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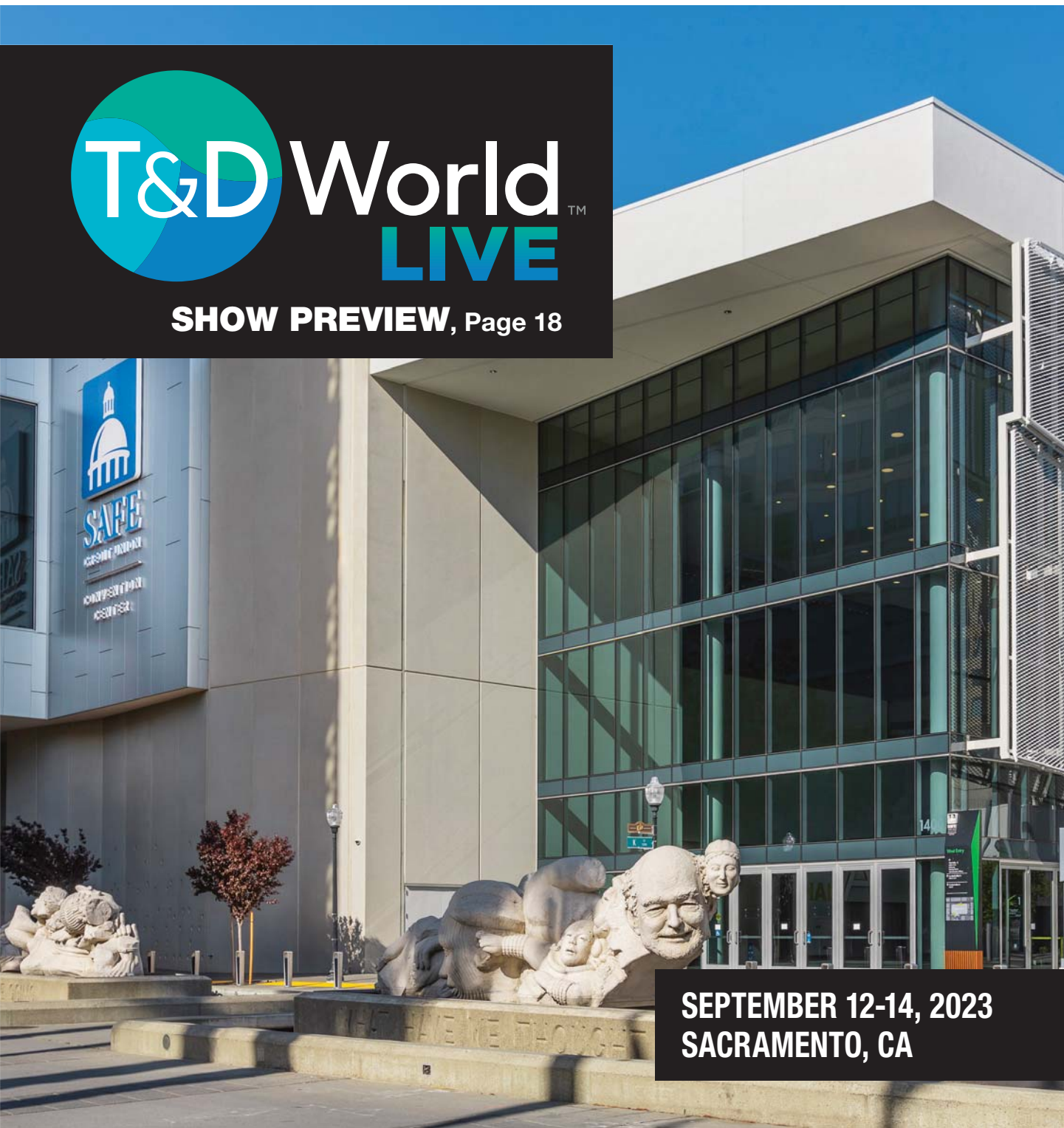

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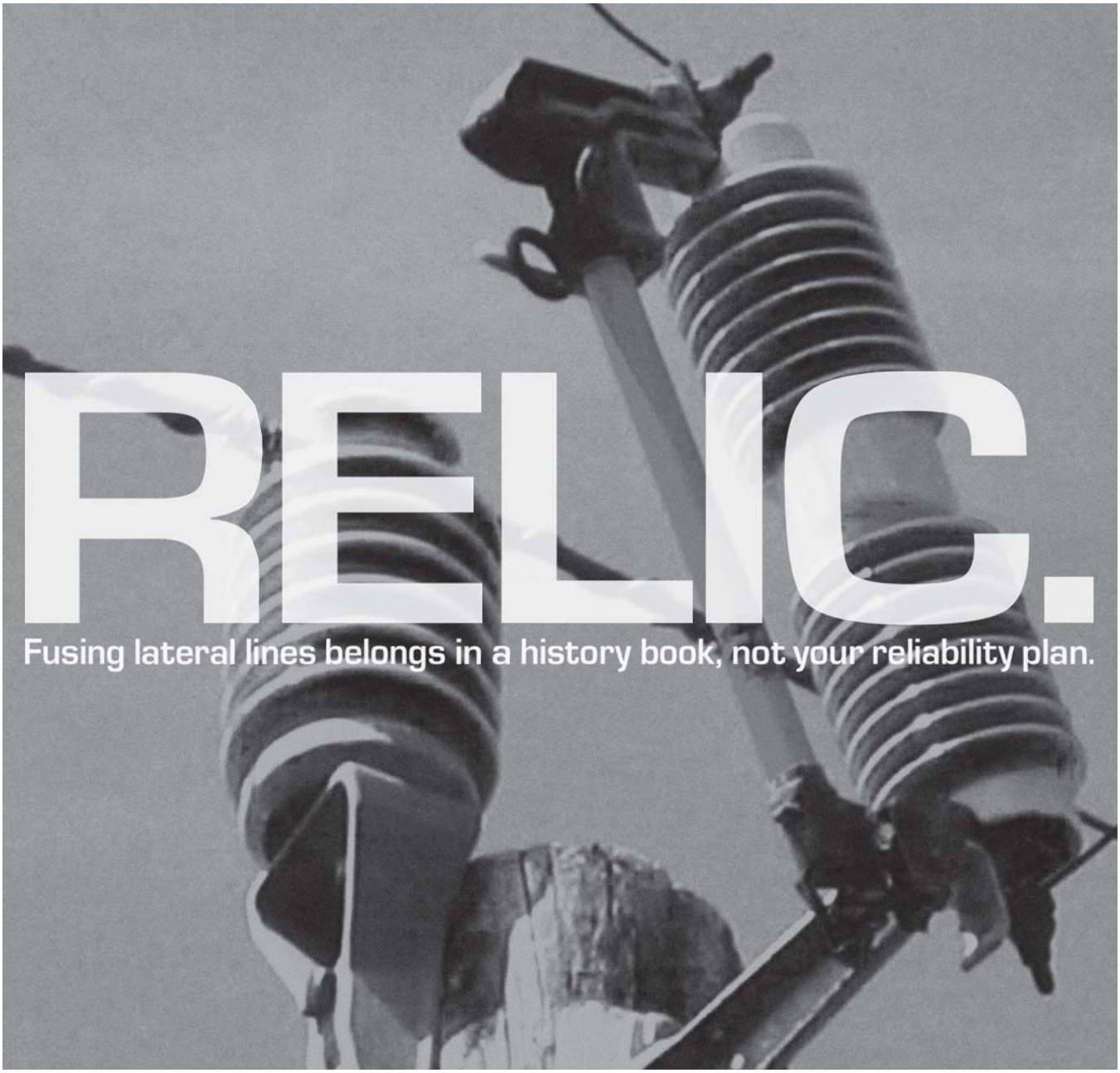

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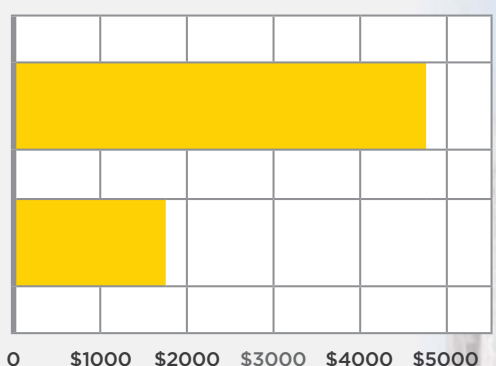

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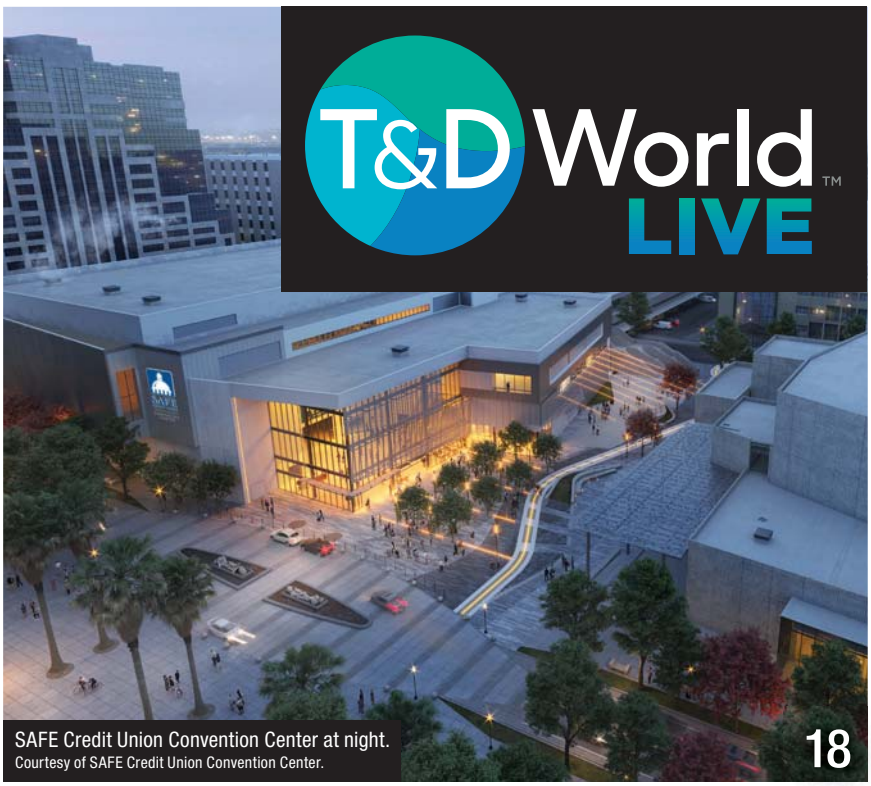

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IIJA, IRA and Private Funding Propel Renewable Energy Development

You're probably familiar with the Infrastructure Investment and Jobs Act (IIJA), and the Inflation Reduction Act (IRA), both of which provide funding for clean energy initiatives and electricity infrastructure improvements, among other things. Some of that money is now in recipients' hands and is beginning to impact the industry.

The White House announced in May 2023 that $220 billion in funding from the IIJA has been released so far. The money is being used on more than 32,000 projects across 4,500 communities throughout the country as part of President Biden's Investing in America agenda. The DOE's Grid Deployment Office (GDO), which is tasked with distributing the IRA funding and just commemorated its first anniversary, reported in its August 2023 newsletter that it has so far released $407 million in grid resilience grants to 23 states, 13 tribal entities, and four regions, including the District of Columbia.

In addition, the U.S. Department of Agriculture released $10.7 billion in clean energy grants and loans to rural electricity providers. The Biden administration declared this as the "single largest investment in rural electrification" since the 1936 Rural Electrification Act. This money funds two initiatives. The first provides $9.7 billion in funds from the IRA and will be administered under the Empowering Rural America (ERA) program to build out renewable energy programs, zero-emission projects and carbon capture. ERA is exclusively for rural electric cooperatives. The second program, Powering Affordable Clean Energy (PACE) provides $1 billion that can be used to forgive up to 60% of loans for renewable energy projects that use wind, solar, hydropower, geothermal, or biomass, as well as for renewable energy storage projects.

The funding announcements that I've mentioned here are just the first of many more to come. There's still a lot of money to be dispersed over the next few years. While this funding alone is not nearly enough to fully create the clean energy future the current administration and lawmakers envision, it has "primed the pump" so to speak, by motivating significant private investment in clean energy development.

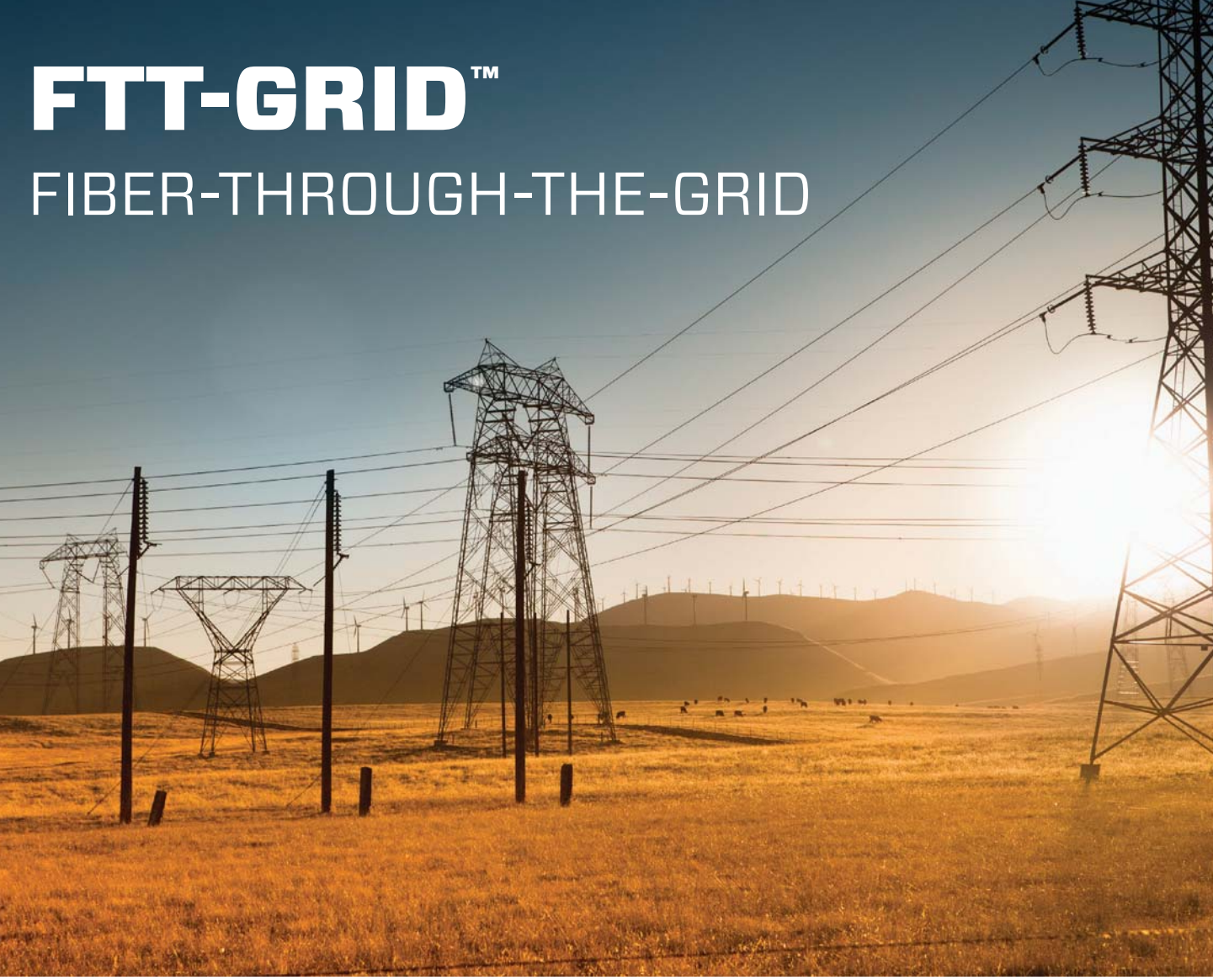
Government funding and incentives along with private investment have led to record renewable energy deployments. According to the U.S. Energy Information Administration, about 21% of U.S. energy consumption in 2022 came from non-fossil fuel (renewables and nuclear) — a tie with 2020 as the highest share since the early 1900s. Wind, solar and battery storage accounted for 68% of new power additions to the grid over the past five years, according to American Clean Power's Annual Market Report 2022. That same report also revealed that energy storage had a record 2022, commissioning 4 GW/12 GWh, which was an 80% increase in total operating storage capacity. In total, according to the report, the U.S. had nearly 228 GW of wind, solar and energy storage capacity online at the end of 2022, with another 137 GW of clean energy projects under development.

Fifteen to 20 years ago, many experts questioned whether transmission and distribution grids could operate reliably with large amounts of intermittent renewable energy. But, thanks to technological advancements, as well as tenacity and stellar problem-solving skills by utilities, grid operators, and solution providers that support them, the nation's grids have steadily increased the amount of renewable energy being delivered.

I live in Texas and believe it serves as a good example of how combining government funding and incentives with private investment are working. Texas is big; it covers nearly 269,000 square miles of land. The state has more installed wind capacity than any other state and is second to only California in solar capacity. Solar is catching up, however. The EIA estimates Texas will install more utility-scale solar capacity in 2023 than any other state — around 7.7 GW. The boom in new solar is driven by the falling costs of solar installations, hefty tax incentives (up to 26%) and completion of several large solar projects, including the state's largest — Roadrunner, a 497 MW solar plus storage project located in the Permian Basin, the largest petroleum-producing basin in the U.S.

ERCOT, the state's independent system operator, breaks down capacity by fuel type on its website. It lists the maximum solar and wind capacity in the state at just over 21 GW and nearly 39 GW, respectively. Natural gas remains the state's main power generation fuel source. Nevertheless, in certain conditions, often in the mornings before the temperature reaches triple digits, wind and solar energy's contribution surpasses that of natural gas. If you add in nuclear, hydro and energy storage, the percentage of zero carbon capacity sometimes trumps natural gas and coal combined. The latest statistics from the EIA show that in June 2023, wind, solar, and nuclear generated up to 55% of total power in Texas, keeping the use of natural gas-fired generation below 50%.

This summer (as of Aug. 17), Texas has broken 10 daily electricity consumption records, with the most recent at the time of this writing being 85,435 MW on Aug. 10. In addition to extreme heat, Texas is experiencing record population growth… more than a half million people have moved to the state each year since 2020. This population growth, coupled with numerous 100+ degree days and an islanded transmission system have caused concern and even led to a couple of voluntary conservation requests from ERCOT. So far, however, the grid has held up. Texas, an oil and gas state, is proving that renewables have a place alongside fossil fuels. The combination has so far allowed the Lone Star state to provide reliable electricity to its residents at a reasonable cost (another result of the state's abundant renewable energy and, to be fair, lower natural gas prices in 2023) even during extreme heat. I think Texas is a good example of what the IIJA and IRA were designed to do in these early years, but we can't forget that grid investment is also key to continued progress. TDW



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S.E.E. is a True Exchange

I had the privilege of attending this year's Southeastern Electric Exchange in Hollywood, Florida, for the first time this past June. Our late technical editor, Vito Longo, used to attend every year and loved it, and now I know why. It is all about southeastern utilities sharing with one another: their successes and failures, their best practices and their ideas and predictions. The power delivery industry is changing so fast that these collaborations are more important than ever. The event covered distribution, substations, transmission, right-of-way, and generation needs continue to be part of the conversation as our nation moves to a more diverse mix of energy sources.

The cool thing about S.E.E. though, is everything is open for healthy debate and discussion. How are we going to move forward if we don't allow differing opinions, experiences and expertise to enter the discussion? The opening general session speakers set the tone, to a certain extent, for the exchange of ideas. Jack Uldrich, a global futurist, session one speaker, struck an optimistic, encouraging tone, saying that the "future depends on the electric utility industry."

He mentioned several exciting technological projects utilities are involved with around the nation: Dominion's offshore wind, Xcel Energy's iron-air battery system, Duke's microgrid at Camp LeJeune.

"We no longer live in linear times; we live in exponential times," he said. Some of his speech was not unique to the utility industry, as he is more of a generalist, but his reassurance about the question of AI taking over everyone's jobs resonated with the audience. "It's easy to imagine the jobs that will go away, but it's hard to imagine those jobs that don't yet exist. As long as there are problems in the world, there will be jobs." With Chat GPT being introduced this past November, AI has been one of the bigger news stories this spring. Of course the utility industry has already been using AI for a while in different forms, and I only see our industry as benefiting from its advancements and applications.

The session two speaker introduced a more cautionary tone. Robert Bryce is author *of A Question of Power: Electricity and the Wealth of Nations,* and the creator and host of the *Power Hungry* podcast. Although Bryce contended he wasn't Democrat or Republican, he was not afraid to share his opinion on politics and institutions. He opened his presentation describing a recent tour he took of the Fukushima power plant and how Japan is not concerned with climate change like the United States is. It is concerned about "energy security." Japan is now planning to build as many as 22 new coal-burning power plants after having to effectually shut down its nuclear power after that Fukushima disaster.

Bryce's message was that our electricity system is a marvel, and is crucial to civilization and modernism, yet we are facing some difficult times with aggressive decarbonization goals, and subsequently, more rules and regulations. There are several challenges to meeting these goals even if we wanted to: supply chain issues; batteries that aren't quite as scalable as they need to be yet; siting, permitting and ROI for renewables. When he mentioned an irrational fear of radiation in his introduction, though, I could see that he approved of nuclear power being a viable option for energy reliability and security. I did have to agree with him when he said "Every system depends on the grid. Don't take it lightly."

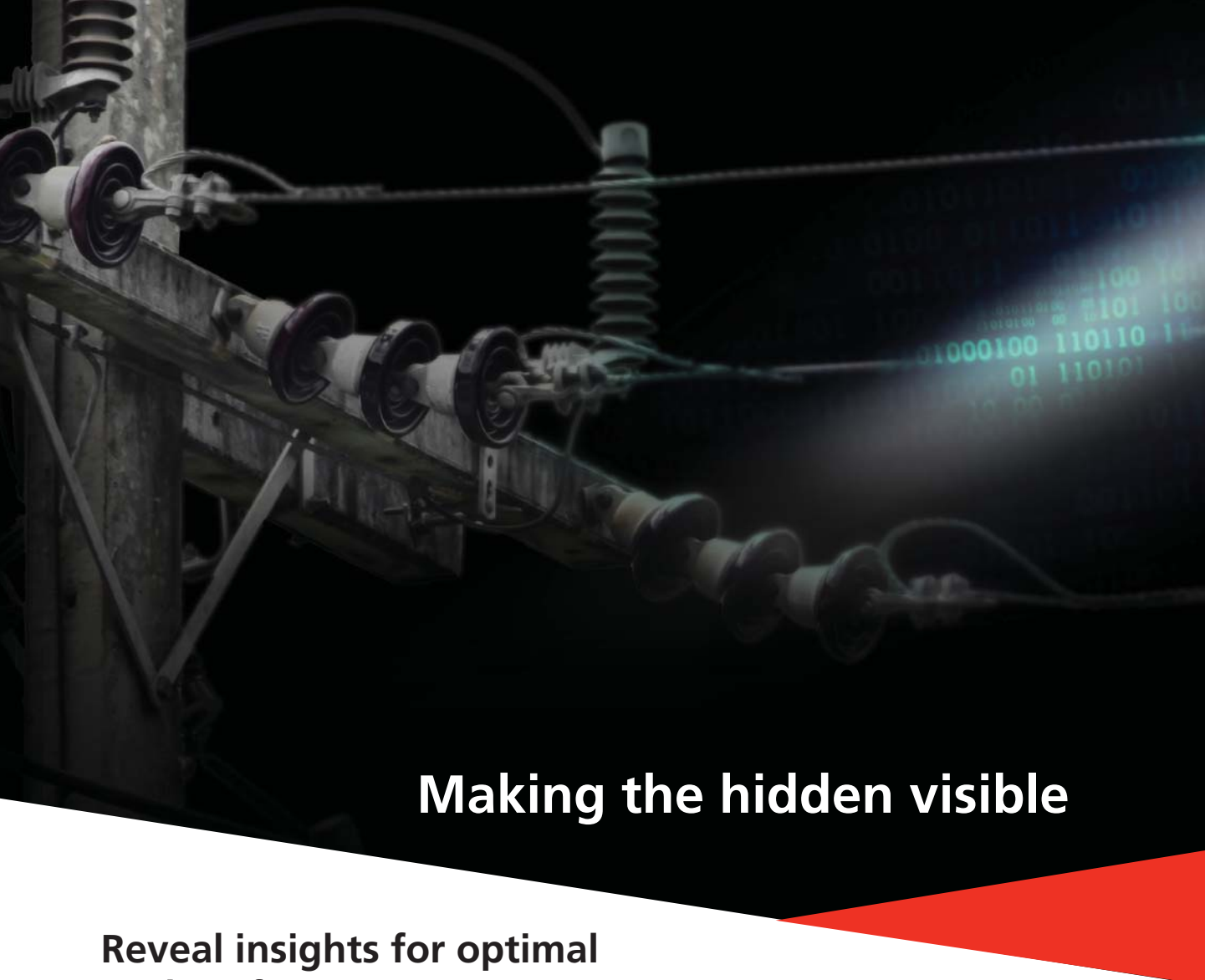
Project Awards

In keeping with the exchange of ideas and best practices, S.E.E. presents project awards, which T&D World loves to see because utility projects is our favorite subject. Each award winner was able to present their projects and technology in a special session. I attended the Industry Excellence Award Winner for Distribution, awarded to Alabama Power's Green Valley Distribution Undergrounding Project. Holly Joiner, central engineering underground coordinator, and Adam Carr, grid investment manager, for Alabama Power presented the experiences. The Central Engineering Underground Program uses system outage and maintenance cost data to identify existing overhead distribution lines that would be beneficial to underground. The project consisted of installing an underground distribution system serving 101 active meters across 100 separate properties, needing 100 separate easements. The design and construction teams navigated many limitations such as property easement constraints, tight workspaces, various challenging terrains and converting customer service entrances. About 8,000 feet of inaccessible overhead distribution line built in the 1960s was removed from a vegetation-dense right of way in the rear-lot customer properties. Look for a more in-depth article on this project in a future issue of T&D World.

