducing air pollution across the state is not only crucial for improving the health of our communities, but it also presents an exciting opportunity to invest in clean transportation options,” Governor Hochul said. “By putting more electric buses on the road and installing fast chargers in underserved areas, we can provide New Yorkers with access to the latest in sustainable transportation. This not only advances equity and sustainability, but it also sets the stage for a brighter, cleaner future for all.”***



Doreen M. Harris, President & CEO, NYSERDA said, "We are proud to work with our partners ChargePoint and EVGateway to bring electric vehicle charging to upstate New York areas and strategically place the latest technology and infrastructure in locations that have had less fast charger deployment to date. Electric vehicles, including electric buses help community members and children alike have easy access to clean transportation as a part of their routine for work, school or to complete other essential errands."

The Direct Current Fast Charger (DCFC) program, administered by the New York State Energy Research and Development Authority (NYSERDA), seeks proposals from electric vehicle (EV) developers and installers that have a minimum of two years' experience and at least 10 fast chargers or 200 Level 2 chargers in operation. Under this solicitation, proposals will be considered that would develop two or more fast charging sites, with at least half of all stations located in underserved areas. Each site must be able to charge at least four vehicles and have a total site capacity of 600 kilowatts or more. Additionally, each site must be located within 12 miles of Buffalo, Rochester, or Syracuse city centers, and each proposal must have at least one site located within the city limits.

NYSERDA will accept applications for round three of the program from qualified EV developers and installers through February 28, 2023, and a scoring committee will evaluate all proposals based on the published criteria. Co-locating Level 2 EV chargers or distributed energy resources as part of the plan is encouraged.

For more information, a webinar will be held on December 20, 2022, at 2 p.m. ET.

Also announced today are two awards from funding offered in the first two rounds of the program awarded to improve fast charger access in other upstate New York areas. Awards include:

- **ChargePoint, \$7 million** - Awarded under Round One and Round Two, ChargePoint will install fast charging stations at four locations in each of the Central New York, North Country, Finger Lakes, Western New York, and Mohawk Valley Regional Economic Development Council areas. Each site will have four DC fast charge plugs for EV drivers with 25 percent (5 of 20) located within a half mile of a disadvantaged community.
- **EV Gateway, \$750,000** - Awarded under Round Two, EVGateway will install fast charging stations at three locations in the Southern Tier Regional Economic Development Council area. Each site will have four DC fast charge plugs and two Level 2 plugs for EV drivers with 66 percent (2 of 3) located within one mile of a disadvantaged community.

And today, under the New York Truck Voucher Incentive Program (NYTVIP) program, \$6 million is being made available to purchasers of new, zero-emissions all-electric school buses, with an additional \$2 million available to purchase electric paratransit vehicles providing supportive community services. The program can cover up to 100 percent of the incremental vehicle cost on the condition that these buses are housed at bus depots or operate on routes located within a half-mile of a disadvantaged community.

Funding for both the Direct Current Fast Charger Program and the New York Truck Voucher Incentive Program are part of New York State's \$127.7 million portion of the federal Volkswagen Settlement funds administered by the New York State Department of Environmental Conservation. Additional funding for the DCFC Program comes from RGGI auction proceeds. The DCFC program provides up to 80 percent of the cost to build publicly available charging stations for electric vehicles, does not use funding from the National Electric Vehicle Infrastructure (NEVI) Program so are and is not subject to NEVI program rules.

Department of Environmental Conservation Commissioner Basil Seggos said, "To reduce emissions and achieve New York's nation-leading climate goals, our State is providing critical support to bolster electric vehicle use. I applaud Governor Hochul for these significant investments to help more upstate communities grow the electric vehicle market, make EVs accessible to more New Yorkers, and help deliver the health, environmental, and economic benefits of a clean transportation transition."

NYPA Interim President and CEO Justin E. Driscoll said, "New York State has committed to being a leader in electric vehicle infrastructure to advance the transition to a cleaner, greener transportation system. Today's announcement highlights a collaborative effort, directed by Governor Hochul, that will provide even more incentives to improve charging access in upstate cities, including underserved communities, and encourage wider use of electric vehicles for bus transport. The New York Power Authority's EVolve NY fast charging network is paving the way toward widespread electrification and sustainability."

*State Department of Transportation Commissioner Marie Therese Dominguez said, "Working collaboratively with our many partners across the State to meet the goals of the Climate Leadership and Community Protection Act, the Department of Transportation plays a key role in helping New York achieve its nation-leading clean energy and climate goals. Today's announcement on electric charging access for underserved communities in Upstate New York reflects the State's commitment to a cleaner, greener New York while providing incentives to support electric school and para transit buses. The green revolution is upon us, and with Governor Hochul's unwavering support, New York continues to lead the way."*

State Senator Tim Kennedy said, "In order to fully support our ambitious climate goals outlined in the CLCPA, it's imperative that we're investing in sustainable green infrastructure and electrification initiatives across New York State. Today's announcement will create greater accessibility to clean energy and continue to incentivize the transition to zero emission vehicles statewide."

Assemblymember William Magnarelli said, "I welcome this announcement from NYSERDA. The largest barrier to the electrification of transportation is the lack of infrastructure. Most people will not seriously consider an EV until they reliably charge it. The projects announced today are an important step in this effort." →

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Assemblymember Patricia Fahy said, "Electrifying New York's transportation sector which accounts for a third of all greenhouse gas emissions in the state is a necessary component in our strategy to meet the climate mandates set forth in the Climate Leadership and Community Protection Act. Today's investments furthers New York State's commitment to expanding electric vehicle infrastructure across Upstate, reducing range anxiety, and prioritizing improved access to electric vehicle ownership for New Yorkers. Electrifying more of our school buses by using federal Volkswagen Settlement funds in part will improve the health of our students across the state on their way to and from school. Thank you to Governor Hochul for continuing to build-out New York's electric vehicle infrastructure and prioritizing the electrification of our transportation sector."

ChargePoint President and CEO Pasquale Romano said, "New York's emissions reduction goals are among the most ambitious in the nation, and Governor Hochul has rightly acknowledged that electric vehicles must be part of the solution. Now we must work together to make sure every community and travel corridor especially those in underserved areas has access to charging. "We thank Governor Hochul and NYSERDA for their efforts to expand electric vehicle charging across the Empire State and look forward to working with NYSERDA and the Central New York, North Country, Finger Lakes, Western New York, and Mohawk Valley communities on this exciting project."

*EVGateway Vice President of Corporate Affairs Divina Anzures said, "EvGateway is excited to partner with NYSERDA to improve EV Charging infrastructure in the state of New York, especially in areas serving disadvantaged communities. We are looking forward to helping shape the state's DC Fast Charging Corridor."*

New York State's \$1 billion investment in electrifying its transportation sector is vital to meet the State's sweeping climate and clean energy plan. The State, under Governor Hochul's leadership, is rapidly advancing measures that all new passenger cars and trucks sold be zero emissions by 2035, along with all school buses being zero emissions the same year. Reducing carbon emissions and pollution from vehicles creates cleaner air and healthier communities, particularly in underserved areas. A range of initiatives grow access to electric vehicles and improve clean transit for all New Yorkers including EV Make Ready, EVolve NY, the Drive Clean Rebate, the New York Truck Voucher Incentive Program (NYTVIP), Charge NY, and federal funding under the NEVI Program. These programs are designed to get 850,000 zero-emission vehicles on the road by 2025 and expand electric vehicle charging infrastructure.

## New York State's Nation-Leading Climate Plan

New York State's nation-leading climate agenda is the most aggressive climate and clean energy initiative in the nation, calling for an orderly and just transition to clean energy that creates jobs and continues fostering a green economy as New York State recovers from the COVID-19 pandemic. Enshrined into law through the Climate Leadership and Community Protection Act, New York is on a path to achieve its mandated goal of a zero-emission electricity sector by 2040, including 70 percent renewable energy generation by 2030, and to reach economy wide carbon neutrality. It builds on New York's unprecedented investments to ramp-up clean energy including over \$35 billion in 120 large-scale renewable and transmission projects across the state, \$6.8 billion to reduce buildings emissions, \$1.8 billion to scale up solar, more than \$1 billion for clean transportation initiatives, and over \$1.6 billion in NY Green Bank commitments.

Combined, these investments are supporting more than 165,000 jobs in New York's clean energy sector in 2020, a 2,100 percent growth in the distributed solar sector since 2011 and a commitment to develop 9,000 megawatts of offshore wind by 2035. Under the Climate Act, New York will build on this progress and reduce greenhouse gas emissions by 85 percent from 1990 levels by 2050, while ensuring that at least 35 percent with a goal of 40 percent of the benefits of clean energy investments are directed to disadvantaged communities, and advance progress towards the state's 2025 energy efficiency target of reducing on-site energy consumption by 185 trillion BTUs of end-use energy savings.

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# IN-PERSON GATHERINGS: THE HIGHLIGHT OF 2022



**ELISABETH MONAGHAN**  
Editor in Chief

This past year presented its share of challenges. While the worst of the COVID-19 pandemic is behind us, many are feeling the after-effects. Some businesses did not survive the shutdowns, a lot of companies that laid off employees are still struggling to fill the roles that were vacated, and disruptions to the supply chain continue to make it difficult for even the most successful companies to operate.

Additionally, we continue to face challenges that have been around since before the pandemic, including the ongoing impacts of climate change and the frequency and the intensity of extreme weather events. In the past, EET&D published articles about topics like vegetation management, storm preparedness and wildfire risk mitigation at specific times of the year. Today, as we see wildfires occurring more frequently, and with a prolonged hurricane season, these articles no longer tie to one season or quarter – which is why you will see more coverage of these topics in this issue and future editions of the magazine throughout the year.

In addition to articles in this issue that take on natural and man-made disasters, several subject matter experts talk about what's next for the electric energy sector. For example, Sean McEvoy with Veritone makes the point that with the emergence of EVs, and the forecast for increased EV use, there will be millions of EV batteries manufactured. McEvoy provides suggestions for how to repurpose these batteries, once they are no longer being used to charge EVs.

ABB's Luis Duran talks about future-proofing the Distributed Control System, and Phil Beecher with WI-SUN Alliance broadens the focus on smart technology, exploring how cities across the globe can use IoT to improve their sustainability and pave the way for a carbon-free future.

For this quarter's Grid Transformation Forum column, Laurent Schmitt with Dcbel Energy addresses the European grid's push for renewables and the EU's role in the digital transformation. In his article, "The Top Three Trends Driving Canada's Adoption of Smart Home Technology," Schneider Electric's Lorne Hedges looks at Canada's adoption of smart home technology and how it benefits those utilities homeowners who invest in it.

For our final Powerfull Forces column of 2022, we feature VP, Utilities for Capgemini Claire Gotham. Gotham talks about how, when she first started working in the electric energy space, the industry had not experienced much innovation in about 100 years. Since then, that has changed, and in her position as an executive in the industry, Gotham sees more utilities and energy consumers embrace innovation. Today's technology requires manufacturers, software developers and energy providers to innovate and adapt quickly or get left behind.



A final reflection on 2022 is how, after a three-year hiatus, many of us were able to meet with our industry partners in person. Whether catching up with clients at a user conference or meeting with industry colleagues at a trade show, it is so nice to communicate without a computer screen or mobile phone between us. Those in-person connections also indicate that we really are getting back to some semblance of normal.

I mentioned in our Q3 issue that this past spring, EET&D Publisher Steven Desrochers and I attended both IEEE PES T&D in New Orleans and DistribuTECH in Dallas. In August, Steven participated in CIGRE Paris 2022. CIGRE, or the International Council on Large Electric Systems, brings together organizations and industry leaders from around the world to address existing and future electrical power systems. This year, attendance at CIGRE Paris was at a record-level high, with about 9,000 individuals, representing more than 90 countries.

I recently returned from London, where I attended Bentley Systems' Year in Infrastructure (YII) conference. Like other organizations, Bentley held its conference virtually in 2020 and 2021, so it had been three years since the staff and attendees gathered in the same location. Being able to go to the event was the perfect way for me to wrap up 2022.

Reconnecting with our advertisers, readers and other industry partners in the same space at the same time truly was one of the highlights of this past year. I look forward to seeing even more of our colleagues in 2023.

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

**[Elisabeth@ElectricEnergyOnline.com](mailto:Elisabeth@ElectricEnergyOnline.com)**

*Elisabeth*

# EXAMINING THE EUROPEAN GRID'S READINESS FOR RENEWABLE POWER

LAURENT SCHMITT



*For the Grid Transformation Forum, Laurent Schmitt CEO of Dcbel Europe shares his thoughts on the EU's push for renewable energy.*

## **Given the EU's push for renewables, what is the readiness of the European grid for renewable power?**

The new Repower EU plan is considering a significant acceleration of renewable distribution in response to the European energy crisis, which is the most obvious short-term measure to mitigate the significant fossil energy cost increase in wholesale markets as well as the low availability of the French nuclear portfolio.

- While grids have so far not been major roadblocks to renewable integration, we should anticipate they will become bottlenecks – we are starting to see this in Holland. So, it is essential to evolve our electricity market design to provide more transparency on grid bottlenecks and clear indications to investors on the areas where it is the easiest and most economical to enable renewable investments.

- In congested areas it is also key to consider alternative non-firm grid connection options, for example, incentivizing renewable investment with storage capabilities to offset congestion during certain periods of the day. This is useful both at high voltage (for large-scale renewable farms) as well as low voltage levels (for rooftop PV).
- While rooftop PV is appealing as it minimizes the land impact, the bundling of PV with storage self-consumptions schemes as well as dynamic export tariffs is essential to ensure successful renewable injections during periods when grids can absorb excess renewable self-consumption. →





### What more needs to be done and can it be done in time to meet the RePowerEU targets?

- Revisiting the energy market design will provide incentives to consumers that best align their flexible consumption with available renewable energy. It will also minimize usage of very expensive fuels during peak conditions.
- Options include the implementation of the Clean Energy package, the development of a new flexibility code to further automate the dynamic participation of flexible consumers into intraday, and a balancing of markets to capture renewables when they are available.
- Such participation is today only happening at the industrial level or for large building loads, so we must focus our efforts on expanding this concept to enroll all flexibilities arising from new heat pumps, EV smart charging – including bidirectional charging – and home battery storage, which currently is self-financed with home rooftop PV under self-consumption.
- Latest IEA reports indicate that grids will require four times more flexibility between now and 2050, as a result of such fast renewable expansion which needs to capture every flexibility throughout the system to make demand more elastic in the market mechanism, as well as to offset grid congestions when they happen.

### What is Europe planning to accelerate renewables developments?

- The EU is particularly focusing on rooftop PV integration as these are renewables that are the easiest to integrate into the electricity system and require less complex permitting (as they do not have any direct impact on extra land permitting). The new EU solar energy strategy targeting to double the current installed capacity by 2025 (320GW extra capacity) and quadruple it by 2030. This initiative is expected to be supported by a dedicated new solar rooftop initiative mandating solar in all new buildings within 2025-2030 combined with storage and smarter tariffs as well as the continued development of citizen energy communities. This new plan is expected to be considered through the next European Energy Performance Building Directive. This directive will define new energy efficiency labeling and mandating trajectories to shift the European building stocks towards net zero building between now and 2050 (through incentives to support integrated building upgrades combining PV, heat pumps as well as EV charging together with home & building energy management).

- The current European residential building portfolio is composed of around 80M single family homes, 10% of them being today equipped with PV under feed-in tariff. As a result of these several incentives, we expect the solar install base to at least quadruple over this building portfolio within 2030 representing a portfolio of 32-40M building to be equipped with solar and storage within 2030. In the same time analysis of European EV deployments (see the Eurelectric reference report) highlights a likely deployment of 30M charging points through residential homes which largely intersect with this solar & storage market and will lead to the possibility to have larger installations (expanding typically from 4kw household towards 8kw). The rapid switch to self-consumption business models brings new opportunities of differentiation for integrated solar, storage and smart charging.

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“ [...] enabling flexibility services through Vehicle to Grid (V2G) bidirectional charging would save up to 412-882 Million GBP in energy system costs [...] for only 50,000 contributing electric vehicles (EVs). ”

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### How much investment do you estimate could be needed to make the grid renewable ready?

- Several analyses have been made by Eurelectric, as well as ENTSO-E based on the Ten-Year Network development plan scenarios. I would suggest referring to their latest report.
- Beyond investments in physical reinforcement on critical corridors, it is also necessary to establish new flexibility marketplaces to make sure such investments are optimized versus the flexibility that the demand side will progressively be able to provide.
- As a concrete example, a recent study by Imperial College London has highlighted that enabling flexibility services through Vehicle to Grid (V2G) bidirectional charging would save up to 412-882 million GBP in energy system costs (deferral of backup generation capacity, deferral in distribution network reinforcement, as well as reduction in renewable curtailments during low loads periods) for only 50,000 contributing electric vehicles (EVs). →

### What is the expected impact on consumers?

- The current energy crisis is accelerating EV and PV adoption at a residential scale, which is opening new flexibility options at the edge of the energy system as well as new home energy optimization strategies protecting users against rising home electricity prices. Regulators are working on new regimes to facilitate residential flexibility participation in energy markets, resetting the historical demand response approaches which so far, has not worked fairly for residential low voltage environments. As an example, the UK regulator Ofgem has designed a new regulation allowing to leverage submetering data to remunerate smart charging flexibility more accurately into real-time markets, potentially opening up for new innovative tariffs combining flat and dynamic tariffs behind the meter depending on flexibility of associated resources. A real flexibility revolution moving forward!
- Today's new edge IoT technologies are capable of directly self-optimizing into dynamic prices – whether for flexibility or energy – which allows EV charges during home PV peaks or through the hours of the week where the electricity is really the cheapest. These technologies are expanding to incorporate Appstore marketplaces enabling consumers to select their preferred flexibility options from commercial aggregators, retailers and utilities.



At current power prices, local home PV installations are becoming business as usual where an 8Kw solar installation can be returned in less than five years, covering over 60% of the energy needs of a typical netzero home equipped with EV and bidirectional charging.



- New integration strategies are investigated at the home level through direct DC integration across PV, EV charging as well as home batteries which significantly increase the storage roundtrip efficiency typically moving from less than 80% round trip efficiency through AC into efficiencies higher than 90% with DC. EVs are progressively migrating to bidirectional charging – which we expect will become a default option by 2025 as per most EV OEM feedback – which ultimately will allow minimizing the investment required for home standalone storage using the EV battery to optimize self-consumption through days and nights while enabling new real-time energy transactions with the grid. Bidirectional chargers will progressively become default options of Home solar inverters, overall reducing the cost of netzero home electrical installations.
- At current power prices, local home PV installations are becoming business as usual where an 8Kw solar installation can be returned in less than five years, covering over 60% of the energy needs of a typical netzero home equipped with EV and bidirectional charging. Such installation will be able to self-consume around 70% of the solar PV produced on their roof while the surplus will be stored to be transacted with the grid at best times through grid morning or evening peaks which ultimately will maximise export revenues from 10c/Kwh into 50-70c/Kwh as currently observed in wholesale markets.
- At the heart of future netzero homes is the potential for greater control and user interactions. Users get a better grasp on cost, but also, sustainability. For those concerned about their carbon footprint, there is the option to utilize grid energy when it is generated by via renewable sources. Homes will progressively be equipped with new-generation home economic dispatch optimization to make all associated controls seamless, live and automated while providing simple metrics and data proving associated environmental and economic benefits.

### ABOUT LAURENT SCHMITT:

**Laurent Schmitt** joined Dcbel in early 2021 as CEO of Dcbel Europe. Before joining Dcbel, he held the positions of secretary general of the European Network of Transmission System Operators (ENTSO-E) and global smart grid strategy leader at GE Grid Solutions. He has been a member of several strategic industry committees including CIGRE, IEC and EPRI and is currently the chairman of the digital task force of SmartEn, the European association for demand response and distributed energy resource flexibility. Schmitt graduated in power system engineering from Supélec in Paris and holds an Executive MBA from INSEAD, France.



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# THE TOP THREE TRENDS DRIVING CANADA'S ADOPTION OF SMART HOME TECHNOLOGY





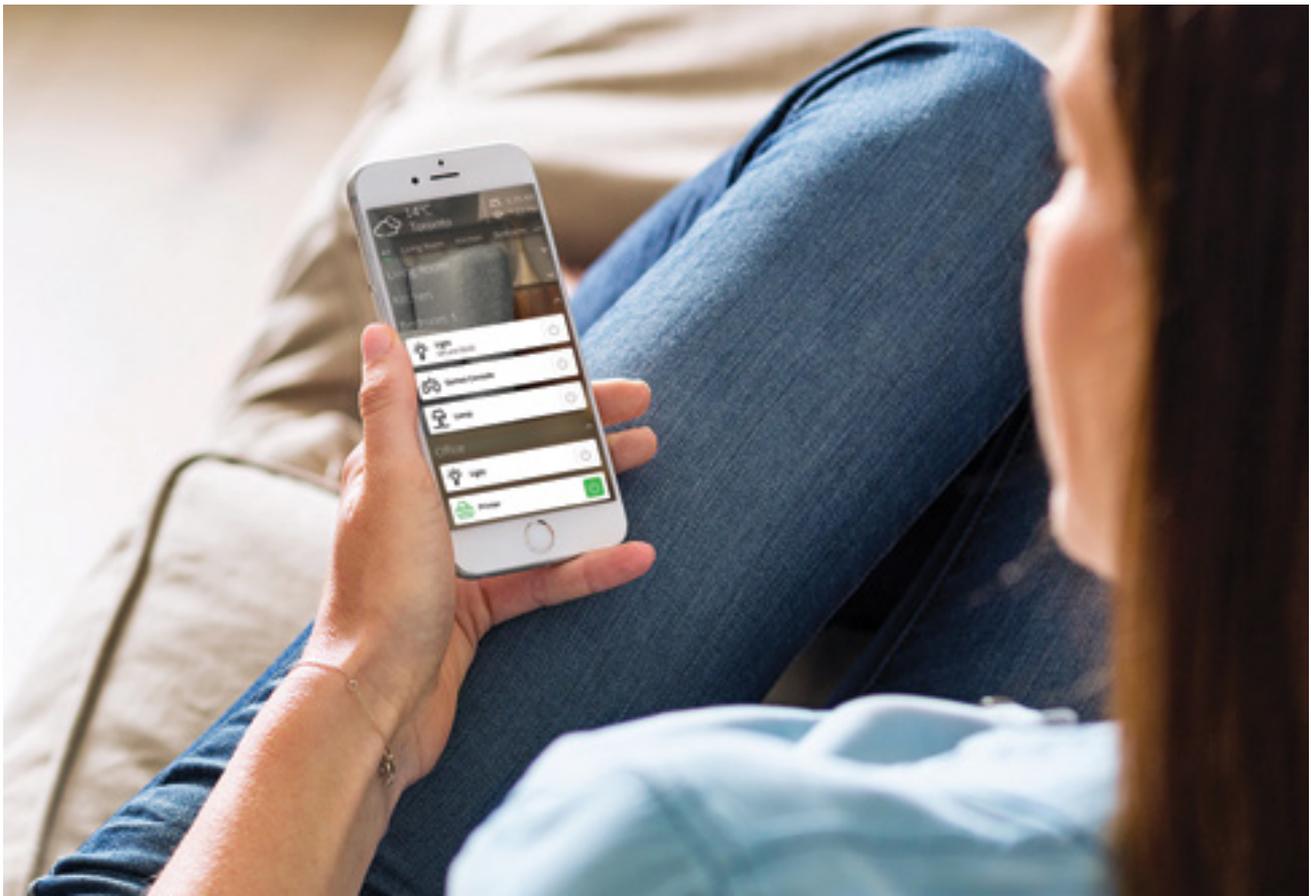
### **LORNE HEDGES**

It's been said that home is where the heart is. But as Nelson Mandela once noted, "a good head and a good heart are always a formidable combination."

