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Looking to the Future of the Line Trade

By **AMY FISCHBACH**, Field Editor

Welcome to this year's Lineman supplement, which celebrates what's ahead for the line trade — a more diversified workforce, bridging the knowledge gap and monitoring and working on infrastructure from the sky. Over the last 14 years I have covered the line trade for *T&D World*, I have seen more women topping out as journeymen linemen and an increasing number of utilities investing in drone programs. In addition, linemen are becoming specialized to serve on aerial work crews nationwide.

Bridging the Gap

Through the years, more linemen are also hanging up their harnesses and stowing away their work boots as they move into retirement. While some of these experienced linemen move out of the field and into roles in safety and training, others leave the line trade — taking their years of experience and wisdom with them.

To ensure linemen's knowledge and skills don't get lost along the way, utilities have explored many different strategies and technologies. Duke Energy has captured the data from its veteran lineworkers in its circuit mapping software.

"Up until about 20 years ago, switching locations, the locations of fuses along the line, and the driving directions for how to get to each was part of a vast information storehouse locked in the memories of older line workers," said Barry Anderson of Duke Energy. "Today, that vital encyclopedic data resides in circuit mapping software and GPS tools that are accessible to all line workers, regardless of their home territory. That is invaluable information for crews who travel in from different areas to help restore power after storms."

Eye in the Sky

Speaking of storms, drone technology has expedited outage response and damage assessment for many companies nationwide. The "Eye in the Sky" story in this year's supplement looks at how companies are using drones to capture imagery of destruction in the aftermath of severe storms.

In the past, linemen had to "walk the line" and encounter the possibility of hidden hazards during the damage assessment process. Today, operators can fly drones over the storm-damaged areas and then quickly send the imagery to the field supervisors, who can then line up materials and prioritize work for the line crews. "A drone team can capture the entire area remotely avoiding all hazards while still collecting imagery from above, which can provide details not even seen from the ground," said Chris Sorrentini of BHI Energy/D&D Power.

Women in Line Work

This year's Lineman supplement also highlights women in the line trade. As the utility industry works to increase diversity, more women are becoming aware of the opportunities to work as linemen.

I spoke with six female linemen at different stages of their careers — from an apprentice lineman to a power line maintainer with 34 years in the trade. The women share their stories about how they got inspired to work in the line trade and what it's like to work as a woman in a male-dominated occupation.

When they topped out in the trade, they all had different views of the title of "journeyman." For example, Rae-Lynn Hawco of Voltage Power prefers the title, "linewoman" because she says it feels strong.

In contrast, Lorrie Reece of Southern California Edison (SCE) said she preferred the designation, "journeyman lineman" because she believed there should be no gender specification to the position. "When I was hired with SCE, my supervisor asked me what I preferred, and I said, 'there is no journeywoman classification because it is not needed,'" Reece said. "Gender has nothing to do with it. You either have it or you don't."

Aerial Linemen

Along with women in the line trade, I am also profiling the adventurous lives of aerial linemen. A few years ago, I had the opportunity to see a human external cargo (HEC) crew in action at the 2019 Transmission & Distribution Maintenance Management Association conference hosted by the Los Angeles Department of Water & Power. While I didn't have the opportunity to fly with the HEC team, I was able to sit in an Air Chair, check out the personal protective equipment and observe a live demonstration.

Rather than solely working from a bucket truck, these linemen use the HEC or long-line method to access hard-to-reach structures and perform line work. Through specialized training, the linemen learn how to safely and efficiently work with the helicopter pilot and their team on the ground to get the job done.

I hope you enjoy reading these feature stories about the lives of linemen as much I did writing them. I look forward to welcoming the *T&D World* readers and their families to Kansas City for the International Lineman's Rodeo this October. While we had to celebrate virtually last year due to the COVID-19 pandemic, I think linemen are ready to compete at the Rodeo and enjoy the camaraderie of the line trade. TDW

Aerial Linemen

By working from a helicopter, these linemen are reaching new heights in the line trade.

By **AMY FISCHBACH**, Field Editor

Back in the early 1900s, linemen constructed a power line, likely with mules, in the "middle of nowhere" in Arizona. Today, the third largest public power utility, Salt River Project (SRP), uses specially trained transmission line crews to change out the structures through helicopters.

"The lines that we work out here are some of the oldest lines in the system or even in the United States," said Journeyman Lineman Matt Davis, who serves on SRP's aerial team. "The linemen who originally built the lines must have been some strong guys because it is still a lot of hard work today with the modern tools and equipment. Some of these structures are on the top of mountains, next to canyons and in rock. How they ever got built in the first place is crazy to me."

More than a century ago, roads were built to the structures, but over the decades, the ROWs have disappeared. For that reason, Davis said it's often easier to fly in materials and linemen rather than put the wear and tear on the vehicles. Nationwide, other utilities and line contractors are also leveraging helicopter work to save time and improve the productivity of their field workforce.