Other winners included:

- Environmental Category: Florida Power & Light's North Florida Resiliency Connection
- Customer Service and Billing: FPL's Appointment Tracker and Self-Scheduling Standy Appointments
- Substation: FPL's A Violet by Any Other Name (Vero Beach Substation)
- Supply Chain: American Electric Powers' Emergency Restoration Structures Kitting Program
- Transmission Line: PPL Electric Utilities' Dynamic Line Ratings
- Safety: Exelon/Baltimore Gas & Electric: Energy-Based Safety
- Training: FPL's New Hire Engineer Training and University Partnership Program

As Jack Aldrich stated in the opening session, the future depends on the electric utility industry and based on these winners, I would say the future is in good hands. TDW



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It's All About The DNA

I don't know how many times I have heard the term "next generation" applied to some technological advancement. It's a handy phrase to describe the latest innovation of a specific improvement of a digital technology. It's also used to emphasize something that is modern, up to date, or the next big thing. It's easy, however, to get mixed up or lost. This is especially true if there have been so many developments people are at a loss how to characterize them. Maybe it might help to use something like a family tree or DNA. It would give an indication of how yesterday and today's technologies are related yet different.

What got me thinking about this was a discussion I had last month with Andreas Berthou, global head of HVDC (high-voltage direct current) at Hitachi Energy. We got together to discuss the application of HVDC technology on the SunZia Transmission project. Editor's note, see *T&D World's* August "Charging Ahead" (*https://tdworld.com/21268392*) for the complete story. In the course of our discussion, Andreas mentioned that Hitachi Energy had been selected by Hydro-Québec to upgrade their 40-year old Châteauguay HVDC back-to-back converter station.

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Châteauguay's refurbishment represents more than an upgrade, it's transformational in its scope. It caught my attention because I have had a long standing interest with Châteauguay that extends back to its pre-commissioning days. I really wanted to talk more about Châteauguay, but that wasn't possible. SunZia was the focus of that article and space was limited, so we moved on.

Digging Deeper

After finishing that assignment, I had some time to dig into the links Andreas had sent me and learn more about how Châteauguay was being rejuvenated. Early in my engineering career, I was the lead engineer on the Blackwater back-to-back HVDC converter station, which had a great deal in common with Châteauguay. The two converter stations were related by the same lineage of HVDC technology they shared. It's important to recognize they didn't represent different generations, but were more like siblings sharing a technological DNA. This DNA stretched back to the early days of thyristor-based LCC-HVDC (line-commutated converter) systems.

The idea that applications such as Châteauguay and Blackwater could share DNA is a valuable concept when it comes to assembling this family tree. After all in its simplest terms, DNA is the information passed from one generation to the next. Over the course of my career, I was able to visit all of the converter stations represented in that family tree except one. That was the Cahora Bassa converter station, which was the patriarch of the line, but of the ones I did visit, it was easy to see the differences and the similarities.

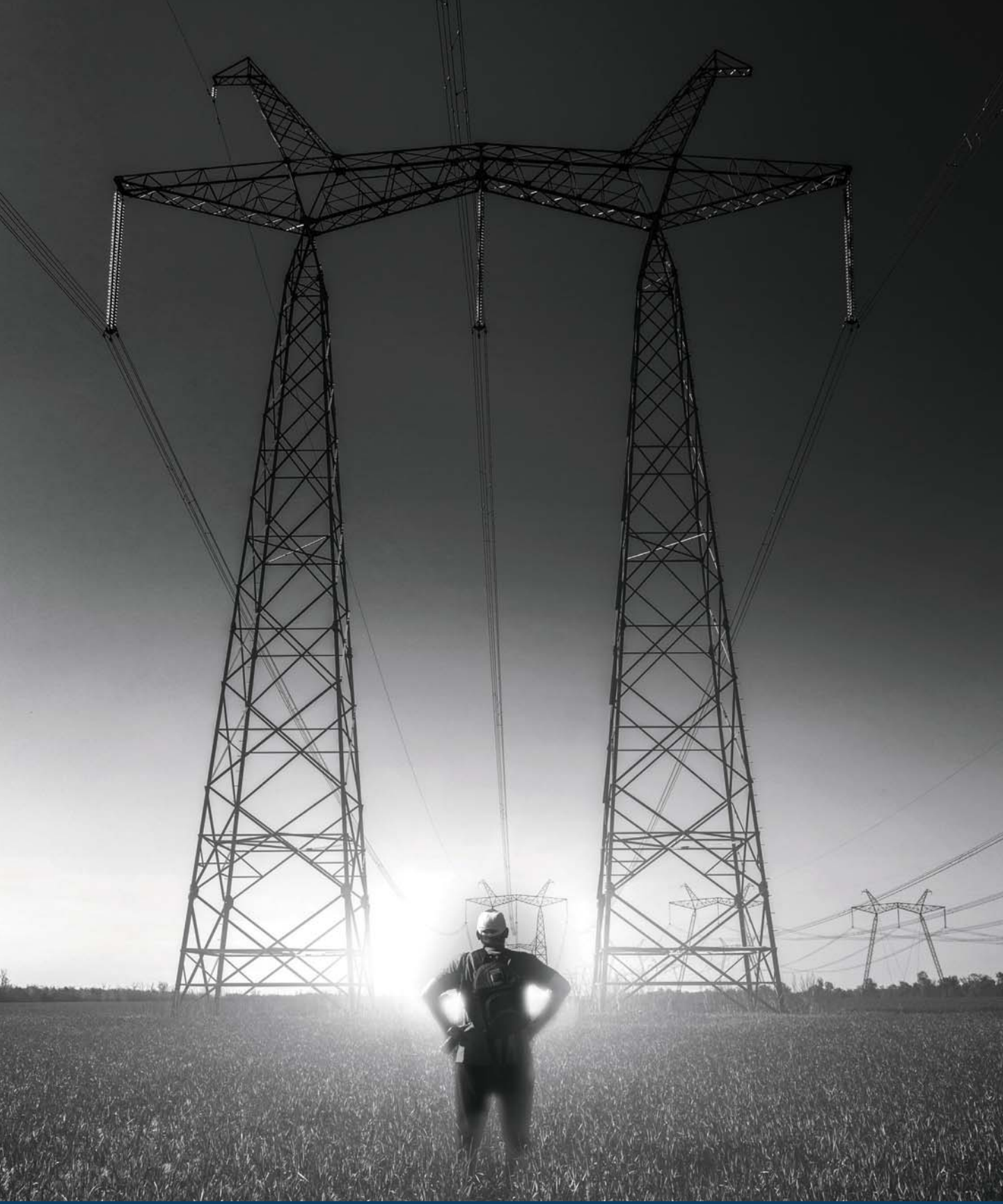
Each member of this family represented an important milestone that improved the overall advancement of HVDC technology. Valuable data was gathered from their successes as well as their failures. That is why Châteauguay's renovation had my attention. The power grid is changing, and this facility is moving from LCC-HVDC technology into the state-of-the-art VSC (voltage source converter) technology.

Technological DNA

So what's this update all about? Châteauguay was commissioned in 1984 and providing clean renewable energy long before that was the cool thing to do. Hydro-Québec is one of the largest hydroelectricity producers in the world and their Châteauguay facility connects the electrical networks of Québec in eastern Canada with the state of New York using HVDC technology. HVDC was used since the two networks are asynchronous (i.e., out of phase) and cannot be connected directly using traditional AC (alternating current) systems.

Originally Châteauguay consisted of two separate 500 megawatt (MW) converter stations with a total rating of 1,000 MW, but that is changing. In late 2022 Hydro-Québec selected Hitachi Energy to refurbish Châteauguay with its VSC-HVDC technology. It increases the facility's rating by 50 percent to 1,500 MWs. The VSC-HVDC upgrade interconnects the 735 kV (kilovolt) Canadian grid with the 765 kV New York grid, which will increase the efficiency and controllability of the Châteauguay facility.

Because of the robustness of the original HVDC DNA developed for this family of converters, it is possible to splice it with VSC-HVDC DNA. That opens new doors when utilities consider upgrading their power electronics. Châteauguay's features will include black start capabilities, require no reactive power supplements, lower active power losses, and other improved traits commonplace in today's HVDC schemes. It's going to be interesting seeing how DNA splicing like this changes our ideas about updating technologies! TDW



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Microgridation Is Changing The Power Grid

Is decentralization the answer to extreme weather events fueled by global climate change?

Officially autumn begins in September, and it can't come soon enough! Copernicus, the European Union's climate change service said the Earth saw the hottest June on record. That was followed by several U.S. climate tracking agencies reporting the planet recorded a series of the highest average global temperatures ever reach in July. The sizzling temperatures were reported in North America, Europe, and Asia, but heat wasn't the only extreme weather events making headlines in 2023.

There were wildfires, bomb cyclones, floods of biblical proportions, and more including concern about the power grid's ability to provide electricity. While some portions of the globe were coping with prolonged heatwaves and lingering heat domes (i.e., a high ridge of hot stagnant air), others grappled with dangerous storms that included extensive flooding. It hasn't been a good year for the power grid with the extreme weather conditions.

Summer saw peak demand records continuously being broken, but the power kept flowing. Of course there were bumps in the road with outages and near outages affecting large numbers of customers. Experts are concerned that this summer's heat stress will have future consequences on the power grid. If you're interested in real-time outage tracking, the PowerOutage.us website is a good place to see what's taking place across the U.S. at any given time.

Heatstroke or Heat Exhaustion

The effects of extended heatwaves are insidious because they tend to be cumulative. According to a report from the Department of Energy (DOE) extreme heat is listed as one of the leading threats to reliability and resilience to the power system. This summer some portions of the power system experienced the equivalent of a heat exhaustion whereas others suffered what could only be called heatstroke, but there's a resolution – the decentralized power system.

One of the most prominent technologies for decentralization is microgridation (i.e., the integration of microgrids in the power system). Microgridation puts the power source close to the load, which makes a utility's system more robust. It does it without resorting to the old-school tradition of "more wire in the air." Conventional approaches such as building transmission, adding distribution, or installing generation plants need help to get the job done. Today's microgrids can provide that boost a utility's power network when it comes to climate resiliency.

Before moving on, it's a good idea for everyone to be on the same page. What is a microgrid? According to NREL (National Renewable Energy Laboratory), "A microgrid is a group of interconnected loads and distributed energy resources that acts as a single controllable entity with respect to the grid. It can connect and disconnect from the grid to operate in grid-connected or island mode."

According to a study performed by the marketing company Reliable Research Reports, "the global microgrid market is expected to grow at a CAGR (compound annual growth rate) of 6% during the forecast period of 2023-2030." They went on to say, "The global microgrid market size was estimated at US$29.99 billion in 2023 and it's expected to surpass US$85.7 billion by the end of 2030." The paper pointed out that "some of key players in the market include ABB, NEC, GE, Aquion Energy, Echelon, Raytheon, S&C Electric Co, Eaton Corporation, Sunverge Energy, Siemens, Toshiba, General Microgrids, and Lockheed Martin, among others."

Microgrid technology has matured to the point it's adaptable to any requirement needed by a utility for their power

network. They can be installed or either side of the meter and their sizes can be wide-ranging. Also, microgrids are a valuable tool for utilities adopting net-zero goals in the transition from fossil fuels to clean energy alternatives. It all starts with the addition of distributed energy resources (DERs) including battery energy storage systems (BESS).

Microgrid Variety

Earlier this year, San Diego Gas & Electric (SDG&E) announced they were expanding their BESS and microgrid sites. They currently have 20 BESS and microgrid sites rated 95 megawatts (MW) in service with another 200+ MWs in development. SDG&E points out their microgrids can operate independently of or parallel to their large regional grid. This flexibility allows SDG&E to keep critical community facilities powered during outages while reducing the overall impacts of power outages on their customers.

Recently, Lebanon's electricity infrastructure got a boost from microgrid technology. The existing power system has some issues that were ideal for microgridation. According to Sungrow they were awarded eight contracts with local partners in Lebanon to supply utility-scale microgrid/BESS projects. The projects will be commissioned in the 4th quarter in 2023 and have a cumulative capacity of 14 MW (megawatts)/ 24.9 MWh (megawatt hours) with a photovoltaic capacity of 12.4 MW. The news release said the solar-plus-storage system will provide power to communities and facilities in need of electricity.

Microgrid technology gave Duke Energy options when it came to serving the town of Hot Springs, North Carolina. Rather than building a second feeder to fix an outage prone feeder, Duke Energy decided a microgrid was more flexible for the needed backup power source. The solar powered 2MW/4.4 MWh microgrid has enough power to supply the town for extended periods of time. The microgrid utilizes Wärtsilä's sophisticated energy management system, the GEMS Digital Energy Platform, for integrated control of both the solar and energy storage facilities. The microgrid went into service in early February 2023. Duke reported they have numerous smaller microgrids on their system, but this is the first one that is powering an entire town.

In early May, 2023 microgrid technology experienced a quantum leap with the opening of California's first residential community. Shadow Mountain is described as being a novel microgrid community, and it has been getting a great deal of attention in the power delivery industry. The Shadow Mountain master plan is a research and demonstration project involving the University of California, Irvine, the U.S. Department of Energy, Southern California Edison (SCE), Schneider Electric, KB Home, and SunPower. It's located in Menifee, CA and has two adjacent communities/microgrids with a unique electric power system.

The communities have regular electric power service from SCE, but then it gets impressive. Each of the 219 homes in the two communities are all-electric, solar-, and battery-powered homes with electric vehicle capabilities. In addition the homes are connected to their community's microgrids. In the event of a power outage on the grid, a home can draw power from its own minigrid or the larger community microgrid. With all the combinations/configurations of power sources, we are going to be hearing more about this project and managing the complex interactions found in microgridation.

Smarter Microgrids

Speaking of managing microgridation, let's explore this subject matter a little further since artificial intelligence (AI) has been reported in advanced microgrid management systems. Microgrids are no longer simply backup power supplies, they are being designed to offer a variety of applications on both sides of the meter, but it's resulting in some amazingly complex schemes.

One of the most challenging applications is found in the coordinated local grid area, such as a community microgrid. Controlling them becomes more difficult because of diversity of power sources and loads. AI's analytic abilities were made for this scenario. AI can turn terabytes of data, from many different sources, into usable information that can be used to optimize a microgrid's performance.

By sifting through masses of customer load data, energy production data, energy storage capacity data, and historical weather data, the microgrid's controller becomes a microgrid energy management system or digital twin. It makes forecasts that improve the microgrid's demand response and energy trading abilities, but it doesn't stop there.

AI's ability also allows the microgrid to be a real-time decision maker. That enhances its energy distribution, which improves the reliability, resiliency, and efficiency of the microgrid, not to mention enhancing grid stability. Predictive maintenance is another advantage related to its decision-making skills. When the machine learning algorithms are applied to a digital twin, they excel at finding patterns that predict when the microgrid's components can be expected to fail.

This is an important trait for industrial asset management systems and it's no different with the power grid's microgrids. Digital twins detect abnormalities and that allows for proactive maintenance. Using this tool lets operations personnel mitigate risks by planning maintenance at non-critical times, and reduces unscheduled outages. AI integration has another attribute that is getting attention throughout the power delivery industry, autonomous operation.

As the technology evolves, the potential for making smarter microgrid management systems with autonomous AI-based capabilities are becoming a reality. Today's schemes require limited human interaction, and it's crucial as more DERs come on the power grid needing efficient interaction with the growing numbers of microgrids.

These latest digital trends may seem like science fiction, but they are not. They're smart microgrid technologies that are available today. They're complicated, but they're very user friendly and an important tool needed for the 21st Century power grid! TDW

AEP ADDS TRANSMISSION JV STAKES TO FOR-SALE LIST

The leaders of American Electric Power Co. have decided to put on the sale block its stakes in two transmission joint ventures as part of their plan to streamline the Columbus-based company and focus on its regulated businesses.

President and CEO Julie Sloat and her team said in May they were exploring the idea of offloading their Prairie Wind Transmission and Pioneer Transmission holdings in Kansas and Indiana, respectively, as well as their stake in a larger transmission portfolio under the Transource name. (They also have struck a deal to sell AEP's unregulated renewables group for $1.5 billion and are looking to sell several other subsidiaries.) Any Transource deal is still being considered but Prairie Wind and Pioneer are now on the market.

AEP owns 50% of Pioneer (Duke Energy Corp. is an equal partner) and 25% of Prairie Wind, where Evergy Inc. is a 50% owner and a unit of Berkshire Hathaway Energy also owns 25%. Combined, AEP has invested $123 million in the two ventures' property, plant and equipment and its portion of their rate base in the first six months of the year was $107 million. (By comparison, Transource has assets in six states and is 86.5% owned by AEP, with Evergy controlling the remainder. More than half of AEP's $430 million in investments in that venture have been made in Missouri.)

On a July 27 conference call, Sloat said the transmission investment sales are happening primarily because she wants AEP to focus on its core business and be able to tell a cleaner story to investors.

"We don't need to engage in asset sales to make the balance sheet work. What we need to do is make sure we're being as efficient as possible," Sloat told analysts. "I want to make sure that every dollar we do put to work is one that makes sense for our customers but also is something that makes sense for our service territories."

Sloat and CFO Ann Kelly announced the transmission venture sale plan along with AEP's second-quarter earnings, which came in at $521 million, slightly below prior-year numbers, on revenues of $4.4 billion. Higher interest rates and mild spring weather compared to 2022 weighed on those numbers, the executives said. Normalized residential sales fell 2.4% year over year while industrial sales were essentially flat. Commercial sales, however, grew nearly 8% — in line with Q1's number — thanks in part to strong economic development momentum in Ohio and Texas.

Shares of AEP (Ticker: AEP) were up slightly to $85.45 on the afternoon of July 28, recovering some of the ground they lost on the heels of the earnings report. Year to date, they have fallen about 10%, trimming the company's market capitalization to about $44 billion. *—Geert De Lombaerde* ■

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DOE LAUNCHES REBATE PROGRAMS FOR TRANSFORMERS AND CRITICAL INDUSTRIAL EQUIPMENT

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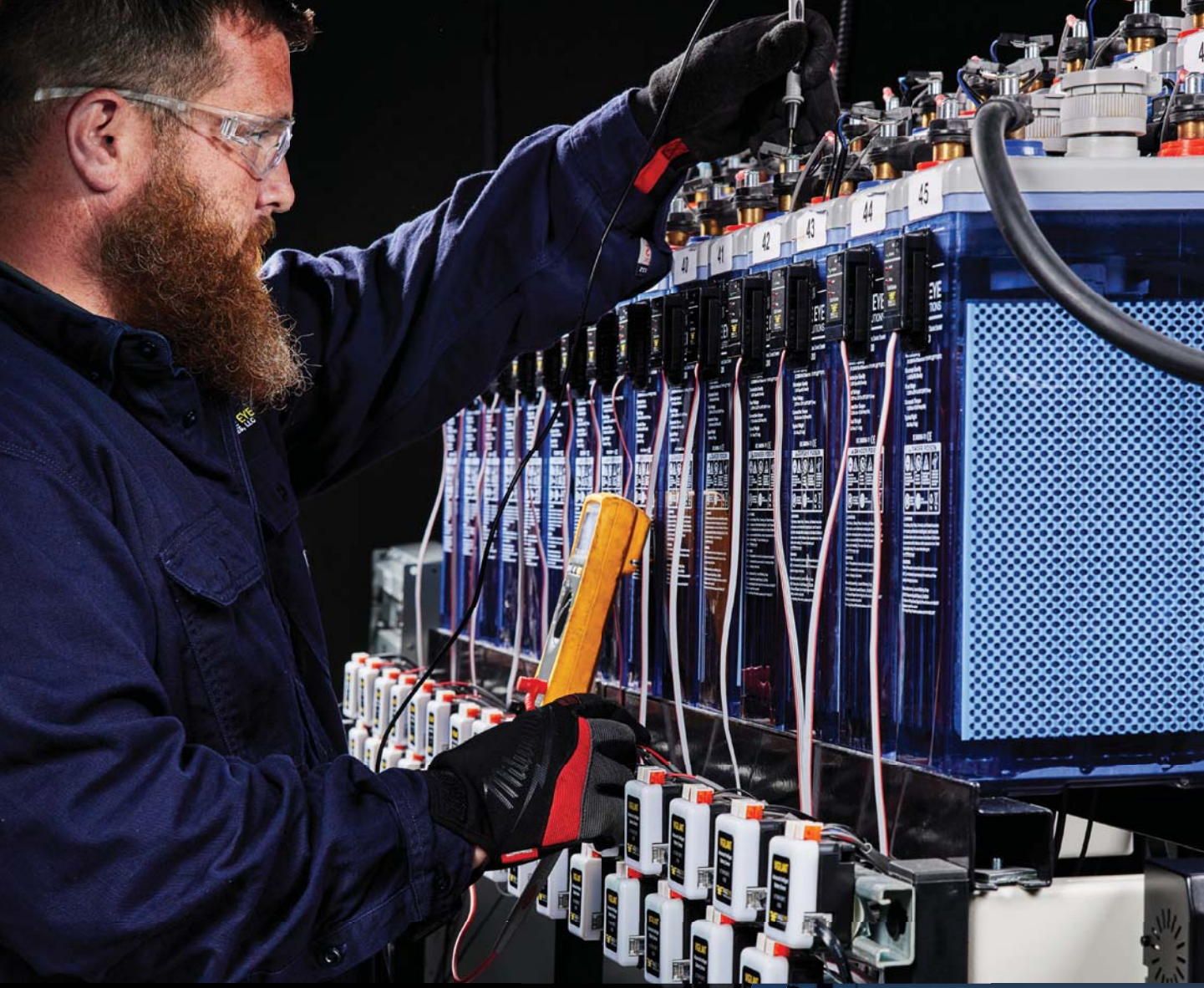
The U.S. Department of Energy has announced $20 million to support the installation of energy-efficient distribution transformers and extended product systems that use equipment with electric motors, such as pumps, air compressors, and fans. This funding, made possible by the Bipartisan Infrastructure Law, will be distributed through two rebate programs, one focused on transformers and another on extended product systems. The rebate programs aim to help domestic manufacturers, utilities, tribes, hospitals, schools, and other operators finance equipment upgrades, which will conserve energy and reduce costs while slashing greenhouse gas emissions across multiple sectors of the economy.

Qualified applicants can receive up to $25,000 in rebates through this program. Details regarding eligibility and rebate calculations were published in previous distribution transformer rebate guidance and extended product system rebate guidance. The application portal for distribution transformer rebates is open from Aug. 1, 2023, to Dec. 31, 2023, or until funds are exhausted. The application portal for extended product systems will open in the coming weeks.

"Today's announcement will help more affordably upgrade distribution transformers—essential pieces of energy infrastructure that ensure electricity can move safely and reliably to homes and businesses across America—as we focus on modernizing our electric grid to meet our growing energy needs and combat the climate crisis," said U.S. Secretary of Energy Jennifer M. Granholm.

According to the DOE statement, older, less efficient equipment that composes the bulk of distribution transformers currently on the electric grid pose an increased risk to the security and effectiveness of the nation's electricity system. Authorized by the Energy Act of 2020 and funded by the Bipartisan Infrastructure Law, the rebate program seeks to help eligible entities replace aging and inefficient transformers with new, qualified energy efficient models. Transitioning to these newer models should reduce overall power consumption and emissions while cutting operation costs and delivering consumers savings in the form of lower utility bills, the DOE said. *—T&D World Staff* ■



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SAFE Credit Union Convention Center exterior marquee.
Courtesy of SAFE Credit Union Convention Center.

Sharing information and best practices among companies in the same industry is usually uncommon. For electric utilities, however, it's key to success.

By **TERESA HANSEN**, Vice President of Content

HOSTED BY SMUD

There are few industries where sharing best practices and lessons learned from company to company occurs. The electricity industry is unique in that sharing this information is not only common practice, but it's key to meeting current and future challenges. *T&D World* recognizes this and understands that it's important for us to create content that maximizes this enormous benefit that few other industries enjoy. For 75 years, *T&D World* has built on this tremendous opportunity, providing content created by utilities for utilities, covering the latest technologies, projects, trends and most anything else that impacts electric utilities. We're proud of our history as a print magazine, but we're also proud that as communication mediums changed, *T&D World* changed, too, adding websites, e-newsletters, webinars and webchats, podcasts and videos to our repertoire of offerings. We even organized and produced virtual events during the height of the pandemic. The digital age in which we now live certainly has made it easier than ever for like-minded, utility employees and executives to connect and share their knowledge and experiences.

Nevertheless, even in today's world nothing beats meeting and conversing face-to-face. This is why last year *T&D World* introduced its most ambitious addition to date…*T&D World Live*. This annual event, which premiered in October 2022 in Charlotte, North Carolina, will be held in Sacramento, California, this month on Sept. 12-14. I'm happy to report that our inaugural event was a success and we've been hard at work building on that first event to create what we believe is an even better event in 2023.

Our goal is to bring you and your colleagues the same in-depth knowledge that we bring to you in the pages of *T&D World* magazine, but at a face-to-face event, which can offer even more. *T&D World Live* will allow you to hear about projects and technologies from

This year's conference will feature a plenary session titled 'Commercial Vehicle Electrification: Getting it Together.'

the individuals who helped conceptualize and implement them. You can ask them questions during their presentations or sit next to them at lunch or be part of a bigger discussion during the networking receptions, or better yet maybe do all three of these things and more. We love bringing you written and online content, but as great as they are, they are no match for face-to-face learning and discussion.