This is the perfect descriptor of a smart home. Smart home technology is one of the newest additions to the real estate industry, making living spaces luxurious and comfortable while helping homeowners save money and energy. After all, what could be better than controlling almost every device in your home with a single app, no matter where you are in the world?

Smart home technology has evolved significantly, and Canadians are beginning to realize the tremendous benefits these devices can bring to their lives. In fact, a recent study revealed 89% of Canadian homeowners believe it's important to have energy-efficient appliances or devices when buying, building or renovating a home. Moreover, most Canadian homeowners are interested in further integrating energy monitoring systems (71%) and smart switches (63%) into their homes.

It's clear the future for the home automation industry is bright. With that in mind, here are the top trends driving the adoption of smart home technology in Canada. →



## 1. Environmental impact

Homes and buildings are significant sources of greenhouse gas emissions (GHG). After accounting for the electricity used for heating, cooling, lighting and appliances, they total 18% of national GHG emissions and account for more than 50% of all emissions globally.

With more and more companies embracing a hybrid work model, meaning more time at home, this number is set to drastically increase in the coming years. As Canada aims to achieve its goal of net-zero emissions by 2050, we're seeing more homeowners embrace technology in the fight against climate change.

The practicalities of this vary, both in the current and future potential. For Canadians looking to keep a more sustainable home, the ability to access real-time data on energy use provides an opportunity to not only gain insight but to improve their home's environmental impact. Just as a Fitbit or Apple Watch allows you to monitor your health – and ideally, improve it – centralizing your home's usage data allows homeowners to set and meet specific environmental impact goals. For example, if their hub or app converts their home energy usage into carbon emissions, occupants can easily track their progress towards a net zero home.

As homes become smarter, this process will not only become more effective but more efficient. In adopting emerging technology such as artificial intelligence and machine learning, our homes can use data insights to continually optimize and automate energy usage. In other words, they'll learn and anticipate when, where and how much energy is required to efficiently light, heat and power themselves while maintaining the occupants' comfort needs.

Innovations in solar technology will also soon make it a viable energy source for a broader spectrum of residential homes and locales. This has the potential to mainstream the prosumer movement – where energy users generate power from renewable sources, which they can often sell back to the grid – a key milestone in attaining net zero home emissions.

By helping Canadian homeowners gain insight and control their energy usage, smart home technology delivers Canadians the opportunity to make their homes more sustainable while lowering their environmental impact for the betterment of all.

## 2. Control

Years of excessive energy usage have made our homes profoundly wasteful. Recent innovations such as smart meters and systems that let us control heating and lighting from an app are starting to change that, but we still don't really understand how our homes operate. For example, our energy bill tells us how much we've consumed but not when, by which appliance in which room or, crucially, how effectively. By contrast, your car tells you how many miles you've got left until you need a refill or what the remaining range is on an electric charge. In other words, we have no insight that allows us to make smarter decisions and waste less.

We all like the idea of better control through ease of technology. This phenomenon can be seen in the mass adoption of wireless speakers, video doorbells, intelligent assistants and climate control devices. To gain true control of our homes, they need to become truly intelligent. To do this, smart panels can be installed in our electrical systems and appliances can be retrofitted or embedded with sensors. We also need to be able to integrate all our current and future smart devices under one central app. By allowing more robust systems to be tailored to the occupants' needs, the home experience will become more comfortable, sustainable and resilient.

## 3. Cost savings

Simply put, we're facing a sharp rise in energy costs. With the rapid adoption and coming expansion of electric vehicles and accompanying infrastructure as well as the electrification of heat, global electricity consumption is expected to double by 2050. If we continue down this current path, our energy bills could skyrocket, increasing by as much as 70%.

By adopting and applying smart home technology, homeowners will be able to identify the best energy source and when to use them to reduce costs. With the implementation of data-informed AI-based predictions and automation, Canadians will have the potential to reduce consumption and heating costs by up to 50%. And just as importantly, they get to save on energy without having to compromise on comfort.

### ABOUT THE AUTHOR:

**Lorne Hedges** is the national manager, business development at Schneider Electric Canada. He has an educational background in electro-mechanical technology, robotics and business with a marketing focus and brings over 30 years of experience in the electrical industry with General Electric, Cutler-Hammer (now Eaton Electrical) and Schneider Electric. Hedges is responsible for launching Schneider Electric's EV charging systems in Canada and is presently developing Schneider Electric's smart home integration program in the Canadian market.



# THE FOUR DS OF WINTER STORM PREPAREDNESS

CHRIS MCCARTHY

Storm preparedness is a constant, year-long effort intended to mitigate or minimize issues related to severe weather. When seasons roll in that tend to bring intense storms, they test how resilient the grid can be in the face of extreme weather. Winter especially presents unique challenges with ice and snow, and the cold temperatures make it that much more important for customers' power to stay on.

As utilities plan for severe weather, four key aspects to consider when analyzing their systems and determining their priorities include **data**, **devices**, **design** and **dispatch**.

## Data

As utilities strategize for grid-hardening improvements, the best place to start is by analyzing system data. Data indicate which areas of the system are prone to outages and help utilities determine improvement priorities.

Many utilities rely on System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI) to assess system performance. While these are the most common reliability metrics utilities use globally, in many cases they exclude Major Event Days (MEDs). However, these are the very events utilities must better understand to prepare for storms.

In fact, the data show an urgent need to consider the impact of MEDs. Without MEDs, the U.S. linear trend line for SAIDI grew at a rate of approximately 2.2 minutes per year from 2013 through 2021. In contrast, the U.S. linear trend line for SAIDI with MEDs grew at a rate of 40.2 minutes per year. The gap between these two data sets is increasing at an alarming rate of 38 minutes each year.

Examining only SAIDI and SAIFI can also mask problems at the individual customer level. Because SAIDI and SAIFI are average customer experiences across the broader system, these calculations hide outliers in the data – the customers who experience outages more frequently than the average. With this in mind, focusing on granular, customer-centric metrics, such as Customers Experiencing Multiple Interruptions (CEMI), Customers Experiencing Multiple Momentaries (CEMM), and Customers Experiencing Long Interruption Durations (CELID) help utilities pinpoint areas on the grid that require more immediate attention.

Examining a range of data – starting from a systemwide analysis that includes MEDs and then drilling down into customer-specific metrics – provides utilities with a more holistic view of their system. This ultimately helps prioritize starting points for distribution upgrades that will enhance the customer experience.

## Design

As utilities plan their initiatives to enhance resilience, reassessing system design can lead to foundational and long-lasting improvements. Sometimes, more ground-up changes can seem expensive or time-consuming, and that it is easier to rebuild the grid after each storm. However, with the increased frequency of severe storms, the cost of restoration efforts can exceed the cost of preemptive system redesigns. In the last decade, there has been a significant rise in MEDs whose restoration costs have totaled more than \$1 billion. →





Weighing these costs can make it easier to invest in grid-hardening solutions. This is especially true in the case of undergrounding lines. Often regarded as a more capital-intensive endeavor, the benefits of burying lines and minimizing exposure to severe weather can result in significant long-term savings by avoiding the cost of rebuilding overhead lines after storm damage.

Whether lines are overhead or underground, utilities can also consider changing radial circuits into looped configurations. These loop circuits involve connecting two or more circuits from different substations or generation sources, which creates a beneficial redundancy on the system. When a permanent fault occurs, utilities can isolate the issue and reroute power from an alternate source, restoring any customers who are not in the faulted segment.

### Devices

One of the most important aspects of preparing for winter storms is choosing advanced technology that can mitigate and minimize issues. In winter, snowy, icy conditions can make roads too hazardous to drive and delay crews from getting into the field. That can result in customers waiting long times without power and living without essentials such as heat and clean water. But smart switching devices can be the first to respond and react quickly when storms arise.

Fault-testing technologies are a critical component of storm-preparedness plans. In winter storms, when wind and snow can bend tree branches, many issues are temporary in nature. Fault-testing devices can quickly and automatically restore service and keep these temporary faults from becoming permanent outages, ultimately avoiding unnecessary truck rolls. This not only saves costs but also protects line crews from risky working conditions during severe weather.



**Not only does this relieve some work for utilities during high-pressure situations, but it restores power to customers in unfaulted areas within a matter of seconds.**



Fault-testing technologies can now be placed anywhere throughout the distribution system, providing end-to-end advanced protection from the substation to the grid edge. This also helps utilities segment the grid into smaller, more manageable portions and keep fewer customers from experiencing an outage. On looped circuits, advanced technologies can handle two-way power flow and automatically reroute power in the event of a permanent fault.

For communications-enhanced devices, one of the challenges during the peak of any storm can be the volume of messages devices transmit because of numerous events occurring on the grid. Wading through thousands of messages in a system with centralized intelligence can be time-consuming for utilities and make it difficult to distinguish which are the highest priorities. The value of distributed and localized intelligence on the grid is highlighted during these times because it enables devices to work in teams, analyze real-time system information and autonomously make restoration decisions. Not only does this relieve some work for utilities during high-pressure situations, but it restores power to customers in unfaulted areas within a matter of seconds.

### Dispatch

Having advanced technology in key areas throughout the distribution system has a direct impact on the overall speed of restoration efforts. Because fault-testing devices keep temporary faults from becoming permanent outages, these devices save utilities from unnecessarily having to dispatch crews for issues that can be solved automatically.

This means the only outages that remain are for permanent issues, so utilities know when crews are dispatched, they will be going to locations that likely have damage and require more involved repair work. Ultimately, this helps create efficiency and ensures crews are dispatched to priority areas that need servicing.

Furthermore, when outages occur, the grid must be restored from the substation to the grid edge, in that order—so when crews are dispatched, they work from the substation out. Subsequently, this leaves the grid edge as the last area to be restored, often resulting in prolonged outages for customers at the end of the line.

Advanced end-to-end lateral protection decreases the need to dispatch crews to the grid edge. By avoiding these truck rolls, utilities can save crews from avoidable work during a period of intensive restoration efforts and ultimately reduce the overall time it takes to bring power back to all customers after a storm.

As winter weather sets in, extreme conditions reinforce the importance of storm preparedness and grid resilience. It is a fitting time to examine holistic system data and advance preparedness planning. Considering system design and innovative devices can help mitigate and minimize outages in times when it matters most. Ultimately, this ensures the efficient dispatch of crews, reduces overall restoration time and keeps power on for customers, even during the storm.



#### ABOUT THE AUTHOR:

**Chris McCarthy** is senior vice president of sales enablement & operations at S&C Electric Company, where he is responsible for advanced sales messaging and training, regulatory affairs and the sales technology stack for daily commercial activities. He previously served as S&C's managing director for Europe, the Middle East and Africa. Earlier, McCarthy was S&C's director—grid automation and control, where he was responsible for product management and global strategy for all of S&C's automation offerings. McCarthy received a Bachelor of Science degree in electrical engineering from the University of Illinois at Urbana-Champaign; a master's degree in electric power engineering from Rensselaer Polytechnic Institute in Troy, New York and a master's degree in business administration from the Keller Graduate School of Management.

# UTILITY WILDFIRE RISK MITIGATION WITH DIGITAL TWINS

ROBERT BROOK

If you turn on your TV, read a newspaper or look at social media, it is obvious that wildfires are becoming an increasing global threat. No industry is more cognizant of this danger than the electric utility sector. They face a unique challenge. How can a utility reduce the ways their infrastructure can ignite a blaze while simultaneously minimizing the impact a fire has on its network and customers' energy flow?

The most effective way to minimize the outcomes of a fire is to prevent one from happening. While utilities cannot control lightning strikes or human carelessness, they can greatly reduce the chances of igniting a fire from things that are within their control, like conductor clashing, vegetation encroachment, or equipment failure.

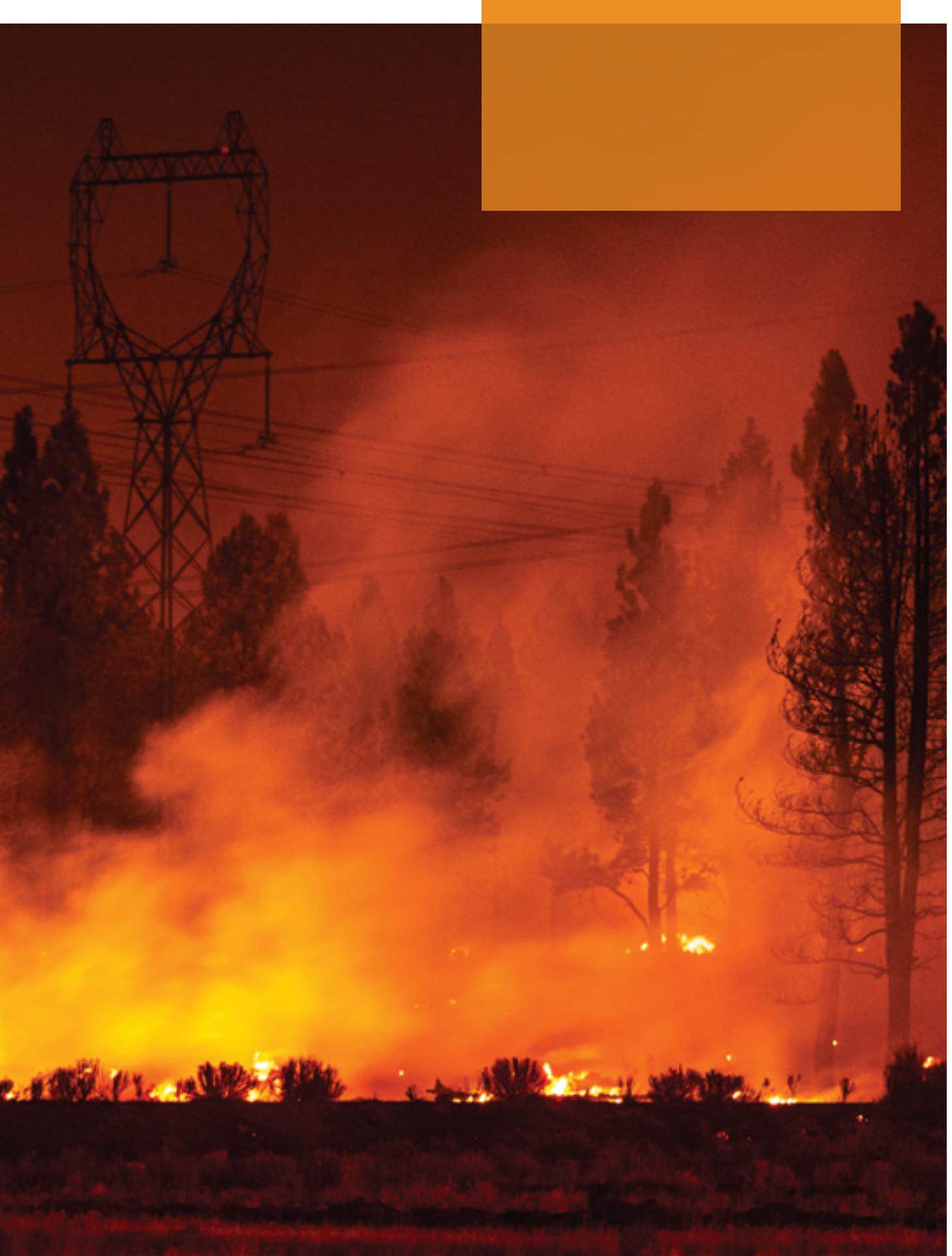
## Wildfire challenges facing the utility sector

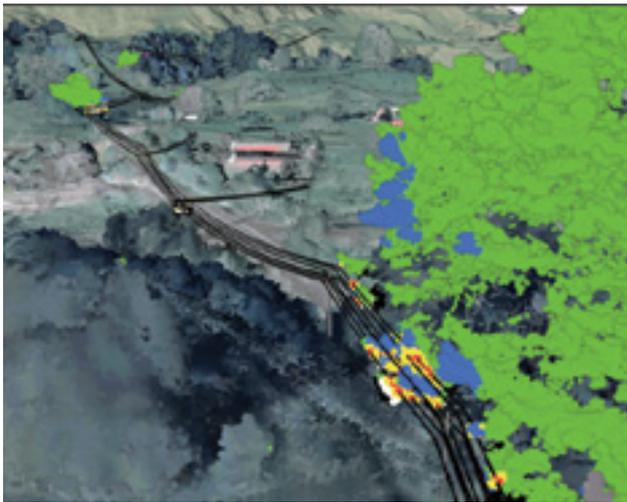
Utilities face numerous and often formidable challenges in preventing or mitigating wildfire damage. The power lines and coupled equipment utilities rely on are inherently complex and increasingly hazardous — not only because of weather conditions or climate but also from the threats of vegetation encroachments. In many areas in the utility's network, vegetation runs through or along their spans, making them susceptible to wildfire disasters.



**Figure 1:** Vegetation encroachment

The size and scale of a typical utility network further complicate matters. A utility faces the critical challenge of carefully overseeing thousands of miles of power lines, which requires extensive monitoring and manual inspection of their assets. Failure to identify even the smallest network vulnerabilities can have severe financial and operational consequences. Utilities are realizing that manual processes are no match for the threat of wildfires — they need the proper processes, management systems and emerging technologies to safeguard operations more efficiently while keeping surrounding communities and ecosystems in mind. →





**Figure 2:** Vegetation encroachments in a span

### The case for innovation

The scope of work for wildfire risk mitigation is bigger than ever before. Population growth and climate change have caused the volume and intensity of wildfire disasters to increase. As a result, there is a greater need for utilities to evolve and develop innovative processes when approaching and managing these events.

In the past, on-site fieldwork and paper processes were the only options to capture data about network assets, the surrounding operating environment and operating risks. Now, with a greater need for optimization, risk management processes are quickly changing and adapting to digital transformation. Vegetation management data primarily drives the case for innovation, as direct contact between vegetation and a utility's assets is one of the most common wildfire sources. However, vegetation poses risks that go beyond simple proximity to a network's power lines. Other factors include neighboring trees growing into power lines, nearby trees falling onto power lines, or power wires swaying into trees.

While vegetation is the primary causal factor, it is not the only utility risk. Typically, utilities have prioritized cost management and operated their equipment until it fails, but asset failure has been the cause of some recent fires. Additionally, equipment interaction, like conductor clashing, is a threat. To mitigate these risks utilities must analyze their equipment, identify problem infrastructure and evaluate or eliminate the threat through maintenance, replacement, or grid hardening programs.

Forward-thinking organizations are integrating simulation and analytics solutions into a four-step method to guide their management process. The method consists of identifying problems, forming a plan, executing it and then performing an audit to report progress. First, identifying information and answering questions, such as where growth patterns have changed, can help utilities to further strategize and build an effective course of action for the work that needs to be done. This is where having a digital twin will help serve as an indistinguishable counterpart for practical purposes through system simulation, integration, testing, monitoring and maintenance dashboards, all in one integrated platform.

### Innovative solutions for wildfire prevention

Utilities are on the frontline when it comes to wildfire prevention. So, what can utilities do to better control their risk and avoid the ever-increasing threat of wildfires? For one, they can model their network, using a digital twin to better understand what could happen if a wildfire ignites. In doing this, utilities can better prepare to defend the communities they serve and their critical assets from wildfires.

Digital twins can not only predict how a utility will perform but can also identify wildfire threats like vegetation encroachment or high-risk equipment and precisely simulate adverse weather conditions across the network. Digital twins can also model specific weather environments to calculate blow-out or conductor sag. This type of modeling not only reduces costs but also integrates all field data into a single, refined dashboard. When using a digital twin, utilities have proven to be better equipped for wildfire risk mitigation by incorporating geospatial data, indicating early-warning risks and improving response and recovery measures.



**Figure 3:** Prioritizing Spans based on utilities' specific standards

When looking for the right digital twin solution, it's important to investigate technologies that offer an all-inclusive accurate wildfire risk mitigation strategy consisting of a network model setup, pre-wildfire preparation, during wildfire response and post-wildfire recovery. By implementing this strategy, utilities can simulate conditions in which failure might occur and cause wildfires while identifying and eliminating potential problems across your network before they happen.

### Case Study: How digital twin technology helped a utility protect their community during a wildfire

A physics-enabled digital twin platform that builds 3D interactive models of critical infrastructure networks and assets has been used to help mitigate risks associated with wildfires. An Australian electricity infrastructure company sought out this digital twin to help keep their systems protected and strengthen their commitment to safety. The utility regulates one of the continent's largest electrical distribution networks – delivering electricity to more than 880,000 homes and businesses across 95% of New South Wales and southern parts of Queensland through 125,000 miles (201,168 km) of the network.

The digital twin project for the company began with classifying a LiDAR dataset to build a 3-D network model of the utility's poles, conductors and surrounding vegetation. The all-encompassing digital twin model allows the platform to run real-world scenarios and assess current and future risks while prioritizing network investment, maintenance and disaster response protocol.

Australia has been no stranger to wildfires, so as the wildfire risk and damage grew during the summers of 2019 and 2020, the utility was able to house and overlay its critical data through the digital platform in preparation. This gave them the ability to identify and assess damage and risks to equipment to mitigate wildfires. As a result, repairs were implemented and power was restored to communities around the utility's impacted areas.

The digital twin's successful work for the utility's wildfire mitigation and response led the company to expand its scope with the platform to undertake other grid-hardening activities, such as encroachment and pole leasing analysis as well as modeling to assess fall-in risk for vegetation throughout the utility's network.

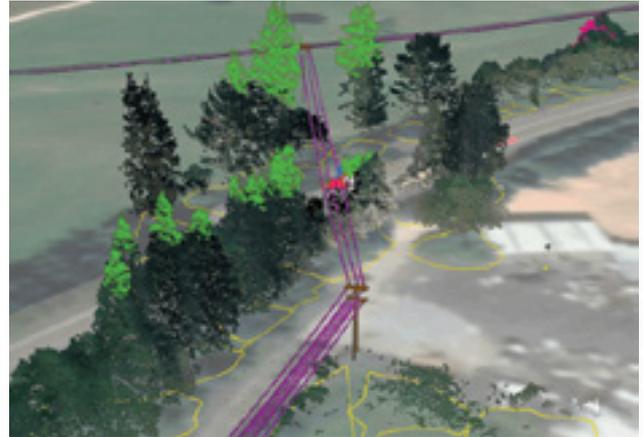


Figure 4: Example of tree-by-tree segmentation for vegetation management

### Conclusion

To prepare for what is expected to be an increasingly challenging climate, utility providers and other stakeholders must remain innovative when it comes to seeking and implementing solutions that reduce risk. Continuing conversations around technologies like a digital twin and other solutions will enable utilities and their stakeholders to better manage and mitigate risk. In this work, digital twins are at the forefront of allowing utilities to simulate, analyze, report and safeguard their networks. By incorporating information from field analysts, digital twins provide a better method of communication throughout an entire utility's field of work. As utilities are one of the most frequent initiators of wildfires, they have the responsibility to utilize proper, accurate management systems to minimize risk.



#### ABOUT THE AUTHOR:

**Robert Brook** is SVP and GM Americas at Neara and has spent more than 30 years in the energy and information technology industries and is a recognized expert in the development and implementation of technology for infrastructure and asset management as well as risk mitigation. He previously has filled key industry positions, including president of Hecatic Labs, senior director of business technology at Pacific Gas and Electric Co. and global utility industry manager at Esri.

# FINDING A SECOND LIFE FOR ELECTRIC VEHICLE BATTERIES:

## WHAT THE U.S. CAN LEARN FROM EV LEADERS FACING RECYCLING AND REUSING CHALLENGES

SEAN MCEVOY

Electric vehicle (EV) adoption in the U.S. has lagged, accounting for only 1% of the 250 million vehicles on the road. To put it into perspective, Norway has reached 78% EV adoption (92% when adding hybrids and plug-in hybrids). While U.S. EV purchases doubled last year, there's still a long way to go to reach the level of adoption seen in other countries. However, the U.S. has an opportunity to get ahead of the pressing issues facing countries with high EV adoption rates, which will undoubtedly need to be solved as U.S. adoption increases.