While many linemen spend their decades in the line trade working from a bucket truck, a select group are accessing infrastructure from the air. Instead of solely climbing poles and scaling structures, they are instead dropped off at the tops of transmission towers to expedite line work and reach inaccessible locations.

"It is really a rush, and it is fun," Davis said. "It is something different that not a lot of people get to do."

Here are the stories of Davis and other aerial linemen who through extensive training, learn how to safely and efficiently, work from the air.

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Joe Robertson *of IBEW Local 220:* **Traveling Lineman**

For the last decade, Joe Robertson has worked as an aerial lineman. As part of his training through the International Brotherhood of Electrical Workers (IBEW), he has dead ended wire, installed marker balls and dampeners and changed out insulators. He said he enjoys the solitude of helicopter work.

"I think you have a little bit more freedom out there," he said. "You are secluded. You can be on top of a mountain, and you don't even hear a bird sing. You just hear your fellow linemen talking back and forth, and you focus on the job and get it done. It's a peaceful feeling."

Robertson thought back to the first time he rode in a helicopter, and he recalls feeling like he was in a movie. "The pilot flew me around a little rough to jar me a little bit," he said. "Flying in sideways to land was interesting."

Right now, he uses the Human External Cargo (HEC) method. He said this work method has changed over the years. In the past, he remembers flying under the helicopter with a lot of tools in his belt. Today, all the tools are transported separately.

"You have two connection points on your harness, and you are no longer required to carry any working materials," he said. "Everything is flown in, and it's just me and my buddy."

His local has five different two-person crews who are certified to do aerial work.

"Training has come 10,000-fold compared to how it used to be," he said. "We have really good training now."

As part of his training through the International Brotherhood of Electrical Workers (IBEW), Joe Robertson has dead ended wire, installed marker balls and dampeners and changed out insulators.

Right now, Joe Robertson of IBEW uses the Human External Cargo (HEC) method.

For the last two-and-a-half years, he has worked as an aerial lineman for PAR Electric, which has helicopters in its fleet. For several months, he will only perform helicopter work, and then other times, he will focus on other types of tasks. He is trained in not only aerial work, but also distribution and underground.

"We are all over Northern California changing out bells for 500 kV and structures for 60 kV," he said.

As an aerial lineman, he said it's important to be prepared to travel for work.

"I have always traveled, so it's not a big deal to me, he said. "It fits my lifestyle perfectly."

The 44-year-old plans to retire early, buy a sailboat, and travel via the wind. In the meantime, he said he enjoys training the future linemen, and he takes pride in being patient with those who are new additions to the helicopter team.

"I enjoy training an apprentice or a lineworker who has worked for 40 years but has never done aerial work," he said.

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Matt Davis *of Salt River Project:* **Working Barehand**

Davis worked as an outside contractor for IBEW Local 769 for Wilson Construction and Sturgeon Electric before coming to Salt River Project (SRP), where he had the opportunity to join the helicopter team. He is now one of 15 transmission linemen specialized in aerial work and serves on the 500 kV barehand crew for SRP in Arizona.

"I never really came into it to be part of a helicopter crew, but it is always interesting because of the new jobs and different terrain," said Davis, who has worked in the line trade for the past 15 years. "It's an awesome experience."

Davis, who works out of the East Valley Service Center, is part of a crew who performs power inspections and maintenance on hard-to-access transmission lines across the state of Arizona. He and his crew inspect all the hardware and metal components and check out the conductors for any issues through the "climb-and-shake" method.

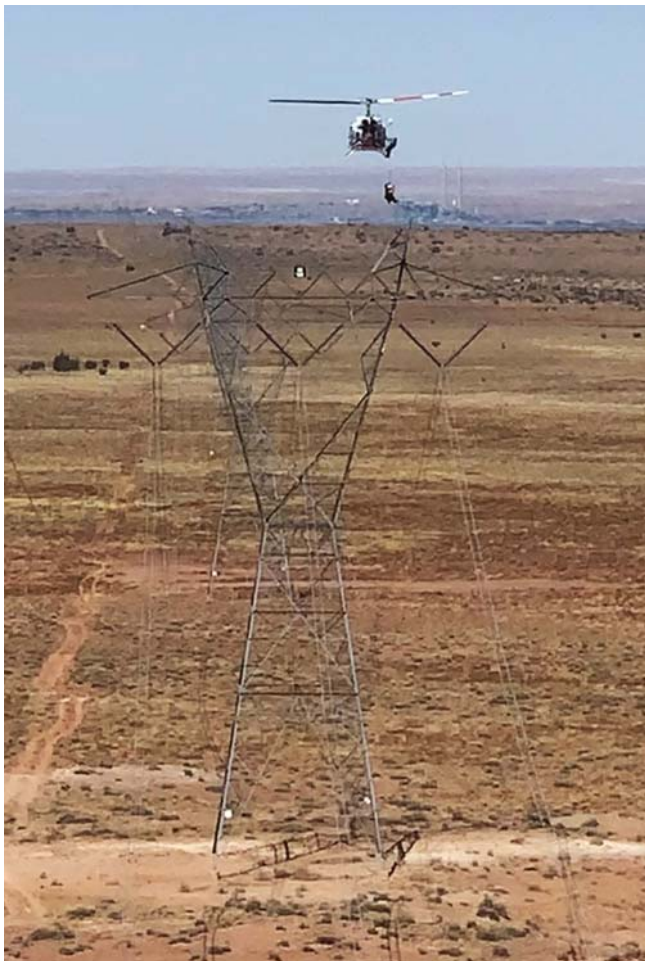
"By using the hoisting operations with the helicopter, we save a tremendous amount of time," Davis said. "We inspect 70 to 80 towers a day as a team, and I climb about six to 10 towers each day."