Host Utility - SMUD

The conference we're offering at *T&D World Live 2023* is the product of some truly talented industry experts and professionals, as well as in-house editorial staff, who make up our advisory board. This amazing advisory board also had input and help from Sacramento Municipal Utility District (SMUD), *T&D World Live*'s host utility. SMUD, a municipal utility, has been serving the Sacramento area for more than 75 years. It provides electricity to more than 1.5 million customers, making it the nation's sixth largest community-owned, not-for-profit electric service provider. It services a 900 square mile territory and owns nearly 11,000 miles of power lines.

Panel sessions will cover undergrounding, workforce needs, and EV charging.

When you view the program, you'll see that several individuals representing SMUD are participating in our conference program, including Heidi Sanborn, SMUD's Board President, and Frankie McDermott, the utility's Chief Operating Officer. If you saw the article featuring McDermott in the *T&D World* August issue, you know that SMUD has had some challenges over the past couple of years, but more importantly has implemented some projects and processes during that time that allowed it to meet its challenges head on all while providing stellar customer service. McDermott will provide more detail about these latest initiatives.

Conference Program

The conference brings together some of the top minds in the electric utility sector during an exceptionally important time in the world's energy future. It begins on Tuesday, Sept. 12, at 1:30 p.m. local time, with multiple one-hour panel sessions from 1:30-2:30 and 2:30-3:30. The panel session will be followed by a plenary session titled "Commercial Vehicle Electrification: Getting it Together." This session will be open to all *T&D World Live* registrants, as well as attendees registered for the one-day co-located Commercial Electric Vehicle and Infrastructure Conference (CEVIC). The TDW Live conference program continues throughout the day on Wednesday and into Thursday morning, wrapping up at 12:30 p.m. that day.

The conference program includes 35 breakout sessions, two plenary sessions and one keynote, featuring nearly 100 speakers and moderators, more than 60 of whom represent utilities or transmission operators. These sessions will provide a wealth of information and the chance for attendees to interact with speakers by asking questions and discussing their own challenges and successes. The sessions include panel discussions, use cases,

Schedule at a Glance

Monday, Sept. 11
12:30 p.m.–5:30 p.m. Learning Lab
3 p.m.–5 p.m. Registration Open
Tuesday, Sept. 12
7:30 a.m. – 6:30 p.m. Registration Open
8 a.m. – 1 p.m. Exhibitor Move In
8 a.m. – 12 p.m. Learning Lab
9 a.m.–11:30 a.m. Technical Tours
12 p.m. – 1:30 p.m. PowerUp Lunch Roundtable Discussions
1:30 p.m. – 3:30 p.m. Panel Sessions
3:45 p.m.–5 p.m. Plenary Session
5 p.m. – 7 p.m. Welcome Reception & Exhibit Hall Open
Wednesday, Sept. 13
8 a.m. – 6:30 p.m. Registration Open
8:30 a.m. – 10 a.m. Keynote Session
10 a.m.-2 p.m. Exhibit Hall Open
10 a.m. – 10:30 a.m. Beverage Break
10:45 a.m. – 11:30 a.m. Breakout Sessions
11:30 a.m. – 1 p.m. Attendee Lunch
1 p.m. – 4:30 p.m. Breakout Sessions
2:15 p.m. – 2:45 p.m. Beverage Break
4:30 p.m. – 6:30 p.m. Networking Reception
Thursday, Sept. 14
8 a.m.-12 p.m. Registration Open
8 a.m.-9 a.m. Attendee Breakfast
8 a.m. – 10:30 a.m. Exhibit Hall Open
9 a.m. – 9:45 a.m. Breakout Sessions
9:45 a.m. – 10:15 a.m. Coffee Break
10:30 a.m. – 5 p.m. Exhibitor Move Out
10:30 a.m. – 11 a.m. Breakout Sessions
11:15 a.m. – 12:30 p.m. Plenary Session

and formal presentations about the latest trends and cutting-edge technology. The schedule also includes ample networking opportunities for casual conversation with colleagues and peers, including the Power Up Lunch on Tuesday, which offers an

T&D World Live also includes an exhibit hall that will showcase some of the latest and greatest new technologies and solutions.

opportunity to exchange ideas, discuss best practices and learn from your peers in a small group setting. You pick the topic and sit at a table with others who are interested in the same topic.

In addition, we've organized several pre-conference offerings, including two Technical Tours and two Learning Labs (workshops). The first Learning Lab will take place on Monday afternoon and the second Learning Lab and the two Technical Tours will be held on Tuesday morning. Details about these opportunities are available at *https://events.tdworld.com/2023/conferenceprogram*.

The CEVIC, mentioned above, will address the gap between ready-to-roll commercial EVs and the multi-year wait for

The Power Up Lunch on Tuesday offers an opportunity to exchange ideas, discuss best practices and learn from your peers in a small group setting.

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Prisma Photonics, CEO

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ComEd, Manager of Data Science

RACHEL ZOOK
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charging infrastructure. We're bringing together key players from the commercial fleet market, the utility market, and others in the ecosystem to facilitate discussion, exploration, and collaboration on how to build the infrastructure necessary to support the evolution and transformation of commercial electric vehicles. California has set a target of 2035 for 100% zero-emission car sales, and 2045 for full transition of all vehicles, both heavy- and light-duty, to zero-emission technologies. The state also aims to have 5 million zero-emissions fleet vehicles (both public and private) on the road by 2030. So, what better place than Sacramento to discuss the details of how to work together to meet these ambitious goals. The CEVIC is scheduled for Sept. 12, beginning at 7:30 a.m. and continuing through the welcoming reception that will be held on the exhibit floor from 5:30 p.m. to 7 p.m. local time.

Attendees must register for the CEVIC, Learning Labs, Technical Tours, and Power Up Lunch separately from the T&D World Conference and Exhibition. Pricing and additional session and speaker details are available at *https://events.tdworld.com/2023/agenda.*

The conference content is extensive and

can't be adequately covered here, but session and speaker details about the general and breakout sessions are available on the event website at *https://events.tdworld.com/2023/conferenceprogram.*

Exhibition

In addition to all the great content, it's important to note that T&D World Live also includes an exhibit hall that will showcase some of the latest and greatest new technologies and solutions from more than XX exhibiting and sponsoring companies. The exhibition hall is designed to provide an ideal environment and plenty of time for attendees to network with other attendees, as well as these solution providers.

All event activities will take place at SAFE Credit Union Convention Center in downtown Sacramento. Details about the venue and hotels are available here: ***https://events.tdworld.com/2023/venue.***

For full details and registration for T&D Conference and Exhibition 2022 visit ***https://events.tdworld.com/2023/registration.***

Note: All event details are current as of press time and are subject to change. TDW

EXHIBITOR'S LIST

EXHIBITOR	BOOTH #
AEM	209
AFL	424
Almetek Industries, Inc.	507
AP Sensing Americas	525
ARCOS	703
Asymmetric Unmanned, LLC.	318
Bosch Security Systems, LLC	410
CivilGrid	406
Cleaveland / Price Inc.	425
Creative Composites Group	606
Delphire Inc.	517
E Source	412
Eco Electrical Systems	413
Electrical Grid Monitoring (EGM) Inc.	701
Electromark	610
Emerald Transformer	707
Energy Experts International	519
ENERZA, Inc.	620
Epoch Solutions Group, LLC.	508
Fulcrum	503
GeoSpatial Innovations, Inc.	320
GeoStabilization International	302
GlenGuard	418
Gyro-Stabilized Systems	708
HV TECHNOLOGIES, Inc.	524
IEEE Standards Association	526
IFS	624
Indji Systems	721
Infrared Inspection Systems	319
Jordan Transformer	705
Landis+Gyr	409
LiveEO	308
Logic20/20 Inc.	324
MAPSearch	625
Megger	510
Micatu, Inc.	514
NACFE (North American Council for Freight Efficiency)	419
Noteworthy AI	709
Ohio Gratings, Inc.	220
Overstory	609
Permacast Walls	725
Phoenix Contact	403
PLP	307
Portadam, Inc.	408
Prisma Photonics	325
PRG	411
Radius Recycling	416
Safegrid Oy	420
Safeguard Equipment, Inc.	402
Safety Management Group (SMG)	518
SecuControl, Inc.	621
Smart Grid Solutions	720
SR Diversified, LLC	608
Systems With Intelligence Inc.	603
Technosylva	521
Trident Industries	602
Tri-State Drilling, LLC	509
Uticom Systems, Inc	724

Montana Utility Manages Raven Roosts on Towers

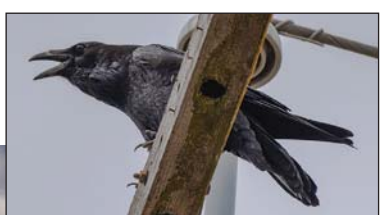
NorthWestern Energy shares three strategies to reduce faults from the growing raven population.

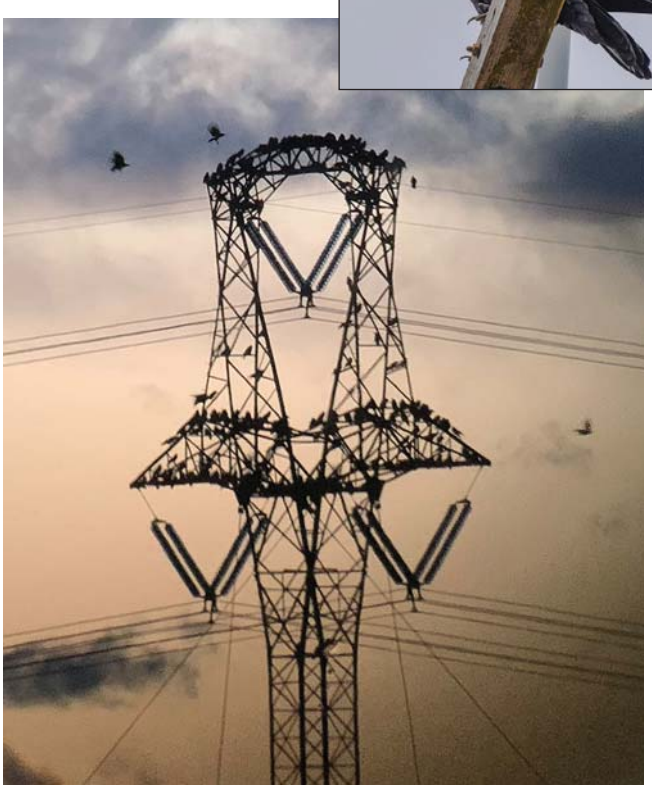
By **JAMES S. LUECK** and **MARCO RESTANI**, NorthWestern Energy

Parallel single-circuit 500-kV transmission lines in central Montana — jointly owned by NorthWestern Energy, Puget Sound Energy, Portland General Electric, Avista Corp. and PacificCorp — are an integral part of the Northwest power grid. These lines have experienced numerous zero-sequence, single-phase line-to-ground (S-L-G) faults of unknown origin since being energized in 1984. Research conducted along the lines from 2002 to 2010 determined many faults were likely caused by raptor streamers. Streamers are fluid feces forcefully ejected by raptors spanning many feet in length that are conductive and can bridge the air gap between conductors and towers.

More recent S-L-G faults on the 500-kV transmission lines from January 2017 to March 2017 differed from past events because they were sustained — relay reclose unsuccessful — and, therefore, of much greater concern and consequence to the service and stability of the grid. Additionally, on three occasions in 2017, both parallel lines faulted simultaneously. Initially, the faults were identified through the energy management system (EMS) by supervisory control and data acquisition (SCADA) processes. Further information obtained from NorthWestern Energy's grid operations enabled the identification of the specific towers where the faults occurred. When crews visited the towers to investigate the sustained faults of unknown origin, they found insulators heavily contaminated with bird droppings.

The discovery of these fouled insulators confirmed the recent faults were not caused by raptor streamers. Moreover, the faults also occurred in late winter and early spring during dense fog or misty precipitation. These local weather conditions appeared to act as a catalyst, which suggested insulation breakdown as the reason for the faults rather than air-gap compromise caused by raptor streamers. Examination of event oscillograph outputs reflected that raptor streamer faults occurred indiscriminately across the voltage waveform, whereas contaminated insulator faults occurred at or near peak voltage. The outputs also revealed a distinct voltage rise (~35%) for approximately two cycles due to neutral shift on the un-faulted phases of the same circuit, as well as a similar rise (~20%) on the nearest adjacent circuit phase, which, if similarly contaminated with droppings, helped to facilitate the simultaneous fault.





Common ravens roosting on 500kV towers. Photo by NorthWestern Energy. (Upper right) Common Raven. Supercaliphotolistic / iStock /Getty Images Plus.

Initial Strategies

NorthWestern Energy's attempts to reduce faults from the accumulation of bird droppings over the last few years have involved several strategies.

First, tower crews cleaned contaminated insulators discovered during ground inspections following faults (that is, retroactive cleaning) and during routine transmission line maintenance flights (that is, preemptive cleaning). Depending on site accessibility, crews accessed towers by either climbing or using a bucket truck and cleaned insulators by hand or with a power washer, respectively. Crews could clean a maximum of only one tower per day when climbing and cleaning with hand brushes and two towers to three towers per day when using a bucket truck and pneumatic power sprayer. The sprayer was loaded with either

pulverized corn cobs or walnut shells, media that effectively removed droppings without damaging the glass insulators. In late winter 2020, a helicopter-mounted, high-pressure water sprayer enabled crews to clean eight towers per day.

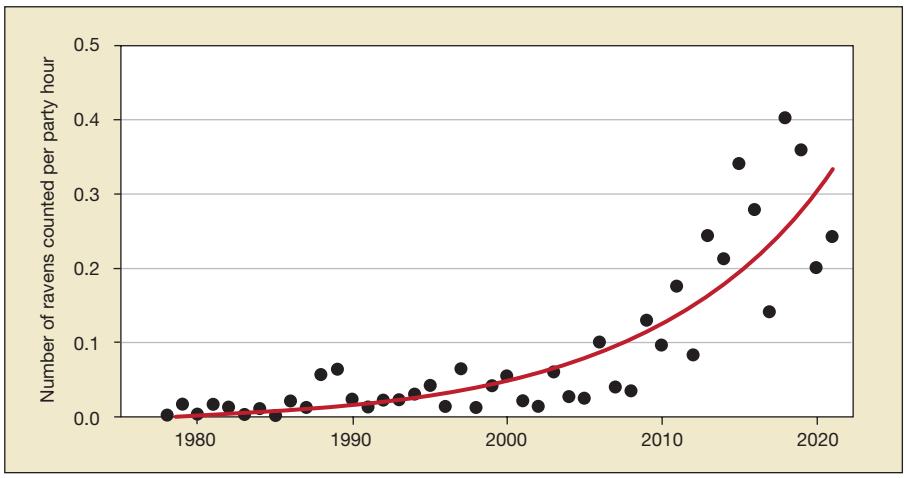
Second, tower crews replaced standard glass insulators with silicon-coated insulators on towers with the heaviest accumulation of droppings. Silicon-coated insulators historically have been used in marine environments to mitigate faults derived from salt accumulation and coastal fog. NorthWestern Energy believed coated insulators might also protect against contamination from bird droppings because of their physical properties: hydrophobic, higher-flashover voltage ratings and longer current leakage paths.

Identifying The Source

Curiously, the accumulation of bird droppings and number of non-streamer faults decreased during the summer of 2017, so the identity of the avian perpetrators remained unknown until late fall. In November 2017, while Northwestern Energy crews were finishing insulator washing late one afternoon as the sun began to set, hundreds of common ravens arrived from all directions to roost on towers for the evening. Finally, the utility had identified the birds responsible for causing the recent faults.

During the non-breeding season, ravens gather in groups to roost at night on trees, cliffs and anthropogenic structures such as towers, buildings and bridges. The single-night number of ravens at an individual roost can be impressive, approaching or exceeding 2000 birds. Raven roosts are typically seasonal, forming

500-kV insulators heavily contaminated with bird droppings and pellets. Photo by NorthWestern Energy.



The number of common ravens observed during the Billings Christmas Bird Count has grown exponentially. The graph uses data from the Audubon Society. Graph by NorthWestern Energy.

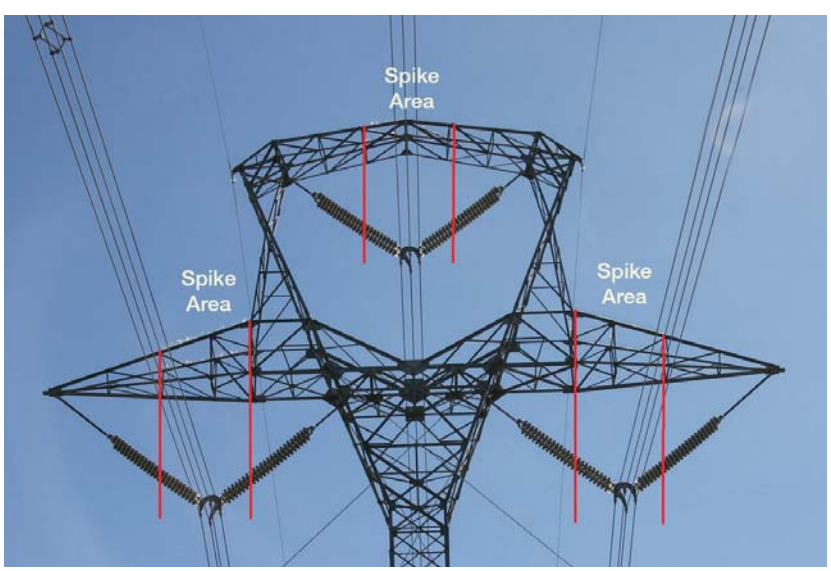
in the fall and disappearing in late spring as individuals disperse to breeding territories. This pattern of tower use coincided with the occurrence of NorthWestern Energy's recent troublesome faults: most in the winter, fewest in the summer.

The size of the roosts on the 500-kV lines varied and consisted of two towers to 10 towers, depending on the location. Over the years, NorthWestern Energy has found seven large roosts on its transmission lines, spanning 110 miles (177 km) in central Montana.

A Third Strategy

After determining roosting ravens were the source of the problem, NorthWestern Energy's third strategy was to install stainless-steel, avian perch deterrents to the lattice above insulators on towers within roosts. Spikes were approximately 6 inches (152 mm) in length and ordered in coiled strips of 100 ft (30 m). Spike strips were attached with screws to various-diameter polyvinyl chloride conduits, custom cut to fit tower members of differing sizes and configurations. Crews used metal zip ties to attach conduits to towers. From June 2018 to October 2019, crews installed deterrents on an average of four towers per day. To date, they have installed deterrents on 99 towers.

Crews installed and positioned perch deterrents to protect approximately half of each insulator string — a length of 126.5 inches (3213 mm) — from accumulating droppings. These arrangements effectively broke the leakage path of current responsible for faults and represented the utility's working 500-kV hot-line gap settings of 50 inches to 55 inches (1270 mm to 1397 mm), adjusted for worksite elevation. By design, deterrents limited but did not completely exclude ravens from roosting on specific towers. Somewhat counterintuitively, NorthWestern Energy's goal was to keep ravens on the towers they were using to discourage them from spreading to new towers, which would have created additional fault risks and mitigation efforts.



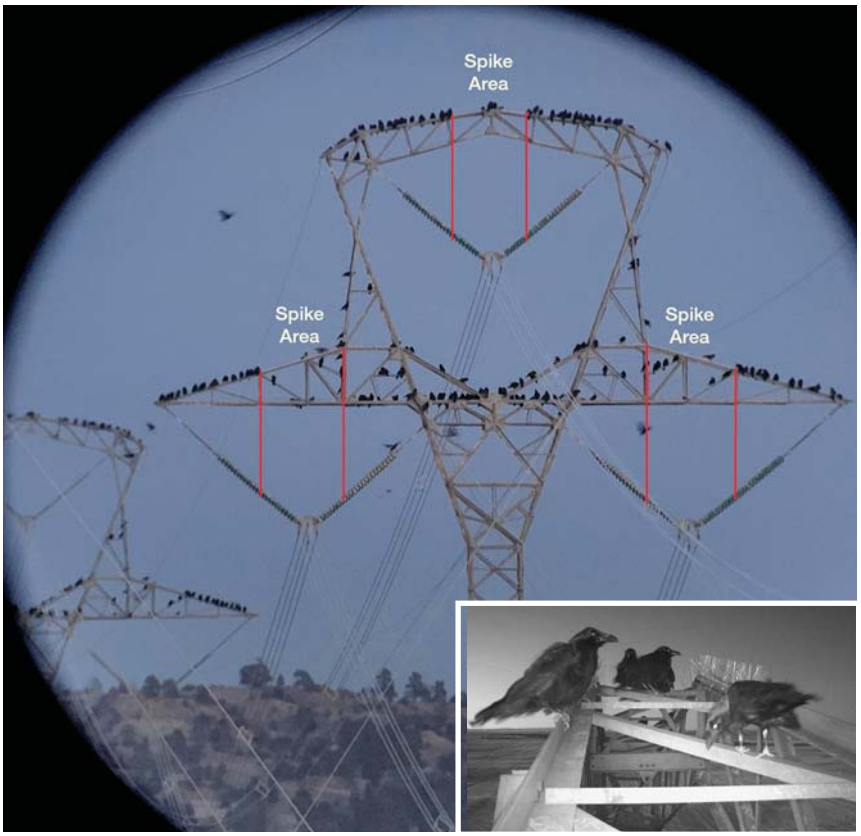
Protecting approximately one half of each insulator string with perch deterrents. Photo by NorthWestern Energy.

Perch deterrents installed on a 500kV tower. Photo by NorthWestern Energy.

The three-pronged approach of washing insulators, installing perch deterrents and replacing glass with silicon-coated insulators has proven highly successful. The number of sustained faults declined from an average of 13 per year from 2016 to 2018 to an average of six faults per year from 2019 to 2021, and then dropped to only one fault in 2022. Although wind-dispersed raven droppings eventually contaminated the entire length of insulator strings on towers with perch deterrents during the winter, the rate of accumulation greatly decreased, reducing the time and effort needed for washing. Seasonal rains and declining roost sizes kept insulators free of contamination from spring to fall.

Why Ravens Now?

The 500-kV transmission lines have been in service for 40 years, so why did ravens only recently begin flocking to the towers for nocturnal roosting? Long-term data from the North American Breeding Bird Survey by the U.S. Geological Survey (USGS)



Protecting approximately one half of each insulator string with perch deterrents. (Inset image) Night capture of ravens on tower. Photos courtesy of NorthWestern Energy.

show common raven abundance in central Montana during summer has significantly increased the last 10 years to 15 years. A combination of ecological factors at the landscape scale has likely facilitated raven population growth. For example, ravens are generalist feeders and readily exploit human-provided food subsidies such as cereal grains, landfill garbage and vehicle-killed deer, all of which have increased as native habitats have been converted by varying land uses.

Data from the National Audubon Society's Christmas Bird Count show the winter raven population in central Montana is exhibiting exponential growth. This trend was statistically associated with the increasing number of faults annually from October to April before NorthWestern Energy took corrective actions. Therefore, continuing challenges to the operation of the 500-kV transmission lines should be expected. Existing roosts have the potential to become larger and spread onto previously unused towers as the wintering population increases. Ravens commute daily 15.5 miles to 34 miles (25 km to 55 km) one way to

Continued on page 30

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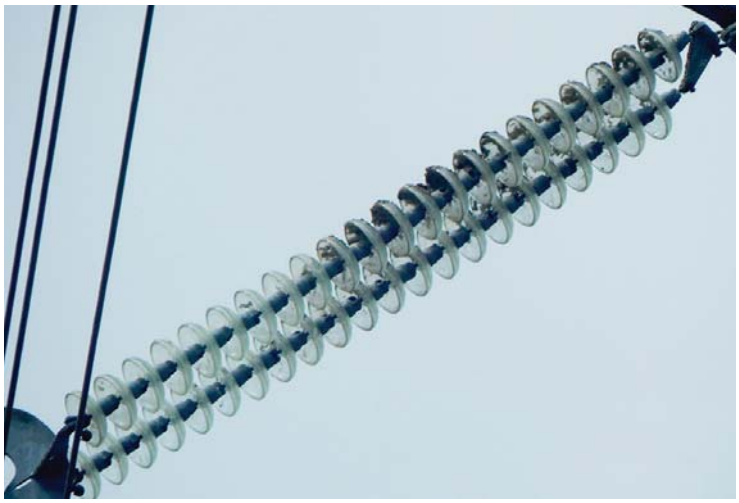


Protected (left) and unprotected (right) portions of insulator strings showing the difference in accumulated droppings. Photo by NorthWestern Energy.

nocturnal roosts in other regions of the U.S. and Europe, so roosts along the transmission lines probably attract ravens from a wide geographic area in central Montana. Moreover, seasonal movements of ravens also play a role in roost formation, where individuals can migrate over 300 miles (483) from their summer breeding ranges to food-rich areas in the winter.

Strategies To Avoid

Over the years, NorthWestern Energy has considered but ultimately decided against hazing and shooting to reduce the size of raven roosts because these methods can illicit strong negative reactions from the public. More importantly, these methods have the additional potential drawback of dispersing ravens from established roosts to other towers, thereby spreading the risk of contamination and increasing the possibility for faults over a wider area.

The utility has found success with its three-pronged approach of washing insulators, installing perch deterrents and replacing glass with silicon-coated insulators. TDW

JAMES S. LUECK (*James.Lueck@northwestern.com*) has worked for NorthWestern Energy within the electric transmission department since 1975. He is currently the advisor for the 500-kV electric transmission operations. He holds an associate degree in electrical engineering technology.