Take China, for example. According to Bloomberg, it was the most significant early adopter of EVs and is currently the world's leader with 40% of the global market share, which reached 20 million this year. It's also facing a tremendous challenge in reusing and recycling batteries, which ever-increasing sales of new EVs will only exacerbate.

Battery recycling is no easy task. EVs are typically powered by lithium-ion batteries, which have a lifespan between 10 to 15 years, depending on environmental conditions and how they're maintained. EV manufacturers typically offer an 8-year warranty, meaning most EV owners will be responsible for battery replacement once it reaches its end of life for powering vehicles.

### Giving a second life to EV batteries

Fortunately, companies are already developing innovative solutions. Positive Energy, for example, is a Quebec-based organization recovering and reconditioning end-of-life EV batteries. Taking these EV batteries, they reuse them in renewable energy applications across residential and commercial projects. Recognizing that end of life does not mean the definitive "end of life" for the battery, the company understands that energy accumulators are still useful in storing electricity and redistributing energy as a service.

To understand how EV batteries can be repurposed, let's take the Tesla Powerwall2 as an example. It holds 12.2kWh of usable capacity with an additional 10% as a reserve. The least expensive Tesla models have 60kWh, the smallest capacity battery in their fleet. If you calculate that after 10 years, the battery still maintains 50% capacity, there's still enough power for 2.5 power walls. After 15 years, there's more than enough capacity for a 15kWh single Powerwall. And the average powerwall currently lasts between 10 and 20 years. →





Now factor in repurposed batteries, assuming they are on the lower side of lifespan. There is still a potential three decades of use, depending on how much it's utilized. If half of all vehicles sold in the U.S. are EVs by 2030, and roughly 17 million new vehicles are sold each year, by 2040, 8.5 million batteries could be repurposed to power homes or businesses. And that's not factoring in the 15 million that will be on the road by 2030, adding millions more batteries that can be reused.

### Leaning on AI to make second life a reality

However, to make this viable, companies will need to analyze different data sets in real time to make accurate predictions to determine the status of their battery fleet. This process is intensive if done manually, as these data points must be processed after every charge or discharge cycle, considering factors like temperature, charge and discharge rate.

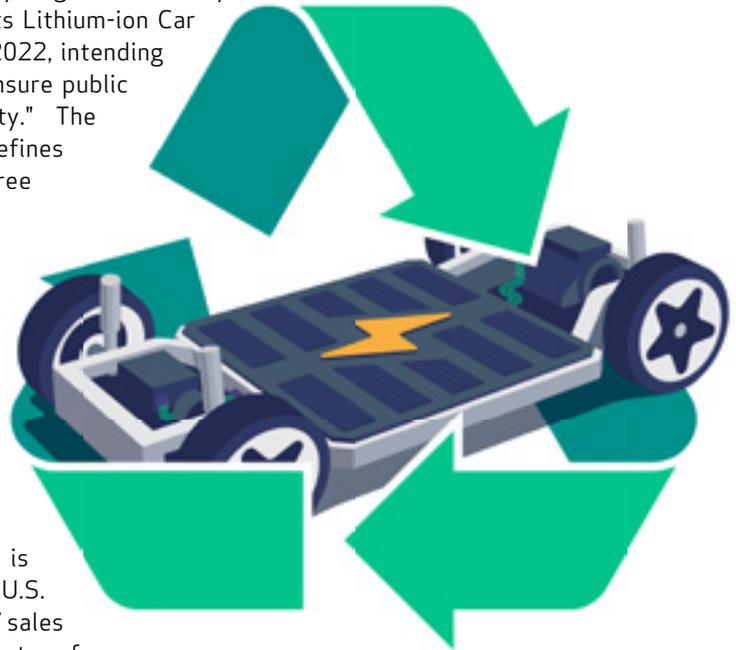
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“  
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Forward-thinking enterprises are utilizing artificial intelligence (AI) and machine learning (ML) to accelerate the process, eliminate human error and reduce costs. Through continuous training, AI can spot patterns and make far more accurate predictions and decisions. For example, with historical data sets across an entire fleet of EV batteries, real-time insights unlock information from maintenance cycles to forecasting how much life a battery has left.

In California, the largest U.S. EV market, the government created the Lithium-ion Car Battery Recycling Advisory Group in 2019 to advise the legislature on policies about the recovery and recycling of lithium-ion vehicle batteries. Led by the California Environmental Protection Agency (CalEPA), the Department of Toxic Substances Control (DTSC) and the Department for Resources Recycling and Recovery (CalRecycle), it completed policy recommendations in its Lithium-ion Car Battery Recycling Advisory Group Final Report in May 2022, intending to "restore, protect and enhance the environment to ensure public health, environmental quality and economic vitality." The report includes two policy proposals. The first policy defines responsibility for out-of-warranty batteries under three possible circumstances. The other policy proposal is a "producer take-back policy." This makes the auto manufacturer responsible for ensuring "repurposing, reuse or recycling of EV batteries by a licensed facility at no cost to the consumer if and when the owner no longer wants them, and in the event no other entity has taken possession of the battery." Manufacturers must also provide consumers and the service and repair industry with educational materials explaining the return process.



While EV adoption in the U.S. is still relatively low, it is nonetheless on an upward trajectory. According to the U.S. Energy Information Administration, plug-in hybrid and EV sales increased in recent months, particularly in the fourth quarter of 2021. Data from Wards Intelligence indicates that 11% of light-duty vehicle sales were EVs and hybrids. Experts speculate that this is largely due to more offerings from manufacturers.

With Federal tax credits and new policies to incentivize consumers to shift to electric, the U.S. is likely to see a significant uptick in EV adoption over the next decade. This gives future-focused companies the unique opportunity to develop innovative solutions for battery recycling and reuse to get ahead of these industry challenges.



#### ABOUT THE AUTHOR:

**Sean McEvoy** is a seasoned software executive with years of experience in the software industry working at such companies as IBM, DELL, Quest Software and Symantec.

McEvoy has held executive leadership positions across an array of business units including customer success, sales, professional services, product management, engineering and channel development. Having lived outside the U.S. in both Europe and Asia, Sean has a strong understanding of international markets.

In his current role as senior vice president at Veritone Inc., McEvoy is responsible for business development for Veritone's Artificial Intelligence platform. McEvoy holds a BSc. in software engineering and an MBA in international business.

# THE ROLE OF IOT IN OVERCOMING URBAN CHALLENGES

PHIL BEECHER

The Internet of Things (IoT) has been widely embraced across industries and applications, with the vast majority (92%) of IT decision makers reporting that investing in IoT technologies is necessary to stay competitive in the marketplace. But businesses aren't the only ones eyeing IoT for its myriad advantages; municipalities are, too.

In fact, many cities are recognizing the role that connected technologies can play in saving energy and solving other challenges they face. Here's an overview of three ways in which IoT can make a dramatic difference in cities around the world - and in the lives of their citizens.

## **Safety first**

Most city leaders would agree that all other matters are secondary to the safety and security of their citizens, making this a great place to start when considering implementing IoT. Unsurprisingly, research has shown that this is also the most popular use case from 2022, echoed by 87% of survey respondents stating that they're keen to deploy the technology in these areas sometime in the next 18 months.

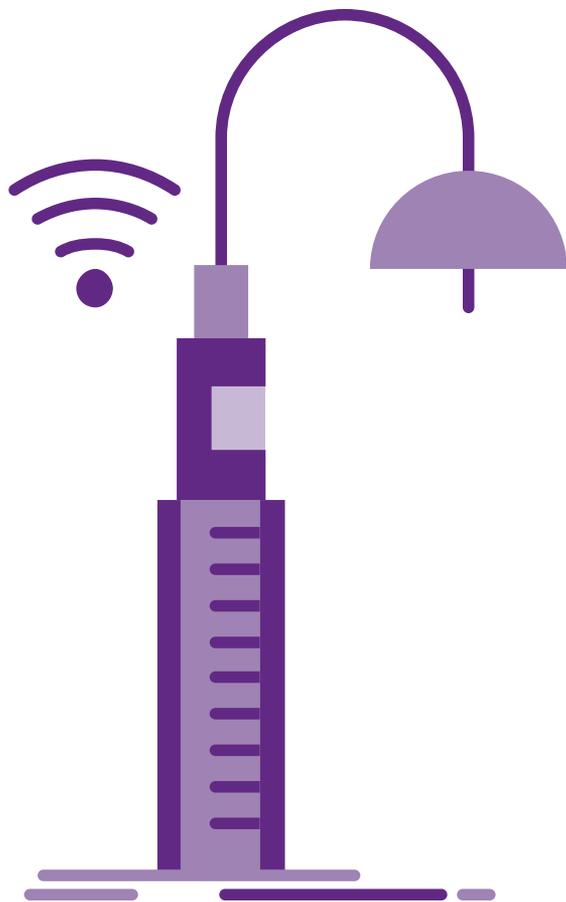
Streetlights are actually an ideal launching pad for a smart city that is just getting started. Smart streetlights can help lower energy consumption; hence, reducing carbon dioxide emissions, which ultimately leads to better air quality. Additionally, illuminating streets, walkways, landmarks and other infrastructure like bridges and tunnels with connected lights go a long way in keeping pedestrians safe as they move about a city.

Once a street lighting infrastructure is in place, cities can build upon a large, outdoor wireless communications network to add on other services and applications. A natural next step might be to increase smart surveillance through the use of sensors and other technology (such as gunshot detection). The data collected through such mechanisms can then be used by governments to help prevent crime and keep citizens safer.

## **More sustainable solutions**

Of course, one of the most meaningful aspects of using IoT in an urban setting is to overcome the environmental challenges that are so often problematic in these areas. For one, outdated and inefficient lighting is the cause of as much as 50% of an average city's entire energy bill. Using connected streetlights solves these challenges, reducing energy waste, CO<sub>2</sub> emissions and excessive costs. →





There are numerous other ways in which IoT can be used to support sustainability in cities around the globe. For instance, the City of London – the one-square-mile original portion of the international city which houses the financial headquarters of the United Kingdom – has deployed 15,000 connected streetlights, along with other applications for environmental purposes and monitoring lifebelts along the River Thames. A lot can be done to lower energy consumption and preserve the planet through IoT solutions.

#### **Better traffic management**

Finally, when most people think of cities, they often think of a few things: entertainment, excitement and... horrendous traffic. There's nothing like bumper-to-bumper streets, limited parking, exhaust fumes and vehicle noise to put a damper on otherwise scenic, lovely cities. Whether residents or passers-by, government leaders want everyone in their towns to be able to enjoy the upsides without having to suffer through these downsides.



It's no wonder, then, that traffic-related smart initiatives are on the rise, with smart parking seeing the largest uptick since 2017 (77% up from 57%). Connected traffic lights and controls are other areas in which there has been a big increase in investments (76% up from 58%), in addition to noise and air sensors (79% up from 62%) and electric vehicle charging (79% up from 66%). When cities use IoT to better manage traffic, they not only keep drivers safer, but they also help to reduce CO<sub>2</sub> emissions and noise pollution, while improving traffic flow and parking.

IoT has the potential to solve countless urban challenges, and it's exciting to see its impact already. As cities continue to adopt more and more smart solutions, our global connectedness and improved outcomes are sure to continue to rise as well.



#### ABOUT THE AUTHOR:

**Phil Beecher** is the president and CEO of Wi-SUN Alliance and a recognized global expert on wireless IoT

# THE POWER OF INTEGRATION AND OPENNESS IN FUTURE-PROOFING THE DCS

LUIS DURAN

The Distributed Control System (DCS) has undergone a rapid change in recent years to reflect the needs of the modern plant. Agility and flexibility are key, and automation systems are required that can deliver this, along with the productivity and efficiency gains that make the automation of processes worthwhile. In years gone by, monolithic systems were the norm, supplied by a handful of manufacturers that had the technology and expertise to provide turnkey solutions to automate entire processes in one go.

As a consequence, users were often left with a patchwork of legacy systems from different manufacturers and different eras. This makes upgrading or refitting component parts and devices a challenge, as compatibility can be a major issue, complicating the life cycle management of assets.

Meanwhile, with the growth of digitalization, operators of these systems are increasingly demanding a seamless and modern user experience, with the same ease of use found in consumer devices and an expectation of interoperability of technologies from different suppliers in a secure environment. Against the backdrop of a skills shortage, this is particularly true of the younger cohort of engineers entering the industry, who expect the technologies they use in the field to offer the same levels of intuitive operation and interoperability as the devices such as smartphones and tablets that they use in their everyday lives. Ease of maintenance is another basic requirement, with field repairs and service available within minutes at the touch of a button.

## Collaboration is key

Against this backdrop of industrial reinvention, societal change and evolving technology, suppliers of DCS solutions are having to adapt to meet the needs of the plant of the future. Increasingly, the direction of travel is toward openness and interoperability. One such initiative which is driving this trend is the Open Process Automation Forum (OPAF). Comprising users from a broad range of fields including oil and gas, chemical, pharmaceuticals and mining, as well as companies from the IT and telecommunications sector and automation providers, OPAF is working to define a standards-based, open, secure and interoperable architecture for modern process automation.

The stated goals of the organization are to enable readier access to leading-edge capabilities for DCS users, allowing integration of best-in-class components, while preserving asset owners' application software at a significantly lower cost relative to future replacement. Further, the standard is intended to provide a framework for an open systems architecture that promotes innovation and value creation, applies across multiple industries, is commercially viable and allows for an inclusive collaboration among users and suppliers. →





Another organization contributing to the acceleration of change in the DCS world is NAMUR, a global consortium of process industry end-user organizations with roots in Germany's chemical industry. NAMUR Open Architecture (NOA) was established in 2016 and sets out a vision for how digital technologies interact with control systems in process-oriented industries while preserving the integrity and security of the production environment. NOA seeks to make production data easily and securely usable for plant and asset monitoring as well as optimization by maintaining shared standards that all manufacturers signed up to the agreement must adhere to. As well as creating a more open market for customers which will drive innovation. The goal is to effectively segregate core control and automation functionality from non-time-critical monitoring and optimization.

#### **Ingraining flexibility**

Another vital change in approach towards DCS design is the emergence of digital functionality. Whilst digitalization has been around for some time, in recent years the capabilities of digital ecosystems have helped to transform the automation landscape. Edge and cloud technologies are providing a flexible and secure computing infrastructure, including servers, data storage, development environments, business intelligence services, artificial intelligence (AI) and data analytics for improving risk management, optimizing productivity and achieving sustainability targets. An extended, digitally enabled environment can provide users with safe, secure, application-level access to core control OT data, as well as data from other industrial IoT devices, without disturbing core control operations.

The key to establishing this framework from a technological perspective has been ingraining openness and flexibility into the development of new products, services and systems. The participants of both OPAF and NAMUR collaborate to establish and maintain standards that guide the development and design of automation equipment. For the end user, this commitment to collaboration can only be a good thing, as it removes from the equation the prospect of being locked into proprietary hardware and software. Ultimately, the goal is to encourage innovation, both for automation system manufacturers, and the companies that use those systems. It also promotes a focus among system manufacturers on what their end users need from a DCS. Crucially, it means that new technologies can be rapidly adopted and leveraged, irrespective of who they were developed by.

#### **The benefits of big data**

Data is at the heart of the digital transformation, and yet the challenge of accumulating and analyzing the vast amounts of data generated by industrial processes remains a pressing one for the industry. Moreover, data for its own sake is of little value. Turning this data into genuinely useful and timely insights into the performance and efficiency of systems, as well as maintenance needs at any given time remains a challenge facing automation solution providers and it's top of mind for those who embrace Industry 4.0.

Key elements of the digital ecosystem can now provide automation users with AI-enabled analytics and edge software to continuously analyze operational data at the point of production. This flexible, edge-oriented solution can predict issues and prescribe actions for the improvement and optimization of asset operations, as well as inform predictive maintenance strategies.

Edge solutions also work with higher-level applications where operations data can be combined with other types of operational, information and engineering technology data for strategic business analysis. Such applications can be deployed either on-site or in hybrid/cloud configurations that can be accessed from almost anywhere at almost any time. For example, sensors linked to the cloud can provide granular monitoring for the condition of a single device, while at the same time tracking fleet-wide performance, allowing small individual efficiency gains to rapidly mount up when extrapolated across the plant. Maintenance needs can be automatically flagged up when a device reaches a certain setpoint, with this data feeding into life cycle management systems to facilitate rapid replacement of faulty or obsolete devices with minimum downtime.

A group of automation providers that are participants of OPAF, has helped to pioneer and maintain open standards in DCS systems. Open platforms can help to preserve end users' automation investments while affording them the ability to benefit immediately from emerging capabilities as they enter the market.

### Keeping an open road to the future

As new technologies continue to develop that can be used to augment the functions of the DCS, maintaining an open structure that will enable them to be easily accommodated will be increasingly important. In this way, process operators can be sure that their Distributed Control Systems will have the flexibility to be able to continually adapt to changing requirements, without compromising core essential functions. As such, initiatives such as OPAF and NAMUR have a key role to play, both now and in the future.



#### ABOUT THE AUTHOR:

**Luis Duran** is currently responsible for ABB safety system product offering and is actively involved in the Open Process Automation Forum, where he is currently co-chair of the Business Working Group. He received a BSEE and MBA from Universidad Simon Bolívar in Caracas, Venezuela and has more than 30 years of experience in numerous areas of automation including process automation.

# SEEING WHAT'S NEXT: GRID MODERNIZATION IS JUST THE BEGINNING OF THE STORY



## **BRANDON RASO**

***Editorial Note:** This is the second in a series of three articles by Brandon Raso about the impact that location intelligence is having across the operations of electrical utilities. Location intelligence uses next-generation GIS technology and analytics to deliver actionable insights that utilities could not previously access.*

Kids ask a lot of questions. Sometimes the sheer volume of questions is overwhelming. That is particularly true when it comes to watching movies, when nothing is safe from a deluge of questions: “Why did Thanos become a bad guy?” “Who would win in a fight between Hulk and She-Hulk?” “Why can’t anyone lift Thor’s hammer?” and, of course, “In *Avengers: Endgame* when the good guys win and reverse Thanos, and then half of the universe vanishes, but then all of those people reappear exactly where they were when they disappeared, what happens to people who were in airplanes that were flying? Would the people reappear outside of the airplanes and then fall to the ground and go splat? And what about people who were in cars and trains? Would they get run over? And what about...?” Getting through each Marvel movie is a gauntlet of questions like those, but nothing prompts questions more than when kids see the movie end and the credits start to roll. Then it’s a million versions of the question: “What happens next?” →



That question keeps coming to mind as I see the progress that utilities are making with grid modernization initiatives, which are bringing automation to operational processes across transmission, distribution and customer support. My first article for *EE T&D* discussed a compelling example of this involving field crews using mobile devices with location intelligence applications to bring far greater efficiency and accuracy to infrastructure projects. These first-order benefits of grid modernization are significant across the organization:

- A safer, more reliable grid
- Far greater efficiency through more accurate data and process improvements
- Enhanced safety for workers and the public
- Effective management of DERs
- Enhanced services and flexibility for customers
- And much more

But those first-order benefits are not the end of the story. If we ask ourselves, “Then what?” we get to an even more exciting phase of second-order benefits that are made possible through Advanced Grid Management. Advanced Grid Management utilizes the technology and insights from modernized grid infrastructure to achieve previously-impossible real-time insights that make decision-making across the organization faster and smarter.

Sandy Simon, who works for a Boston-based consulting and systems integration company, wrote an excellent introduction to Advanced Grid Management for *EET&D* in 2019, and it is a must-read because it provides such an effective introduction to this topic while also providing critical advice for those that are already thinking deeply about this issue. One key point she makes in her discussion is that ADMS (Advanced Distribution Management Systems) is not a synonym for Advanced Grid Management:

*ADMS has vaulted to the top of utility executives' priority lists based on its promise of integrating existing real-time systems with advanced visualizations and functionality that streamline operations ensuring utilities are better positioned to meet reliability and resiliency goals. ADMS is also viewed as a cornerstone to the utilities' ability to respond and participate in a changing market in a way that keeps them relevant to both consumers and emerging players. Most utility organizations place ADMS front and center. However, ADMS is only an element of what should be a utility's overall Advanced Grid Management program.*

Simon's article was prescient because ADMS has increasingly been the reflexive answer to the question of “Then what?” when people in the utility industry look to the future. ADMS has tremendous benefits, but it's only part of the story. Advanced Grid Management is much more than that because it will transform how every department in a utility makes decisions and takes action. Sandy's article does an excellent job of mapping out examples of those areas of transformation, including integrated processes, enhanced analytics and more. When I talk through these concepts with people in the industry, I distill that information into two words: optimizing and forecasting.

Once the foundation of grid modernization is in place, Advanced Grid Management enables utilities to do real-time optimization that has never been possible before, while also doing forecasting that liberates them from being in a purely reactive mode for so many aspects of their operations. That is a game-changer for managing load. It's a game-changer for running a cost-effective grid and for preparing for and responding to emergencies, including wildfires and storms. It is transformative for predictive maintenance on critical infrastructure and ensuring reliability of the grid. It is groundbreaking for managing bi-directional energy customers with DERs are buying from the grid and selling back to the grid. And for preparing for the wave of retirements from a graying workforce.

Advanced Grid Management is about seeing what's truly happening now and also seeing what is likely to happen next. Both of those are holy grails that have never been within reach for utilities, but they are now within reach for utilities pursuing robust grid modernization initiatives. The key is to have a strategy for Advanced Grid Management that thinks bigger than just one slice of what is possible with the foundation that is being built.

#### ABOUT THE AUTHOR:

**Brandon Raso** is the director of utility design and engineering at Locana, a location and mapping technology company. Raso has more than 15 years of experience delivering GIS solutions in the utility industry, including his current role working at Locana where he helps utilities leverage location intelligence to solve complex construction and operational challenges. Before joining Locana, Raso was the GIS and mapping technology supervisor at Puget Sound Energy. Before entering the private sector, he had a successful decade-long career in the U.S. Navy in sea combat operations. He earned his degree at the University of Utah.

# CAN ELECTRIFICATION HELP US MOVE FORWARD WITH OUR DECARBONIZATION GOALS?





### CHRISTOPHER ROMAN C.E.M.

Decarbonization is a goal for many communities, counties, cities and states throughout the U.S. However, decarbonization cannot happen with our real-world projects being implemented by the masses. So, the ultimate question is: what is the proper path to understanding and building cost-effective projects that meet these goals? And electrification may be the key. If you are building a decarbonization project, or have already started one at your facility, here is a handy electrification checklist to consider before funding your decarbonization project!

Let's start at the beginning. What is electrification? Electrification is the practice of designing or changing, machinery to use electricity as a fuel source. This practice is also commonly referred to as "fuel switching." Cars converting their combustion engines to use batteries charged with electricity is the most common example of electrification today. When considering electrifying the equipment in your facility, we need to work through the following checklist: **Energy Auditing, Work Conversion, Prices, Incentives, & Project Funding.**

Energy auditing is the first key to building a sound electrification project. Energy auditing is the practice of categorizing and organizing the equipment types that may be eligible for electrification. This practice consists of capturing nameplate data, pulling specification and performance sheets of those equipment model numbers and obtaining mechanical drawings of the equipment to fully understand the design intent of the machinery. Obtaining this information does take time and is generally why auditing costs are higher than we would like them to be. →



**The higher your Therm blended rate and the lower your electric blended rate is one indicator that you might have a very successful electrification project on your hands. Conversely, if you have a very low \$/Therm and a very high \$/kWh then electrification projects may become difficult to implement.**



The types of audits that everyone should be looking to obtain are ASHRAE Level 1 and Level 2 energy audits. Level 1 audits range from \$0.08 per square foot to \$0.15 per square foot. A level 2 audit ranges from \$0.15 per square foot to \$0.25 per square foot. On a 100,000-square-foot facility, a level 1 and 2 ASHRAE audit would run \$23,000 on the low end. These necessary auditing costs are generally recouped in the energy savings measures derived; however, there may be no need to pay for energy audits depending on your local utility. For example, San Diego Gas & Electric (SDG&E) offers a no-cost Comprehensive Audit Program (CAP) where you receive an ASHRAE Level 1 and Level 2 audits.