MARCO RESTANI (*Marco.Restani@northwestern.com*) is a wildlife biologist for NorthWestern Energy. He is also professor emeritus at St. Cloud State University. His research and management program focuses on raptors and ravens. He holds a bachelor's degree from the University of Montana, master's degree from Montana State University, and a Ph.D. degree from Utah State University.

Editor's note: More information about NorthWestern Energy's efforts to reduce faults caused by raven roosts can be found in a peer-reviewed, scientific paper published in the journal *Human-Wildlife Interactions* (Restani and Lueck 2020, 14:451–460, *https://digitalcommons.usu.edu/hwi/vol14/iss3/15/*).

A California wind farm generates renewable energy.
Photo 13636945 © Biserko | Dreamstime.com

EVs as Grid Assets

A California electricity provider and its partners are creating a blueprint for other utilities to reduce overall grid strain.

By **BRETT WILEY**, East Bay Community Energy, and **JOSEPH VELLONE**, ev.energy

The summer of 2023 was one for the books. From Florida to California, states across the U.S. faced all-time high temperatures. According to Axios, Texas, Tennessee, Alabama, Mississippi, North Carolina, South Carolina and Oregon all had record-breaking heat waves in July 2023 — boosting energy demand from air conditioners, exacerbating already dire drought conditions and contributing to the frequency and intensity of wildfires.

In this era of a new normal — where the electric utility industry will likely continue experiencing unprecedented levels of strain — managed electric vehicle (EV) charging software can help to turn the 26 million EVs hitting U.S. roads by 2030, as projected by the Edison Electric Institute, into assets for the grid. As a result, a growing number of utilities and energy providers are investing in EV solutions that support a clean energy future, with a focus on maximizing the use of renewable energy resources while saving customers money.

Such projects can be replicated across the U.S. to future-proof even the most fragile grids — which is exactly what MCE, a not-for-profit electricity provider, has been doing alongside its partners. Beyond installing more EV charging stations and working to lower the up-front cost to purchase a clean vehicle, MCE knows firsthand that the key to unlocking greater synergy between EVs and the grid is incentivizing smart charging programs, which translates into a win-win-win: for the electric utility industry, customers and the grid.

Pathway To Adoption

As a community-owned utility, MCE offers customers 60% to 100% renewable electricity, while investing in local clean energy programs. More than 1.5 million Bay Area homes and businesses participate in MCE programs that increase access to clean energy technologies and improve their quality of life while also progressing the global energy transition to meet climate goals.

The utility launched its MCE Sync program in 2021 as an opportunity to promote EV adoption in the Bay Area, while simultaneously increasing the use of renewable energy and improving grid reliability. As part of the program, a free mobile app provides customers a hassle-free way to charge EVs during off-peak hours and save money without any special hardware. With inflation surging and high gas prices, the utility sought to deploy an innovative technology that would enable customers to save as much money as possible from going electric.

The app-based load-shifting program was developed in partnership with ev.energy, a cloud-based platform that optimizes EV charging with a focus on grid resiliency, decarbonization and social equity. ev.energy's platform charges EVs with the lowest-cost, greenest electricity available while always ensuring the customer's vehicle is charged by the time they specify. ev.energy has partnered with numerous utilities and energy providers across North America to offer similar programs aligning EV charging with grid constraints.

Incentivizing smart charging programs could be one key to protecting grids from too much demand from EVs at the wrong times.

The transition to time-of-use (TOU) rates in California is viewed as one of the major pathways for reducing grid strain and increasing decarbonization. However, an analysis of the impact of TOU rates shows off-peak hours are not fully aligned to when renewable energy is being distributed onto the grid. In fact, the overnight hours when many customers charge tend to be some of the dirtiest times to consume electricity. The MCE Sync app seeks to address this by not only shifting load out of peak hours but shifting it into hours with high renewable-energy generation.

The app launched as a six-month pilot with 232 enrolled participants. The plan was to pilot the program and then scale it to additional customers using learnings from the initial cohort. The program's ability to be hardware-agnostic (offering customers the option to enroll by either a connected vehicle or charger) and equity-conscious (with special solutions for low- to moderate-income customers) created a unique space to include a diverse array of customers. The pilot program's goals were as follows:

- Reduce customer energy bills by automatically charging EVs off-peak.
- Support grid resiliency by reducing demand during the 4 p.m. to 9 p.m. window.
- Nudge customers toward low-carbon charging and automatically align EV load with renewable energy generation in real time.

MCE Sync participants were auto-enrolled into the ev.energy demand response market as well, which triggered additional events that increased the benefit to customers. Photo by ev.energy.

Pilot Results

MCE Sync enabled drivers to easily take advantage of off-peak rates when electricity was less expensive. For example, to fully charge a Chevy Bolt with 100% renewable energy on the EV2 off-peak rate cost $2.30/eGallon. This compares to the average cost of gasoline in California at over $5.50/gallon. For reference, the last time a gallon of gas in California was under $2.05 was January 2005.

In addition to helping drivers save money, the app aligned EV charging with low-carbon electricity, supported grid reliability by avoiding charging during peak times and charged vehicles fully by the time drivers needed them.

The first customer cohort produced successful results, shifting 93% of EV electricity usage away from the 4 p.m. to 9 p.m. peak, reducing carbon intensity by 55% on average and saving EV2 rate customers around $12/month before event-based incentives. On a household basis, the average load reduction during the 4 p.m. to 9 p.m. peak was 12.4%, with solar customers having an average of 21.9% peak load reduction and non-solar customers 3.6%.

In addition, participants were encouraged to take advantage of low-carbon events when solar energy generation was particularly high. Customers got push notifications on their mobile phones 24 hours in advance of a low-carbon event. The notification nudged them to avoid charging overnight and instead plug in during daytime hours, if possible, to charge with abundant solar. During the pilot period, 90% of customers participated in at least one event, enabling MCE Sync to shift approximately 50% of the overnight load into daytime windows with up to 80% lower-carbon electricity.

Key Learnings

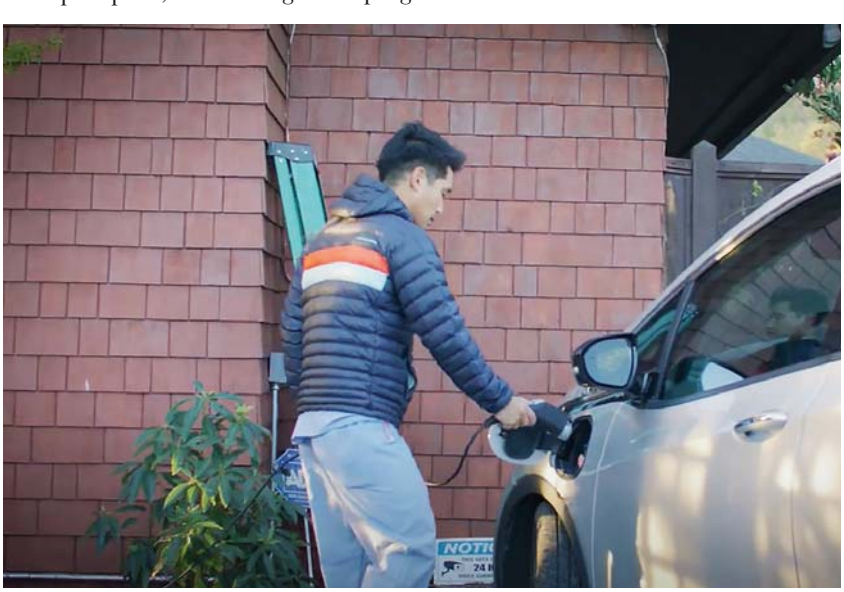
The pilot program provided insight into new strategies for electric service providers and the EV charging market as a whole.

Electricity providers should consider these learnings:

- TOU rates alone are not enough to successfully address grid reliability and carbon concerns. The app was able to smooth out rebound timer peaks and align with day-ahead emissions.
- An emphasis on equity. Pilots should represent the customer service area so they scale effectively into programs. Provide locally relevant messaging to participants with trusted partners, translate content for non- English speaking audiences, and add incentives for low-income customers.
- New programs should align with existing programs. MCE Sync participants were auto-enrolled by ev.energy into MCE's demand response market as well, which triggered additional events that increased the benefit to customers.

The EV charging market should consider these learnings:

- Nudges work. Combining behavioral economics with active load control provides the best load-shifting results compared to each program on its own.
- Vehicle application programming interfaces (APIs) should be open to all. Auto manufacturers should make their telematics platforms reliable and open to enable customers to enroll in vehicle-to-grid integration programs.



Increasing customer adoption of EVs in the residential as well as commercial sector is going to require future-proofing the power grid and changing customer behavior.

- Third-party evaluation is necessary. Third-party evaluation can help to quantify the impacts and distill lessons from pilot phases into strategies for program enhancement and scaling.

Based on these learnings, MCE and ev.energy determined that increasing customer incentives and education could further reduce grid strain by emphasizing the benefits of the charging program. When drivers better understand the benefits, they are more likely to schedule their charging times outside of peak hours and may even change their behavior to receive greater financial incentives. Additionally, aligning charging with rooftop solar generation could further reduce customer bills.

The Bottom Line

MCE and ev.energy announced the expansion of the MCE Sync program in June 2022. The expanded program continues to offer incentives that reduce the cost of EV charging at home and increases community resiliency with a focus on low- to moderate-income populations. MCE's goal is to have around 4.000 EV drivers enrolled in its program by May 2023.

MCE Sync now offers additional benefits, including EV charging aligned with home rooftop solar generation and grid solar availability, grid-reliability incentive payments worth up to $10/month and customer education about smarter charging strategies.

The EV market is growing approximately 40% to 80% each year, according to Virta Global. With EVs expected to comprise one-half of U.S. auto sales by 2030, utilities need to treat EVs like they would treat any other distributed energy resource and find ways to best manage the energy load. That is the only way to nip grid strain in the bud to future-proof energy systems now.

And with ZEV states leading to limit new car sales to EV-only after 2035, the time to start planning for the massive wave of EVs connecting to grids is now. If utilities can make better use of the distribution, they can eliminate the challenges of strain and usage. TDW

BRETT WILEY (*bwiley@ebce.org*) managed MCE's EV charging infrastructure, EV rebate, managed home EV charging and fleet electrification programs for nearly five years. He currently manages East Bay Community Energy's residential electric mobility programs. Some of his other prior work experiences were at Groundswell, Sierra Club, National Park Service, and The White House Council on Environmental Quality. Wiley received his B.S. in Biology from Truman State University, his MPA in Energy & Sustainable Development from Indiana University's School of Public and Environmental Affairs (SPEA), and his Certificate in Social Entrepreneurship from SPEA and Indiana University's Kelley School of Business. He is also an Adjunct Professor at Presidio Graduate School.

JOSEPH VELLONE (*joseph.vellone@ev.energy*) is head of North America at ev.energy. In this role, he partners with energy providers such as MCE and National Grid, manufacturers such as Volkswagen and Siemens, and charging networks such as ChargePoint and Volta to deliver greener, cheaper, grid-friendly EV charging to drivers across the U.S. and Canada. He previously spent five years with the Boston Consulting Group's energy and environment practice. He holds a master's degree in energy economics from the London School of Economics and a bachelor's degree in public policy from Princeton University.

Learning from the Wisdom of Our Ancestors

Understanding traditional land and vegetation management practices can shape modern strategies.

By **JEREMY HAYWARD**, Redding Rancheria Economic Development Corporation

For thousands of years, Indigenous people around the world have been living sustainably and in harmony with the environment. They have developed unique traditional land and vegetation management practices that have been passed down through generations. This category of knowledge, referred to as Traditional Ecological Knowledge (TEK), promotes the health and vitality of the land, plants and animals in each of their respective geographies.

The Indigenous groups in North America have a rich history of traditional land and vegetation management practices allowing them to live sustainably for thousands of years. For example, the Redding Rancheria comprises three neighboring tribes: the Wintu, Pitt River and Yana people. These tribes are known to use traditional vegetation management practices to care for the land.

The tribes that make up the Redding Rancheria have a long history dating back more than 10,000 years. For centuries, these tribes managed the forests with an understanding of the need to promote healthy growth of new resources. Also, they strive to reduce the abundant fuels that could lead to fires, which could cause damage to the soils and vegetation the tribes rely on for food and other resources. It's important to the people, the animals, insects, and all life to properly care for the land.

The Carr Fire inflicted damage to the outer parts of Redding, California. Photo courtesy of Redding Rancheria Economic Development Corporation.

Managing the Land

After European settlers made their way west to California, the tribes' traditional methods of managing the forests were halted. Most of the forest lands were taken by the government and for subsequent decades, mismanaged by government agencies and timber companies. Restoring these forests to a state where they can use traditional vegetation management practices will require a lot of work. The tribes need to reduce the fuel that has been building up for centuries to safely burn without destroying the soil, trees, vegetation and habitat for all life in these forests.

Despite the challenges faced by the people of Redding Rancheria, the tribe has worked to preserve its cultural heritage and traditional practices. Today, the tribe is recognized by the federal government as a sovereign nation.

The traditional land and vegetation management practices of these tribes have been developed over centuries and are essential for the sustainability of the land and its resources. These practices are deeply rooted in the culture and traditions of the tribes and are an essential part of the tribes' cultural heritage. The tribe's traditional practices provide important

lessons for modern land management strategies and can help to promote a healthier and more sustainable environment for future generations.

Strategies for Sustainability

As a proud member of the Redding Rancheria Tribe, I am honored to share our traditional land and vegetation management practices that have allowed us to live sustainably in the region for thousands of years. Our practices have been developed over centuries to promote the health and vitality of the land, plants and animals in the region. These practices have been passed down through generations and have been a cornerstone of our culture and way of life.

One of the most important land and vegetation management practices used by our people was the use of controlled burns. Controlled burns were used to clear the land of dead brush and other debris, which helped to reduce the risk of wildfires. This practice also promoted the growth of certain plants, such as acorns, which were an important food source for the tribe. Our people understood that controlled burns were a natural way to maintain the ecosystem and promote plant growth while also reducing the risk of larger devasting wildfires.

Selective harvesting was another important land and vegetation management practice used by our people. Selective harvesting involved only harvesting plants that were ripe and ready for harvest, leaving younger plants to grow and mature. This practice helped to ensure that the large variety of plants in the region remained healthy and vibrant. By selectively harvesting plants, our

Shasta Mountain offers recreational biking opportunities. Photo courtesy of Redding Rancheria Economic Development Corporation.

This forest surrounds the outskirts of Mount Shasta, California. Photo courtesy of Redding Rancheria Economic Development Corporation.

A scenic overlook includes a view of Black Butte Mountain. Photo courtesy of Redding Rancheria Economic Development Corporation.

people were able to ensure that the land was not over-harvested and that the plants could continue to grow and thrive.

Our people also had, and have today, a deep respect for the natural resources in the region. The tribe used natural resources, such as water and timber, in a sustainable manner, only taking what was needed and leaving enough for future generations. This practice helped to ensure that the region remained healthy and sustainable.

Our people understood that taking care of the land and its resources was critical for our survival and the survival of our future generations. Growing up we were always taught to make decisions for the prosperity and health of our seventh generation. Today we are still making decisions to ensure we preserve the forests for our own seventh generation.

These traditional land and vegetation management practices have been passed down through generations and have helped to ensure the sustainability of the land and the health of the ecosystem. They have also been a cornerstone of our culture and way of life. Our people have always understood the importance of living in harmony with the land and have worked tirelessly to maintain this balance.

A Global Perspective

Our traditional land and vegetation management practices are not, however, unique. Many other Indigenous people around the world have similar practices that are designed to promote the health and vitality of the land and the environment.

The Sámi people of Scandinavia have a long history of land and vegetation management practices. These practices include the use of controlled grazing and selective harvesting, as well as the management of wildfires using traditional burning practices. The Sámi people have also developed a deep understanding of the ecology of the region and the importance of maintaining the health of the ecosystem.

The Karen people of Thailand also have traditional land and vegetation management practices that have been developed over centuries. These practices include rotational farming, where fields are left fallow for several years to allow the land to recover, and the use of natural fertilizers, such as animal manure. The Karen people also practice controlled burning, which helps to clear the land of dead vegetation and promotes the growth of new vegetation.

The Haudenosaunee Confederacy, also known as the Iroquois Confederacy, is an Indigenous confederacy made up of several tribes in the northeastern United States and southeastern Canada. The Haudenosaunee have a long history of sustainable land management practices, including the use of controlled burning to promote the growth of certain plant species and the use of fish weirs to manage fish populations in rivers and streams.

The Indigenous people of the Amazon rainforest in South America use slash-and-burn agriculture to create fertile land for farming. Unlike the widespread current clear cutting of forests in the Amazon region, this traditional practice is done in a sustainable way. Only a small portion of the forest is cleared at any given time and the land is left fallow for several years to allow the forest to recover.

The Maori people of New Zealand also have traditional land and vegetation management practices that have been developed over centuries. These practices include the use of controlled

burns to manage forests, the planting of certain trees to promote soil health and the use of traditional fish traps to manage fish populations in rivers and streams.

Benefits of Traditional Practices

Traditional land and vegetation management practices, such as controlled burns, help to reduce the risk of large-scale wildfires by reducing the amount of flammable vegetation and promoting the growth of certain plant species. These practices have been used for centuries by indigenous people and have been shown to be effective in preventing wildfires.

The Sierra Mountain range is shown from the Monmouth side. Photo courtesy of Redding Rancheria Economic Development Corporation.

In addition, the practices help to promote biodiversity by ensuring that the land is healthy and vibrant, which in turn provides habitat for a range of animal species. By managing the land and vegetation in a sustainable manner, these practices help to create a diverse and resilient ecosystem.

In addition, they help with cultural preservation. Traditional land and vegetation management practices are an important part of many Indigenous cultures and are essential for preserving cultural heritage. By reviving these practices, we can ensure that cultural traditions and knowledge are preserved for future generations.

Another key benefit is sustainable resource use. Traditional land and vegetation management practices promote sustainable resource use by ensuring that natural resources are used in a responsible and sustainable manner, leaving enough for future generations. These practices can help to ensure the long-term sustainability of our natural resources.

The revival of these, and other traditional land and vegetation management practices, could be beneficial for environmental and fire mitigation purposes. These practices have been used for centuries by indigenous people and have been shown to be effective in promoting a healthy and sustainable environment.

Fire devastated the area around Whiskey Town in Shasta County. Photo courtesy of Redding Rancheria Economic Development Corporation

To revive these practices, we must first acknowledge the importance of traditional knowledge and practices. We must recognize the contributions of Indigenous people to the development of sustainable land management practices and work to incorporate these practices into modern land management strategies where possible.

Education is also essential in reviving traditional land and vegetation management practices. We must work to ensure that young people are educated about the importance of these practices and the role they play in creating a healthy and sustainable environment.

Collaboration between indigenous communities and land managers is also critical. This includes major landowners and governments, along with utility companies who manage land and vegetation on or near generation, transmission and distribution facilities. By working together, we can create land management strategies that incorporate traditional knowledge and practices, while also meeting our modern and urgent environmental and fire mitigation needs.

Traditional land and vegetation management practices have been used by Indigenous people for centuries and have proven to be effective in promoting a healthy and sustainable environment. By incorporating these practices into modern land and vegetation management strategies, we can reduce the risk of wildfires, promote biodiversity, preserve cultural heritage and ensure the long-term sustainability of our natural resources. As we face increasing environmental challenges, we must learn from the wisdom and knowledge of Indigenous people and work collaboratively to create a healthier and more sustainable world for future generations. TDW

JEREMY HAYWARD (*jeremy.hayward@win-river.com*) is the president of Redding Rancheria Economic Development Corporation and a director of Essential Vegetation Management Services, LLC, a tribal-owned business that supports utilities, governmental entities, and commercial businesses that require critical vegetation services to mitigate fire risks.

ELECTRIC UTILITY OPERATIONS

SEPTEMBER 2023

tdworld.com/electric-utility-operations

OUR SEPTEMBER FEATURED LINEWORKER

Lesandro Carranza

Southern California Edison and IBEW Local 47

- Born in Southern California and has one brother.
- Married and has 15-year-old and 21-year-old daughters.
- Enjoys riding motorcycles like his Harley and dirt bikes and playing in a softball league with his fellow lineworkers.
- Participates in Lineman's Rodeos.
- Plans to work on future heavy terrain projects, which will involve coordinating with helicopters for pole setting and reconductor and human external cargo (HEC).

Early Years

When I got out of the Marine Corps, I was looking for a good place to work. I knew a utility job would be a stable job, so I applied and got hired, not knowing anyone who worked at the company. When I was first hired on, I worked as a meter reader, and now I'm an electrical crew foreman.

Day in the Life

As a foreman, I'm in charge of a line construction crew with two lineworkers, an apprentice and a groundman for the Tulare District. My day-to-day job is to change out poles, transformers and wire. I also do underground transformers and various types of cable. I also enjoy taking on large projects such as circuit reconductors, heavy terrain work involving pole and wire replacements with helicopters and HEC jobs. Another thing I enjoy doing is emergency work such as car hit poles, wire downs, bad cable and other such work. Restoring customers power is a very satisfying and rewarding part of my job.

Lessandro Carrranza is focusing on day-to-day line work like pole changeouts and equipment upgrades as well as emergency work in his district.

Safety Lesson

In my trade, I hear about guys getting hurt, sometimes in a split moment and sometimes from things beyond their control. I try to do what I can to keep my crew and myself safe each and every day no matter what I'm doing. Safety is of the utmost importance.

Memorable Storm

I have worked fires, floods, snowstorms and other types of storms. The most memorable one was Hurricane Sandy in New York in 2012. We were flown out by the Air Force in huge planes called C5s with our bucket trucks, line trucks and our equipment in the plane with us. We worked in northern New York and New Jersey. I worked in the town of Ramsey where people were out of power for weeks before we got there. The devastation was catastrophic. We were there for three weeks, and when we finally got the power restored to the area, the people where so grateful. I'll never forget what a difference you can make by doing something as small as restoring their power.

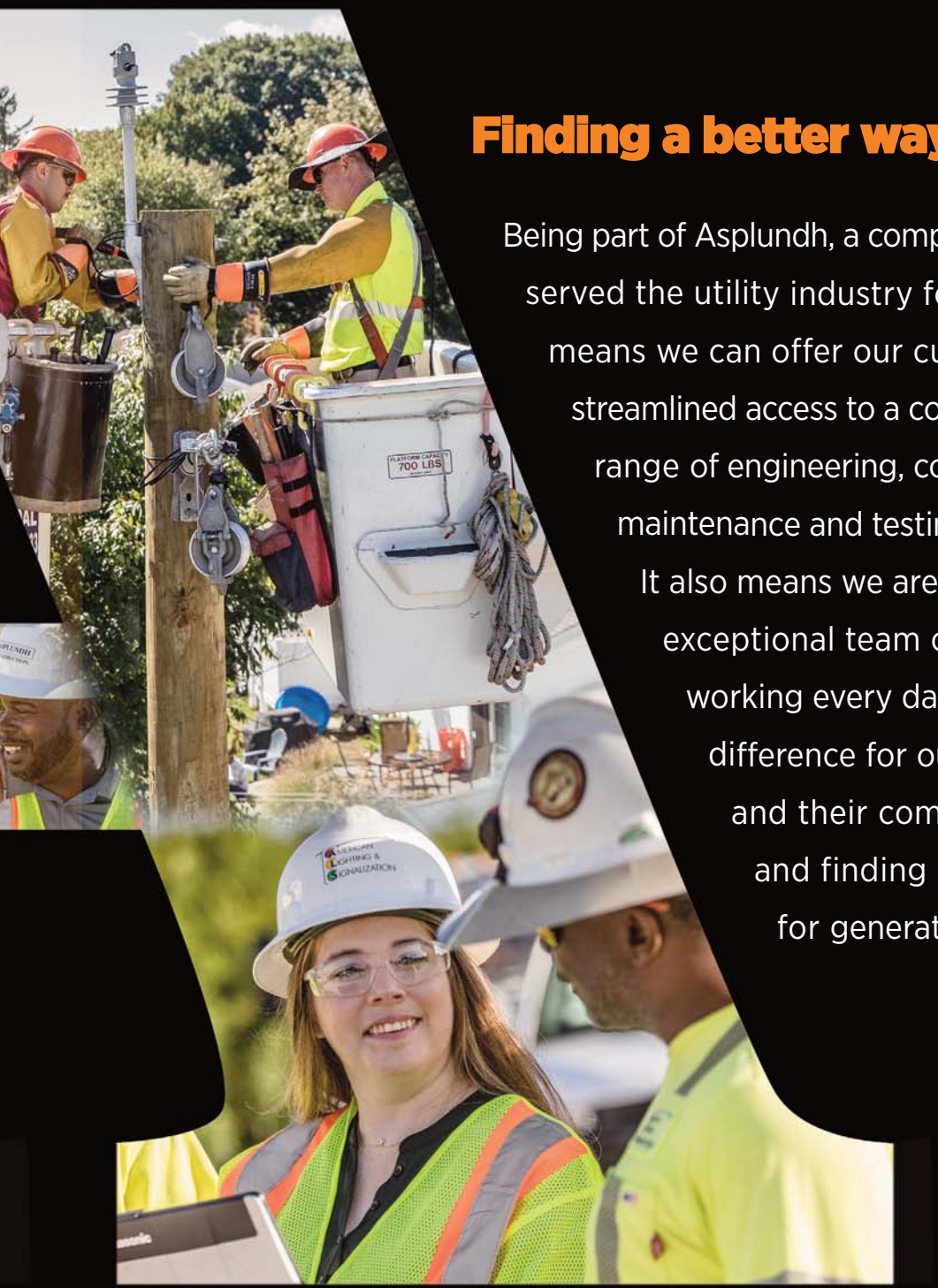
Tools and Technology

I can't live without my climbing gear like my hooks and belt. In today's day and age, we also use helicopters to make our job easier. We have hot arm trucks and a lot of battery tools, which we didn't have back in the day. At one time, everything was done with hand tools and crimpers. I think the new technology helps us to save our bodies, have longer careers and not be so beat up when we make it to retirement.

Future Plans

I love what I do and wouldn't change my path for the world. I don't see myself doing anything else and hope to retire as a union lineman and foreman someday at a ripe old age. TDW

Editor's Note: If you are interested in being profiled in our monthly Lifeline department or know of a journeyman lineworker who would be a good candidate, email *T&D World* Field Editor Amy Fischbach at *amyfischbach@gmail.com*.



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OG&E crews repaired damage and restored power in Shawnee, Oklahoma, after tornadoes, large hail and damaging winds with 70 mph wind gusts moved through the area.

Lineworkers Untwist Tornado's Damage

The second part of our Storm Strategies series focuses on Oklahoma Gas & Electric's award-winning restoration efforts.

By **AMY FISCHBACH**, Field Editor

A tornado, measuring more than a mile wide, spun through Oklahoma after midnight on April 20, inflicting damage and destruction to the Oklahoma Gas & Electric (OG&E) service territory. In response, the electric company mobilized nearly 3,000 people to work 24/7 to restore power.

In the aftermath of the twister, which hit Norman and Shawnee, Oklahoma, crews cleared debris, damaged structures and downed trees. The tornado splintered and knocked down more than 600 power poles and destroyed 110 transmission structures, crossarms and other equipment attached to the poles.

At the peak of the storm, OG&E reported 23,000 outages, but the crews worked around the clock to restore power and energize customers. Due to the tireless work of the line crews and support teams, power was restored to 70 percent of the customers within 72 hours and to all the impacted customers in less than a week. Here's a look at the work behind the restoration effort in April 2023.

Inspecting Damage

Following the tornado, crews relied upon both aerial and ground patrols to assess damage and destruction to OG&E's infrastructure, says Aaron Cooper, OG&E manager of corporate communications.

"We used different interactive assessment tools to gather real-time data on damage," Cooper says. "The assessors and troubleshooters captured data while evaluating the damage. This data enabled the operations leadership to quickly allocate appropriate resources."

With this information, the supply chain team could then start to source and deliver the required materials and supplies, and the vegetation management team could dispatch vegetation crews to clear trees and debris. The engineering team also used the data for design purposes. Additionally, OG&E used Google Earth to evaluate site accessibility and traffic control requirements.

"Due to the amount of residential damage, the work areas were very congested and required constant engagement by all," Cooper says.

To further expedite restoration, OG&E launched a new application to manage storms. Teams can document issues in real time and in one centralized location with the geospatial tool, which identified customers unable to receive power during the assessment process.

"With the application, teams uploaded images of damaged equipment and avoided the need for multiple truck rolls," Cooper says. "This method allowed us to more accurately plan for expected service work during restoration and reduced calls to our customer service center."

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OG&E crews rebuilding Shawnee's electric infrastructure following April 19's damaging winds and tornadoes.

2023 Oklahoma Tornado: By the Numbers

The April 2023 tornado led to significant damage to the grid, especially in Shawnee, Oklahoma. Here's a rundown of the damage inflicted by the twister.

- 900 distribution poles
- 125 transmission structures
- 253 transformers
- 72 miles of overhead wire

Coordinating Crews

Once the restoration was in full swing, OG&E brought in 2,500 contractor resources from across the United States to help with the restoration.

"A majority of our leadership team was boots on the ground in the field coordinating and overseeing the 3,000 restoration personnel we had actively working to restore power to our customers," Cooper says.

Setting up the staging sites rapidly and laying out a solid logistics plan was crucial to achieving success, he says.

"Because the damage from the tornado was so severe, the storm response required significant resources," Cooper says. "The high demand for materials, particularly poles, necessitated the acquisition of multiple staging sites."

OG&E organized storm response staging sites across the affected area. Dedicated lineworkers and other tireless restoration crews gathered daily and nightly for shift assignments and meals.

Because restoration efforts wrapped up more than 48 hours earlier than predicted, OG&E donated the remaining food and other supplies from the staging sites in Shawnee, Oklahoma, to the local food bank.

"It was an extraordinary team effort with the Shawnee community," he says. "We want to thank Mayor Bolt, all the elected officials and our community partners who worked together to restore power and aid the Shawnee community."

Focusing on Safety

OG&E line crews leveraged the use of various equipment including backyard buckets, diggers, track machines and skid steers to access work sites safely and perform work effectively.

In the aftermath of the tornado, OG&E activated its Incident Command System, which guided the company's processes and procedures for the restoration. To further increase safety during the restoration, the team participated in safety meetings to discuss possible hazards and share lessons learned from the previous day.

Before starting any work, the crews also conducted tailboard conferences to identify all potential hazards and devise strategies to mitigate them.

"Our top priority is always safety first," Cooper says. "Since we experience severe weather frequently in Oklahoma, our team is well prepared to work under such conditions."

Honoring the Storm Response

To honor the electric company for its response to not only the April 2023 tornado, but also a February 2023 storm, Edison Electric Institute (EEI) honored OG&E with two 2023 Emergency Response Awards.

Just a few months before the tornado hit, severe storms rolled into OG&E's service area, causing significant wind damage to Norman, Shawnee and Oklahoma City, Oklahoma. More than 2,500 personnel restored service to homes and businesses following repairs to the grid, including replacing downed power lines, more than 350 broken power poles and other equipment attached to poles.

"I am proud of our team's great work in restoring power following these significant weather events and appreciate EEI's recognition," says Sean Trauschke, OGE Energy Corp. chairman, president and CEO. "OG&E energizes life for the communities we serve, and we help our neighbors when we can. We appreciate the communities we serve each day for their support for our hardworking employees."

The EEI awards recognize electric companies' recovery and assistance efforts following service disruptions caused by extreme weather or natural events. A panel of judges selected the winners following an international nomination process. Tom Kuhn, EEI president and CEO, says ensuring the safety of customers, communities and crews is the industry's top priority, and safety is especially critical during severe storms and extreme weather events.

"I commend OG&E's commitment to restoring service for its customers safely and efficiently under challenging conditions following the devastating tornadoes in both Norman and Shawnee," he says. "OG&E and its storm response team are extremely deserving of this national recognition, and I am honored to present them with this well-earned recovery award." TDW

Editor's Note: To see more images from OG&E's tornado restoration, see our gallery at tdworld.com: *https://tdworld.com/21271832*.

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Parting Shot

Photo courtesy of **EVERSOURCE**.

Eversource crews work in Tilton, New Hampshire, to complete electric system upgrades to enhance reliability for customers.

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Nine SmartValve units were installed at the Stockdill substation to unlock 120 MW of additional energy, while six units at the Yass substation provided another 50 MW. Photo courtesy of Smart Wires.

Renewables Flow Via Australia Interconnector

Transgrid delivers Victoria-NSW interconnector upgrade, releasing the flow of renewable energy between Australian states.

By **OLIVER KING**, Transgrid, and **AIDAN LAWLOR,** Smart Wires Inc.

Australia's electricity grid is undergoing the biggest change in this lifetime as coal-fired generation retires earlier than anticipated and the shift to renewables gathers increasing speed. At the heart of the transition is Transgrid, which operates and manages the high-voltage electricity transmission network in the eastern Australian states of New South Wales (NSW) and the Australian Capital Territory (ACT), connecting generators, distributors and major end users.

The Transgrid network comprises over 13,000 km (8078 miles) of high-voltage lines and 113 substations in NSW and the ACT, with connections to Victoria and Queensland.

Transgrid is working to deliver Australia's energy transition to a renewables-based grid as efficiently as possible, without sacrificing grid security and reliability. A key part of that goal is using the existing network as effectively as possible by embracing innovations that can help to unlock additional capacity. In 2020, Transgrid signed a contract with Smart Wires Inc. for the delivery of modular power flow control technology, SmartValve, as part of the Victoria-NSW Interconnector (VNI) project. The A$45million upgrade of the main link between NSW and Victoria has unlocked 170 MW of additional energy.

Project Need

The integrated system plan prepared by the Australian energy market operator (AEMO), which operates Australia's national electricity market, identified a need to increase the transfer

The modular power flow controllers enable real-time control of electricity flows along power lines. If the SmartValve system detects areas of congestion on the network, it can automatically redirect flows to less congested lines with spare capacity. Photo courtesy of Smart Wires.

Graphic courtesy of Transgrid.

capability between Victoria and NSW. Transfer between the two states was restricted by thermal, voltage stability and transient stability limitations.

Over time, these limitations on the interconnector would have led to reduced access to lower-cost generation sources in the southern states, resulting in an increased economic cost of generating electricity across the Australia electricity market and growing the requirement for new generation investment to maintain adequate supplies.

AEMO and Transgrid jointly initiated a regulatory investment test for transmission (RIT-T) to assess network and non-network options to increase transfer capacity between Victoria and NSW. In line with the RIT-T process, AEMO and Transgrid published a project specification consultation report (PSCR), which identified the need for and benefit of additional export capability from Victoria to NSW. The PSCR was followed by the project assessment draft report (PADR), which identified and sought feedback on the proposed preferred option that

Yass substation, Transgrid continues to look at the use of modular power flow control solutions as part of its network development process. Photo courtesy of Smart Wires.

would deliver the highest net economic benefits to stakeholders (referred to as net market benefits).

All consultation submissions to the PADR were evaluated and considered before publication of the final report, the project assessment conclusions report (PACR). The preferred option was to implement the following by 2023:

- Install a second 500/330-kV transformer at the South Morang terminal station.

- Re-tension the 330-kV South Morang-Dederang transmission lines and associated works, including replacement of series capacitors, to allow operation at thermal rating.
- Install modular power flow controllers on the 330-kV Upper Tumut-Canberra and Upper Tumut-Yass lines to balance power flows and increase transfer capability.

The RIT-T analysis determined this preferred option would generate sufficient market benefits to recover the project cost within a short time frame and, therefore, was not subject to future uncertainties. The RIT-T recommended the optimal technology option for Transgrid to proceed with; however, the purchase of equipment remained subject to national and corporate procurement rules.

The project was also recognized as a priority by the NSW state government in its transmission infrastructure strategy.

Project Scope

The VNI upgrade project involved the installation of 15 SmartValve units at 330 kV across two sites, the Stockdill substation in the ACT and Yass substation in NSW, in 2022. Nine SmartValve units were installed at the Stockdill substation to unlock 120 MW of additional energy, while six units at the Yass substation provided another 50 MW.

In Australia, renewable energy often is produced in remote regions, which can cause bottlenecks on grid infrastructure.

The modular power flow controllers enable real-time control of electricity flows along power lines. If the SmartValve system detects areas of congestion on the network, it can automatically redirect flows to less congested lines with spare capacity.

Transgrid was the first large-scale user of SmartValve technology in Australia. It is already used extensively in the UK, US and South America to help unlock renewable energy flows and achieve net-zero targets.

Transgrid's then Head of Infrastructure Development Jeremy Roberts said: "By using the SmartValve technology, we were able to upgrade substations while using existing transmission line infrastructure. It meant no new lines needed to be built, so the extra energy we needed could be unlocked with minimal environmental and community impacts associated with building or upgrading existing lines.

"Clever technology like this helps us to meet the challenge of supporting a decarbonised future, while ensuring a consistent, reliable supply of lower-cost energy for customers," he added.

Following the preliminary investigations, design and approval processes, construction got underway in early 2021 and the project was delivered in November 2022.

Project Benefits

The VNI project is expected to deliver significant benefits for consumers:

- Increased export capability from Victoria to NSW, with 170 MW capacity unlocked on the interconnector to enable greater access to renewable energy generation across the states
- Consumer savings of AUD$268 million (a net present

economic benefit) from a reduction in dispatch costs through more efficient dispatch of generation in the two states as well as a reduction in capital costs associated with new generation build in NSW
- Accelerated development of renewable generation by quickly and cost efficiently unlocking more capacity on the existing grid
- Improved security of supply that supports more reliable supply of electricity to customers, including during periods of peak demand
- Boost to local employment during project implementation, with over 100 local people employed during the project, including electricians, carpenters, farm workers, traffic controllers and maintenance workers

Embracing New Technology

Speaking at the delivery event for VNI, Transgrid CEO Brett Redman outlined why the technology was so attractive to the transmission network: "Australia's energy transition is already happening — faster than many thought possible — and we need to work both faster and smarter to help the transition happen. The speed at which the energy transition is accelerating means we must embrace new technology and innovate, and VNI is a perfect example of how Transgrid is doing just that.

"The project has unlocked 170 MW of additional energy, enough to power more than 30,000 homes — and we haven't needed to build any new transmission lines to do it," Redman added. "VNI will enable the integration of renewables, increase competition among generators, drive down electricity prices and support the decarbonisation of Australia's economy."

Smart Wires General Manager for Australia Aidan Lawlor spoke about Transgrid's leadership in using this technology: "Smart Wires works with major utilities throughout the world — and we see Transgrid as a leading utility in this space. It is very gratifying to finally be here and see the enormous benefits and potential of power flow control — at scale — now here in Australia — just as we've implemented in other parts of the world.

"And this is just the first step. There is huge potential for power flow control to enable many major projects central to Australia's energy transition."

Transgrid continues to look at the use of modular power flow control solutions as part of its network development process. TDW

OLIVER KING is a seasoned project director with 18 years of experience across multiple industries, including oil and gas, utilities and transmission — having now spent 18 months at Transgrid in Sydney, Australia. King's goal is to tangibly deliver value-added solutions to problems — applied innovation in its truest sense.

AIDAN LAWLOR is a professional engineer with more than 20 years of experience in senior management, project delivery and stakeholder engagement roles in the Australian and Irish energy industries. Lawlor leads Smart Wires Inc.'s Asia Pacific team as general manager, working closely with Transgrid and other transmission owners in the region to implement modular power flow control technology.

BY **ANTHONY ALLARD**, HITACHI ENERGY

Protecting the power grid from overvoltages and service interruptions can be done with a targeted maintenance approach. Photo courtesy of Hitachi Energy.

Bring Data Together To Unlock Intelligence

New digital tools enable utilities to protect the grid by providing better ways to address power surges and vegetation hazards.

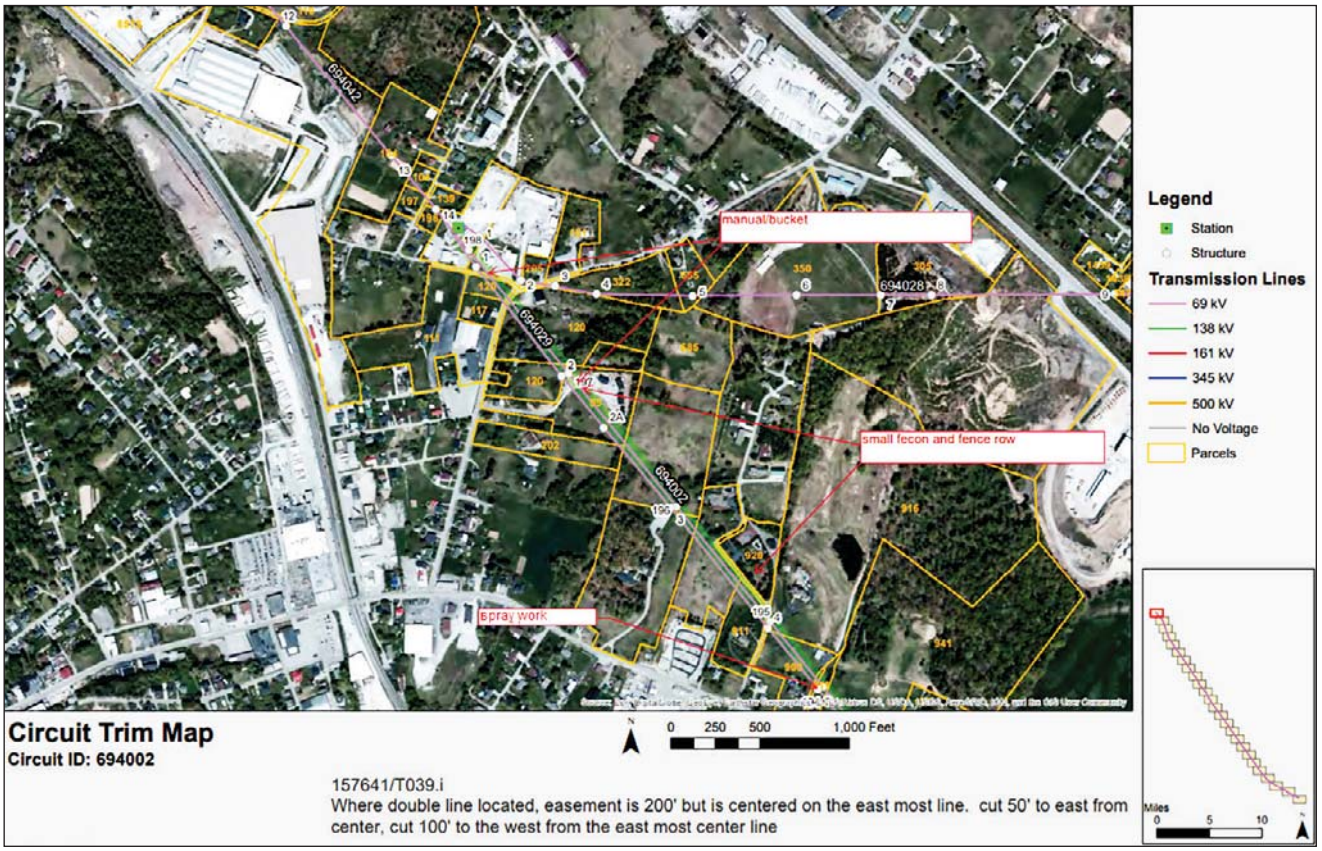
Failures in power grid infrastructure can lead to loss of life and property damage, exposing electric utilities to significant financial and reputational risks. As a result, utilities are looking increasingly to underground as much of their equipment as possible. However, this is not a practical option in many areas and can be prohibitively expensive.

Many power interruptions are caused by healthy trees brought down by sustained wind events located off a right-of-way. Another key source of risk is overvoltages, caused by lightning strikes and even routine switching events. These kinds of risks can be difficult to predict with human judgment alone. Fortunately, artificial intelligence (AI) and machine learning (ML) systems have reached a level of maturity that can help utilities to better assess their risk and develop targeted mitigation plans.

Landscape At Scale

Hitachi Energy introduced its Hitachi Vegetation Manager solution to do exactly that — enable utilities to assess risk and develop mitigation plans. Part of the company's Lumada Inspection Insights portfolio, the vegetation manager analyzes data from drones, light detection and ranging (LiDAR), satellites and other visual inputs to prioritize potential areas of risk. In turn, this data enables utilities to optimize their deployment of resources, most notably field crews, which are in limited supply because of labor shortages. This solution features two native iOS-based field apps and a web-based back-office application, making it easy and intuitive to use.

"This approach leverages human insights garnered across traditional methods, which often have involved field crews inspecting the lines with paper maps or relying on data from disparate



A map for the trimming plan. Graphic by Hitachi Energy.

sources that has typically been kept in silos," said Jeff Pauska, vegetation manager product director at Hitachi Energy. "What we are doing with Hitachi Vegetation Manager is bringing all this data together in one place, accessible through a single pane of glass, which unlocks a new level of intelligence in the decision and work-planning process."

Beyond remote-sensing data sources, utilities benefit from capturing the tacit knowledge of foresters and arborists, supervisors, crews and others who have experience with vegetation risks in the areas they operate. Typically in the minds of individuals with the best knowledge of the territory, this information is incorporated into hazard assessments, complementing digital intelligence.

Mitigate Power Surges

Another key source of risk for T&D grids is overvoltages, most frequently caused by lightning strikes, overheating or even routine switching events. Such surges can damage electrical equipment, causing outages and prompting costly replacement of components. To address this hazard, utilities rely on surge arresters. If the overvoltage is particularly severe in terms of size or duration, the surge arresters take the brunt to protect downstream equipment. Unfortunately, in rare instances, this process can result in explosions that spread hot particles and sparks.

"In some environments, a single spark can lead to extremely destructive outcomes," said Helena Garriga, head of power and industry components at Hitachi Energy. "Climate change is creating conditions where fire risk is increased, and so we have collaborated with our customers to find ways to avoid those sparks altogether."

The result of this collaboration is the Spark Prevention Unit (SPU), a product installed in conjunction with surge arresters to minimize wildfire risks. SPU monitors the current and thermal

This pole-mounted SPU monitors the current and thermal load of a surge arrester and automatically disconnects it from the network in case of a thermal overload, thus preventing any arcing, sparking or ejection of hot particles that potentially could ignite a fire. Photo courtesy of Hitachi Energy.

This pole-mounted SPU monitors the current and thermal load of a surge arrester and automatically disconnects it from the network in case of a thermal overload, thus preventing any arcing, sparking or ejection of hot particles that potentially could ignite a fire. Photo courtesy of Hitachi Energy.

load of a surge arrester and automatically disconnects it from the network in case of a thermal overload, thus preventing any arcing, sparking or ejection of hot particles that potentially could ignite a fire. The company has tens of thousands of these units deployed in the field, mainly in wildfire-prone areas like California, the Mountain West region and Australia.

Hitachi Energy recently upgraded the SPU with wireless connectivity, which makes it possible to transmit information about the status of the SPU — whether it is operational or tripped — its geographical location, the time of a tripping event and the status of its batteries to facilitate better planning of maintenance and replacement of devices. This capability enables utilities to use real-time data to identify the exact location of a disconnected surge arrester, ensuring repair crews can be dispatched appropriately and better target root-cause investigations. The Wireless SPU Indicator is currently being trialed by numerous utilities, including a municipal utility in northern California.

Dynamic Responses

Utilities are turning to a variety of new tools like Hitachi Energy's vegetation manager and wireless SPU option to better assess their power grid infrastructure risks and develop targeted mitigation plans. Real-time data unlocks a new level of intelligence for utilities to better prioritize potential areas of risk and respond dynamically to protect the power grid. TDW

ANTHONY ALLARD is executive vice president, managing director, U.S. and head of Hitachi Energy's business in North America. Allard was most recently chief operating officer of Berkeley Energy Commercial Industrial Solutions (BECIS), a leading energy-as-a-service solution provider in Singapore. Having spent most of his career in the power sector at GE and Alstom Grid in the U.S., he has held several executive-level positions, including general manager and board member for Prolec GE Transformers in the U.S. He also was general manager for the XDIGE high-voltage products partnership and spent 10 years working for Alstom in both North America and the Americas in strategy and operations management roles.

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Power Outage Detection for Meters

Copper Labs has announced its new patent, awarded for the use of drive-by automated meter reading (AMR) technology for outage detection. This capability provides real-time insights and alerts to help utilities detect and manage power outages without the need for advanced metering infrastructure. By leveraging existing meters rather than relying on outage reports from utility customers or box truck crew surveys, Copper is providing a streamlined and low-cost way for electric utilities to increase reliability and resiliency.
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ARCOS delivers SaaS solutions for managing resources, ensuring accurate, compliant shift scheduling and automatic planning for all types of events. ARCOS Mobile Workbench is a utility-specific mobile workforce management solution that connects the field and back office through a single pane of glass for flexible and responsive field operations. ARCOS Utility Insight acts as a single source of truth for your operations, with real-time dashboards that keep all stakeholders from dispatch to the C-suite in sync. Tightly integrated, the ARCOS platform helps organizations save time and money, while improving customer satisfaction and the efficiency, safety, and accuracy of operations. Stop by booth 703 to meet the team and see a demo.

ARCOS LLC | arcos-inc.com | Booth 703 at T&D World Live

Advanced Grid Monitoring

Monitoring, and ultimately managing, a diverse energy mix at the edge of the grid will require more than intermittent measurements and involves more than just fault detection. EGM's advanced grid monitoring solution is based on a suite of 3rd Generation sensors that combine fault detection and current measurement capabilities with National Renewable Electric Laboratory (NREL) research. In Booth #701, we will demonstrate the benefits of advanced, sensor technology, called the Meta-Alert System Solution developed by Electrical Grid Monitoring (EGM).

Additionally, functionality tests include:

- Accurate identification of faults (AFLD) Accurate Fault Location Detection to allow rapid power restoration
- DER Integration support and storage addition in the overall system
- Next Generation Precision Voltage Measurement

Pilots with operational applications such as ADMS/DMS/OMS

benefit from accurate, timely data captured from many points on the network with advanced analytics.

Electric Grid Monitoring | egm.net | Booth 701 at T&D World Live

Spot IR Thermometers

Teledyne FLIR, part of Teledyne Technologies, has released two new spot IR thermometers: the FLIR TG54-2 and FLIR TG56-2. Built on the foundation of FLIR's TG54 and TG56 models, the FLIR TG54-2 and FLIR TG56-2 provide advanced tools to perform accurate inspections and detect hazards before any contact is made. The new TG54-2 is a 20:1 spot IR thermometer can provide non-contact temperature readings with a distance-to-spot ratio of 20:1, allowing users to measure smaller targets from a safer distance. Equipped with infrared technology, Class II laser sighting, and the ability to measure up to a maximum IR temperature of 850 °C (1562 °F), the TG54-2 ensures pinpoint precision. Built to endure a 3 m (9.8 ft) drop and carrying an IP65 rating, it's ready for even the most demanding applications.

For those dealing with higher temperature readings, the FLIR TG56-2 measures IR temperature up to 1300 °C (2372 °F) and includes a Type K thermocouple for contact temperature measurements. The TG56-2 is also designed to offer non-contact temperature measurements from an even safer distance, thanks to its infrared technology, 30:1 distance-to-spot ratio and Class II laser sighting.