The second item on our checklist is work conversion. Work conversion is the math behind normalizing two units of energy into one common unit of energy to understand their relationship. In an electrification project, we are generally working on converting units of natural gas, or Therms, into units of electricity, or kilowatt-hours (kWh). To make the conversion we need a common energy unit to unite the two units. That common unit is the British Thermal Unit or BTU. A BTU is a unit of heat, or ability to perform work. Converting a Therm or a kWh to a BTU is very straight forward but the conversions aren't commonly understood and are among the main points in understanding electrification. There are 3,412 BTUs in one kWh, and there are 100,000 BTUs in one unit of natural gas (Therm). Obviously, Therms can do more "work" since they contain more BTUs, but Therms have the ability to do about 29% more work unit-over-unit. This can create an issue for electrification projects, as the end result is that the machinery must be able to get the job done in the same/similar fashion as it was consuming a different fuel source. The output from your energy auditing efforts will reveal how much more kWh you may need to consume to complete the same amount of work the machinery was doing while consuming natural gas. The energy analysis would yield the potential value of the electrification project and the outcome could be very different for different folks.

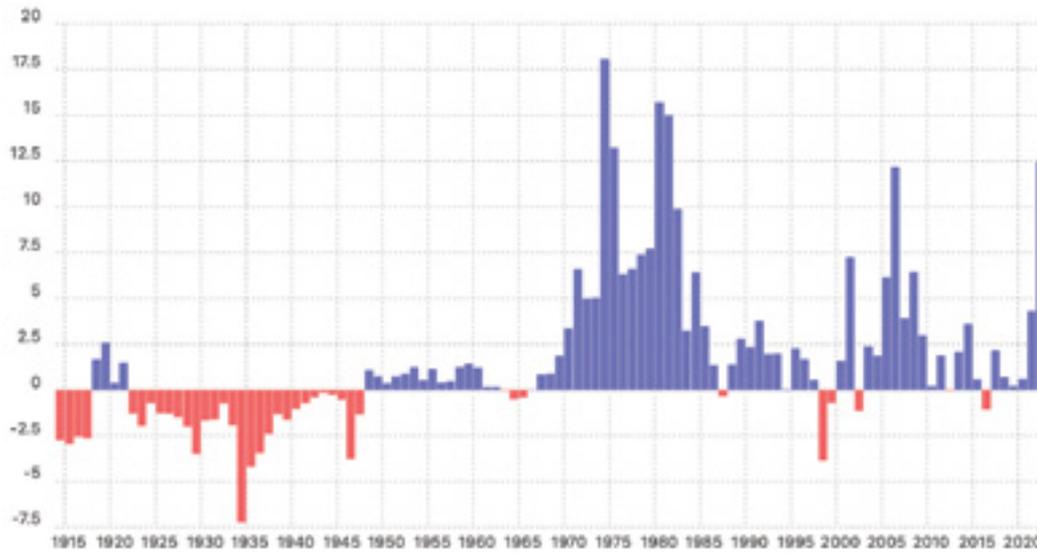
Our third item is prices. Unit pricing is probably the most important variable in ensuring you have a successful electrification project. There are two ways we need to look at prices. The first is to look at your utility tariffs and your annualized billing for both gas and electric. When evaluating your utility tariffs, the idea is to derive an accurate blended rate for each unit. A typical blended rate for electricity, depending on where you live, can be \$0.07 / kWh up to \$0.35/kWh, and a typical blended rate for natural gas (Therms) can be \$0.75 / Therm to \$1.50 / Therm. The higher your Therm blended rate and the lower your electric blended rate is one indicator that you might have a very successful electrification project on your hands. Conversely, if you have a very low \$/Therm and a very high \$/kWh then electrification projects may become difficult to implement. Two quick examples of each scenario's opportunity/cost:

1. If your current fuel costs are \$0.07/kWh & \$1.25/Therm and the existing machinery currently consumes 100,000 Therms annually, that will cost you \$125,000/year to operate. The same machinery, operating on electricity (kWh), would be able to consume 1,785,714 kWh annually before the project would "break even".
2. If your current fuel costs are \$0.35/kWh and \$.75/Therm and the existing machinery consumes 100,000 Therms annually, that will cost you \$75,000/year to operate. The same machinery, operating on electricity (kWh), would only be able to consume 214,285 kWh annually before the project would "break even".

The second way we need to evaluate pricing is to look at the Consumer Price Index (CPI) and see how the prices of units changed on a national level, over time. The CPI is calculated by the U.S. Bureau of Labor Statistics and can help bring these numbers into focus. Obviously, past performance is not purely indicative of future performance but it is a decent indicator to monitor.

### Price Inflation for Electricity since 1913

Consumer Price Index, U.S. Bureau of Labor Statistics



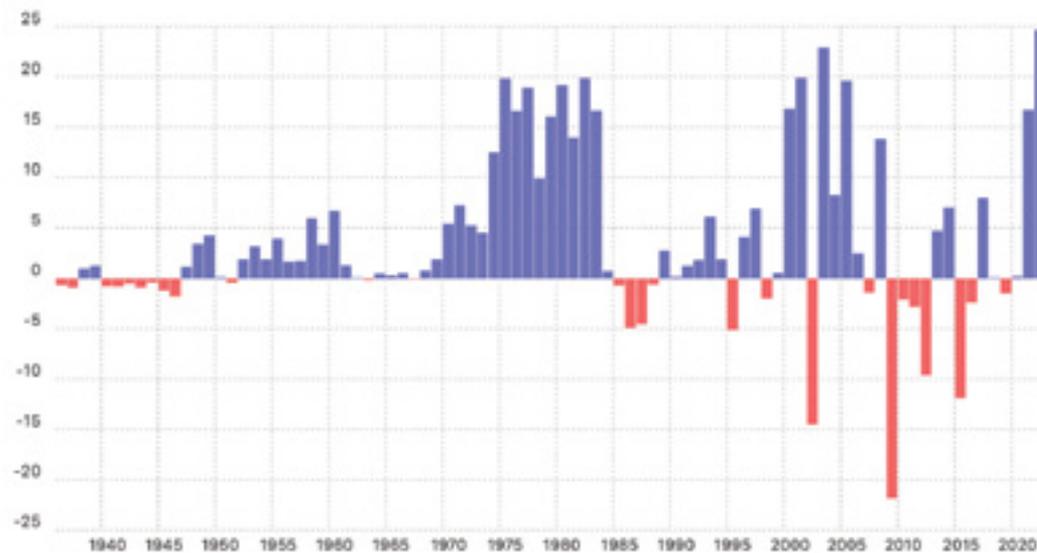
Years with the largest changes in pricing: 1974 (18.07%), 1980 (15.70%), and 1981 (15%).

Source: <https://www.in2013dollars.com/Electricity/price-inflation>

Over the last 109 years, electricity experienced an average inflation rate of 1.54% per year. In the last two years on the graph, 2021 & 2022, the electricity inflation rate has been 3% and 7.5% respectively. →

### Price Inflation for Utility (piped) gas service since 1935

Consumer Price Index, U.S. Bureau of Labor Statistics



Years with the largest changes in pricing: 2022 (24.68%), 2003 (22.92%), and 2009 (-21.83%).

Source: [https://www.in2013dollars.com/Utility-\(piped\)-gas-service/price-inflation#:~:text=The%20current%20national%20average%20price,of%20change%20indicates%20significant%20inflation](https://www.in2013dollars.com/Utility-(piped)-gas-service/price-inflation#:~:text=The%20current%20national%20average%20price,of%20change%20indicates%20significant%20inflation)



There are also new “pilot programs” emerging in the state of California that are focusing on reducing the Green House Gas (GHG) emissions versus the specific units of energy we mentioned previously. One program that brings electrification into focus is SCEs called the Clean Energy Optimization Pilot (CEOP). Pilot programs always have the ability to become a “main-stream program,” but that evolution is highly dependent on the program’s success/cost-effectiveness. SCEs GHG reduction pilot program supports electrification in a big way. Natural gas, or Therms, are very carbon intensive. You can reduce a tremendous amount of GHGs annually by executing electrification projects and receive a very hefty incentive per unit of GHG reduced. The value of each unit is somewhere around \$600 per unit of GHG reduced year over year. There are many technologies that are maximizing the value of the CEOP program. One of them is the High Efficiency Dehumidification System (HEDS). HEDS is an HVAC technology that is aiding in electrification and therefore eliminates, or reduces, the need for facility Therm consumption. Because the Therm savings are carbon intensive it translates into high GHG reduction. The estimated incentive for installing one HEDS unit, in the CEOP program, can be anywhere from \$90,000 to \$170,000 per unit. Extremely lucrative!

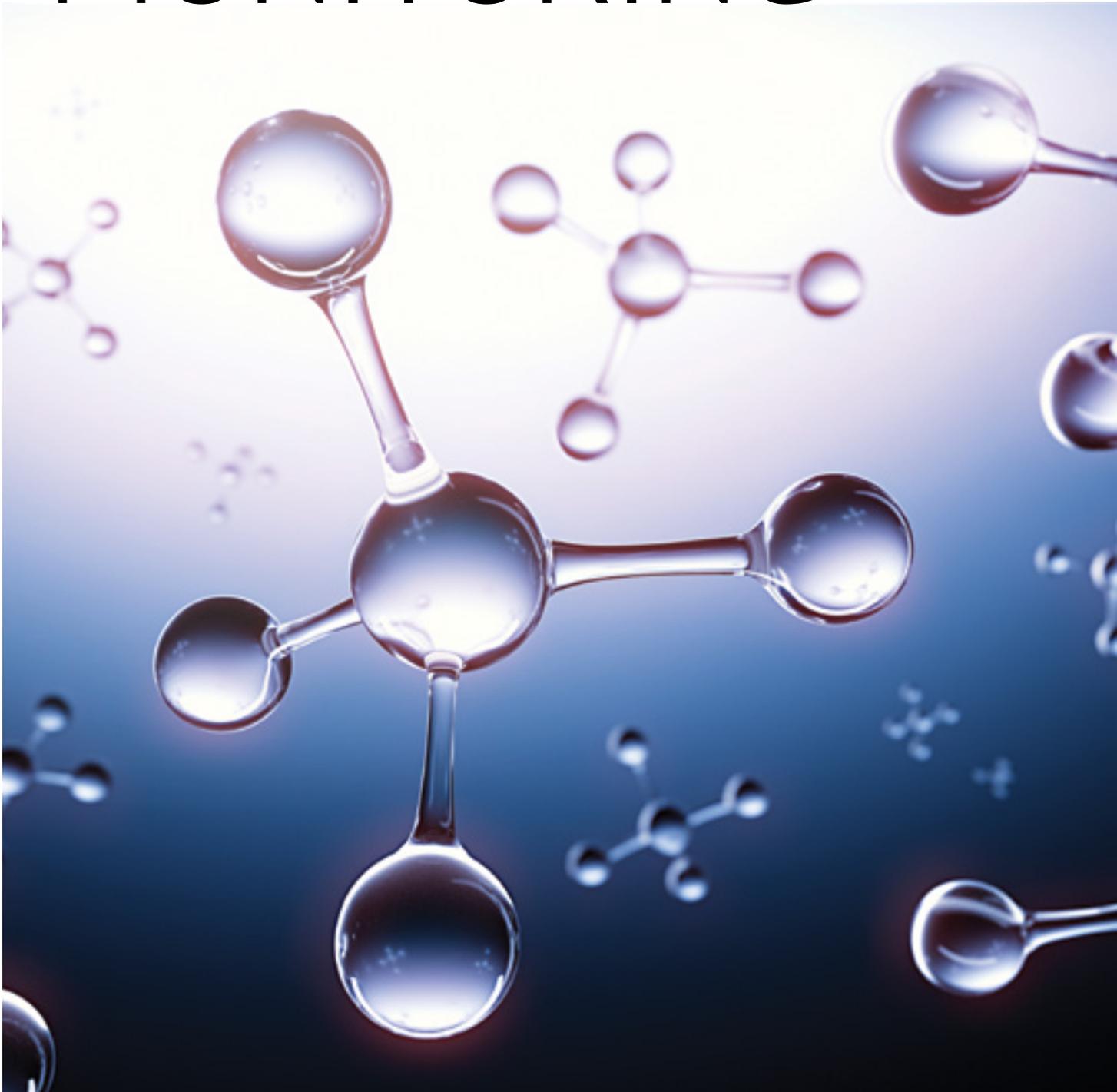
Our fifth and last item on our electrification checklist is project funding. If you have made it this far in your project checklist, chances are you have derived a valuable project and now it needs to be approved internally and funded. Before you take the project to your CFO or approval board, it is important to research the financing options that may be available to you. Bringing multiple funding options to the table does a few things. First, it shows that you care about the project and have put as much forethought into it as possible. Secondly, it provides the reviewer(s) multiple options to say “Yes!” If you only bring one possible solution to them, asking for funding, they might not be in a positive financial position to say yes to your funding request at that time.

However, if you bring low, or no, interest financing options to the table you increase your odds of implementing your electrification project. Examples of no/low interesting financing options are the California Energy Commission’s Energy Conservation Assistance Act and San Diego Gas & Electric’s (SDG&E) 0% Interest On-Bill Financing Program. The CEC financing program offers 1% financing, only to cover their administration costs and has a very wide net of eligible energy projects that can receive the funding. SDG&E financing program has a lower interest rate, zero; however, they have a very tight focus on energy projects that can be funded using this option. And of course, there are always market-rate financing options and there are many companies who can provide this service for electrification projects; however, they will be at market interest rates, which are currently rising. If market rate financing is the only option for your project, be sure to understand how much more interest you might be paying on the project, compared to funding it internally, as the interest could easily detract, or eliminate, the value of the savings from the electrification project.

#### ABOUT THE AUTHOR:

**Christopher Roman** currently leads the strategic business development for Conservant Systems. Roman is a dedicated energy industry professional who has previously held positions at A.O. Reed & Co., San Diego Gas & Electric and UC San Diego Health. Roman has established himself as a creative problem solver who brings unique solutions to complex problems. Roman is also passionate about improving the indoor air quality (IAQ) of facilities so that 99.99% of pathogens are removed from the air we breathe.

# EMISSIONS MONITORING





## **STEVE LINDSAY**

### **Forging a path to emissions reduction, but first an assessment**

Leaks in the gas industry are extremely expensive. According to the U.S. Environmental Protection Agency (EPA), methane (CH<sub>4</sub>) is 25 times as effective as carbon dioxide (CO<sub>2</sub>) at trapping heat within the Earth's atmosphere.<sup>1</sup> Over the last two centuries, atmospheric concentrations of methane have more than doubled. Greenhouse gas (GHG) is estimated to be responsible for approximately a quarter of the historic levels of warming in the world today.

Not to ignore the environmental costs to the Earth; the costs to industry are massive as well. Fugitive emissions account for approximately 7% of all methane getting into the atmosphere, and it's estimated that operators lose 2.3% of all gas extracted through leaks every year. In 2021, the costs to the industry regarding methane leaks reached \$19 billion. This year, it is predicted to rise even above that number.

Even without such a commercial driver, the impetus for industry to reduce this waste would be compelling. Governments around the world looking to drive toward net zero are toughening regulations on emissions generally with particular focus on fugitive emissions and/or leaks in the oil and gas industry. →

<sup>1</sup> <https://www.epa.gov/gmi/importance-methane#:~:text=Methane%20is%20the%20second%20most,trapping%20heat%20in%20the%20atmosphere.>

In the U.S., methane emissions are central to the EPA's plan released last year to require operators to detect and repair leaks. Their aim is to slash methane leaks from oil and gas operations by almost three-quarters from the levels detected in 2005 by 2035.<sup>2</sup> In the EU, meanwhile, the European Commission is also proposing to crack down by introducing penalties for leaks and potentially banning routine flaring and venting, which are commonly used to control methane levels in facilities.<sup>3</sup> The latter's impact will likely be more drastic because while fugitive emissions account for about 7% of methane escaping, venting accounts for 37%.<sup>4</sup>

The Global Methane Pledge launched by the E.U. and U.S. a year ago now has more than 100 countries that have agreed to reduce global methane emissions by at least 30% from 2020 levels by 2030.

"To limit warming to 1.5 degrees C and avoid near-term tipping points, the world must rapidly reduce methane emissions in addition to decarbonising the global energy sector," the governments said in a joint statement announcing the pledge. Beyond governments, investors and the public are also increasingly pressuring companies to address the issue.

Unfortunately, most systems of monitoring emissions are not up to the task. Traditional approaches will increasingly struggle to meet government requirements or business needs as operators pursue their own greenhouse gas reduction strategies. Complying with current ordinances is oftentimes nearly impossible for the average operator. As such, the entire system requires an overhaul to meet modern problems with modern solutions.

Existing leak detection and repair (LDAR) programs are usually manual, labour-intensive, costly and time-consuming. Approximately 90% of fugitive emissions come from flanges, pressure relief devices, valves and pumps that proliferate across upstream wells and downstream facilities. In an average refinery, for example, there may be over 75,000 connectors and valves. On a large facility, over 200,000, all requiring manual inspection on foot with wand-based sniffers. There are many problems with inspecting this equipment in this manner.

Importantly, this process is inefficient and human error and equipment failure at every level. While operators attempt to be as effective and reliable as possible, mistakes will always be made, and equipment can prove unreliable at any time. Furthermore, there are other significant consequences.

The first is that inspections are sporadic. The scale of the task and the expense and labour involved means many flanges are checked only when maximum permission allows at the end of a cycle. This means that leaks can persist for months before detection, and second, that over-reporting emissions is common. In the absence of any proof to the contrary, when a leak is found, it must be assumed to have started immediately after the last inspection. As businesses seek to reassure stakeholders of their seriousness in tackling emissions, that has both commercial and reputational costs. Over-reporting of leaks ensures that the company is more liable than would be otherwise the case should the emissions be detected in a timely fashion and corrected. Ideally, inspections would be automated to reduce the labor cost and done constantly, but thus far this has not been the industry standard to date.

The second consequence is that, given the work is mainly manual and paper-based, the data gathered is rarely used effectively. The lack of digitized work processes makes it difficult to analyse, manage audits, or track trends. This also makes reporting more difficult, as paper-based documents can be lost or accidentally destroyed whereas a fully-digital system does not have these risks.

While there is increasing pressure to detect and address leaks quicker, the only option for many would be to significantly increase headcounts for more regular rounds in an environment where both labour shortages and competitive pressures argue for the opposite. In most cases, it is impractical. Instead, operators choose to bear the emissions costs and opportunities lost.

But that needn't be the case.



<sup>2</sup> <https://www.reuters.com/business/environment/us-unveils-crackdown-methane-starting-with-oil-gas-rules-2021-11-02/>

<sup>3</sup> <https://www.euractiv.com/section/energy/news/leak-draft-eu-law-cracks-down-on-methane-leaks-from-fossil-fuels/>

<sup>4</sup> <https://www.catf.us/resource/benchmarking-methane-emissions/>

### Sourcing a better way

There have been some attempts to address the weaknesses of traditional LDAR programs. Cameras with gas cloud imaging set on drones or even aircraft or satellites can be used to capture methane emissions more regularly. But they cannot pinpoint the sources of a leak, which remains a laborious manual task. When an emission is detected, operators must still manually inspect the nearby location to find the faulty equipment.

Instead, industry leaders have started to transition to a more digitized approach, with a real-time methane monitoring solution based on cost-effective wireless sensors just recently developed. Low-energy sensors that cover more plant areas than traditional detectors provide a far more efficient and powerful solution. This system provides a wide range of benefits.

Firstly, and most obviously, it enables operators to detect leaks and identify their source quickly, eliminating the costly and time-consuming manual labour. Operators can use the information to prioritize repairs, address the most-pressing leaks first and avoid downtime in operating systems. In upstream and midstream operations, automated quantification of emissions and user-configurable alarms can immediately alert operators to critical product losses at remote and unmanned locations. Downstream, in refineries and chemical plants, automated emissions monitoring can rapidly locate and quantify the source of leaks to improve maintenance efficiency and reduce both losses and environmental damages.

Crucially, it also captures and digitizes the data to enable not only accurate and easy reporting and audits but to allow for analysis in order to properly identify trends and optimize operations. That can help identify design issues and other problems leading to leaks and ultimately shift the LDAR from a reactive to a proactive stance. In the future, the data could also help drive predictive maintenance regimes.

Nor is it just leaks: closer monitoring and analysis could identify the operational issues resulting in higher levels of flaring and venting, which constitute over five times the level of methane emissions compared to leaks. Many sites today simply have no way of measuring their venting emissions, leaving them unable to develop a proper solution to a costly problem.

Perhaps the most important point: with an enterprise-level, near-real-time view across all sources, the solution provides true visibility and transparency for emissions data. This is vital for regulatory reporting and public accountability. But it's also a crucial driver for businesses' own emission reduction strategies. It finally enables them to determine a baseline and benchmark for emissions data against which to set targets, measure their progress and provide evidence of success.

Many operators' road to emissions reduction will be long and potentially challenging. However, if a starting point is not measured, a goal is impossible to delineate.

### A better solution

With efforts to stay ahead of the Global Methane Pledge and the EPA's plan to reduce methane leaks, companies across the industry are pledging their commitment to achieving net-zero carbon emissions. By identifying concrete sustainability goals and incorporating science-based targets into their plans, industry leaders and their customers will be able to work towards a carbon-free future.

The increasing significance of global climate policy trends indicates that innovative tools like wireless gas detector real-time methane monitoring solutions are growing in necessity and will be essential in helping companies achieve their targeted net-zero rates.