The TG56-2's color display screen is designed for easy viewing of current and reference temperature readings simultaneously.

Teledyne FLIR | www.flir.com

Fabric for AR/FR Workwear

GlenGuard is an inherent, solution-dyed fabric used to make arc-rated, flame-resistant (AR/FR) workwear. GlenGuard is lightweight and breathable to keep workers comfortable, and its protective properties are engineered to overcome and outlast even the harshest conditions. With a good weight-to-protection ratio, GlenGuard helps workers reach their peak performance and stay in compliance. Made using solution-dyed fibers, the best fiber technology for color retention in AR/FR fabrics, GlenGuard's proprietary Wickzz Moisture Management System delivers advanced wicking capabilities to keep wearers cool and dry. GlenGuard's inherently flame-resistant fabrics are available in three unique weights that offer CAT 2 protection from the threat of arc flash – 5.3 oz, 6.1 oz Entwined Rip Stop, and 6.4 oz – and an array of vibrant colors. GlenGuard also offers a 4.5 oz fabric with CAT 1 protection..

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Florida Power & Light

We're excited to support the expansion of Electrathon America, a program that empowers high school students to design, build, and race electric vehicles! Participating high schools receive build-your-own EV kits, giving students the opportunity to apply their creativity in a practical setting, and encouraging them to think about future careers in STEM fields.

Diane Leopold
Chief Operating Officer at Dominion Energy

Solar + Peaking = Reliability! I recently visited Ladysmith and Hollyfield. It felt right seeing both on the same day. When clouds roll in and there's a reduction in the output of the solar arrays at Hollyfield, the combustion turbines at Ladysmith can be quickly dispatched to meet demand.

Georgia Power Company

To commemorate Vogtle Unit 3 going into operation, our CEO Kim Greene was joined by community leaders, co-owners and other partners who made this special moment possible. While in Waynesboro, she shared, "It is important that we make these kinds of long-term investments and see them through so we can continue providing clean, safe, reliable and affordable energy to our 2.7 million customers. Today's achievement is a testament to our commitment to doing just that."

POWER Engineers

In light of Education Support Professionals week, #POWER had the pleasure of hosting students from the Inclusion Equity and Diversity in Engineering Student Center at the UW-Madison College of Engineering. Students had the opportunity to get hands-on experience participating in engineering activities, engage with our multidisciplinary professionals through a Q&A panel where they could ask both engineering and career-related questions, and have a brief glimpse into a day in the life of a career engineer.

Carim Khouzami
President and CEO at Baltimore Gas & Electric

On August 7, severe weather that included high winds, rain and lightning, caused extensive impact to Baltimore Gas and Electric's service area and equipment.

I truly appreciate the swift work of our crews, our other employees across the company who supported storm response and the mutual assistance personnel, who all worked around the clock to repair the significant damage and restore service to the over 132,000 customers impacted, 36 hours faster than our historic models predicted.

PECO

PECO's Mobile Command Vehicle stationed in Concord Township, Delaware County continues to serve as a hub for restoration planning activity in a heavily damaged area caused by Monday's significant storm. Here's a sneak peek of the inside and outside view.

AD INDEX

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A Big Step Forward on Transmission Infrastructure

Planning, siting, permitting, financing and building transmission infrastructure is a complex, time-consuming and difficult process. Congress, the Federal Energy Regulatory Commission, state legislators and bulk electric system operators like the California ISO have been working to identify new and more efficient ways to make sure we have the transmission infrastructure required to move power.

The need for additional transmission capacity in California is particularly critical. As noted in the CAISO's 20-Year Transmission Outlook published in 2022, the state will require as much as 120 GW of new clean energy resources to meet the decarbonization goals of Senate Bill 100 by 2040. The vast majority of those new resources are expected to come from within California and from offshore wind. But, consistent with the California Public Utilities Commission's "Preferred System Plan" and the California Energy Commission's "starting point" scenario for achieving state decarbonization objectives, both agencies anticipate meeting a portion of California's clean energy needs from out-of-state resources that will require additional transmission capacity.

Now, with approval by the CAISO Board of Governors of our new Subscriber Participating Transmission Owner model for development of generation and transmission from *outside* the CAISO balancing area, we believe a big step forward has been taken regarding transmission infrastructure in California and the West. We are also confident this new model, which will facilitate delivery of critically needed resources to the CAISO grid, can be used more broadly in the West on future projects so everyone can save time and money in getting new transmission projects up and running.

The Subscriber PTO model can enable new transmission lines outside the CAISO balancing area for developers wanting to build and place their transmission facility or facilities under CAISO operational control and use those transmission facilities to connect generation to the CAISO grid. The transmission project to connect such generation, financed subscriber or transmission owner, would be outside the revenue requirement of the CAISO's transmission access charge.

The process that resulted in the approval by the CAISO Board began more than a year ago when we started discussing the concept and issues with developers of the proposed TransWest Express (TWE) transmission project. In June of 2022, following up on those initial conversations and consistent with section 4.3.1.1 of the Transmission Control Agreement, we received TWE's application to become a Participating Transmission Owner in the ISO balancing authority area.

TWE's plans call for building a 732-mile combined HVDC and AC transmission line that has the potential to bring up to 3,000 MW of Wyoming wind power into California and other states in the desert Southwest as early as 2027. The line splits at the end of the HVDC portion in Utah, allowing 1,500 MW to go to the Los Angeles Department of Water and Power, while the remaining 1,500 MW can serve the CAISO and NV Energy.

Costs for the $3 billion project will be recovered through TWE tariffs from subscribers using the transmission lines to move power and would not affect the CAISO's transmission access charge. The subscriber rights would pay for the generation, transmission, and congestion on the portion of the line used by the subscriber.

This model is the first that enables development of out-of-state generation to be provided using the subscriber approach. The subscriber model also allows development of out-of-state renewable generation identified in the CPUC's Final Decision Ordering Supplemental Mid-Term Reliability Procurement, the CPUC resource portfolios used in the CAISO's 2023-2024 transmission planning process, and the new transmission facilities required to reach identified resource locations. These portfolios call for out-of-state wind generation that requires new transmission to reach the CAISO border: 1,000 MW from Idaho, 1,500 MW from Wyoming, and 2,328 MW from New Mexico. These volumes build on the amounts provided as part of the CAISO's 2022-2023 transmission planning. They also match the values that the ISO used to size transmission needed from the CAISO border to load centers in the 2022-2023 plan and they align with the longer-term requirements set out in the scenario provided by the CEC and the CPUC to the CAISO for the CAISO's 20-Year Transmission Outlook.

A ceremonial groundbreaking for the transmission line, which has been in planning and development for some 20 years, took place in Wyoming in June. If successful in securing subscribers for the generation, TransWest Express plans to energize in 2027. Adding more wind power to our grid would also help bolster reliability, as demand for electricity is projected to grow in the coming years through increased electrification of the transportation and building industries, and as California continues adding more renewable energy to the grid.

Transmission planning is a core function of the CAISO. As part of that work, we actively engage stakeholders and the public in determining short and long-term infrastructure needs. Once the needs are identified by Regional Planning and Grid Assets, Infrastructure Contracts & Management, where I serve as director, picks up the reins to get the contracts executed, resources online, and managed to ensure the resources and transmission are available for consumers.

The process is robust and challenging, but it is also gratifying when we emerge with a creative solution, a viable project and a sound, efficient way of getting it financed. At the CAISO, we will continue to do all we can to make sure California has the infrastructure needed to operate a reliable, safe and cost-effective power system and look forward to more creative solutions. TDW

DEB LE VINE is Director, Infrastructure Contracts & Management, at California ISO.

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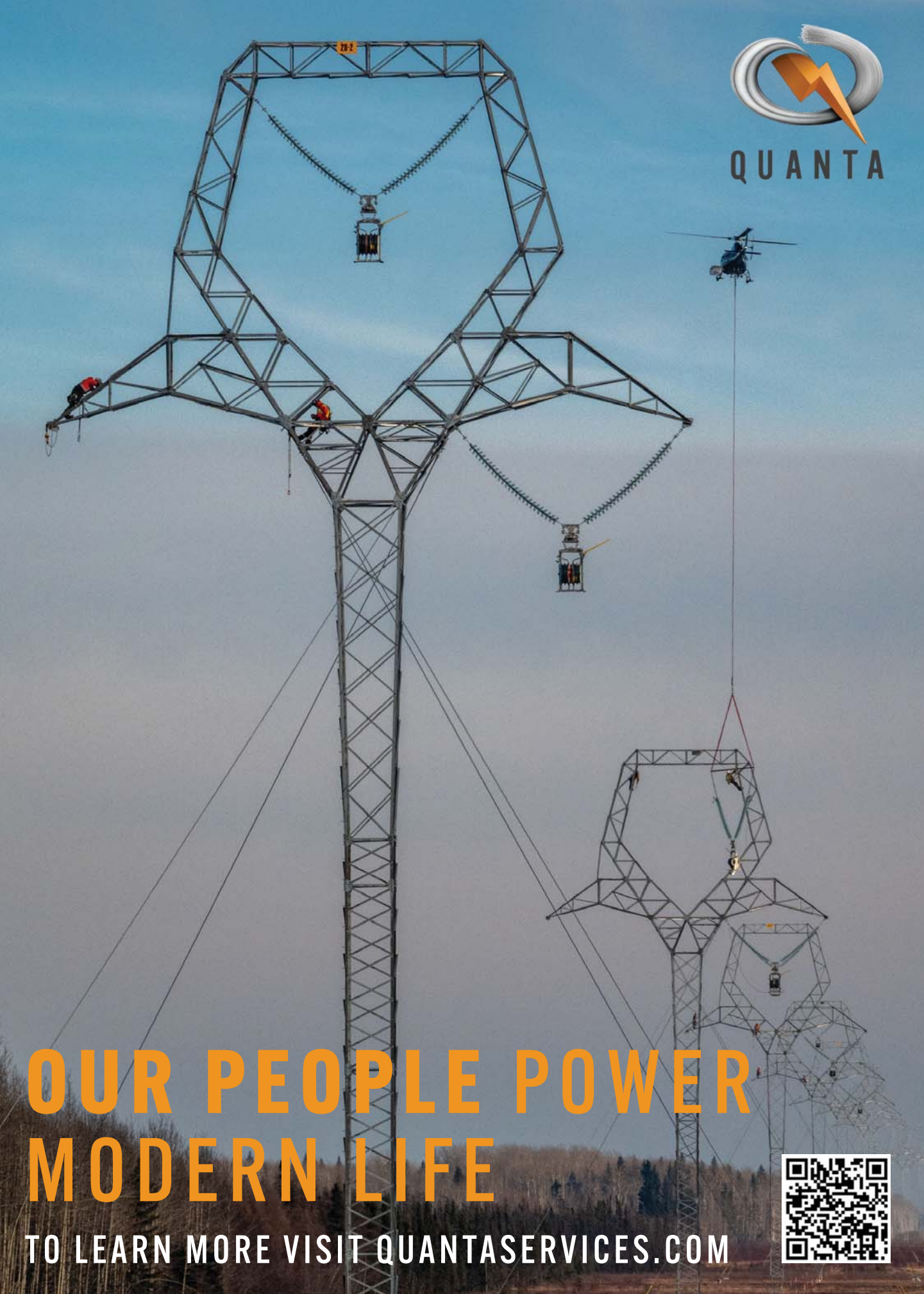
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Powering Progress

By **AMY FISCHBACH**, Field Editor

Lineworkers nationwide are lighting up lives, one family at a time. Beyond constructing and maintaining infrastructure, they are also illuminating homes following severe storms and going above and beyond the call of duty to serve customers.

For our annual Lineworker Supplement, we are celebrating the line trade with stories about people behind the power. These hard-working men and women are inspiring future generations of lineworkers with their passion for building the grid of the future.

The following stories in this year's edition reflect lineworkers' dedication to the trade. Here's what's in store for this year's Lineworker Supplement.

Providing First-Time Electricity

For the last few years, I've heard stories about Light Up Navajo, a humanitarian effort organized by American Public Power Association (APPA) and the National Utility Tribal Authority (NTUA). This year, I decided to dive into the world of Light Up Navajo with an article about how line crews are volunteering their time and talents to provide rural electrification to Navajo families.

While *T&D World* has published stories and photo galleries about lineworkers providing first-time electricity to homeowners overseas, this story focuses on a humanitarian project in our own backyard. Seventy-five percent of all U.S. families without electricity live on the Navajo Nation, which is the size of West Virginia and spans Arizona, New Mexico and Utah.

The volunteer lineworkers travel from their utilities across America by plane and truck to the Navajo Nation. They come from utilities of different sizes in varying locations, but they all have one thing in common — their lives are forever changed by their experience volunteering. This story explores how the project began, how lineworkers make a difference and what APPA and the NTUA see in the future for Light Up Navajo.

Rebuilding Puerto Rico

Over the last few years, we have covered the hurricanes that have hit Puerto Rico and the devastation they have caused to the island's transmission and distribution system. For our 2023 supplement, I'm taking a look at how LUMA is building a more reliable and resilient grid by hardening its substations, installing infrastructure that can stand up to storms and investing in renewable energy.

Recently, LUMA partnered with the International Brotherhood of Electrical Workers to launch the island's first Department of Labor certified lineworker apprenticeship program. The utility also opened a new training campus to prepare the next generation of lineworkers for a career in the line trade.

Training Women in Line Work

Two years ago, I featured a story in our Lineman Supplement called, "Women in Line Work." I featured six women who have made their mark in the trade and discussed the opportunities and challenges women face in the utility field workforce.

Years later, I decided to revisit that topic after Olivia Wilson, a journalist for the BBC World Service, listened to an audio version of the story and interviewed me for a radio documentary about women in line work. I also heard from the son of Judi (Shepardson) Hanson, who sent me photos of his mom climbing poles for United Telephone Company of the Northwest in the 1970s in Oregon. In addition, I learned about a book called, *High Voltage Women: Breaking Barriers at Seattle City Light*, by Ellie Belew about the first class of 10 female lineworkers in 1972 at Seattle City Light. Along the way, I became connected with two women — Alice Lockridge and Joanne Ward — who both worked at the utility, as well as Susan Blaser, the first woman to top out at Kansas City Power & Light, now Evergy, and her daughter, Randi, who just topped out at Ameren Illinois.

After featuring these women in my "Women on the Line" series for the Line Life Podcast, which is sponsored by Huskie Tools, I'm sharing their stories with our Lineman Supplement readers in an article focused on training past and future women in the line trade.

Honoring Rodeo Champs

To round out the supplement, we are including an article about past champions of the International Lineman's Rodeo. For lineworkers nationwide, this event is a time for their families to come together and to enjoy the camaraderie of the trade, but most of all to compete.

Many journeyman teams give it their all, but only one team is crowned the best of the best each year. With the 40th anniversary of the Rodeo around the corner, I am highlighting a few of the past winning teams, who share their secrets and strategies to crossing the podium on the awards night.

Thank you for reading these stories in the 2023 Lineman Supplement, and don't forget to listen to the upcoming Line Life podcast episodes featuring some of these topics. Subscribe on your favorite podcasting app, listen to all the episodes at tdworld.com/podcasts and reach out to me at *amyfischbach@gmail.com* with ideas about future podcast guests. I look forward to seeing all of you and your families in my hometown of Kansas City this October. TDW

AMY FISCHBACH (*amyfischbach@gmail.com*) is the Field Editor for *T&D World* magazine.

Mutual Aid

SRP dedicated a total of 14 employees to assist on the project, joining line workers from 26 utilities and 16 states to bring power to people who have lived without it.

Without a Storm

Volunteer lineworkers bring first-time electricity to American homeowners through the Light Up Navajo project.

By **AMY FISCHBACH**

When the lights go out in communities nationwide, crews join forces to rebuild infrastructure and restore power. Through the Light Up Navajo project, volunteer lineworkers provide mutual assistance — but without a storm.

The humanitarian project, which launched in 2019, brings the line trade together to illuminate the 13,500 homes without electricity on Navajo Nation. About 75% of all U.S. households without power live in this 27,000-square-mile region, which spans parts of Arizona, New Mexico and Utah, has 300,000 residents and a total of 55,000 homes.

With Monument Valley as a backdrop, Greenville Utilities crews worked to extend a power line that will serve 24 Navajo families.

In 2022, 69 utilities from 14 utilities in 10 states volunteered to provide electricity to 137 homes on Navajo Nation, reducing the cost to connect each home by 25%, said Walter (Wally) Haase, the general manager of the Navajo Tribal Utility Authority (NTUA). This year, lineworkers from 26 public power utilities in 16 states volunteered for the project, including Dean Frescholtz, journeyman lineworker and section supervisor for Salt River Project (SRP), a member of the American Public Power Association (APPA).

After spending 23 years in the line trade, Frescholtz said he'll never forget the homeowners see the lightbulbs go on for the first time in their homes. "They were very excited to have power, and it made me felt great," he said. "It felt like a humanitarian effort in our own backyard. I didn't even realize before I had volunteered to do this that there were people living in the state of Arizona in 2023 who did not have electricity."

Jeff Haas, the acting president and CEO and senior vice president of membership and education for the APPA, said many APPA members aren't aware that 30% of the Navajo people don't have electricity or running water. The NTUA is a public power enterprise, and when APPA communicates the need for assistance, their members are answering the call for help. "The beautiful thing about public power is that it's community-driven to its core," Haas said. "So, when we communicate the need, we find there are many willing parties to volunteer to take their line crews, equipment and materials across the entire country to the Navajo Nation to provide support."

One of the common misconceptions about the Navajo people is that they do not want their homes wired for electricity and connected to the grid, he said. Haas recently visited the Navajo Nation to observe the volunteer line crews in action and talk to the Navajo families, and said that's simply not the case. Many of the homeowners on Navajo Nation have been waiting years to get access to electricity. Traditionally, if a home is not one mile from a connected circuit, it can take a long time to go through the federal permit process and a commitment from the utility to extend the electricity beyond that one mile.

"I think we need to get better and need federal support to reduce the time it takes for the permitting process," he said. "It's the Navajo people's land, and they want this service, and they deserve this essential service. How can their children access broadband, do their homework effectively and learn and thrive without such an essential service as electricity and running water? We, as a country, can do more, without a doubt."

Coming Together

Four years ago, the APPA partnered with the NTUA to expedite rural electrification on Navajo Nation. At that time, Haase of the NTUA was serving as the APPA board chair, and he started to bring attention to the plight of the Navajo people. When he traveled around the country to speak at conferences, Haase remembers the audience members' shock that so many Americans were without essential services and the majority were living on Navajo Nation.

"They were all under the impression that it was more of a Third World country problem, and they couldn't believe that there was that large of a population in the United States that didn't have access to these facilities," he said.

Over time, the interest in electrification of the Navajo homes escalated, and more people started asking questions about the role of the federal government in the issue and how they could help. "Many of my fellow APPA members and other members came up to me and said, you know, this is really wrong," Haase said. "Our communities solved the problems 100 years ago or more, and the co-ops solved the problems in the 1920s, 1940s and 1950s. They felt compelled to say this is an injustice, and it's a moral issue."

At that point in time, 15,000 homes on Navajo Nation had no electricity or running water. To shorten the timeline for the Navajo families to get service, Haase partnered with the NTUA and APPA to launch Light Up Navajo. The project is not only giving lineworkers the opportunity to help their fellow Americans, but also gain a new set of skills in the line trade. Back in their home service territories, the systems may be completely built-out or the power lines are mostly buried underground. On the Navajo Nation, however, the volunteer line crews have a valuable training opportunity, Haase said.

The Navajo Nation line crews also perform distribution work and work in challenging conditions, which prepares them for storm response. Volunteers string wire, install poles, set transformers and install meters on a distribution system from start to finish — all while working with knowledgeable peers, learning best practices and gaining experience.

"When you get called out on mutual aid, you're going to be working in areas where there is a natural disaster — tornadoes, windstorms, hurricanes or freezing rain — that brings down lines," Haas said. "Working on the Navajo Nation gives line crews an opportunity to really test their mettle in a situation where the lines aren't energized."

This valuable opportunity to train line crews is often a motivating factor and a justification for APPA's member utilities to send crews to the Navajo Nation. It also allows the lineworkers to create a network within the trade. "Lineworkers are a very tight-knit community," he said. "To see these individuals working literally arm and arm for a purpose as noble as bringing electricity and essential service to the Navajo people is one of the most rewarding work-related and personal experiences I've had in my lifetime."

Expediting Electrification

Before the launch of the Light Up Navajo initiative, the NTUA relied on state and federal funding to extend electricity on an annual basis to Navajo homes while maintaining its own vast distribution system. The Navajo Nation, however, is the size of West Virginia, and it has rugged terrain, slowing the rural electrification. In 2018, Demonstration of Energy and Efficiency Developments, a research and development program, funded an analysis of what it would take to get line crews from across APPA's membership to participate in efforts to bring electricity to Navajo homes.

"We looked at how to create efficiencies and apply best practices as it relates to creation of the distribution system on the Navajo Nation and use APPA's resources," Haas said.

For the pilot project in 2019, lineworkers from 12 states and 25 utilities connected 233 homes to electricity in six weeks, reducing the total number of U.S. homes without electricity by 1%. "We learned very quickly that there was some inertia, and that the utilities that participated got a lot out of it," Haas said.

The next year, dozens of utilities signed up to participate in Light Up Navajo II, but the volunteer mission was canceled due to the COVID-19 pandemic. That didn't stop the NTUA, however, which was able to leverage the Coronavirus Aid, Relief, and Economic Security Act to extend electricity to several hundred homes that year.

The following year, the APPA brought volunteers back on Navajo Nation, and for 2023, the open volunteer slots filled up quickly for Light Up Navajo IV, which started in April 2023 and was extended from June to July to accommodate the number of available line crews.

Going Above and Beyond

The line crews who volunteer for Light Up Navajo are paired with NTUA foremen who know the system, the local Navajo language and how to navigate the desert landscape and mountainous terrain. "They work in tandem with NTUA line crews, so there are limitations as to how many crews can be sent at any one time," Haas said. "Having someone who knows

Grand River Dam Authority worked near the Utah border, working against dust storms.

where they're going and how the system operates is important."

The lineworkers often work 12-hour days, but they are proud and extremely happy to be volunteering their time, Haas said. Case in point: One of the line crews worked well past 9 p.m., and by the time they got back to their motel, none of the restaurants or food service facilities were open. "They worked so long that they missed their dinner," he said. "The sense of purpose is extremely strong on this project."

Because the Navajo Nation encompasses such a large region, the NTUA dispatches the volunteer crews to different districts to work in the small communities. That way, they can focus on electrifying a certain portion rather than overlapping during the multi-week project. "We have four crews at a time, because we need to balance our workforce, our materials and our own equipment," Haase said.

During one Light Up Navajo project, however, the NTUA scheduled five crews to come in, and three of the crews from the previous week called their bosses back home and asked to stay an extra week to get their work done. They received permission to continue volunteering, and as a result, eight crews were on site simultaneously.

"That's quite an endeavor to manage all that manpower, materials and equipment, but it's a fantastic story where they just felt in their body, heart and mind that they didn't want to leave," Haase said. "They wanted to finish helping their community members get power for the first time."

Haas said public power utilities of all sizes have sent line crew volunteers to the Navajo Nation, but they all have one thing in common — they know it's the right thing to do. "They have to juggle their interests at home because there's limitations locally with regards to local assets, lineworkers, materials and equipment," he said. "Sending a truck or line crew across the country may be difficult, but we are finding that our members are really good about figuring out how to get it done."

Constructing Lines

Like mutual aid following a storm, the project organizers sent line crews to different regions to perform line work. The crews stayed in local hotels, sometimes an hour or more from the work sites, and the NTUA provided lunch to the volunteers.

Frescholtz said during the volunteer project, he worked with lineworkers from SRP's distribution line maintenance department. SRP sent 14 employees including a supervisor, working foreman, lineworkers, an operator and a mechanic to Navajo Nation in 2023.

The lineworkers construct power lines to homes that have already been wired for electricity by the NTUA and its outside contractors. The homeowners must first file a request for electrification, and then once their home is ready to accept electricity, the volunteer line crews travel to their location to build a

Step by Step: Electrifying Homes on Navajo Nation

Before the volunteer line crews even step foot on Navajo Nation, a lot of work has already been done to set up the homes for electrification. Here's a glimpse at the process.

1. A NTUA customer fills out an application to be part of the program. The applications are taken on a first-come, first serve basis, says Walter Haase, general manager of NTUA.

2. The NTUA creates a design for the line and figures out how to connect it to the electrical system.

3. The federal government owns the land on Navajo Nation, so the NTUA must secure right-of-way (ROW) permission. Haase estimated that it takes about $13,000 to complete the paperwork and use the land to get the ROW for each home.

4. The utility hires outside experts to perform environmental, biological and zoological surveys of the project site. If the power line will be less than a mile long, it takes six to nine months, but if it's more than a mile, it can take a year-and-a-half. This process can take even longer if the experts discover a cultural artifact, rare plant or protected animal species.

5. Using grant funds, the NTUA hires an outside contractor to install the 200A service to the home.

6. The field workforce for the NTUA or outside contractor installs the meter pole and socket.

7. The NTUA inspects the inside wiring of the home.

8. The staff orders the bill of materials and has it available for the crews that are coming out to volunteer for Light Up Navajo.

9. The line crews arrive on Navajo Nation to perform the line work for anywhere from one to three weeks at a time.

10. After the line has been energized, the lineworkers experience the joy of the homeowners when their lights come on in their homes for the first time.

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Light Up Navajo IV crews connected more than 10 homes to a project that spanned more than 10 miles. Photos courtesy of NTUA.

power line and set up a meter to get the power flowing.

In his day-to-day job, Frescholtz supervises crews on distribution pole replacement projects, but on the Light Up Navajo volunteer project, he was installing poles and stringing lines to provide first-time power for the Navajo Nation. "There's no storm that knocked all the poles down that we're going to put back up," he said. "It's mutual assistance because other utilities are coming to help to build power lines for the first time."