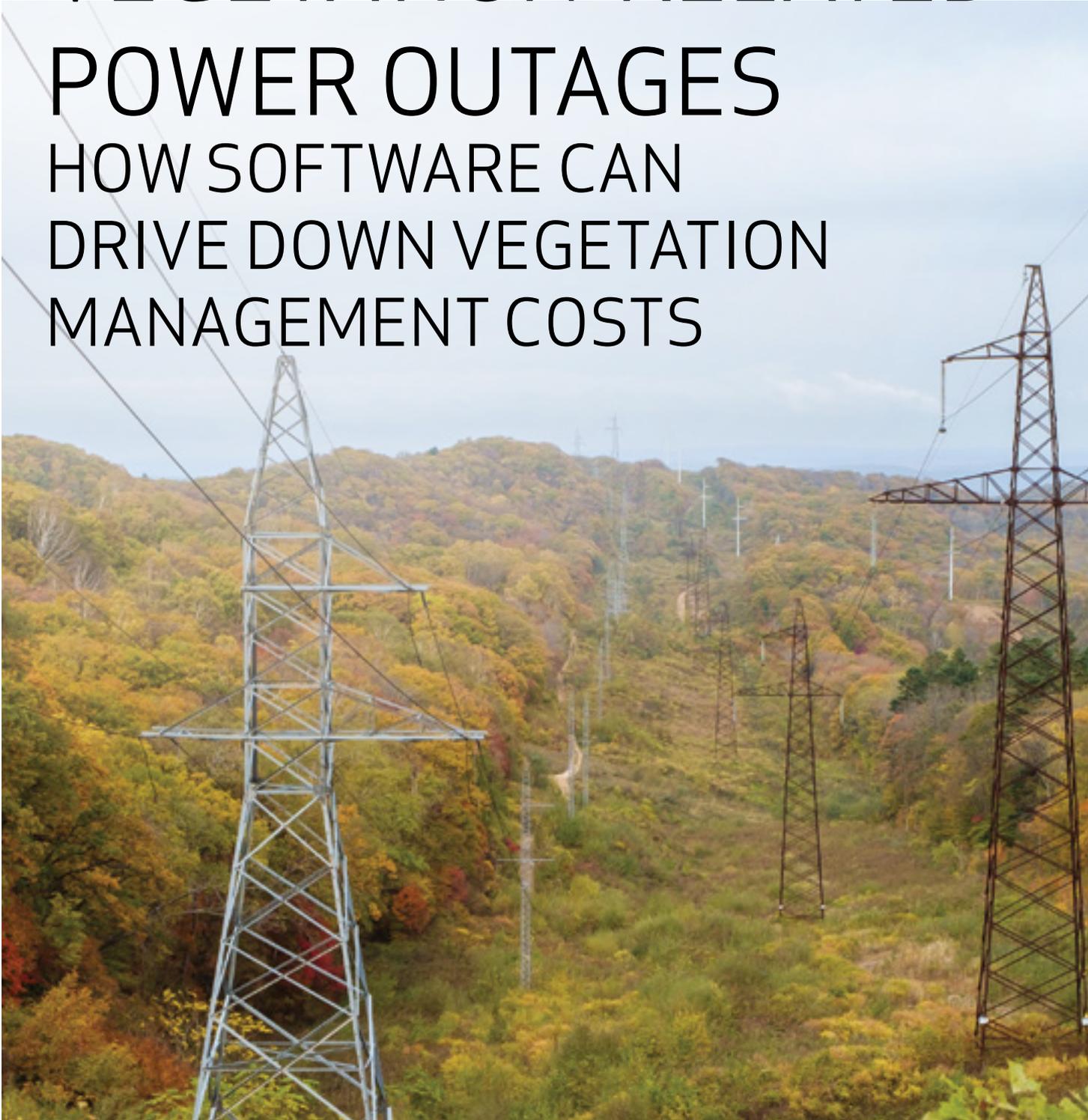
By utilizing these new technologies, accidental leaks will be detected far earlier and corrective action may be taken to prevent further emissions into the environment. Gas cloud detection cameras allow for near-instantaneous notification of a leak that might otherwise lead to an environmental issue.

Additionally, the data collected from monitoring these systems will allow operators to further prevent any environmental damage while ensuring they are maintaining compliance with government legislation. Further, by cross-referencing past data against current operational statistics, companies can verify their best standard operations are in place to meet all health, environmental and safety standards being enacted.

### ABOUT THE AUTHOR:

**Steve Lindsay** is the business development director, Honeywell Process Solutions. He is responsible for the growth of industrial processes and personal safety, as well as environmental, health and safety solutions. Lindsay strives to produce outcomes that solve SIS, EHS and ESG challenges in the energy industry, partnering to produce outcomes that solve SIS, EHS and ESG challenges in the energy industry. He has been with Honeywell for over 30 years.

# OUTSMARTING VEGETATION-RELATED POWER OUTAGES HOW SOFTWARE CAN DRIVE DOWN VEGETATION MANAGEMENT COSTS





### **BRIAN E. HOFF**

According to the Federal Energy Regulatory Commission (FERC), vegetation management, particularly trees that grow or fall into overhead power lines, is the single largest cause of electric power outages. The agency also says that tree and power line conflicts have caused significant wildland fires in both the U.S. and Canada. Two key recommendations presented by FERC are to 1) improve current systems for managing utility vegetation management (UVM) workload and schedules, and 2) adopt consistent and industry-accepted best practices for UVM.

#### **Vegetation management today**

Traditional vegetation management systems rely on manual inspection of assets to assess which trees need attention, usually quarterly. Because the grid is expansive, it is nearly impossible to have a view into all areas that need trimming with this traditional approach.

The blackout that happened in the northeast United States in 2003 is a good example of the scale of the impact mismanaged vegetation can have on the grid. The outage affected an estimated 55 million people and caused significant long-term economic loss. According to FERC, the outage was caused by conflicts between high-voltage transmission lines and vegetation. The agency concluded that “had these specific trees been pruned or removed before these outages, the blackout most likely would not have occurred.” →



Electric power outages caused by the natural world colliding with overhead lines is something utilities have been battling for the past 100 years. Managing vegetation is key to providing a safe and reliable supply of electricity.

There have been no cascading failures like the 2003 blackout since the implementation of the FERC guidelines for UVM. Still, there have been major UVM-related outages. One major western utility failed to comply with state vegetation management laws that protect its bulk transmission corridors, resulting in more than 20 wildfires burning half a million acres. The utility paid regulatory fines of \$2.1 billion and settled civil claims for more than \$25 billion.

There is a clear understanding among electric utilities that legacy vegetation management systems are outdated, too costly and ineffective. Many UVM programs rely heavily on visual inspections, where they largely depend on ground crews and local intelligence. Utilities that use this tactic understand that this is a weakness, but they aren't ready to reduce dependency on local ground inspections.

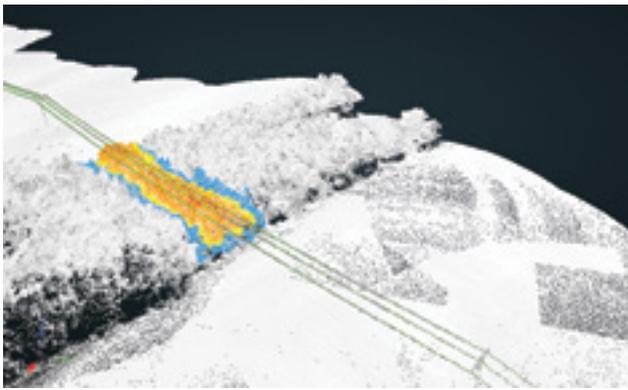
Today, vegetation management requires countless hours to survey and gather data before countless *more* hours are spent clearing all the hot spots. There is a better, safer, more efficient and cost-effective way to scale vegetation management.

### **Data collection = intelligence**

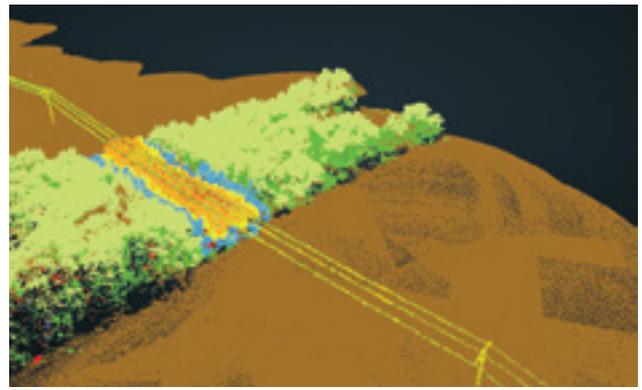
Utilities universally agree UVM is vital to preventing outages, but it represents one of their most significant recurring maintenance expenses. The cost of new technology that would improve field intelligence must be justified by cost savings derived from the UVM program. Further, large utilities with longer transmission lines recognize the value of automation and advanced analytics, while relatively smaller utilities with smaller budgets may have difficulty justifying the cost.

Many large utilities report budgetary constraints brought on by the recent pandemic. Additionally, many utilities are not currently using advanced analytics beyond internal systems as a part of their UVM program. For example, LiDAR (Light Detection and Ranging) is used sparingly for vegetation clearance limits and line sag, and LiDAR alone cannot provide species identification and growth rates based on weather conditions and precipitation rates.

And those using LiDAR are the relatively larger utilities. The cost, however, remains prohibitive for large geographic areas, especially those that require frequent inspections. However, the cost is decreasing which will lead to better access to data.



Built-in AI features drive automated identification of encroachment areas and asset defects with increased precision.

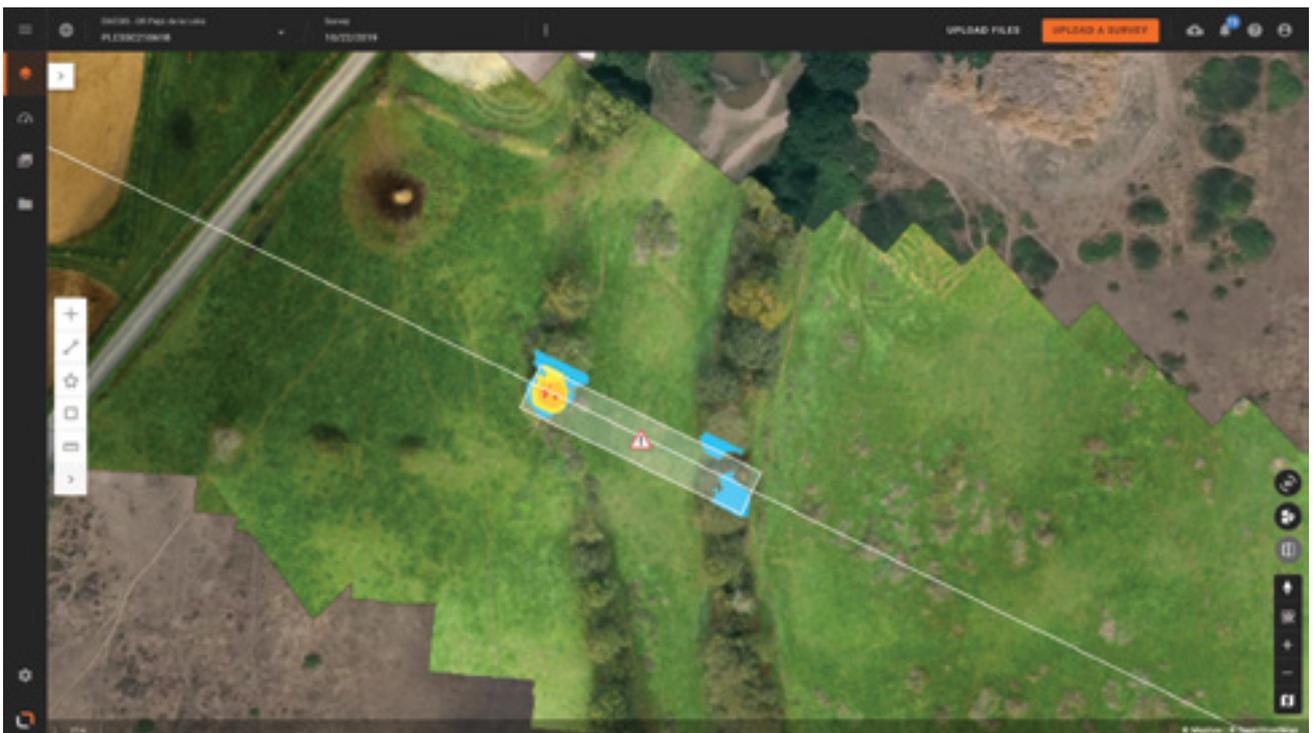


21<sup>st</sup> century AI/ML technology is the key to the cost-effective management of vegetation with associated images of trees and transmission lines. Innovation will fundamentally change the way utilities manage this issue.

Current systems lack many insights needed for proper management of the grid's vegetation such as weather's effect on growth, specific growth patterns of tree species and additional factors which could play a role in outages, such as buildings and other structures. And if there were systems that could be predictive – while being more efficient – utilities would line up at the door.

If utilities could choose which data collection technologies they want in automation solutions, they would include:

- Weather pattern prediction and its impact on vegetation growth
- Real-time wind and fire risk identification and its impact on growth rates
- Identification of tree species with growth rates and patterns
- The predictive impact of vegetation growth retardants →



The provision of more timely and accurate data from the field when combined with vegetation growth rate data will enable utilities to deliver optimize tree trimming plans.



AI-enabled data management solutions are available and offer utilities a clear upgrade path from their legacy vegetation and risk management programs.

Here's where software comes in. Analytics provided by AI and machine learning techniques can combine weather and precipitation forecasts, obtain quality imagery of large tree canopies above transmission wires and expand data collection beyond trees and vegetation. AI-based vegetation management involves two components: data capture and analytics. The potential value is derived by using data-driven visual images captured by many different sources (drones, fixed-wing, helicopters, satellites, humans, sensors) to drive vegetation management decisions.

Global T&D utilities must invest in data analytics to facilitate reduced forced outages and to minimize the probability of catastrophic events, such as fires and major regional outages. Sources estimate that large utilities each pay over \$100 million for vegetation management programs each year. California utilities alone pay a combined total of more than \$1 billion a year on vegetation management.

The cost of vegetation management is staggering and continues to grow each year. Containing the rising cost of vegetation management activities involves:

- Data-driven visual intelligence supported by analytics
- Support for all major visual inspection file types
- Improving GIS network accuracy with AI-driven updates
- A shared database for vegetation management and asset inspection

Data-driven visual intelligence can significantly reduce vegetation management costs by up to 20% and tree-caused unplanned outages by up to 30%. The result of a singular platform for vegetation management and asset inspection functions can offer up to a 90% reduction in the cost of data management and integration.

Reducing risk exposure for T&D utilities and their customers by detecting early and mitigating a single catastrophic failure cannot be reduced to mere dollars and cents. For many utilities, a miscalculation will be measured in billions of dollars and never-ending regulatory scrutiny. There is also intangible damage done to its reputation and customer goodwill.

#### **Use case shows significant value**

The following business case study demonstrates the potential economic value generated by using data-driven analysis to drive vegetation management decisions based on an assumption of status quo versus an analytics-driven approach to vegetation management.

In this case, we are taking a two-step approach:

1. Move from an annual rotational trimming strategy (generally over four years with 25% of the territory trimmed per year) to a purely risk-based approach that identifies and categorizes overgrowth encroachment risk across the entire region. This drives the highest priority trimming in the current year.

2. Move from a distance-based vendor payment model to a volume-based model. This approach shifts payments from miles/kilometers covered to actual acres trimmed.

The case study includes several assumptions:

- The utility services 1,000 miles of power lines or 15,168 acres.
- Clearance around the power lines is expected to be 125 feet on both sides of the lines.
- All images have been previously captured and those costs are included in the analysis.



Today's AI and machine learning technology enables utilities to analyze data faster and more accurately than ever before. Vegetation Management software improves current capabilities with tools to make data-driven decisions that, combined with local experience, will reduce operational costs.

Generally, data-driven vegetation management involves data capture, vegetation management analytics and asset inspection analytics. For this use case, we focused on data capture and vegetation management analytics only. An initial \$100,000 investment in software-driven data analytics returns \$74,053 in savings to the user, for an ROI of 74.1%.

A human-guided artificial intelligence-powered predictive model enables utilities to more effectively and efficiently handle vegetation management and save on manpower while spending less overall. Ultimately, software can reduce outages by 30% and vegetation management costs by up to 20%.

In addition, utilizing drones, satellites, LiDAR, big data analytics for smart grid and AI-driven technology, which moves away from a time-based trimming approach to a risk-based one, allows utilities to more efficiently focus on the problem areas. The software can analyze the data and images and give a trained system manager a holistic view of the entire area and provide predictions on where to focus next.

When looking at how this risk-based approach affects the bottom line, the results are eye-opening:

- 51% cost reduction per acre of mechanical trimming
- 30% cost reduction on volume trimming
- 30% reduction of actual trimming work

Vegetation management is a critical and expensive maintenance responsibility to protect transmission and distribution infrastructure. But, done the right way, it can ultimately save money in outage losses and improve the safety of consumers.

#### ABOUT THE AUTHOR:

**Brian E. Hoff** is an executive for GE Digital's Grid Software Innovation Solutions. In this role, he leads the product management strategy for the analytics portfolio and is focused on co-innovation with customers and developing customizable solutions to help electric utilities meet their energy transformation goals. Hoff has more than 27 years of experience in the energy industry serving in a variety of roles in nuclear, corporate services, engineering, information technology, cyber security and emerging technology. He graduated from Hamilton Technical College with a B.S. in electronics engineering technology and earned an M.B.A. from the University of Phoenix. Additionally, he has completed Northwestern's Kellogg School of Management's Global Advanced Management Program.

# DER REVOLUTION: TURNING THE ELECTRIFICATION CHALLENGE INTO OPPORTUNITY





### **ABHAY GUPTA**

Over the past decade, warnings about the impact of solar and energy storage on the utility industry have grown louder, foreshadowing that distributed energy resources (DER) like solar, battery storage, electric vehicles (EVs) and smart energy devices are coming, and utilities need to prepare. The truth, however, is that widespread DER adoption isn't just looming on some distant horizon – it is already here.

The U.S. Department of Energy estimates that there will be in excess of \$110 billion in DERs deployed nationwide by 2025, not including the billions in infrastructure spending that will also be required to integrate distributed resources with the grid.

Solar, for one, has topped 120 GW installed capacity in the U.S. Nearly 12 GW of battery storage are on the grid today (80% of which has been deployed since 2020 alone), and there are currently 10 million electric vehicles (EVs) on the road today with an expected 145 million by 2030.

At the same time, the Federal Energy Regulatory Commission (FERC) is leveling the economic playing field between solar, battery storage, electric vehicles (EVs), smart energy devices and other DERs. Approved in September 2020, FERC Order 2222 is becoming a reality for state regulatory agencies, independent system operators (ISOs) and regional transmission organizations (RTOs), who must all develop plans to give DERs access to wholesale energy markets. →

While several utilities are making strides in small-scale DER integration and efforts like these are important first steps – like Arizona Public Service’s 8 megawatt hours of battery storage to defer the capital investment of a transmission reconductoring – the time has come for utilities to do more than proof-of-concept deployments and pilot electrification projects.

Why? The longer utilities wait to engage DERs at an enterprise level, the more difficult and expensive it will be to coordinate and manage rapid DER expansion of their grids. DER deployments will only accelerate as cost of ownership continues to fall and wholesale markets unlock additional benefits, whether utilities choose to take an active role or not.

### The future is electric

When it comes to managing rapid DER expansions on the grid, EVs are top of mind for many utilities. With EV registrations climbing three times faster than overall U.S. vehicle registrations, sales soaring nearly 200% and state mandates phasing out gasoline vehicles, many wonder if the electric grid can sustain an exponential increase in demand.

While the basis for this concern stems from the amount of electricity needed to charge these vehicles, the problem arises more specifically from when these vehicles are charged. For the majority of EV owners, charging is most convenient at home. This also means, however, the most popular charging times occur when owners return home from work each day, coinciding with existing residential peak electricity demands. Though this may seem inconsequential at first, over time, utilities suffer from a more congested grid and consumers will experience higher electricity costs. EV adoption trends also cluster in localized areas, and demand spikes typically occur within specific neighborhoods and near each other, adding further stress on the grid.

Because accommodating the influx of EVs on the grid is critical, many utilities are looking to introduce new services like home and public charging infrastructure that simultaneously bolsters grid reliability. But, this also leaves many utilities grappling with the question of where to start.

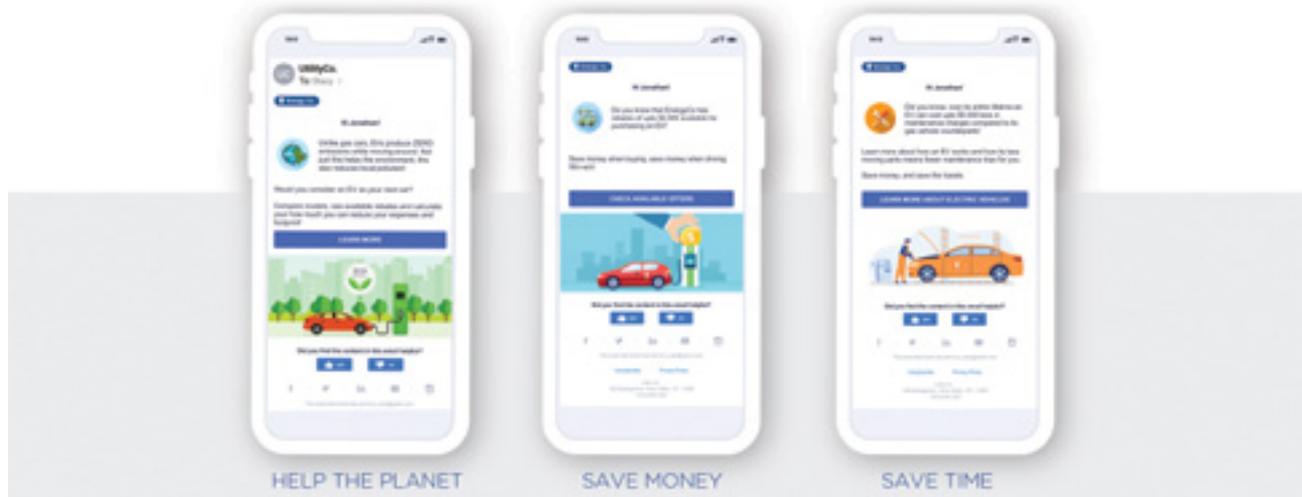
### Navigating the EV journey

Most utilities will first need to understand their current position on the EV-adoption spectrum. In the U.S., EV penetration varies significantly by geographic region and therefore determines the level of sophistication needed to support a utility’s upcoming strategies and investments. Depending on how little or how much a utility is already engaging with EVs, four phases of a successful EV journey can be activated sequentially or in parallel:

#### 1. Accelerating customer awareness, education and adoption

Utilities across the country are under pressure to reduce carbon emissions, and EVs can play a key role in advancing their organization’s electrification initiatives. A survey conducted at the end of 2020 by Consumer Reports found that 71% of U.S. drivers would consider buying an EV in the future and over 70% understood their environmental benefits. Yet the same survey found that only 30% of respondents said they knew much about EVs.

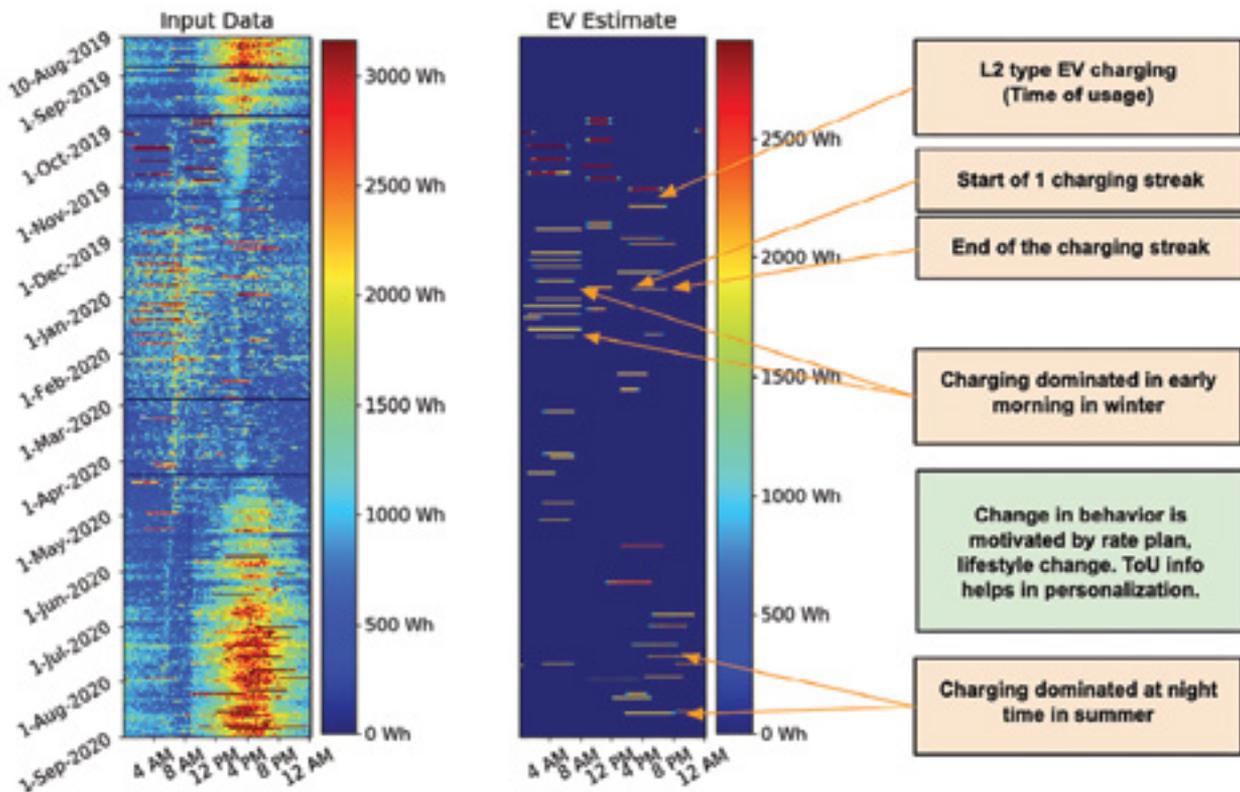
Utilities with little EV adoption in their territory – think 0% to 0.5% penetration – will benefit most from investing in customer education that supports the adoption of EVs within their territory. This can range from informing customers on the intertwined relationship between EVs and the utility, enhancing customer engagement that normalizes the purchase of EVs and offering discounts on things like smart chargers to help promote EV adoption among customers.