Over the course of three weeks, his team of volunteers built six miles of power line, set 104 poles and strung more than 63,000 ft of wire. Last year, when the SRP crews volunteered for the project, they energized a few homes in one day, but this year, they brought electricity to 10 homes. He said that it was more remote than last year's volunteer project.

Frescholtz said he enjoyed the work because it was much different than what he's used to in Arizona. In his service territory, his crews often work in congested metropolitan areas, where they must contend with lane closures and traffic control plans. "Light Up Navajo was really nice because it was in the wide-open countryside on dirt roads," he said. "It was nice to just go out there and get back to the grassroots of building a straight power line without running angles or installing buck arms and three pot banks."

One challenge the crews faced, however, was working in difficult terrain. To overcome this obstacle, the crews used a bulldozer to pull line trucks with trailers. He said his team learned lessons from their first year on the volunteer project. This time, they only took six-by-six trucks, which are four-wheel-drive boom and bucket trucks. They also brought a hole digger, wire trailer and pole trailer to transport materials.

"We have very few trucks at SRP that are actually four-wheel drive because we work in the city most of the time, but all the trucks we took up there had four-wheel drive applications," he said. "We knew we were going to have some difficult conditions, and they did quite well up there."

While constructing about 40 of the poles, however, the trucks couldn't navigate the sandy terrain. To help the SRP crews, NTUA supplied a bulldozer so the lineworkers could hook pulling ropes from their trucks and move them through the sand with pulling trailers.

Beyond the access issues, the lineworkers were also challenged by the weather conditions. "Working in Phoenix, Arizona, we're used to heat — that's what we deal with on a day-to-day basis," he said. "But up on the Navajo Nation, there's more of a four-season atmosphere up there. A few of the days, the lows were in the 20s, and high was 30 degrees. We're not used to working in cold temperatures like that."

The chill combined with the strong winds provided a unique work environment for the Arizona crews. The SRP team traveled about three-and-a-half hours north of their service territory for the volunteer project.

"The weather changes quite rapidly, and when you're out in 28-degree temperatures, and the wind is blowing 50 miles per hour, it adds wind chill that we are not used to," he said.

Haas agreed, saying while the landscape is beautiful, the terrain and weather conditions can be inhospitable at times. "Even when I was there in April, there were windstorms that made it very difficult to see a few feet in front of you," he said.

Providing First-Time Electricity

During the Light Up Navajo project, Frescholtz said his favorite memory was just being with the people — both those who live on Navajo Nation as well as the other volunteer line crews.

"I not only got to work with journeyman linemen from Utah, but also people who work for other utilities," he said. "We were able to work side by side with them and their supervisors and managers."

Frescholtz also had the opportunity to interact with the community members and help illuminate their homes for the first time, which was life-changing for them and their families. "A good percentage of them were at home when we were able to plug in the meter and turn on the lights for the first time."

This time around, his team remembered to bring a very important item with them — cases of lightbulbs. That way, after the lineworkers built the power line and set the meter, they could screw in the bulbs and demonstrate the glow of electricity. Before their homes were wired with electricity, the homes were illuminated by generators or kerosene lamps.

Without access to electricity, the homes faced other challenges. Navajo families didn't have access to running water, modern forms of heating and cooling or appliances like refrigerators and microwaves, according to the APPA. Every week, they had to drive one or 1.5 hours to watering spots just to fill 250-gallon plastic tanks with water for drinking, cleaning and cooking. Without the ability to use modern appliances like refrigerators, they had to fill coolers with ice to keep their food from perishing.


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Austin Energy worked west of Flagstaff, Arizona, with the San Francisco peak in clear sight. The peak is considered one of four sacred mountains to the Navajo people.

"You can imagine, if you are living on the nation, at times you could be from 45 minutes to an hour from the nearest point to get groceries," Haas said. "Then you have to bring them back to your home and and essentially pack anything that's perishable in ice, and it will last anywhere from two to four days. I've also heard stories of families either renting refrigerators or keeping a refrigerator of their own at a relative's house that in some instances was 40 minutes away one way."

Family members have ended up leaving Navajo Nation due to the lack of access to essential services, but the electrification of the homes allows them to return once again. "They now have essential services they need to raise a family and to thrive," he said. "They'll join the generations of their family that live in these homesteads."

The program not only gives the Navajo families a better life, but it also helps to create trust and bonds between the community members and the volunteer line crews, Haase said.

"This gives an opportunity for a very diverse group of Americans to gain respect for each other," he said. "Anytime you can help one family to have a better life and give them the opportunity to become part of society and be productive, you're helping all of society. It's a tremendously positive experience for everyone, and that's the thing that makes this program so great."

Planning for Future Growth

Through the Light Up Navajo project, utilities are also working together to continue to provide electrification to the homes on Navajo Nation. Frescholtz said that SRP's goal is to continue supporting the project. "There's no plans in the future for this to stop," said. "Every year, we'll continue to put out the request for volunteers, and we'll load up with the same or different personnel to go back up there."

JD Munoz, a working foreman for SRP, said the Navajo families are very grateful for the work of the volunteer line crews. "It's humbling and gratifying to bring these folks electricity for the first time," Munoz said. "To provide power to someone who has never had it is a good feeling. This is my first time working on Light Up Navajo and it won't be my last."

Haas said APPA is committed to continuing the Light Up Navajo project until all the homes requiring electricity have been energized. "These people have, in some instances, literally waited generations — in some cases more than 50 years — to get electricity, and we want to accelerate the number of homes that are connected on an annual basis. We need to do better."

Haase said when he first started at NTUA 16 years ago, about 18,000 families didn't have electricity, and thanks to the efforts of the volunteer line crews, that number has dropped to about 13,500, which is about 52,000 U.S. citizens.

"At the pace we were going by ourselves 50 years from now,

Week in the Life of a Volunteer Line Crew on Navajo Nation

Line crews from across America have volunteered for the Light Up Navajo project. After they fly to the area or arrive after a multi-day drive, they travel to the designated location using their vehicles or rental trucks from the NTUA. Here's a look at what a typical week looks like for a line crew on the Navajo Nation.

Saturday or Sunday: The crews attend a three- or four-hour orientation program, which covers an introduction to the program and cultural sensitivity and awareness. A large focus of the training is on safety because not all utility companies have the same construction standards, says Walter Haase, general manager of NTUA.

Next, the crews are dispatched to different areas on Navajo Nation and teamed up with a foreman from NTUA. They also travel to one of the yards to see a mockup of how things are built, and if possible, they start a job to help get as many families connected as possible during their stay.

Monday and Tuesday. The crews meet at 7 a.m. at the district office to load the material. They then drive about an hour or more to focus on short-line extensions, which are single-family homes less than a mile from the existing distribution line. About two or three families are often connected at one time.

Wednesday. To give the crews maximum time in the field, the NTUA stages the material and brings it out to the work site. Lineworkers then work on community power line projects and build miles and miles of single-phase line and then connect customers off that line. Haase says this is the best training exercise for the crews, but the connection of the individual family members is equally important. "We try to make sure that every crew that comes out has experience in doing that," he says.

Thursday. The line crews stop work early and enjoy an appreciation dinner in the local community that has gotten connected. Navajo family members are invited to talk to the outside crews about what the program means to them and how it has helped them.

Friday. The crew resumes work.

Saturday and Sunday. If the crew plans to stay two weeks in a row, they will also work all day Saturday, a partial day on Sunday, and then continue working on big projects for the rest of the following week to connect as many families as possible.

we would still have United States citizens without electricity and running water and still using outhouses," he said. "Through the additional efforts of the Biden administration and others, we've cut that down from 50 years to 30 years. It's a significant reduction if we keep going at this pace."

Currently, the project's ultimate goal is to try to get to about 500 families a year, which hits the 30-year pace. From there, the project organizers hope to provide power to 1,000 families annually, which will increase it to a 15- or 20-year pace, Haase said. The NTUA is looking to expand programs and dollars to speed electrification and lessen the time families need to wait for the essential services. "Even if I get to 1,000 families a year, it's a difficult task to tell someone that it's 15 or 20 years to get connected, but it's better than 50 years," he said. "This is a big problem, but you have to be happy with taking small victories and moving the ball forward to help more and more people."

Haase would love to have the Light Up Navajo project finished in his career, or at least in his lifetime, but that's going to take more outside help with materials and equipment. "So far, more than 600 families or more than 2,000 United States citizens got electricity for the first time. That's positive for all our partners to recognize, but it also drives them to say how can we help to improve this and get it done faster."

Over the years, not only public power utilities, but also investor-owned utilities and electric cooperatives, have sent volunteer line crews to the Navajo Nation to provide assistance. In the future, Haase said he would like to see more cooperatives and investor-owned utilities join the municipal-owned utilities to expand the program. For 2023, the program length has also been extended a few extra weeks, which he said is a step in the right direction. As of June 25, 2023, the volunteer line crews built more than 40 miles of line and connected 131 families.

In 2021, the NTUA also added a new program — Mutual Aid Training — which further expands the mission of Light Up Navajo. The six-week training initiative, which takes place in the fall rather than the spring and summer, focuses on projects with longer lines and involves not only lineworkers, but also electricians. In 2021, the Los Angeles Department of Water & Power (LADWP) helped the NTUA connect 80 homes, and last year, the lineworkers connected 62 homes.

"Having the opportunity to see firsthand what it's like in a part of America in 2023 without an essential service really did impact me in a profound way," Haas said. "I think many other Americans may be shocked — I may use the word, appalled — to see how our fellow proud Americans have been treated. We need to do more. I think it's our duty as Americans to take care of our own, and for public power's part, we're going to ensure that we continue to do that." TDW

AMY FISCHBACH (*amyfischbach@gmail.com*) is the Field Editor for *T&D World* magazine.

Training Women on the Line

As more women enter the line trade, here are four strategies to recruit, train and retain female lineworkers.

By **AMY FISCHBACH**

Randi Blaser grew up in a family of lineworkers, but it wasn't until she climbed her first pole and later worked her first storm that she discovered a passion for the line trade. She recently topped out at Ameren Illinois, and she said line work can be a rewarding career for women nationwide.

"Women aren't as strong as men, but women are definitely capable of doing what men can do — they just have to do it differently," she said. "With the way things are going with the power tools and all the advances that have been made, it's leveling the playing field for women, and I think that is fantastic. You don't have to be the biggest dude or the biggest girl to do stuff now. If you're interested in the trade, you're mechanically inclined and you can pick it up, you can do exactly what they can do."

Joanne Ward started in the trade as an electrical helper for Seattle City Light in 1978.

Joanne Ward, who retired from Seattle City Light after four decades in the trade, said the opportunities for female line workers in today's utility industry are just as important and even greater today than four decades ago in their offer of skilled work and stable careers. Ward first started as a line crew helper at Seattle City Light in 1978, and later worked as a high-voltage electrician and crew chief before retiring and publishing the book, *Utility*, about life in the trade.

"The current workforce is aging out and job openings are, and will, become extremely plentiful," Ward said. "These jobs will afford a high standard of living, good healthcare coverage, excellent retirement plans and even some defined benefit retirement plans. Women should be educated about them and urged to come get them."

In the 1970s, women started working in the line trade in different parts of the country. One of those women was Ward, who joined her utility as part of the second wave of an affirmative action program in 1978. She searched for a non-traditional job as an avenue to a higher salary and standard of living. After interviewing with a phone company for an installer's position, she learned that Seattle City Light was actively hiring electrical helpers. "I liked the idea of working with my hands and working outdoors in a more physically active job," Ward said. "Those jobs opening up were really a question of equal opportunity for women."

Currently in the United States, the number of women in line work is still a slim percentage of the overall field workforce. Utilities nationwide, however, are working to increase the diversity of their line crews, and many are hiring their first female lineworkers. As more women work in the line trade, here are four strategies to attract, train and retain female line employees.

1. Take a new approach to training.

Susan Blaser, the lead line technician program coordinator at Metropolitan Community College in Kansas City, is training the next generation of both men and women lineworkers. She said back in 1989, when she started out in the trade, she learned the skill of rigging, which helped her immensely during her career.

"If I couldn't do something, I would ask everybody, and then I'd take two different ways and figure out what worked for me," she said. "There's a lot of technology that has come along, but at some point, there are limits, and that's when rigging is going to play a critical role."

About 85% of the students' time is spent outside on the poles, and the program focuses on how to do things correctly and repetitively to ensure safety. So far, nine women have come through the program, and five of them have become lineworkers, including her daughter, Randi.

When Randi attended the summer climbing portion of the program, she opted to pursue line work as a career. Now that she's a lineworker, Randi is often in her hooks and on a pole for hours at a time. At 5 ft tall, she said she has had to learn different ways of doing the work. "As far as women, they're just as equal as men, in my eyes," Randi said. "Just because we don't do it your way doesn't mean we can't do it at all.

We just must figure out a way that we can do it safely. It just might look a little bit different."

For example, when she's working on a pole with a taller coworker, they need to learn different ways to work together. "When you're on the wood pole, and you got someone who is between 6 ft and I'm 5 ft, I can stand up a little higher, and then we can be at eye level with each other, which works out because our feet aren't hitting together," she said. "It can be a challenge, but you can still get the work done by the end of the day."

Alice Lockridge, who was training aspiring lineworkers at Seattle City Light when Randi's mom, Susan, was starting out in the trade at Kansas City Power & Light (now Evergy), agreed. Many women have told her that when they worked with a taller man, they fit better on the pole. She said there are many ways to scurry into a job position. "If I'm shorter, my feet are up closer to the work and out of the way of those great big feet of the guy that's doing the work with me," said Lockridge, who worked as an exercise physiologist at her utility. "My hand goes into little places that they can't. There's a need for both size people. Diversity in experience and body size are all of value."

Another way that women can succeed in the line trade in the early part of their career is to learn one of the basic skills of line work — rope tying. Lockridge founded a group called "Knotty Women," and she has a booth at high school career days to teach girls how to tie different types of knots and pique their interest in the trades at the same time.

"I think the first day you get on a crew, at least you could run over to the truck and tie a load down and not get yelled at," she said. "Being able to tie not just a knot — but a real knot — is a great way for an entry-level worker to get into the job."

Lockridge also said it's important for women to learn how to use their own body weight to perform line work efficiently and effectively. During her time with her company's pre-apprenticeship program, she focused on helping people get and keep physically demanding jobs, with an emphasis on helping women get into the trades. She first prepared the pre-apprentices for the physical entrance-level test and then trained them in the gym for three hours three times a week for the graduation test.

"We wanted to make sure they could actually do it and had the physical capacity to learn the skills," Lockridge said. "The job is hard, and things are heavy, especially in 1988 when I started. Lots of those things have been improved and made lighter, but you still have to get yourself up the pole to work while carrying tools. There's a lot of physical demands on the body."

Oftentimes, the physical evaluations may drive off aspiring female lineworkers, but Lockridge asserted that some can do a chin-up with the right physical training.

"There's strength and skill to doing a chin-up, just like cutting wire or tying a knot," she said. "The reason we use chin-ups is because it shows us that you can manage your body weight. If your feet slip off a pole, you could save yourself until help arrives, or you get your feet back on the pole. It's a fundamental view of whether you are in the physical condition to be able to start learning in a risky climbing environment."

Susan Blaser was the first lineworker to top out at Kansas City Power & Light (now Evergy) before training the next generation of lineworkers at Metropolitan Community College in Kansas City.

Through the training sessions, Lockridge taught the pre-apprentices how to perform the work without getting worn out or injured on the job. "If I had to hoist a bucket of tools up to you on a pole, if I had to do it with just my wrist strength and my grip strengths and biceps, it wouldn't make it up 40 ft," she said. "But if I know how to sit down and use the weight of my behind to make that load go up, I'm a better worker, a longer worker and a less hurt worker."

Beyond the physical training, utilities also need to consider the different ways in which women learn. No two people are exactly like, and if the lesson planned isn't working, it may not be the learner's fault. The instructors may need to find a different way to present that information. "Stereotypically, women are better readers, and don't always need just a visual picture of it," Lockridge said. "Also, we respond really well to positive feedback and not very well to being yelled at and cursed at."

2. Safeguard women with workwear and PPE that fits.

Beyond work methods and the physical demands of the job, women must also have the proper garments to stay safe and comfortable on the job. Back when Ward started in the trade, she remembers rolling up coveralls at the bottom of her legs.

"I would adjust the shoulder straps as much as I could, but they would still hang low on me," Ward recalled.

Finding gloves back then was a challenge. Ward said she has a size-7 hand, which she found was to her advantage when she

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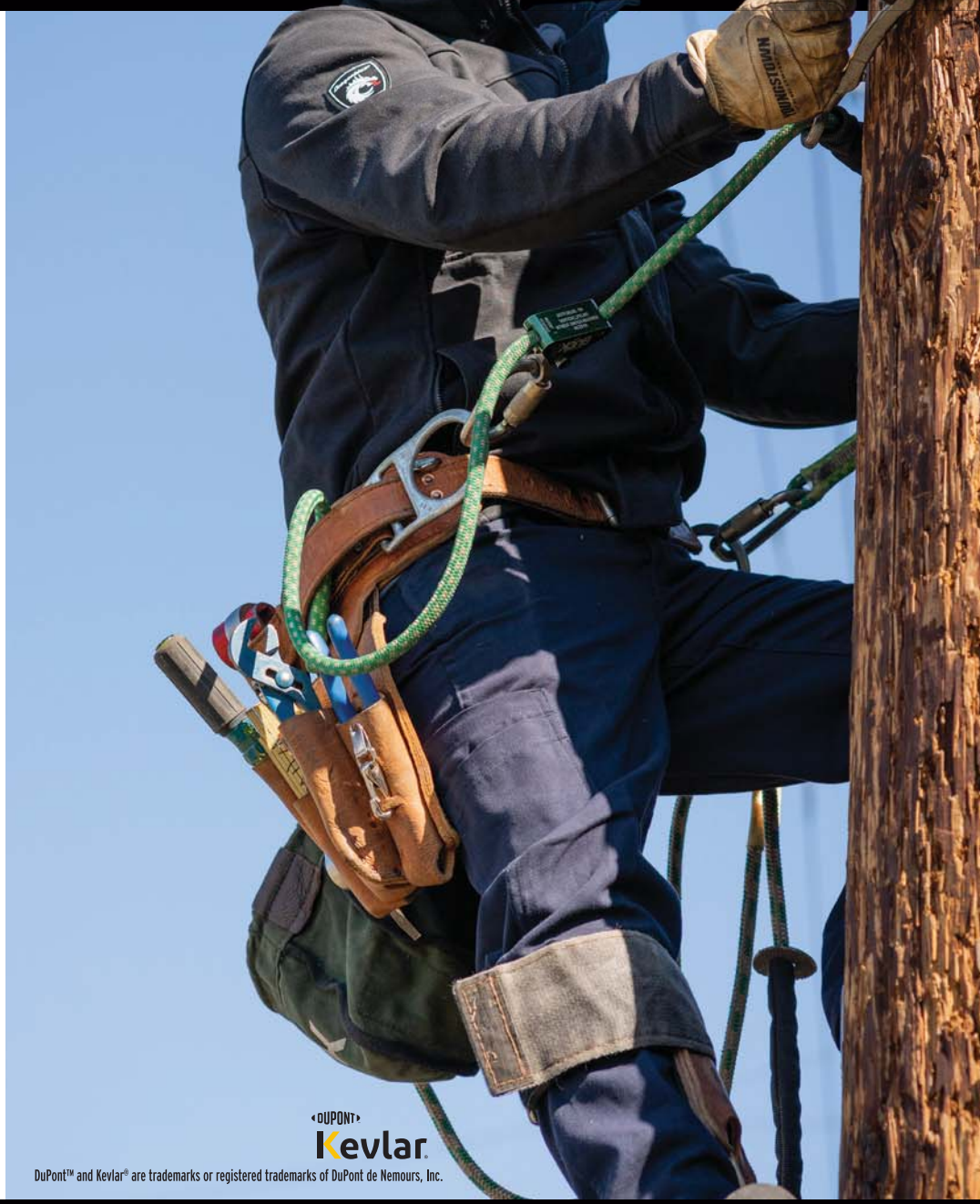

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What You Need to Succeed as a Woman in the Line Trade

After gaining experience either working in the trade and/or training lineworkers, the four women featured in the "Women on the Line" series for the Line Life Podcast share 10 tips for women considering careers in the line trade.

1. Have a thick skin. When she first started out in the trade, Susan Blaser spent a lot of time, energy and frustration trying to prove to people that she was just as good as some of the other guys in the field. She eventually learned to not worry about other's opinions and not underestimate her own abilities as a lineworker.

2. Find a mentor. Learning can be frustrating for anyone, male or female, Blaser added. Try not to get discouraged and find others who want to train you and make you the best lineworker you can be. Joanne Ward agreed, saying throughout her career, she found crew members who were willing to train and mentor her.

3. Get a support team. "These should be folks you can call at any hour, in any mood and talk truthfully (not just sunny day friends, but instead bad-day friends who want to hear the truth and can listen if you cry or curse!," Alice Lockridge said.

4. Secure dependable transportation. If you want to be a considered a valuable worker, you must find a way to get to work, Lockridge added.

5. Trust in your own skills and abilities and practice positive self-talk. Be as kind to yourself as you are to your friends, Lockridge said.

6. Focus on physical fitness. To succeed in the line trade, aspiring lineworkers must be able to be in shape and ready to perform the duties of the job. A pre-apprenticeship program may be a good place for women to start in the trade, Ward said. Randi Blaser agreed, saying her mom's line technician training program provides women with the support they need to succeed in the trade.

7. Learn how to climb. At Metropolitan Community College-Kansas City, one of three semesters is just focused on climbing.

"We have the students come in, and they'll decide whether this is what they want to do or not," Susan said. "Sometimes they self-select out when it's not really what they expected, and they'll decide on a different career path."

8. Show respect for the experience of your veteran lineworkers. "You need to be as friendly as you can, and be ready to help, be useful, and do the dirty work, which will be asked of you—believe me," Ward said.

9. Learn leadership skills. During her career, Ward served as a crew chief on three different crews, and she said she learned a lot about leadership that she wanted to pass on to the women coming up in the trade. She said it's important to make it clear from the beginning that you're not interested in the my-way-or-the-highway methods. "Also, if you're a quiet person, learn to speak up loudly enough to attract attention in a crew meeting," she said. "You have to let your voice be heard."

10. Connect on social. Join social media groups where you can find a place to talk about your day. Within these groups, the other women can understand your perspective and provide support. For example, Lockridge administers a Facebook page titled, "Women in Linework," and women in the trade are welcome to join.

had to work in tight spaces. In certain situations, however, she needed heavy leather gloves. "The first day I came on the job, I had a lovely pair of pig-skin gloves, and they were completely burned through by the end of the day. I learned pretty quickly to get better, thicker, gloves, and I was able to find those that would fit my hand."

Lockridge, who now serves as an advocate for women in the trades, said female lineworkers often reach out to her for advice and assistance. She said women in the line trade today are still challenged by what clothes to wear, how to find clothes that fit and how to get safety gear that's made for their shape and size.

"Sometimes their hands are smaller than the gloves," she said. "I once got a phone call from a woman lineworker apprentice on the East Coast, and she sent me a picture of her doing line work, and I could see her red fingernail polish. She had a guy take a picture of her work, and he didn't know what he was showing me, but she had no gloves. Her company said they didn't' make gloves smaller than a size 8 hot glove, so I went to our stock, pulled out a pair and mailed them to her."

Randi said it's a challenge working as a petite woman in the line trade. "I'm like the 1% of the 1% because I'm very petite for my size, and I'm also a woman in a male-dominated field."

Her utility pays to have her garments altered, which has been a big help, but she said she wants clothes that fit well when she's out on the job. "I'm not here to make a statement and look pretty, but I'm in these clothes all day," Randi said. "I want clothes that are comfortable and look good. I don't want clothes that are baggy and made for men."

Over the years, as more women have entered the line trade and construction industry, more manufacturers have started making FR garments and workwear tailored to women. These companies understand that women's workwear is not just smaller sizes of men's clothing, but specific garments made for women's shapes and sizes. A few of these companies include Ariat, Bulwark, Carhartt, Dovetail Workwear, Fastenal, DragonWear, Lakeland, Lapco, MWG Apparel, National Safety Apparel, Radians, Rasco, Tyndale and Wrangler.

For women in line work, however, finding boots is also difficult, especially with the current material shortages. "For me to find boots right now is probably slim to none," Randi said. "I can get a pair of boots that are 16 in. tall that go to the bottom of my knee, but to move around in those all day is not ideal. I'm struggling with just finding an everyday pair of boots. The pair I have right now are worn down."

Some shoe manufacturers, however, now custom-make boots, Susan added. For example, West Coast Boot Company (Wesco) sizes boots for women lineworkers. Ameren Illinois' safety department has also been able to order extra-extra small gloves from a company called Kunz. The cut-resistant gloves don't come into her size back in the storeroom, but her company custom-ordered her a pair as well to keep her safe. Other vendors are also offering gloves in different sizes to

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INVENTING WHAT'S NEXT

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In 2009, Alice Lockridge organized an all-women lineworker crew to perform the flag raising inside the defunded Satsop Nuclear Plant Cooling tower as the starting session of the Energy Conference. These women were from around the Puget Sound Area and represented a full spectrum of skill levels from a new apprentice to journey-level workers and a retired line worker. Matt Hins

fit workers. Youngstown Glove Company offers certain glove styles in sizes ranging from XX-small to 3X-large.

Other essential items for women starting out in the trade are a proper-fitting belt and hooks, Randi added. While many companies may just ask a woman for her height and hand her a belt, Randi said her mom fitted her for her belt and hooks properly, which has made a significant difference in her day-to-day job. "My mom wants that equipment to fit, which is awesome because you're in that equipment and may be on a pole for six hours," Randi said. "You have no idea how long you're going to be on that pole."