## 2. Analyzing the EVs on the road today and forecasting where EVs will be tomorrow

Utilities with 1% to 3% penetration are beginning to experience noticeable EV pickup, yet have a limited understanding of how this added energy demand affects their grid.

Historically, utilities have relied on DMV data to identify EVs registrations but that data is difficult to obtain in a timely manner and does not update on an ongoing basis or provide charging insights. Fortunately, many utilities already possess this information deep within the data collected by smart meters and by applying artificial intelligence (AI) solutions to utility data, utilities can unearth granular-level insights into individual households within their territory, like pinpointing homes with EVs and further identifying territory-wide charging times and charger sizes. This information helps utilities determine an organization-wide, data-driven plan for accommodating EVs—from effective grid management and customer engagement to rate design and infrastructure investment. →



### 3. Shifting EV load using behavioral mechanisms

Grid congestion and capacity could quickly become a problem for utilities with higher percentages of EVs if all EVs were to charge at the same peak times. That's why utilities with above-average adoption will find themselves considering ways to prevent these EV charging peaks. One way is to expand capacity via infrastructure investments – though this is highly costly and time-consuming. A more favorable alternative is to develop behavioral managed charging solutions.

Leveraging the same end-to-end data analytics as above, utilities can implement behavioral managed charging strategies to better inform drivers about their individual charging patterns, with the goal of helping customers shift their charging patterns more optimally. This includes switching charging times to off-peak hours or encouraging more sustainable charging behaviors backed by incentives.

### 4. Implementing managed charging

Utilities with significant EV penetration, typically 2% to 3%, are familiar with the need for load shifting and will want to – if they haven't already – actively engage customers with behavioral nudges targeted to motivate these shifts from peak charging to off-peak charging. In addition to behavioral charging, this group is best poised for direct load optimization – also called managed charging.

California utilities, which have by far the highest share of EVs of any U.S. state and the most concern for charge management strategies, are prime examples. Utilities can offer managed charging as an automated way for customers to participate in the clean energy economy while enabling utilities to better manage grid loads.

### Unearthing valuable customer data

While most consumers agree changes need to happen on the grid to support long-term electrification and decarbonization goals, few will be self-motivated to change their behavior to be more grid-friendly. Fortunately, using this combination of AI and the utility's existing smart meter data mentioned earlier, utilities have the power to effectively motivate customers toward grid-optimal charging behaviors in which the customer can benefit from lower monthly electricity bills by charging during off-peak hours and utilities can create more balanced grid loads.

What's more, is that utilities can do all this without installing intrusive on-site monitoring hardware or relying on participation in customer surveys – the two most traditional methods of data collection. Not only is the equipment expensive, but this approach is also highly dependent on the participation of homeowners.

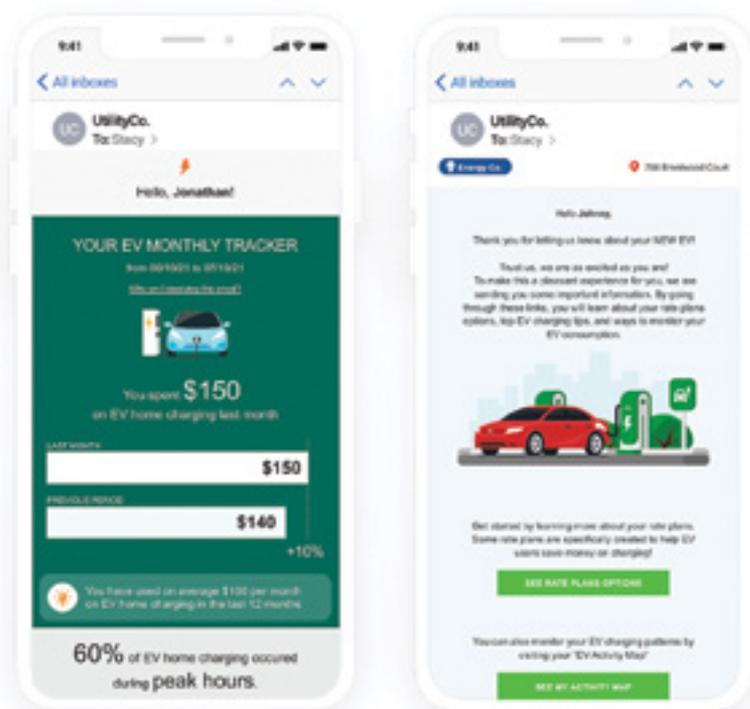
Market research data and surveys also have their shortcomings because it only reflects in-depth knowledge of a representative group of customers. The same is true of surveys. By definition, proxies are always proxies and will lack a precise picture of all EV customers. Another downside to generalized data about customers: it cannot keep up with changes. For instance, COVID-19 dramatically changed charging and driving behaviors. Data based on results gathered in the past will not reflect those changes.

But with 100 million smart meters already deployed across the country, utilities can collect existing data easier and more cost-effectively. Applying advanced data analytics and AI to this data then enables utilities to learn about each customer at a granular level, including charging patterns, charger type and other energy behaviors.

### The power of behavioral nudges

Equipped with this knowledge, utilities are now able to optimize marketing and grid management strategies. For example, utilities can target specific EV owners with the greatest potential for load shifting, based on their peak usage and send personalized messaging (via traditional paper mail, digital emails or even text alerts) that educate these customers on their individual charging patterns and energy consumption. This messaging can also include personalized incentives encouraging these customers to shift the hours they normally charge their vehicle to off-peak hours, helping utilities decrease peak load demands.

EV customers may receive email notifications or alerts from their utility when they are charging on-peak in addition to monthly summary reports and web-based activity heat maps that keep EV owners aware of their specific charging behavior to encourage load shifting. When a utility feels ready, it can also implement more sophisticated EV charging programs, like managed charging. Here, EV owners would enroll in managed charging and the utility would remotely manage vehicle charging for optimal grid flexibility that both minimizes customer electricity costs and ensures energy supply is balanced during peak loads.

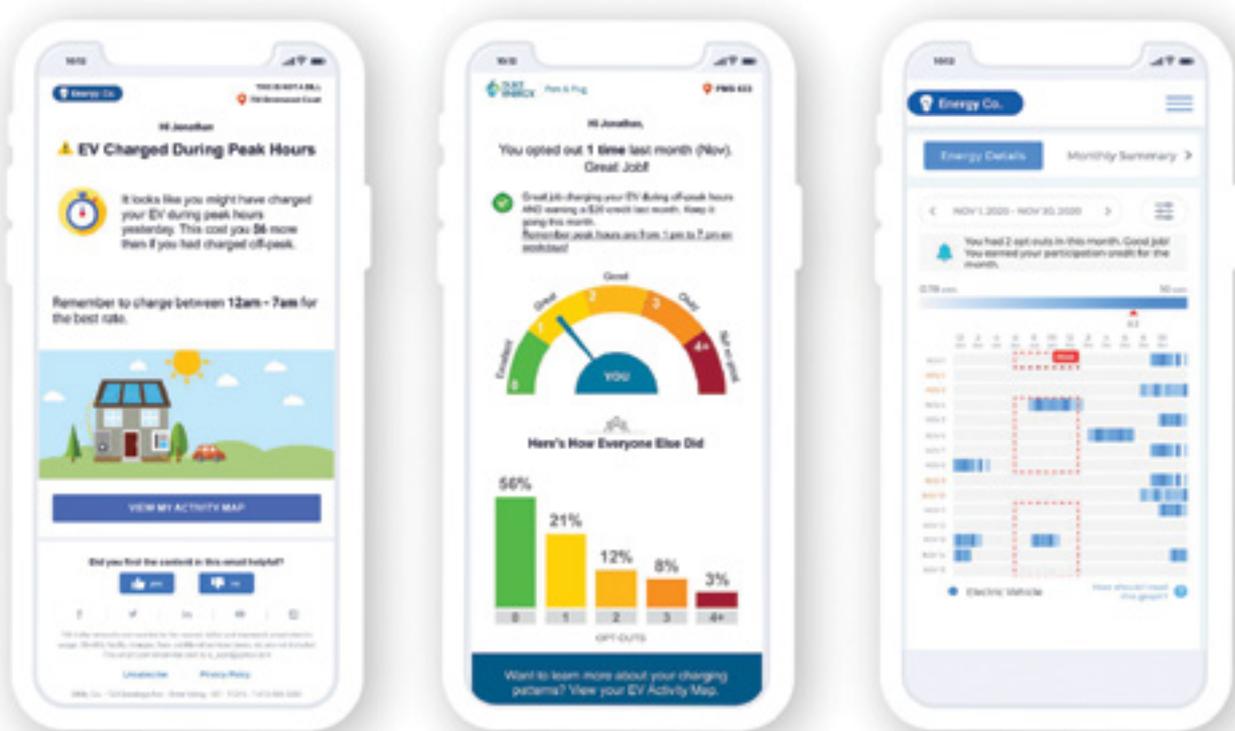


When the financial savings associated with charging during off-peak hours still is not enough motivation, utilities can further reward with a monetary credit per month if they routinely charge off-peak. Each month, customers could receive a recap indicating whether they met their goal and received the incentive.

Knowing which customers charge their EVs during peak hours eliminates the need to run expensive marketing campaigns to recruit EV owners into load-shifting programs and avoids incentivizing EV owners with monetary rewards who already charge their EVs during off-peak hours. →







### Reshaping the modern electricity grid

Data analytics will be the cornerstone enabling utilities to evolve with the grid and energy customers, and through AI-driven EV programs, improve grid management for a smarter, more efficient grid while putting money back into the pockets of customers. Learning to maximize EV upside and mitigate EV-related grid instability utilities can take the first step in reshaping their relationship with the energy grid and preparing for the road ahead.

The shape of today's electricity grid is changing dramatically as efforts to decarbonize the global economy materialize, and DER deployments will continue to accelerate whether utilities choose to take an active role in it or not. To successfully navigate – and more importantly – benefit from the DER revolution, a combination of agile utility programs and a future ready-ready mindset will be essential.

#### ABOUT THE AUTHOR:

**Abhay Gupta** founded Bidgely, with the mission of leveraging data to transform the utility industry. As CEO, Abhay has led the company from concept to market leadership. Prior to Bidgely, Abhay worked at a combination of energy and technology companies including Grid Net, Echelon and Sun Microsystems. He holds a B. Tech from the Indian Institute of Technology Delhi, M.S. from University of Southern California and M.B.A. from Santa Clara University.

# CLAIRE GOTHAM

## UTILITIES FOR CAPGEMINI



**BY ELISABETH MONAGHAN**

*For our final Powerful Forces column of 2022, we are pleased to introduce Claire Gotham, VP, Utilities for Capgemini.*

When Claire Gotham first began working in the electric energy sector in the 1990s, it was a very different industry than it is today. Other than new regulations, an increase in climate change awareness and a growing acceptance of solar power as an alternate energy source, there were few significant changes within the power industry's first 100 years. As Gotham pointed out, "It used to be an industry, where literally, you put the product into the pipe and pushed it out, where it went was transferred through transmission wire to the consumer (we called them rate-payers), and that's what the customer got."

Describing how she found her way into the utility space as a circuitous path, Gotham explained, "My very first job was for a small introducing broker in Atlanta, where we primarily served commercial hedgers. While I was there, I studied for and passed my Series 3 Exam to become a derivatives trader. That was a great entry into the financial and risk side of the power industry. And then, the focus of electricity shifted for me when I got my first job with a utility."

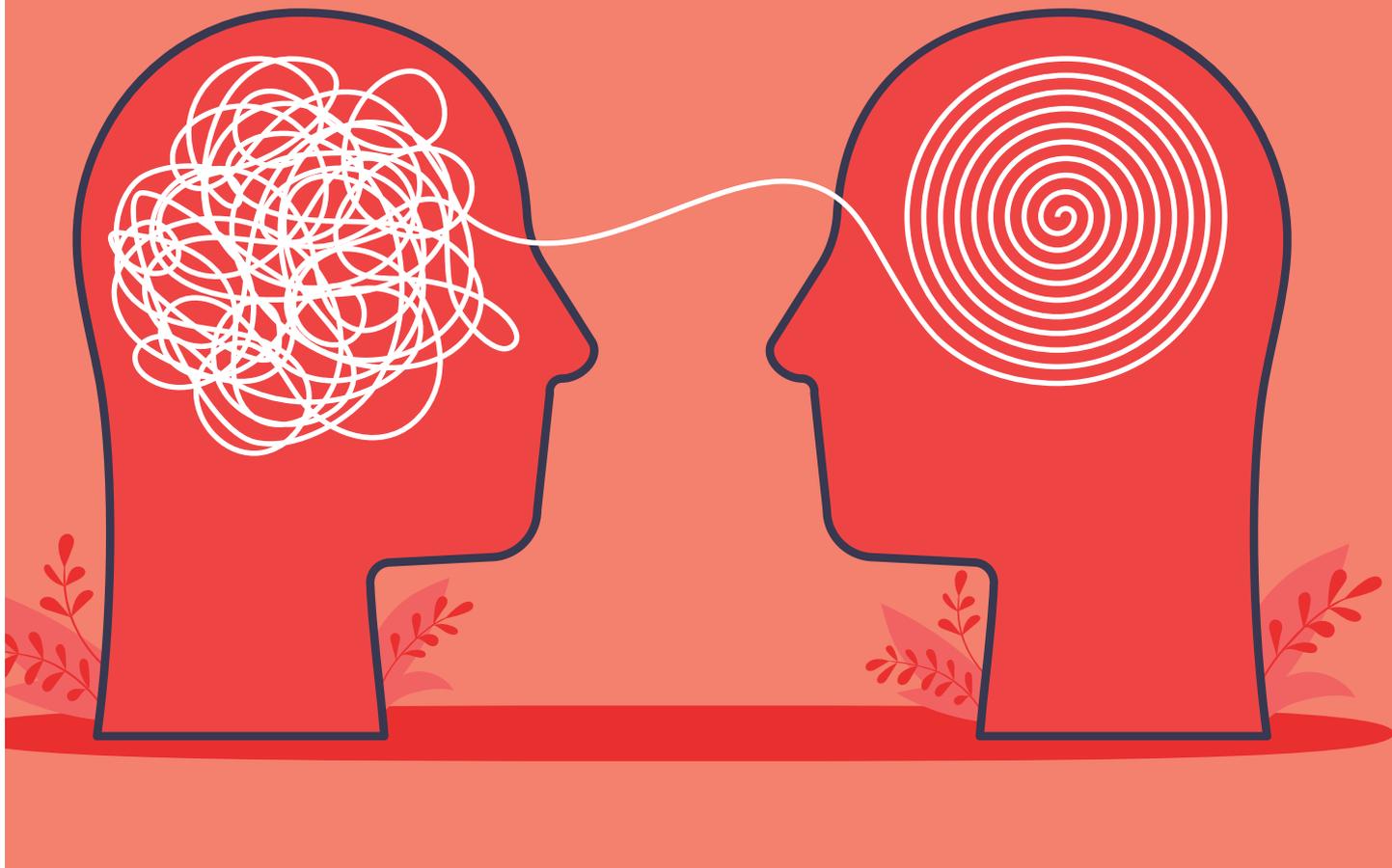
Within a few years, Gotham became a product manager for the largest investor-owned utility on the West Coast. The timing was interesting because once she began working directly for the utility, she saw that the industry was beginning to change.

"For decades, [industry professionals] did not innovate," said Gotham. "They weren't rewarded for innovating. They focused on maintaining a stable grid and providing customer service. Stability maintenance and providing service remain important, but the industry has shifted.

"[Utilities] have to be more innovative now because there is more competition. Today, there are third-party retail providers in the mix. There are also companies that no one would think of as traditional energy providers, and some tech companies or companies that manufacture electric vehicles have signed power purchase agreements (PPAs) with utility companies."

According to Gotham, utilities are taking note of the competition. "Many utilities are doing an excellent job of looking outside of their theoretical walls," said Gotham. "They're looking for new ideas and shifting and looking to diversify their portfolio of generation. And those that are struggling will have to catch up."

One thing that has not changed since she first launched her career is Gotham's appreciation for the role mentors have played. According to Gotham, mentorship – whether formal or informal – is crucial to a person's personal and professional growth, and she still applies the wisdom of those who mentored her along the way.



Among the mentors, whose style influenced her early, on was a woman named Maria Eansor. Eansor was interested in her employees' producing quality work, but she was even more concerned with them as people and took a holistic approach by discussing with them their goals, professional and personal development and their well-being.

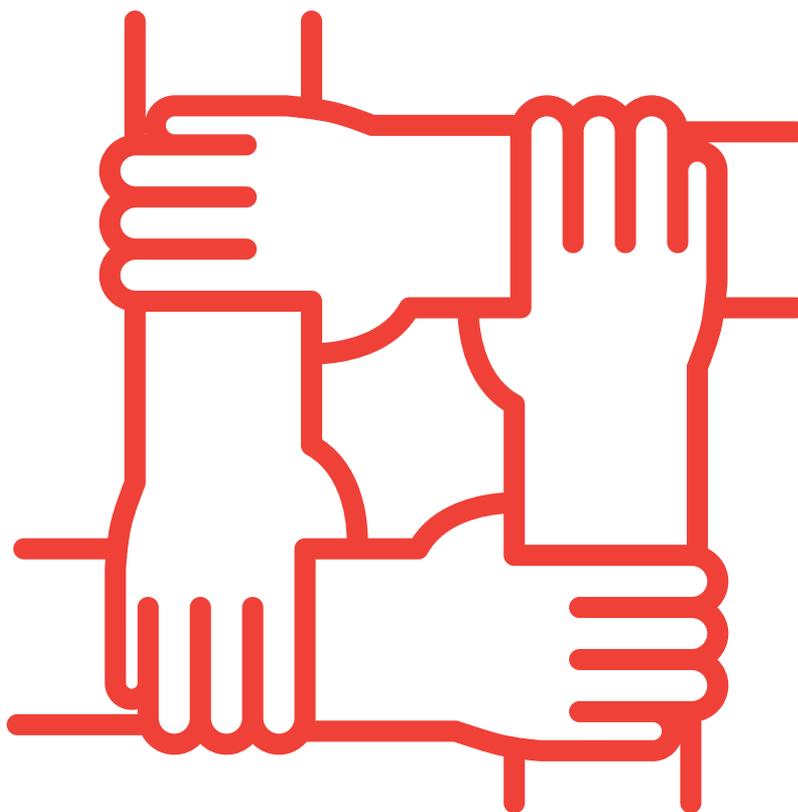
Gotham said she always will be grateful for the lessons and management style she learned from Eansor, but it is the advice of her mentor Rosalie Roth, that continues to resonate with her to this day. Gotham had never met Roth, but because Roth was a female executive in a male-dominated industry, someone suggested Gotham reach out to her. Today, Gotham still applies one of the most compelling pieces of advice she received from Roth, who told her that she needed to find a mentor and also be a mentor. "You need to find a Doc Brown, and you need to be somebody else's Doc Brown," Roth advised Gotham.

For those who may not understand the reference, Doc Brown was the eccentric inventor and time traveler in the movie, 'Back to the Future.' At the end of the film, Brown – who has been a mentor to the film's protagonist, Marty McFly – returns from the future to give the young McFly guidance on what his older self has in store.

As a female executive in an industry that is made up mostly of men, Gotham is particularly committed to being a Doc Brown to women. "What your mentors tell you may not always be accurate, and what you tell mentees may not be correct all the time, but it's helpful to have someone who's 'been there, done that,' and can point out signposts to watch for, and I think it's important to send extend that arm back to other women in the industry."

For those just embarking on their careers, or individuals looking to change their profession, Gotham cites Misty Copeland with the American Ballet, who said, "Know that you can start late, look different, be uncertain, and still succeed."

"I love that quote from Copeland because young people today are forced to choose and decide so soon – too soon – what their professional path is," said Gotham. "For example, they have to declare a major when they're applying to schools before they've even taken a college class. I was lucky enough to be able to take a number of random classes and taste the 'academic buffet' and decide – and at that point, I still didn't know what I wanted to do professionally, so I chose to study what I enjoyed and got hands-on experience when I graduated."



Gotham encourages people to keep an open mind about making significant changes – regardless of a person’s age or stage of career. “Don’t close any doors prematurely. You don’t know what’s on the other side. Those doors lead to different types of people, and it never hurts to have more connections with more folks – not from the standpoint that maybe they do something for you, but rather, maybe you can learn something from them, or they can learn something from you. Maybe they’ll spark an idea, or tell you about a part of the industry you didn’t even know about or hadn’t considered.”

Gotham stepped into her career as a derivatives trainer in an industry once considered relatively stagnant, but her lifelong belief in mentorship and advice to remain open to whatever the future holds is validation that as both an employee and executive, her approach has worked. Changes may have been a long time coming to the electric energy sector, but today, Gotham has established herself as a leader in an industry that both encourages and celebrates innovation – or, as she put it, “I have watched this industry (specifically, utilities) go from being like a massive aircraft carrier turning in the ocean, to one that is moving forward with a bit more ease, like a speed boat.”

#### **ABOUT CLAIRE GOTHAM:**

Claire Gotham is a vice president in Capgemini Americas’ Energy, Utilities and Chemicals business unit, focused on power, utilities and renewables. She is a leader in retail and wholesale energy, trading and risk management and digital transformation. In her role, Gotham draws upon over 25 years of experience in consulting and business development, tackling complex projects, leading diverse teams of project staff, technology specialists and consultants and advising C-level executives, boards of directors and PMO boards to deliver excellent results. Gotham’s deep experience working with various public and private companies makes her a unique leader in the energy industry.