Lockridge said it's common for women to be proportionally longer in their legs than a man their same height, and as such, the harnesses must fit properly. "Her body harness should be shorter than the guy her same height, but not always," she said. "Everyone needs their gear to fit their specific body."

3. Build a support network.

When hiring women in the line trade, Lockridge said there's a golden rule: Never hire one woman at a time. "That's a sure way to drown her and virtually 'prove' that women can't do it," she said. "In the first class at Seattle City Light, there were 10 women hired, and 10 women made it through all their difficulties together and pulled with each other."

She can't say two is a magic number, but she said she prefers the hiring of three women at any one time. The same goes for other minority groups, she said. "Don't put a token out by themselves to represent all of their gender or group," Lockridge said.

Susan also encourages the women who are hired by a utility to seek out other women in the line trade. She said it's essential for women to create a network and have support. "I picked out a small group of individuals that if they told me I was having a good day and I did a good job, I knew in my heart that I had done well to get a compliment from them," she said.

Today, the women in the line trade can connect online through social media groups with other females in the trade. Susan, who is a member of a Facebook group called Line Ladies, said she didn't have that option back when she was a lineworker. "Social media wasn't around," she said. "I was one female at one location in Missouri, and there was no way of networking or getting that mentoring."

Randi said she follows a few groups on social media, but she focuses more on connecting with local female lineworkers in her area, including those women who have gone through her mom's training program. Having a support network will also help tremendously when it comes to storm season. As a freshly topped out lineworker, she said she's often at the top of the list

Randi Blaser, the daughter of two lineworkers, recently topped out at Ameren Illinois and enjoys her job in the line trade.

Looking Back: Working as a Linewoman in the 1970s

In the early 1970s, the Equal Employment Opportunity Commission provided money to hire women and minorities into vocational work. At that time, Todd Cheng said his mom, Judy (Shepardson) Hanson was recently divorced with two kids and no child support, and as a secretary, she was paid $2 an hour.

"The government was maintaining a program to make sure all rural areas were connected with phone lines, and the United States needed more lineworkers and capacity to surge up and run these rural lines," Cheng said. "One day, a manager walked into the secretary bullpen and jokingly said, "Do any of you girls want to be a lineman?" My mom raised her hand and asked, 'How much an hour?'

His mom had the potential to earn a dollar more per hour than she earned typing 90 words a minute, and she got the job.

"She spent the weekend bloodying her calves learning how to turn high heels into climbing spikes and scurry up telephone poles," Cheng recalled.

His mom became the first linewoman at United Telephone Company of the Northwest with its OJT/apprenticeship program. Cheng remembers growing up with the stories about her job and the task lists.

"She climbed poles, dug holes, managed contractors, and projects," he said in a Women's History Month tribute to his mom and her grit on LinkedIn. "She has always overcome barriers and used her persistence to step forward, climbing up, digging out and overcoming."

As an apprentice lineman and grunt on the line crew, Hanson said she learned how to climb 45 ft to 90 ft poles, string cable and hand dig holes 6 ft deep when the auger couldn't break through the rock. At 5 ft tall and 100 pounds, she was able to maneuver into tight spaces and had more manual dexterity than some of her coworkers.

"I was muscular for a little gal," she said. "I was also a tough nut and was like the Unsinkable Molly Brown."

She said she faced challenges as the first woman to work an outside plant job, and she advises current and future women in the line trade to not tolerate discrimination, have a tough shell, be fit and get proper training for the job.

"At that time in central Oregon, women were expected to milk cows, put food on the table and make babies," she said. "The women didn't work in the outside plant. The men didn't know what to do with me, but I learned how to talk like a lineman, and I loved the work and being able to be outside."

She eventually got remarried and had another child and worked as an installer for about four-and-a-half years for her company in Oregon. She said she's proud of the legacy and example she set for her children.

"They learned to not put up with anything, do the best you can and finish strong," Hanson said.

Three women lineworkers at Seattle City Light.

when it comes to callouts for storm work. Her mom lives four hours away and can help with her one-and-half-year-old twins, and she's also found friends who can provide childcare in the Illinois area, including a sitter whose husband works for Ameren and a family who "adopted" her and her son and daughter.

4. Create awareness of job opportunities for women in line work.

To encourage more women to consider careers in line work, Susan said there needs to be more education and awareness about opportunities in the trades. "Parents don't raise their kids to say, 'when you grow up, you're going to be a lineman,' she said. "Schools also don't promote that."

> *"There's open jobs, and lots of opportunity for a woman"*

For example, she was just at a career fair for school counselors, and she set up a table for MCC's lineman training program. Most of the counselors flocked to the fire, police and nursing tables, but few came over to visit with her and learn about the opportunities in line work. By attending her 12-month program, however, her students can earn a high salary even starting out as an apprentice.

"I just don't think women understand that it's something they can do, and they can be supported in, and they can be successful at," Susan said.

Ward agrees, saying there needs to be a culture change at the high school level to advertise the need for young women to participate in technical training. Beyond that, she said the entire culture of the country needs to shift. "This country has traditionally disregarded women as capable of, or sees them as uninterested in, non-traditional trade work," she said. "I think we now need a concerted effort from the federal to the local level to reframe the societal need for lineworkers that shows the need to be great enough to require both women and men as lineworkers for utilities."

When companies approach Lockridge to ask her how they can hire more women, she asks them to send her the documents to see their advertisements and graphics. "It all said, 'we only want boys' in vague words, but women can read that in the wording. Put women in the picture on your graphic, take the word, 'man' off the advertisement and logo and hold recruiting sessions that are selectively geared toward women."

She advises companies to invite women to come in first by themselves or with a group of women and give them insider tips from people who are experienced.

Lockridge said in today's utility industry, the jobs are still available — for the right women who are willing to put in the work. "There's open jobs, and lots of opportunity for a woman," she said. "The door isn't open very wide, but the right women pioneers will still be kicking the doors in." TDW

AMY FISCHBACH (*amyfischbach@gmail.com*) is the Field Editor for *T&D World* magazine.

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LUMA lineworkers are trained through LUMA College's Utility Lineworker Program, certified by the U.S. Dept. of Labor.

Powering Puerto Rico

Lineworkers are building a next generation electrical system to increase grid resiliency and reliability.

By **AMY FISCHBACH**

Three hurricanes inflicted widespread power outages and significant infrastructure damage to Puerto Rico over the last six years. To keep the lights and power on to the communities, the 3,000 men and women of LUMA have focused on a more resilient, customer-focused and clean-energy system for the people of Puerto Rico.

When LUMA assumed operations in June 2021, the grid had suffered decades of neglect and lack of maintenance, said Dr. Shay Bahramirad, senior vice president, engineering, asset management and capital programs. Compounding the challenges, Hurricane Fiona caused $4 billion of damages and outages across the island less than a year later. Even so, the utility has made historic and lasting progress in just two years, she said.

"We have replaced over 5,000 poles, and by replacing them, we have brought them to industry best practices," Bahramirad said. "These assets are going to withstand 169 mph winds. We have installed over 480 automatic outage reduction devices, and they are going to help us find where the outages are so we can restore customers in a timelier way. We've also cleared 1300 miles of hazardous vegetation."

Due to these efforts from LUMA's field workforce, the utility is seeing a 25 percent reduction in frequency and a 35 percent decline in the duration of outages. Over the last year, the utility has also connected 54,000 customers to rooftop solar, making Puerto Rico seventh among all U.S. states and territories in residential solar energy adoptions per capita.

"We are strengthening the entire system and improving overall resiliency and service for our customers, both now in the long term, for the generations to come," Bahramirad said. "We want it to stand the test of time."

The following is a glimpse into the progress Puerto Rico has made in its grid modernization projects and how its field workforce is helping to pave the way to reliability and resiliency.

Improving Reliability

After Hurricane Fiona flooded parts of Puerto Rico and left the island with a widespread blackout, LUMA's field workforce has been focusing on clearing vegetation and restoring and rebuilding infrastructure. The utility is also continuing to partner with FEMA and the federal government to fund upcoming projects addressing generation shortfalls on the island. Case in point:

the utility recently connected the first land-based generator funded by FEMA, which will add about 150 MW of generation and minimize the impact of generation-caused outages.

"We're thinking holistically and methodically about how a modern grid should be built," Bahramirad said. "This includes deploying a modern energy management system, deploying accurate system models and system planning, which never existed on the distribution level in Puerto Rico, and executing basic maintenance. That will lead to a stronger and more resilient electric system that delivers the safe and reliable energy that all Puerto Ricans deserve now and for the years to come."

LUMA has made it its mission to not only improve the reliability of the service, but also build a better energy system for its 1.5 million customers. To do this, the utility is looking simultaneously at the broader industry to see what is possible and focus on the specific areas of the grid in need. For example, the utility has developed the first network microgrid projects leveraging undersea cables in two islands with resiliency challenges. LUMA is collaborating with the Department of Energy and scientists and engineers from labs nationwide on the project.

"Our customers are the core of everything we do," Bahramirad said.

LUMA is a Puerto Rican company that, since June 1, 2021, operates and manages the electric power transmission and distribution system in Puerto Rico.

Clearing Vegetation

Another key focus of LUMA's grid modernization plan is removing hazardous vegetation. Crews have removed vegetation surrounding more than 400 substations throughout the system to improve reliability.

"Vegetation is the number one cause of outages in Puerto Rico, and to date, we have cleared more than 1300 miles of power lines," Bahramirad said. "We have prioritized clearing in areas where they are most needed, and where it will have the greatest impact on reliability and resiliency."

To support its vegetation management efforts, the crews have been using a variety of technologies including drones, LiDAR and various cameras and sensors. To date, LUMA has patrolled and inspected 100 percent of its 115 kV and two 30 kV transmission lines across Puerto Rico using thermal imaging technology.

Through the grid modernization program, LUMA is working toward a brighter future for Puerto Rico.

LUMA lineworkers maintain the electrical grid in Puerto Rico.

"We continue to use the data collected from these imaging systems to make better, data-driven decisions to make improvement in the system," Bahramirad said.

For example, in one neighborhood, by clearing vegetation, the crews were able to identify half of an older pole dangling in front of an elementary school.

"The state of vegetation in Puerto Rico has given us a lot of opportunity for improvement," Bahramirad said. "In other areas, the vegetation clearing we are doing is making it possible for us to execute the repairs and see more of the island. That way, we can avoid the outages and blackouts that have historically affected Puerto Rico."

Upgrading Substations

To further improve reliability, LUMA is transitioning from stray bus, double ring or break-and-a-half to fully digitized substations through the $101 million FEMA-funded substation modernization initiative. The utility is focusing on modernizing 11 of its substations, and work is already underway on five of them. In the future, LUMA plans to bring in partners from across the United States and partner with local contractors to support the projects.

"We are working to not only restore, but fully rebuild and modernize each and every substation through the island, which will increase the safety of our operation," Bahramirad said. "It will also reduce outages and improve energy reliability across the system for all our customers."

Specifically, the crews are upgrading the oil circuit breakers with gas circuit breakers and elevating portions of the substations in the 10-year flood zone. In addition, LUMA is adding fiber optic technology for communication and deploying advanced sensors like phaser measurement units to improve situational awareness and wide area protection to provide enhanced resiliency.

"We are also looking at the system holistically to think about how we can plan the system in a matter that can improve the

By the Numbers: Training Lineworkers in Puerto Rico

With grid modernization projects underway across the island of Puerto Rico, LUMA is investing in the future of its field workforce through LUMA College, the island's first U.S. Department of Labor's certified lineworker apprenticeship program. By partnering with the International Brotherhood of Electrical Workers, LUMA is training the employees necessary to modernize the grid.

To further increase the skilled labor talent in its pipeline, the utility recently opened doors to LUMA College's new campus in Canóvanas. The utility also hired the first two female lineworkers in its history in 2022.

"The education we provide to our students and future lineworkers is based on industry-leading best practices," said Juan Vargas, president of LUMA College. "The programs offered by LUMA College for Technical Training empowers a diverse and highly trained workforce to rebuild Puerto Rico's electrical system."

Here are some fast facts about the new campus, which offers classes in skilled labor, technical safety and line crew leadership.

- 24 acres with 18,000 sq ft of facilities
- 10-acre skills and competency yard
- Only transmission and distribution laboratory in the Caribbean and the fifth of its kind in the United States
- More than 3,000 utility workers have been trained through programs and training courses at LUMA College since 2021.
- 44 students have already graduated from a training program at the new campus.
- $12.5 million was donated by LUMA's parent companies, Quanta and Atco, to build and construct the campus.

A LUMA College instructor showcases the first and only transmission and distribution laboratory in the Caribbean.

resiliency and sustainability of the whole system and enable more renewable energy on the island," Bahramirad said. "When rebuilding the grid, we need to take the opportunity to use the best proven technology that meets the particular needs for each substation."

This is particularly significant due to climate change, which is making the challenges LUMA and Puerto Rico are facing even more severe, she said.

"We are located in a country in a hurricane zone, and what used to be a 500-year flood zone is now a 100-year or even a 50-year flood zone, and it requires the appropriate responses," Bahramirad said.

In addition, LUMA is zoning in on the security and safety of its substations by clearing hazardous vegetation and conducting critical repair assessments of all the equipment. The utility is also working with local and federal law enforcement agencies to prevent the tampering of electrical equipment to protect the employees, contractors, customers and communities.

The field workforce at LUMA has 3,000 men and women. The utility hired its first two female lineworkers in 2022.

Spotlight on Streelights and Solar

Beyond substation modernization, LUMA is focusing on replacing tens of thousands of streetlights through the $1 billion FEMA-funded initiative. Workers are installing more than 300,000 streetlights across the island's 78 municipalities. LUMA's crews, along with contractors, have replaced or repaired more than 37,000 streetlights so far.

Every new streetlight features LED technology, which uses about 65 percent less energy and lasts four times longer than conventional street light bulbs.

"This is an important energy efficiency effort that will have a long-term benefit for Puerto Rico," she said.

LUMA is working toward powering the communities with 100 percent clean energy, and as part of the initiative, the utility is focusing on rooftop solar. The utility has recently added 330 MW of clean energy to the grid.

"No one has done more on the ground to accelerate the clean energy transformation in Puerto Rico than LUMA," she said. "All of this progress is thanks to the hard work of our 3,000 LUMA women and men who continue helping to connect more than3,400 additional rooftop solar customers to the grid each month as we build a cleaner and more resilient energy system for Puerto Rico."

Through the modernization projects, LUMA is focusing on the future of a grid that is reliable and resilient.

"Climate change means we need to expect more, and not fewer, disruptive events," she said. "Everything we do is focused on ensuring the grid has the capabilities to withstand severe storms—from deploying poles that can withstand 160 mph wind to enhancing situational awareness with sensors and improving grid flexibility. Additionally, we are clearing vegetation to mitigate hazards and installing automated devices to restore power more quickly."

By doing the projects the right way, LUMA can integrate the clean energy generation that can improve service for customers across Puerto Rico.

"Building the grid in Puerto Rico is an opportunity to demonstration how LUMA — and the industry as a whole — can make communities more reliable to drive economic activity and more sustainability and mitigate climate change and be more resilient in the face of a natural disaster."

LUMA has already seen the results in Puerto Rico, which has historic reductions in customer interruptions in less than two years of activity.

"These successes have not only come from hard work at LUMA, but also close collaborations with stakeholders, and the local and federal government from FEMA and the Department of Energy to the leadership of various parts of the Puerto Rico government," she said. "We have made incredible progress in just two years, but we know there is more work to be done. We are excited for what's to come and the progress to be made in Puerto Rico in the years ahead."

Juan Saca, the new president and CEO of LUMA, lived and worked in Puerto Rico from 2012 to 2019 during the period of Hurricane Maria and said he has a very special relationship to Puerto Rico and its people. Going forward, he plans to focus on three key priorities — communication, projects and stakeholder collaboration.

"The good news is that we have qualified personnel and federal and state funding to improve service," he stated in a video message outlining his vision to LUMA's customers. "Fortunately, several collaborators have joined us to replace more streetlights, install stronger poles, modernize substations and reduce the risk vegetation poses to power lines. Going forward, we will continue to be transparent about the opportunities and challenges we face. Together we will build a new era of progress for Puerto Rico." TDW

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Editor's Note: Listen to the Line Life podcast to hear an interview with Dr. Shay Bahramirad from LUMA about the progress in grid modernization projects in Puerto Rico. You can also watch a video message from LUMA's new president and CEO, Juan Saca, at *https://youtu.be/zjLGvj_psPY*.

Rodeo Flashback

Three top journeyman teams share their tips, techniques and memories from years of competition.

By **AMY FISCHBACH**

Nearly 40 years ago, the first Lineman's Rodeo took flight in Manhattan, Kansas. A dozen journeyman lineman teams showcased their safe work practices, demonstrated their skills and enjoyed the camaraderie of the line trade. Fast forward to last year, and the event soared to 242 journeyman teams and 366 apprentices.

For this year's Lineman's Supplement, we are taking a trip back in time to talk to a few of the Lineman's Rodeo champions over the last 39 years. These journeyman lineworkers hail from different parts of the country, but they all have one thing in common: They were crowned as the best of the best in the International Lineman's Rodeo competition.

The Duke Energy journeyman team of Sandy Barnhill, Jay Tipton and Keith Griffin won the journeyman division in 2021. They're headed back to Kansas City again this October to compete at the 2023 International Lineman's Rodeo, but this time, they'll be in the senior division. "We've competed in the company Rodeo for 16 years and at the international level for eight years," said Sandy Barnhill, a journeyman lineworker for Duke Energy in North Carolina. "This year, we're entering into a new era for our team, and we're looking forward to it."

Barnhill said the International Lineman's Rodeo is not only a competition, but it gives linemen's families and the community the opportunity to see lineworkers in action. His teammate, Jay Tipton, said his son was able to come on stage with him at the awards banquet, and Barnhill remembers having his team's family members' support on the sidelines.

"For us, it's a wonderful thing because we get to get our families involved and engaged," he said. "They run a stopwatch for us, yell at us and tell us things that we're trying to pay attention to. The Rodeo really helps to solidify what gets done every day by hundreds of line techs. It heightens their awareness of the dangerous situations that everyone finds themselves in, and just how important the jobs are that linemen do to serve their communities every day."

Lineworker Robert Hess of JEA in Florida also said the Rodeo plays an important role in the line trade. He won the competition back in 2013 with his teammates, and he's now training up-and-coming apprentices to compete.

"Competitions like this one are important because they build up our skillset and help us with our day-to-day jobs, as well as with restoring power after natural disasters and during mutual aid," he said. "It also helps in the safety aspect too, especially for apprentices. The practice you get from

the Rodeo really makes you an asset to your company and your team."

Two-Time Champs

Team: ***Ramon Garcia, Jacob Lybbert and Wil Robinson***
Company: ***Southern California Edison***
Location: ***California***
Years won: ***2016 and 2019***

The 2019 World Champion Journeyman Team trophy winners (left to right), Ramon Garcia, Wil Robinson and Jacob Lybbert. Photo by Energized Edison.

Ramon Garcia has been competing at the International Lineman's Rodeo for 11 years with his teammates, Jacob Lybbert and Wil Robinson, and he said his team is the only one at his company to stay together and win twice.

He and his teammates compete in at least four to five rodeos a year. "We use them as a learning experience to prepare for the International Lineman's Rodeo event," he said.

When he and his team won the competition, he remembers three things — the nerves, the excitement and the celebration.

"In 2016, we won a few awards in different events, and as the end came, we knew we were in the running," he said. "The biggest feeling other than joy was the proudest moment in my career to do something no one had accomplished at SCE."

To succeed, competitors need teamwork, chemistry and practice. They must also stay composed and be efficient, he said. Now that the team has won twice, they are helping the next generation of lineworkers.

"We always attempt to bring new teams and hold practices with them," Garcia said.

The team will compete together at the 2023 International Lineman's Rodeo and is planning on going for the gold once again.

"We are still competing and hoping for a third championship," he said.

He said the International Lineman's Rodeo Week is very special to him and his team.

"All weekend long is awesome, and I love the Rodeo," he said. "The best part of it for me is getting to talk to all competitors from different parts of the country. We may have to stay in competition to see the 40th Rodeo."

Florida Trio

Team: ***Robert Hess, Michael Corbitt and Brian Gregg***
Company: ***JEA***
Location: ***Jacksonville, Florida***
Year won: ***2013***

Robert Hess, Michael Corbitt and Brian Gregg of JEA were the top journeyman team at the 2013 International Rodeo Competition.

Robert Hess, a lineworker for JEA in Jacksonville, Florida, has been competing in the Rodeo for about 10 years. He initially got involved because he's an extremely competitive person.

"For linemen, the Rodeo is the closest thing we have to a sport, so when I first heard about it, I had to sign up," Hess said. "It seemed like a fun opportunity."

His journeyman team, which also included Michael Corbitt and Brian Gregg, won the Rodeo in 2013, and he said his team's bond was its strategy.

"The tasks you have to perform at the International Rodeo are usually a mystery until 24 hours before the competition, so it's hard to prepare for it," he said. "What made us win was our relationship, our work ethic and our desire to succeed. We all shared the same hunger and drive. We practiced day in, day out and eventually became brothers who learned each other's strengths and weaknesses. This allowed us to be a solid team during practice, and an even stronger unit on competition day."

To train for the Rodeo, his team practiced before work, after work and during lunch. He said they trained for the Rodeo like they trained for anything else because they knew the more they practiced, the better they would get.

"We spent every second at JEA's training facility where we set up tasks that we thought they'd put in the mystery event," he said. "We practiced everything there was to practice when it came to line work, so that on competition day, we'd be prepared regardless of the task they threw at us."

The hard work paid off, and he said the most memorable experience was walking across the stage and winning the trophy.

"Winning the International Rodeo is like winning the Superbowl or World Series," he said. "It makes you top dog for the year, and it's something you never forget. It felt satisfying to know that all the hard work we put in on the training yard paid off."

Today, he is now helping other Rodeo teams to prepare for the competition by serving as a coach for JEA apprentices who compete at the Rodeo. He orders all the materials, helps to build the training yard, attends practices, points out safety infractions and runs the stopwatch.

"I'm able to coach the guys based on everything I've learned and all the mistakes I made with my team during our practices," he said.

While he is no longer competing, he plans to come to Rodeos to watch JEA's apprentices in action. He also enjoys meeting other lineworkers from all over the world.

"Being able to communicate with people with the same background but completely different views and cultures was interesting," he said. "It made me realize that we all do things differently."

To be one of the top winners at the International Lineman's Rodeo, it takes a lot of hard work and dedication, he said.

"If you're not willing to practice day in and day out, devote all your time and sacrifice your days, it's going to be hard to win top honors," he said. "You have to be stubborn and be willing to work for it."

Carolina Competitors

Rodeo Competitors: ***Sandy Barnhill, Jay Tipton and Keith Griffin***
Company: ***Duke Energy***
Location: ***North Carolina***
Year won: ***2021***

Two years ago, the Duke Energy team won the journeyman division, and they're looking to compete again this year.

Sometimes storms got in the way of competition for Duke Energy's journeyman team of Sandy Barnhill, Jay Tipton and Keith Griffin. During four of the eight years that the team has competed, however, they placed in the top five. Two years ago, the team rose to the top and won the best journeyman team title.

Tipton, lineworker for Duke Energy, in Marshall, North Carolina, said he's been competing since 2006 and feels it's a great way to perfect skills and learn from others. For his team, he said the keys to success are dedication, prayer and a good day.

"We just go out and do the best we can," he said. "We try to stay focused and in control for the competition."

To prepare, Tipton tried to keep himself in the best shape as possible, and he also spent time practicing with his teammates. The team got together after hours or on Saturday mornings, Barnhill added. "We would run through an event or two and just stay in step with each other,."

The team's strategy was to communicate effectively, stick to the plan they developed and then go at it as hard as possible on the day of the event, Barnhill said. "To succeed, you must have a commitment to the trade and a willingness to find a team that you really jell with," Barnhill said. "You have to have the same targets in mind to compete on that level."

Winning the Rodeo requires teamwork and overcoming challenges. When competitors attend the awards banquet, he said there's no guarantee they will even walk on stage.

"It's humbling when you hear your teams number called," he said. "It's the unknown of doing your best and having a good day, but you just don't know."

When the announcer did call his team's name, however, and they were invited to walk across the stage, it was a surreal and awesome moment, Barnhill said. "I realized the talent in that room was extremely high and we were fortunate and blessed."

Tipton said it was a great feeling to have the chance to be recognized in front of his peers. Griffin said he'll never forget the feeling of the hard work his team put in through the years paying off.

"I remembered how we worked really well as a team and overcame the challenges," he said. "It was humbling when they called out our number that we won."

To be the best of the best, it takes more than speed — it requires no point deductions or penalties during the events, Griffin said. "I think a lot of times the young teams get in their head that it's nothing but speed, but at the end of the day, if you can't do it right, you're never going to win the Rodeo," Griffin said. "I think a lot of it is that you have to be clean at the end of the day. You can be the fastest at every Rodeo, but if you don't have the perfect score, you're never going to win."

Now that the team has years of experience, they are now helping the next generation of competitors. "We've had a lot of good finishes in the Rodeo because other people have taken the time to help us out," Tipton said. "So now we are trying to pass that experience on to the next teams. I'm just excited for the next generation. Every year it seems to get better and stronger."

Barnhill agreed, saying that his team supports the Rodeo every chance they get by working with apprentices and teams desiring help to prepare for the competition. "Our leadership in our local area has always been there for us so we definitely want to pass it on," he said. "The Rodeo is an awesome time of year for us, and we look forward to the competition and family atmosphere that is experienced." TDW

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