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## SOUTHERN STATES, LLC

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Hampton, GA, U.S.A. 30228  
Tel: 770-946-4562 | Fax: 770-946-8106  
[www.southernstatesllc.com](http://www.southernstatesllc.com)

## SOUTHWEST ELECTRIC CO.

6501 SE 74<sup>th</sup> Street  
Oklahoma City, OK, U.S.A. 73135  
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Fax: 405-733-9551  
[www.swelectric.com](http://www.swelectric.com)



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Mississauga, ON, Canada L4V 1R2  
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Fax: 718-442-2124  
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[www.vizimax.com](http://www.vizimax.com)



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#### **Pickett and Associates, Inc.**

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[www.omicronenergy.com](http://www.omicronenergy.com)

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[www.dynamicroatings.com](http://www.dynamicroatings.com)

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[www.kinectrics.com](http://www.kinectrics.com)

#### **VIZIMAX Inc.**

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[www.vizimax.com](http://www.vizimax.com)

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#### **S&C Electric Company**

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### AUTOMATION SYSTEMS

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[www.gwelec.com](http://www.gwelec.com)

### CABLE - AERIAL SPACER

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[www.marmonutility.com](http://www.marmonutility.com)

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#### **OMICRON electronics Canada Corp.**

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### CABLE - JUMPER

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**ABB Installation Products (Canada)**  
Tel: 1-905-635-7855  
[www.tnb.ca.abb.com](http://www.tnb.ca.abb.com)

**G&W Electric Co.**  
Tel: 708-388-5010  
[www.gwelec.com](http://www.gwelec.com)

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**VIZIMAX Inc.**  
Tel: 1-450-679-0003  
[www.vizimax.com](http://www.vizimax.com)

### DISTRIBUTION MANAGEMENT SYSTEMS

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

## **E**

### ELECTRICAL SOFTWARE

**RTDS Technologies, Inc.**  
Tel: 204-989-9700  
[www.rtds.com](http://www.rtds.com)

### EMERGENCY STORM SERVICES

**Asplundh Tree Expert, LLC**  
Tel: 1-800-248-8733  
[www.asplundh.com](http://www.asplundh.com)

**Primoris Services Corporation**  
Tel: 214-740-5600  
[www.prim.com](http://www.prim.com)

### ENCLOSURES - METERING EQUIPMENT

**Easi-Set Worldwide**  
Tel: 540-439-8911 | 1-800-547-4045  
[www.easisetbuildings.com](http://www.easisetbuildings.com)

### ENCLOSURES - NEMA TYPE

**HindlePower**  
Tel: 610-330-9000  
[www.hindlepowerinc.com](http://www.hindlepowerinc.com)

### ENGINEERING

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**Sargent & Lundy**  
Tel: 312-269-2000  
[www.sargentlundy.com](http://www.sargentlundy.com)

### ENGINEERING - CONSULTANTS

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**Sargent & Lundy**  
Tel: 312-269-2000  
[www.sargentlundy.com](http://www.sargentlundy.com)

### ENGINEERING - CONSULTANTS - CONSTRUCTION

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

### ENGINEERING - DESIGN

**Albarrie GeoComposites Limited**  
Tel: 705-737-0551 | 866-269-8275  
[www.albarrie.com](http://www.albarrie.com)

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**Sargent & Lundy**  
Tel: 312-269-2000  
[www.sargentlundy.com](http://www.sargentlundy.com)

### ENGINEERING - EQUIPMENT

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

### ENGINEERING - PROCUREMENT - CONSTRUCTION (EPC) TRANSMISSION LINES

**Ampjack Industries Ltd.**  
Tel: 514-451-9511  
[www.ampjack.ca](http://www.ampjack.ca)

## ENGINEERING - PROFESSIONAL SERVICES

**Albarrie GeoComposites Limited**  
Tel: 705-737-0551 | 866-269-8275  
[www.albarrie.com](http://www.albarrie.com)

**Ampjack Industries Ltd.**  
Tel: 514-451-9511  
[www.ampjack.ca](http://www.ampjack.ca)

**Sargent & Lundy**  
Tel: 312-269-2000  
[www.sargentlundy.com](http://www.sargentlundy.com)

### ENGINEERING - SERVICES

**American Engineering Testing, Inc.**  
Tel: 612-315-2399  
[www.amengtest.com](http://www.amengtest.com)

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

### ENGINEERING - SERVICES - T & D

**Ampjack Industries Ltd.**  
Tel: 514-451-9511  
[www.ampjack.ca](http://www.ampjack.ca)

**CTC Global Corporation**  
Tel: 949-428-8500  
[www.ctcglobal.com](http://www.ctcglobal.com)

**Pickett and Associates, Inc.**  
Tel: 813-877-7770  
[www.pickettusa.com](http://www.pickettusa.com)

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**Sargent & Lundy**  
Tel: 312-269-2000  
[www.sargentlundy.com](http://www.sargentlundy.com)

### ENGINEERING - SOFTWARE

**RTDS Technologies, Inc.**  
Tel: 204-989-9700  
[www.rtds.com](http://www.rtds.com)

### ENGINEERING - STRUCTURAL

**Ampjack Industries Ltd.**  
Tel: 514-451-9511  
[www.ampjack.ca](http://www.ampjack.ca)

**Meyer Utility Structures**  
Tel: 901-566-6500 | 800-501-0962  
[www.meyerutilitystructures.com](http://www.meyerutilitystructures.com)

**Pickett and Associates, Inc.**  
Tel: 813-877-7770  
[www.pickettusa.com](http://www.pickettusa.com)

**Sargent & Lundy**  
Tel: 312-269-2000  
[www.sargentlundy.com](http://www.sargentlundy.com)

### ENVIRONMENTAL SERVICES

**Sargent & Lundy**  
Tel: 312-269-2000  
[www.sargentlundy.com](http://www.sargentlundy.com)

## **F**

### FIBERGLASS - PIPE, TANK

**Hastings Fiber Glass Products, Inc.**  
Tel: 269-945-9541  
[www.hfgp.com](http://www.hfgp.com)

#### FIELD AUTOMATION

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

#### FIELD INSTALLATION SERVICES

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**Southern States, LLC**  
Tel: 770-946-4562  
[www.southernstatesllc.com](http://www.southernstatesllc.com)

#### FILTRATION SYSTEMS - OIL

**Albarrie GeoComposites Limited**  
Tel: 705-737-0551 | 866-269-8275  
[www.albarrie.com](http://www.albarrie.com)

#### FUSELINK - CUTOUTS

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

#### FUSES

**ABB Installation Products**  
Tel: 1-800-326-5282  
[www.tnb.abb.com](http://www.tnb.abb.com)

**ABB Installation Products (Canada)**  
Tel: 1-905-635-7855  
[www.tnb.ca.abb.com](http://www.tnb.ca.abb.com)

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

### G

#### GAS AND RELATED PRODUCTS - SF6 INSULATING

**DILO Company, Inc.**  
Tel: 727-376-5593  
[www.dilo.com](http://www.dilo.com)

#### GAS DETECTION - SF6

**DILO Company, Inc.**  
Tel: 727-376-5593  
[www.dilo.com](http://www.dilo.com)

#### GENERAL CONTRACTORS

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

#### GENERAL CONTRACTORS - CONSTRUCTION

**Primoris Services Corporation**  
Tel: 214-740-5600  
[www.prim.com](http://www.prim.com)

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

#### GIS - ENGINEERING SERVICES

**RAMTeCH Software Solutions, Inc.**  
Tel: 651-342-1780  
[www.ramtech-corp.com](http://www.ramtech-corp.com)

**SAM Companies**  
Tel: 512-447-0575  
[www.sam.biz](http://www.sam.biz)

**Sargent & Lundy**  
Tel: 312-269-2000  
[www.sargentlundy.com](http://www.sargentlundy.com)

#### GIS - SOFTWARE

**RAMTeCH Software Solutions, Inc.**  
Tel: 651-342-1780  
[www.ramtech-corp.com](http://www.ramtech-corp.com)

#### GRIPS - CABLE-PULLING

**Hastings Fiber Glass Products, Inc.**  
Tel: 269-945-9541  
[www.hfgp.com](http://www.hfgp.com)

#### GROUND RODS - COPPERWELD

**ABB Installation Products**  
Tel: 1-800-326-5282  
[www.tnb.abb.com](http://www.tnb.abb.com)

#### GROUNDING - EQUIPMENT

**Hastings Fiber Glass Products, Inc.**  
Tel: 269-945-9541  
[www.hfgp.com](http://www.hfgp.com)

#### GUARDS - ANIMAL AND BIRDS

**TransGard**  
Tel: 717-900-6140  
[www.transgardsolutions.com](http://www.transgardsolutions.com)

### H

#### HERBICIDES - VEGETATION CONTROL

**Asplundh Tree Expert, LLC**  
Tel: 1-800-248-8733  
[www.asplundh.com](http://www.asplundh.com)

### I

#### INDICATORS - FAULT

**ABB Installation Products**  
Tel: 1-800-326-5282  
[www.tnb.abb.com](http://www.tnb.abb.com)

**ABB Installation Products (Canada)**  
Tel: 1-905-635-7855  
[www.tnb.ca.abb.com](http://www.tnb.ca.abb.com)

#### INFRARED - IMAGING

**Systems With Intelligence Inc.**  
Tel: 289-562-0126  
[www.systemswithintelligence.com](http://www.systemswithintelligence.com)

#### INSPECTION - FIELD SERVICES

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**SAM Companies**  
Tel: 512-447-0575  
[www.sam.biz](http://www.sam.biz)

#### INSULATORS - GLASS

**Sediver Canada Inc.**  
Tel: 514-739-3385

#### INSULATORS - POLYMER

**Hendrix and Kerite by Marmon Utility**  
Tel: 603-673-2040  
[www.marmonutility.com](http://www.marmonutility.com)

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

#### INSULATORS - SUSPENSION

**Sediver Canada Inc.**  
Tel: 514-739-3385

### L

#### LABORATORY EQUIPMENT AND SUPPLIES

**RTDS Technologies, Inc.**  
Tel: 204-989-9700  
[www.rtds.com](http://www.rtds.com)

#### LADDERS - INDUSTRIAL

**Hastings Fiber Glass Products, Inc.**  
Tel: 269-945-9541  
[www.hfgp.com](http://www.hfgp.com)

#### LADDERS - TOWERS

**Condux Tesmec, Inc.**  
Tel: 507-387-8069 | 1-888-980-1209  
[www.conduxtesmec.com](http://www.conduxtesmec.com)

#### LANYARDS, SHOCK ABSORBING

**Hastings Fiber Glass Products, Inc.**  
Tel: 269-945-9541  
[www.hfgp.com](http://www.hfgp.com)

#### LED PRODUCTS

**Evluma**  
Tel: 425-336-5800  
[www.evluma.com](http://www.evluma.com)

#### LIDAR - INSPECTION

**Pickett and Associates, Inc.**  
Tel: 813-877-7770  
[www.pickettusa.com](http://www.pickettusa.com)

**SAM Companies**  
Tel: 512-447-0575  
[www.sam.biz](http://www.sam.biz)

#### LIDAR - SURVEY

**Pickett and Associates, Inc.**  
Tel: 813-877-7770  
[www.pickettusa.com](http://www.pickettusa.com)

#### LIGHTING

**Evluma**  
Tel: 425-336-5800  
[www.evluma.com](http://www.evluma.com)

#### LIGHTING - COMMERCIAL & INDUSTRIAL

**Evluma**  
Tel: 425-336-5800  
[www.evluma.com](http://www.evluma.com)

**LIGHTING - FIXTURES - MANUFACTURERS & WHOLESALERS**

**Evluma**  
Tel: 425-336-5800  
[www.evluma.com](http://www.evluma.com)

**LOAD MANAGEMENT - COMMUNICATIONS**

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**LOCKOUT SYSTEMS**

**Tech Products, Inc.**  
Tel: 718-442-4900 | 1-800-221-1311  
[www.techproducts.com](http://www.techproducts.com)

**M**

**MAINTENANCE - PREVENTIVE MAINTENANCE EQUIPMENT**

**Albarrie GeoComposites Limited**  
Tel: 705-737-0551 | 866-269-8275  
[www.albarrie.com](http://www.albarrie.com)

**Ampjack Industries Ltd.**  
Tel: 514-451-9511  
[www.ampjack.ca](http://www.ampjack.ca)

**MAINTENANCE - SERVICES AND PRODUCTS**

**Ampjack Industries Ltd.**  
Tel: 514-451-9511  
[www.ampjack.ca](http://www.ampjack.ca)

**MAINTENANCE - TOWER RE-GUYING / PAINTING**

**Ampjack Industries Ltd.**  
Tel: 514-451-9511  
[www.ampjack.ca](http://www.ampjack.ca)

**MAINTENANCE - UNDERGROUND, OVERHEAD**

**Ampjack Industries Ltd.**  
Tel: 514-451-9511  
[www.ampjack.ca](http://www.ampjack.ca)

**Utility Lines Construction Services (ULCS)**  
Tel: 1-877-884-5426  
[www.ulcsinc.com](http://www.ulcsinc.com)

**MARKERS**

**Tech Products, Inc.**  
Tel: 718-442-4900 | 1-800-221-1311  
[www.techproducts.com](http://www.techproducts.com)

**MARKERS - CABLE**

**Tech Products, Inc.**  
Tel: 718-442-4900 | 1-800-221-1311  
[www.techproducts.com](http://www.techproducts.com)

**MARKERS - FIBER OPTIC**

**Tech Products, Inc.**  
Tel: 718-442-4900 | 1-800-221-1311  
[www.techproducts.com](http://www.techproducts.com)

**MARKERS - POLES**

**Tech Products, Inc.**  
Tel: 718-442-4900 | 1-800-221-1311  
[www.techproducts.com](http://www.techproducts.com)

**MARKERS - TRANSMISSION POLES**

**Tech Products, Inc.**  
Tel: 718-442-4900 | 1-800-221-1311  
[www.techproducts.com](http://www.techproducts.com)

**METAL - CUSTOM FABRICATION**

**Ampjack Industries Ltd.**  
Tel: 514-451-9511  
[www.ampjack.ca](http://www.ampjack.ca)

**METAL - CUSTOM MADE PARTS**

**Ampjack Industries Ltd.**  
Tel: 514-451-9511  
[www.ampjack.ca](http://www.ampjack.ca)

**METERS - FREQUENCY, DIGITAL**

**NovaTech, LLC**  
Tel: 913-451-1880 | 800-253-3842  
[www.novatechautomation.com](http://www.novatechautomation.com)

**METERS - PHASE**

**Hastings Fiber Glass Products, Inc.**  
Tel: 269-945-9541  
[www.hfgp.com](http://www.hfgp.com)

**METERS - VOLT**

**Hastings Fiber Glass Products, Inc.**  
Tel: 269-945-9541  
[www.hfgp.com](http://www.hfgp.com)

**MONITORING - COMMUNICATIONS**

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**MONITORING - TRANSFORMERS**

**Dynamic Ratings, Inc.**  
Tel: 262-746-1230  
[www.dynamicratings.com](http://www.dynamicratings.com)

**MONITORS - TEMPERATURE**

**Dynamic Ratings, Inc.**  
Tel: 262-746-1230  
[www.dynamicratings.com](http://www.dynamicratings.com)

**O**

**OIL - CONTAINMENT EQUIPMENT**

**Albarrie GeoComposites Limited**  
Tel: 705-737-0551 | 866-269-8275  
[www.albarrie.com](http://www.albarrie.com)

**OIL SPILL EQUIPMENT**

**Albarrie GeoComposites Limited**  
Tel: 705-737-0551 | 866-269-8275  
[www.albarrie.com](http://www.albarrie.com)

**ON-LINE MONITORING**

**Systems With Intelligence Inc.**  
Tel: 289-562-0126  
[www.systemswithintelligence.com](http://www.systemswithintelligence.com)

**OPERATION AND MAINTENANCE SERVICES**

**Asplundh Tree Expert, LLC**  
Tel: 1-800-248-8733  
[www.asplundh.com](http://www.asplundh.com)

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**P**

**PANELS (POWER DISTRIBUTION)**

**HindlePower**  
Tel: 610-330-9000  
[www.hindlepowerinc.com](http://www.hindlepowerinc.com)

**PARTIAL DISCHARGE ANALYSIS, DETECTION**

**Dynamic Ratings, Inc.**  
Tel: 262-746-1230  
[www.dynamicratings.com](http://www.dynamicratings.com)

**PLATFORMS - LINEMAN'S**

**Condux Tesmec, Inc.**  
Tel: 507-387-8069 | 1-888-980-1209  
[www.conduxtesmec.com](http://www.conduxtesmec.com)

**Hastings Fiber Glass Products, Inc.**  
Tel: 269-945-9541  
[www.hfgp.com](http://www.hfgp.com)

**POLES - DISTRIBUTION - CONCRETE**

**Meyer Utility Structures**  
Tel: 901-566-6500 | 800-501-0962  
[www.meyerutilitystructures.com](http://www.meyerutilitystructures.com)

**POLES - DISTRIBUTION - STEEL**

**Meyer Utility Structures**  
Tel: 901-566-6500 | 800-501-0962  
[www.meyerutilitystructures.com](http://www.meyerutilitystructures.com)  
[www.lwsinc.com](http://www.lwsinc.com)

**POLES - TRANSMISSION**

**Meyer Utility Structures**  
Tel: 901-566-6500 | 800-501-0962  
[www.meyerutilitystructures.com](http://www.meyerutilitystructures.com)

**POLES - TRANSMISSION - CONCRETE**

**Meyer Utility Structures**  
Tel: 901-566-6500 | 800-501-0962  
[www.meyerutilitystructures.com](http://www.meyerutilitystructures.com)

**POLES - TRANSMISSION - STEEL**

**Meyer Utility Structures**  
Tel: 901-566-6500 | 800-501-0962  
[www.meyerutilitystructures.com](http://www.meyerutilitystructures.com)

**POLES - UTILITY**

**Meyer Utility Structures**  
Tel: 901-566-6500 | 800-501-0962  
[www.meyerutilitystructures.com](http://www.meyerutilitystructures.com)

**POWER DISTRIBUTION AND/OR TRANSMISSION POLES**

**Meyer Utility Structures**  
Tel: 901-566-6500 | 800-501-0962  
[www.meyerutilitystructures.com](http://www.meyerutilitystructures.com)

**POWER QUALITY EQUIPMENT**

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**POWER SUPPLIES - UNINTERRUPTIBLE**

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

## POWERLINE - CONSTRUCTION

### **Utility Lines Construction Services (ULCS)**

Tel: 1-877-884-5426  
[www.ulcsinc.com](http://www.ulcsinc.com)

## PROJECT ENGINEERING

### **S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

### **Sargent & Lundy**

Tel: 312-269-2000  
[www.sargentlundy.com](http://www.sargentlundy.com)

## PROJECT MANAGEMENT AND CONSULTING

### **S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

### **Sargent & Lundy**

Tel: 312-269-2000  
[www.sargentlundy.com](http://www.sargentlundy.com)

## PROTECTION AND CONTROL

### **Albarrie GeoComposites Limited**

Tel: 705-737-0551 | 866-269-8275  
[www.albarrie.com](http://www.albarrie.com)

### **RTDS Technologies, Inc.**

Tel: 204-989-9700  
[www.rtds.com](http://www.rtds.com)

## PULLERS - CABLE

### **Condux Tesmec, Inc.**

Tel: 507-387-8069 | 1-888-980-1209  
[www.conduxtesmec.com](http://www.conduxtesmec.com)

## PULLERS - CABLE, AERIAL

### **Condux Tesmec, Inc.**

Tel: 507-387-8069 | 1-888-980-1209  
[www.conduxtesmec.com](http://www.conduxtesmec.com)

## PULLERS - CABLE, UNDERGROUND

### **Condux Tesmec, Inc.**

Tel: 507-387-8069 | 1-888-980-1209  
[www.conduxtesmec.com](http://www.conduxtesmec.com)

## PULLERS - CONDUCTOR

### **Condux Tesmec, Inc.**

Tel: 507-387-8069 | 1-888-980-1209  
[www.conduxtesmec.com](http://www.conduxtesmec.com)

## PULLERS - ROPE

### **Condux Tesmec, Inc.**

Tel: 507-387-8069 | 1-888-980-1209  
[www.conduxtesmec.com](http://www.conduxtesmec.com)

## **R**

## RADIO COMMUNICATIONS

### **S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

## RADIO TWO-WAY - FIXED

### **S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

## RECLOSERS

### **ABB Installation Products**

Tel: 1-800-326-5282  
[www.tnb.abb.com](http://www.tnb.abb.com)

### **ABB Installation Products (Canada)**

Tel: 1-905-635-7855  
[www.tnb.ca.abb.com](http://www.tnb.ca.abb.com)

### **S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

## RECLOSERS - CONTROLS

### **S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

## RECLOSERS - SINGLE-PHASE

### **G&W Electric Co.**

Tel: 708-388-5010  
[www.gwelec.com](http://www.gwelec.com)

### **S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

## RECLOSERS - THREE-PHASE

### **G&W Electric Co.**

Tel: 708-388-5010  
[www.gwelec.com](http://www.gwelec.com)

### **S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

## RECORDERS - TRANSIENT FAULT

### **NovaTech, LLC**

Tel: 913-451-1880 | 800-253-3842  
[www.novatechautomation.com](http://www.novatechautomation.com)

## REELS - CONDUCTOR STRINGING

### **Condux Tesmec, Inc.**

Tel: 507-387-8069 | 1-888-980-1209  
[www.conduxtesmec.com](http://www.conduxtesmec.com)

## REELS - HANDLING EQUIPMENT

### **Condux Tesmec, Inc.**

Tel: 507-387-8069 | 1-888-980-1209  
[www.conduxtesmec.com](http://www.conduxtesmec.com)

## REELS - WIRE, GROUNDING

### **Hastings Fiber Glass Products, Inc.**

Tel: 269-945-9541  
[www.hfgp.com](http://www.hfgp.com)

## RELAYS

### **S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

## RELAYS - SUBSTATION AUTOMATION

### **RMS Energy Co., LLC**

Tel: 1-888-683-3630  
[www.rmseenergy.com](http://www.rmseenergy.com)

### **S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

## REMOTE - SITE MONITORING

### **Systems With Intelligence Inc.**

Tel: 289-562-0126  
[www.systemswithintelligence.com](http://www.systemswithintelligence.com)

## REMOTE TERMINAL UNITS

### **NovaTech, LLC**

Tel: 913-451-1880 | 800-253-3842  
[www.novatechautomation.com](http://www.novatechautomation.com)

## REMOTE VIDEO INSPECTION SYSTEMS

### **Systems With Intelligence Inc.**

Tel: 289-562-0126  
[www.systemswithintelligence.com](http://www.systemswithintelligence.com)

## ROPE - WIRE

### **Condux Tesmec, Inc.**

Tel: 507-387-8069 | 1-888-980-1209  
[www.conduxtesmec.com](http://www.conduxtesmec.com)

## **S**

## SAFETY - CONSULTING & TRAINING

### **DILO Company, Inc.**

Tel: 727-376-5593  
[www.dilo.com](http://www.dilo.com)

### **OECS**

Tel: 612-315-2399  
[oecscmply.com](http://oecscmply.com)

## SAFETY - ENVIRONMENTAL - EQUIPMENT

### **Albarrie GeoComposites Limited**

Tel: 705-737-0551 | 866-269-8275  
[www.albarrie.com](http://www.albarrie.com)

## SAFETY - LINEMEN EQUIPMENT

### **Hastings Fiber Glass Products, Inc.**

Tel: 269-945-9541  
[www.hfgp.com](http://www.hfgp.com)

## SAFETY - SUPPLIES

### **Tech Products, Inc.**

Tel: 718-442-4900 | 1-800-221-1311  
[www.techproducts.com](http://www.techproducts.com)

## SCADA - INSTALLATION SERVICES

### **S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

## SCADA SYSTEMS

### **NovaTech, LLC**

Tel: 913-451-1880 | 800-253-3842  
[www.novatechautomation.com](http://www.novatechautomation.com)

### **S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

## SENSORS - CURRENT

### **Southern States, LLC**

Tel: 770-946-4562  
[www.southernstatesllc.com](http://www.southernstatesllc.com)

## SF6 GAS INSULATED SWITCHGEAR

### **G&W Electric Co.**

Tel: 708-388-5010  
[www.gwelec.com](http://www.gwelec.com)

### **S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

#### SHEAVES - CONDUCTOR - STRINGING

**Condux Tesmec, Inc.**  
Tel: 507-387-8069 | 1-888-980-1209  
[www.conduxtesmec.com](http://www.conduxtesmec.com)

#### SIGNS

**Tech Products, Inc.**  
Tel: 718-442-4900 | 1-800-221-1311  
[www.techproducts.com](http://www.techproducts.com)

#### SIGNS - WARNING

**Tech Products, Inc.**  
Tel: 718-442-4900 | 1-800-221-1311  
[www.techproducts.com](http://www.techproducts.com)

#### SMART GRID SOLUTIONS

**G&W Electric Co.**  
Tel: 708-388-5010  
[www.gwelec.com](http://www.gwelec.com)

**Kinectrics Inc.**  
Tel: 416-207-6000  
[www.kinectrics.com](http://www.kinectrics.com)

**RTDS Technologies, Inc.**  
Tel: 204-989-9700  
[www.rtds.com](http://www.rtds.com)

**SISCO, Inc.**  
Tel: 586-254-0020  
[www.sisconet.com](http://www.sisconet.com)

#### SOFTWARE - T&D LINE DESIGN

**CTC Global Corporation**  
Tel: 949-428-8500  
[www.ctcglobal.com](http://www.ctcglobal.com)

#### SOFTWARE INTEGRATION

**SISCO, Inc.**  
Tel: 586-254-0020  
[www.sisconet.com](http://www.sisconet.com)

#### SPLICES & ACCESSORIES - COMPRESSION JOINT

**CTC Global Corporation**  
Tel: 949-428-8500  
[www.ctcglobal.com](http://www.ctcglobal.com)

#### SPLICES & ACCESSORIES - TENSION

**CTC Global Corporation**  
Tel: 949-428-8500  
[www.ctcglobal.com](http://www.ctcglobal.com)

#### STATIC - VAR COMPENSATION

**VIZIMAX Inc.**  
Tel: 1-450-679-0003  
[www.vizimax.com](http://www.vizimax.com)

#### STEEL - MANUFACTURERS

**Ampjack Industries Ltd.**  
Tel: 514-451-9511  
[www.ampjack.ca](http://www.ampjack.ca)  
**Meyer Utility Structures**  
Tel: 901-566-6500 | 800-501-0962  
[www.meyerutilitystructures.com](http://www.meyerutilitystructures.com)

#### STEEL - STRUCTURAL

**Ampjack Industries Ltd.**  
Tel: 514-451-9511  
[www.ampjack.ca](http://www.ampjack.ca)  
**Meyer Utility Structures**  
Tel: 901-566-6500 | 800-501-0962  
[www.meyerutilitystructures.com](http://www.meyerutilitystructures.com)

#### STEEL PRODUCTS - CUSTOM FABRICATION

**Ampjack Industries Ltd.**  
Tel: 514-451-9511  
[www.ampjack.ca](http://www.ampjack.ca)

#### STICKS - DISCONNECT

**Hastings Fiber Glass Products, Inc.**  
Tel: 269-945-9541  
[www.hfgp.com](http://www.hfgp.com)

#### STICKS - HOT

**Hastings Fiber Glass Products, Inc.**  
Tel: 269-945-9541  
[www.hfgp.com](http://www.hfgp.com)

#### STRUCTURE - PREFABRICATED

**Easi-Set Worldwide**  
Tel: 540-439-8911 | 1-800-547-4045  
[www.easisetbuildings.com](http://www.easisetbuildings.com)

**Meyer Utility Structures**  
Tel: 901-566-6500 | 800-501-0962  
[www.meyerutilitystructures.com](http://www.meyerutilitystructures.com)

#### SUBSTATION

**Easi-Set Worldwide**  
Tel: 540-439-8911 | 1-800-547-4045  
[www.easisetbuildings.com](http://www.easisetbuildings.com)

**Meyer Utility Structures**  
Tel: 901-566-6500 | 800-501-0962  
[www.meyerutilitystructures.com](http://www.meyerutilitystructures.com)

**MindCore Technologies**  
Tel: 450-477-5959  
[www.mindcoretech.com](http://www.mindcoretech.com)

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

#### SUBSTATION - BALLISTIC PROTECTION

**Southern States, LLC**  
Tel: 770-946-4562  
[www.southernstatesllc.com](http://www.southernstatesllc.com)

#### SUBSTATION - CAD DRAFTING SUPPORT

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

#### SUBSTATION - COMMUNICATION EQUIPMENT

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

#### SUBSTATION - COMMUNICATIONS

**Easi-Set Worldwide**  
Tel: 540-439-8911 | 1-800-547-4045  
[www.easisetbuildings.com](http://www.easisetbuildings.com)

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**SISCO, Inc.**  
Tel: 586-254-0020  
[www.sisconet.com](http://www.sisconet.com)

#### SUBSTATION - METAL-ENCLOSED

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

#### SUBSTATION - MOBILE

**Delta Star, Inc.**  
Tel: 434-845-0921 | 800-368-3017  
[www.deltastar.com](http://www.deltastar.com)

**Southern States, LLC**  
Tel: 770-946-4562  
[www.southernstatesllc.com](http://www.southernstatesllc.com)

#### SUBSTATION - STEEL, STRUCTURE

**Ampjack Industries Ltd.**  
Tel: 514-451-9511  
[www.ampjack.ca](http://www.ampjack.ca)

**Meyer Utility Structures**  
Tel: 901-566-6500 | 800-501-0962  
[www.meyerutilitystructures.com](http://www.meyerutilitystructures.com)

#### SUBSTATION - UNIT

**Easi-Set Worldwide**  
Tel: 540-439-8911 | 1-800-547-4045  
[www.easisetbuildings.com](http://www.easisetbuildings.com)

#### SUBSTATION AUTOMATION

**Kinectrics Inc.**  
Tel: : 416-207-6000  
[www.kinectrics.com](http://www.kinectrics.com)

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**VIZIMAX Inc.**  
Tel: 1-450-679-0003  
[www.vizimax.com](http://www.vizimax.com)

#### SUBSTATION CONTROL BUILDINGS

**Easi-Set Worldwide**  
Tel: 540-439-8911 | 1-800-547-4045  
[www.easisetbuildings.com](http://www.easisetbuildings.com)

#### SUBSTATION DESIGN & CONSTRUCTION

**Easi-Set Worldwide**  
Tel: 540-439-8911 | 1-800-547-4045  
[www.easisetbuildings.com](http://www.easisetbuildings.com)

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**Sargent & Lundy**  
Tel: 312-269-2000  
[www.sargentlundy.com](http://www.sargentlundy.com)

#### SUBSTATION FENCING: ANIMAL DETERRENT

**TransGard**  
Tel: 717-900-6140  
[www.transgardsolutions.com](http://www.transgardsolutions.com)

#### SURGE PROTECTION EQUIPMENT

**Meter-Treater**  
Tel: 561-845-2007  
[www.metertreater.com](http://www.metertreater.com)

#### SWITCHES

**S&C Electric Company**  
Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**Southern States, LLC**  
Tel: 770-946-4562  
[www.southernstatesllc.com](http://www.southernstatesllc.com)

**SWITCHES - AIR, GROUP-OPERATED**

**S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**Southern States, LLC**

Tel: 770-946-4562  
[www.southernstatesllc.com](http://www.southernstatesllc.com)

**SWITCHES - CAPACITORS**

**Southern States, LLC**

Tel: 770-946-4562  
[www.southernstatesllc.com](http://www.southernstatesllc.com)

**SWITCHES - CAPACITORS BANK**

**Southern States, LLC**

Tel: 770-946-4562  
[www.southernstatesllc.com](http://www.southernstatesllc.com)

**SWITCHES - DISCONNECT**

**S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**Southern States, LLC**

Tel: 770-946-4562  
[www.southernstatesllc.com](http://www.southernstatesllc.com)

**SWITCHES - DISCONNECT 25 TO 800KV**

**MindCore Technologies**

Tel: 450-477-5959  
[www.mindcoretech.com](http://www.mindcoretech.com)

**S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**Southern States, LLC**

Tel: 770-946-4562  
[www.southernstatesllc.com](http://www.southernstatesllc.com)

**SWITCHES - HOOKSTICK, DISCONNECTING**

**MindCore Technologies**

Tel: 450-477-5959  
[www.mindcoretech.com](http://www.mindcoretech.com)

**S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**Southern States, LLC**

Tel: 770-946-4562  
[www.southernstatesllc.com](http://www.southernstatesllc.com)

**SWITCHES - ISOLATION**

**Southern States, LLC**

Tel: 770-946-4562  
[www.southernstatesllc.com](http://www.southernstatesllc.com)

**SWITCHES - LOAD BREAK**

**G&W Electric Co.**

Tel: 708-388-5010  
[www.gwelec.com](http://www.gwelec.com)

**Southern States, LLC**

Tel: 770-946-4562  
[www.southernstatesllc.com](http://www.southernstatesllc.com)

**SWITCHES - MOTOR-OPERATED**

**MindCore Technologies**

Tel: 450-477-5959  
[www.mindcoretech.com](http://www.mindcoretech.com)

**Southern States, LLC**

Tel: 770-946-4562  
[www.southernstatesllc.com](http://www.southernstatesllc.com)

**SWITCHES - PADMOUNTED**

**G&W Electric Co.**

Tel: 708-388-5010  
[www.gwelec.com](http://www.gwelec.com)

**S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**SWITCHES - REGULATOR, BYPASS**

**G&W Electric Co.**

Tel: 708-388-5010  
[www.gwelec.com](http://www.gwelec.com)

**S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**SWITCHES - SUBMERSIBLE**

**G&W Electric Co.**

Tel: 708-388-5010  
[www.gwelec.com](http://www.gwelec.com)

**S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**SWITCHES - SUBSTATION, DISCONNECTING**

**ABB Installation Products**

Tel: 1-800-326-5282  
[www.tnb.abb.com](http://www.tnb.abb.com)

**ABB Installation Products (Canada)**

Tel: 1-905-635-7855  
[www.tnb.ca.abb.com](http://www.tnb.ca.abb.com)

**MindCore Technologies**

Tel: 450-477-5959  
[www.mindcoretech.com](http://www.mindcoretech.com)

**S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**Southern States, LLC**

Tel: 770-946-4562  
[www.southernstatesllc.com](http://www.southernstatesllc.com)

**SWITCHES - THROWOVER, AUTOMATIC**

**ABB Installation Products**

Tel: 1-800-326-5282  
[www.tnb.abb.com](http://www.tnb.abb.com)

**ABB Installation Products (Canada)**

Tel: 1-905-635-7855  
[www.tnb.ca.abb.com](http://www.tnb.ca.abb.com)

**SWITCHES - TRANSMISSION DISCONNECT AND LOAD BREAK**

**Southern States, LLC**

Tel: 770-946-4562  
[www.southernstatesllc.com](http://www.southernstatesllc.com)

**SWITCHES - VACUUM**

**G&W Electric Co.**

Tel: 708-388-5010  
[www.gwelec.com](http://www.gwelec.com)

**SWITCHGEAR**

**Southwest Electric Co.**

Tel: 405-737-5691 | 1-800-364-5691  
[www.swelectric.com](http://www.swelectric.com)

**SWITCHGEAR - ARC RESISTANT - MEDIUM VOLTAGE**

**G&W Electric Co.**

Tel: 708-388-5010  
[www.gwelec.com](http://www.gwelec.com)

**S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**SWITCHGEAR - MEDIUM VOLTAGE RANGE UP TO 44 KV**

**ABB Installation Products**

Tel: 1-800-326-5282  
[www.tnb.abb.com](http://www.tnb.abb.com)

**ABB Installation Products (Canada)**

Tel: 1-905-635-7855  
[www.tnb.ca.abb.com](http://www.tnb.ca.abb.com)

**S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**SWITCHGEAR - METAL ENCLOSED**

**S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**SWITCHGEAR - REBUILDING AND REPAIR SERVICE**

**Southwest Electric Co.**

Tel: 405-737-5691 | 1-800-364-5691  
[www.swelectric.com](http://www.swelectric.com)

**SWITCHGEAR - SFG**

**ABB Installation Products**

Tel: 1-800-326-5282  
[www.tnb.abb.com](http://www.tnb.abb.com)

**ABB Installation Products (Canada)**

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[www.tnb.ca.abb.com](http://www.tnb.ca.abb.com)

**G&W Electric Co.**

Tel: 708-388-5010  
[www.gwelec.com](http://www.gwelec.com)

**S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**SWITCHGEAR - VACUUM**

**ABB Installation Products**

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**ABB Installation Products (Canada)**

Tel: 1-905-635-7855  
[www.tnb.ca.abb.com](http://www.tnb.ca.abb.com)

**G&W Electric Co.**

Tel: 708-388-5010  
[www.gwelec.com](http://www.gwelec.com)

**SYSTEMS INTEGRATOR**

**RAMTeCH Software Solutions, Inc.**

Tel: 651-342-1780  
[www.ramtech-corp.com](http://www.ramtech-corp.com)

**S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**SISCO, Inc.**

Tel: 586-254-0020  
[www.sisconet.com](http://www.sisconet.com)

**T****TAPE - MARKING****Tech Products, Inc.**

Tel: 718-442-4900 | 1-800-221-1311  
[www.techproducts.com](http://www.techproducts.com)

**TAPE - UNDERGROUND MARKING****Tech Products, Inc.**

Tel: 718-442-4900 | 1-800-221-1311  
[www.techproducts.com](http://www.techproducts.com)

**TEST & MEASUREMENT - SF6 GAS ANALYSER****DILO Company, Inc..**

Tel: 727-376-5593  
[www.dilo.com](http://www.dilo.com)

**TEST EQUIPMENT****OMICRON electronics Corp. USA**

Tel: 1-713-830-4660  
[www.omicronenergy.com](http://www.omicronenergy.com)

**OMICRON electronics Canada Corp.**

251 Consumers Road, Suite 505  
 Toronto, Ontario M2J 4R3 Canada

**RTDS Technologies, Inc.**

Tel: 204-989-9700  
[www.rtds.com](http://www.rtds.com)

**TEST EQUIPMENT - AERIAL LIFT****VON Corporation**

Tel: 205-788-2437  
[www.voncorp.com](http://www.voncorp.com)

**TEST EQUIPMENT - CIRCUIT BREAKER****DILO Company, Inc..**

Tel: 727-376-5593  
[www.dilo.com](http://www.dilo.com)

**OMICRON electronics Corp. USA**

Tel: 1-713-830-4660  
[www.omicronenergy.com](http://www.omicronenergy.com)

**OMICRON electronics Canada Corp.**

251 Consumers Road, Suite 505  
 Toronto, Ontario M2J 4R3 Canada

**Zensol Automation Inc.**

Tel: 514-333-3488  
[www.zensol.com](http://www.zensol.com)

**TEST EQUIPMENT - CURRENT TRANSFORMER TESTERS****OMICRON electronics Corp. USA**

Tel: 1-713-830-4660  
[www.omicronenergy.com](http://www.omicronenergy.com)

**OMICRON electronics Canada Corp.**

251 Consumers Road, Suite 505  
 Toronto, Ontario M2J 4R3 Canada

**TEST EQUIPMENT - GLOVE****VON Corporation**

Tel: 205-788-2437  
[www.voncorp.com](http://www.voncorp.com)

**TEST EQUIPMENT - HIGH VOLTAGE****Hastings Fiber Glass Products, Inc.**

Tel: 269-945-9541  
[www.hfgp.com](http://www.hfgp.com)

**TEST EQUIPMENT - HV TEST SETS, PORTABLE****Hastings Fiber Glass Products, Inc.**

Tel: 269-945-9541  
[www.hfgp.com](http://www.hfgp.com)

**VON Corporation**

Tel: 205-788-2437  
[www.voncorp.com](http://www.voncorp.com)

**TEST EQUIPMENT - METER TEST SETS****OMICRON electronics Corp. USA**

Tel: 1-713-830-4660  
[www.omicronenergy.com](http://www.omicronenergy.com)

**OMICRON electronics Canada Corp.**

251 Consumers Road, Suite 505  
 Toronto, Ontario M2J 4R3 Canada

**TEST EQUIPMENT - RELAY****RTDS Technologies, Inc.**

Tel: 204-989-9700  
[www.rtds.com](http://www.rtds.com)

**TEST EQUIPMENT - SLEEVE, RUBBER****VON Corporation**

Tel: 205-788-2437  
[www.voncorp.com](http://www.voncorp.com)

**TEST EQUIPMENT - TRANSFORMERS****OMICRON electronics Corp. USA**

Tel: 1-713-830-4660  
[www.omicronenergy.com](http://www.omicronenergy.com)

**OMICRON electronics Canada Corp.**

251 Consumers Road, Suite 505  
 Toronto, Ontario M2J 4R3 Canada

**TESTING - REGULATORS****RTDS Technologies, Inc.**

Tel: 204-989-9700  
[www.rtds.com](http://www.rtds.com)

**TESTING SERVICES****Kinectrics Inc.**

Tel: 416-207-6000  
[www.kinectrics.com](http://www.kinectrics.com)

**RTDS Technologies, Inc.**

Tel: 204-989-9700  
[www.rtds.com](http://www.rtds.com)

**S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**Southwest Electric Co.**

Tel: 405-737-5691 | 1-800-364-5691  
[www.swelectric.com](http://www.swelectric.com)

**TESTING SERVICES - ELECTRICAL****S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**THERMOGRAPHIC - EQUIPMENT SALES****Systems With Intelligence Inc.**

Tel: 289-562-0126  
[www.systemswithintelligence.com](http://www.systemswithintelligence.com)

**TOWERS - EMERGENCY T & D****Ampjack Industries Ltd.**

Tel: 514-451-9511  
[www.ampjack.ca](http://www.ampjack.ca)

**Meyer Utility Structures**

Tel: 901-566-6500 | 800-501-0962  
[www.meyerutilitystructures.com](http://www.meyerutilitystructures.com)

**TOWERS - POLES****Meyer Utility Structures**

Tel: 901-566-6500 | 800-501-0962  
[www.meyerutilitystructures.com](http://www.meyerutilitystructures.com)

**TOWERS, TRANSMISSION - RETROFIT****Ampjack Industries Ltd.**

Tel: 514-451-9511  
[www.ampjack.ca](http://www.ampjack.ca)

**TOWERS, TRANSMISSION - STEEL****Ampjack Industries Ltd.**

Tel: 514-451-9511  
[www.ampjack.ca](http://www.ampjack.ca)

**Meyer Utility Structures**

Tel: 901-566-6500 | 800-501-0962  
[www.meyerutilitystructures.com](http://www.meyerutilitystructures.com)

**TRAILERS - CABLE REEL****Condux Tesmec, Inc.**

Tel: 507-387-8069 | 1-888-980-1209  
[www.conduxtesmec.com](http://www.conduxtesmec.com)

**TRAINING****CTC Global Corporation**

Tel: 949-428-8500  
[www.ctcglobal.com](http://www.ctcglobal.com)

**OMICRON electronics Corp. USA**

Tel: 1-713-830-4660  
[www.omicronenergy.com](http://www.omicronenergy.com)

**OMICRON electronics Canada Corp.**

251 Consumers Road, Suite 505  
 Toronto, Ontario M2J 4R3 Canada

**S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**TRANSFORMER MONITORING****Dynamic Ratings, Inc.**

Tel: 262-746-1230  
[www.dynamicratings.com](http://www.dynamicratings.com)

**TRANSFORMERS****Delta Star, Inc.**

Tel: 434-845-0921 | 800-368-3017  
[www.deltastar.com](http://www.deltastar.com)

**TRANSFORMERS - MAINTENANCE****Albarrie GeoComposites Limited**

Tel: 705-737-0551 | 866-269-8275  
[www.albarrie.com](http://www.albarrie.com)

**S&C Electric Company**

Tel: 773-338-1000  
[www.sandc.com](http://www.sandc.com)

**TRANSFORMERS - MAINTENANCE/REPAIRS****Southwest Electric Co.**

Tel: 405-737-5691 | 1-800-364-5691  
[www.swelectric.com](http://www.swelectric.com)

**TRANSFORMERS - MEDIUM & LARGE POWER**

**Delta Star, Inc.**

Tel: 434-845-0921 | 800-368-3017  
[www.deltastar.com](http://www.deltastar.com)

**TRANSFORMERS - MOBILE**

**Delta Star, Inc.**

Tel: 434-845-0921 | 800-368-3017  
[www.deltastar.com](http://www.deltastar.com)

**TRANSFORMERS - POWER**

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[www.deltastar.com](http://www.deltastar.com)

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[www.ctcglobal.com](http://www.ctcglobal.com)

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**W**

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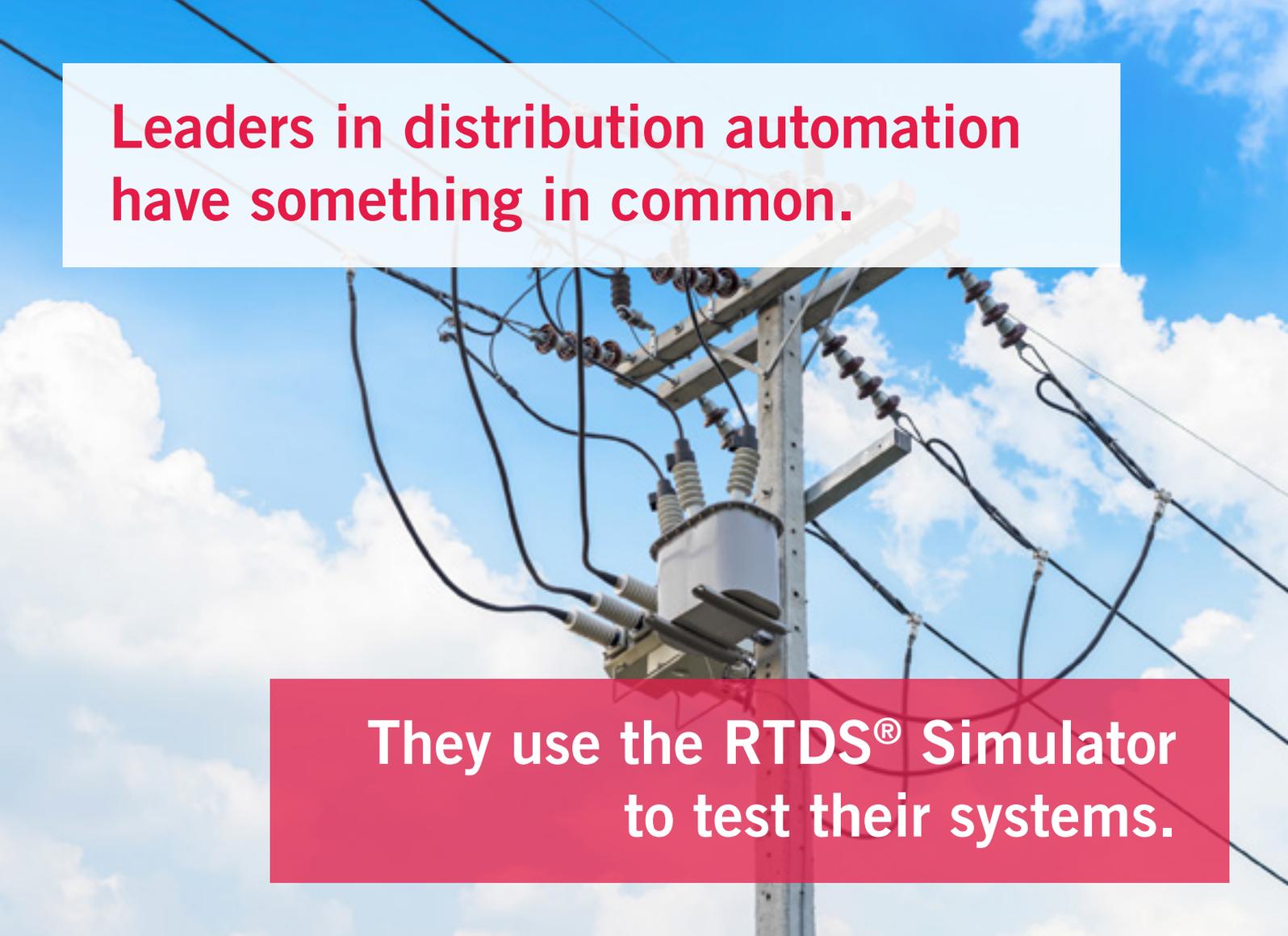
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