Many of the towers are inaccessible with a truck, even though they have all-wheel drive. SRP has two large trucks that can reach the tops of the towers, but the helicopters can also drop the linemen on top of the structures, and then they can climb down.

"The 200-ft trucks weigh 90,000 lbs, and there is no way we can get them to every structure," Davis said. "A helicopter pilot can land five linemen on top of a tower, and we have eight to 10 guys climbing all at one time."

SRP's helicopter team uses the HEC method to transport the line crews and hoist them onto the tower. The helicopter pilots then switch over to the long-line method to fly

Davis, who works out of the East Valley Service Center, is part of a crew who performs power inspections and maintenance on hard-to-access transmission lines across the state of Arizona.



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Hoisting Linemen: Step by Step

In normal hoisting operations, Salt River Project has two pilots and a hoist operator, who communicates with the pilots via radio. Here is how the team works together to land the lineman safely on the top of a structure.

1. The team separates into crews with four or five linemen in the helicopter at one time. The linemen exit from the front or back seat to distribute the weight in the helicopter.
2. The lineman who is exiting the helicopter sits at the door as the hoist operator hooks the hoist onto his harness. The hoist operator then taps the lineman on the leg to signal for him to disconnect his safety from the floor and fully attach to the hoist.
3. The lineman steps out and places his or her feet on the skid or sits into his or her harness and floats on the hoist.
4. The hoist operator then taps the lineman on the shoulder, and down the lineman goes.
5. In less than 30 seconds, the lineman is on the tower, and the pilot flies away.

in materials and tools. Last year, SRP performed about 40 structure changeouts in which the linemen changed out towers to poles.

"In those operations, for the first time, we chopped up the tower and flew them out with the helicopter, and then we flew in new poles with the helicopter," Davis said. "Next year, we will be setting new towers with the helicopters, and we are practicing with the pilots to stack the parts of the tower."

As part of the aerial transmission crew at SRP, Davis and the other linemen complete an extensive training program for two weeks every year. The training kicks off in the classroom, in which the helicopter pilots review the basic helicopter functions and the ins and outs of helicopter work.

"They treat us like part of the helicopter crew," Davis said. "We know what to look for so if we don't like something or something doesn't seem right, we can point it out to the pilots."

Next, the helicopter pilots do a dry run in which they train the linemen with the helicopter off. That way, the team can hear each other talking, and the hoist operator has the opportunity to freshen up on his skills. "When the helicopter is running, it is super loud, and you can't hear anything," Davis said. "You have to use visual hand signals."

The linemen then practice doing hoisting operations at 25 ft, 50 ft and 100 ft from the Bell 212 helicopter to the ground and then from the ground to the helicopter. At that point, the crew practices landing on a mock tower in the middle of a field.

"The pilot practices flying us into a tower with no power lines or anything around," Davis said. "It's good for the linemen to practice landing on the steel, and it's helpful for the pilots, who have a good visual of what it's like."

Finally, the linemen learn how to land on an actual tower with their 100 percent fall protection. The aerial transmission team uses a device called the Lezard from Petzl to hoist onto the towers. They then secure the lanyard, which is clipped to the helicopter, around the tower, for improved safety.

"We are at a point now where we are 100 percent fall protection," he said. "There was a point before I got here where they would hoist on to the towers, and for a few minutes, they were not at 100 percent. For the last seven or eight years, we have been at 100 percent, and it has improved safely greatly."

SRP also uses a twin-engine helicopter for hoisting operations so if one engine fails, the pilot can either complete the task at hand or abort the mission and land the lineman safely on the ground. As an aerial lineman, Davis said he faces the risks of working around heights, helicopters and electricity.

"When we do our tower inspections, all of our 500 kV lines are energized, and there can be isolated statics," he said. "It is challenging and important to make sure everyone is on their 'A' game 100 percent of the time."

Despite the challenges, Davis said he doesn't plan on leaving the aerial transmission crew anytime soon.

"The helicopter work is awesome," he said. "Our crew is open to trying new things that other companies use across the United States. The hoisting operations work great for what we do and the way we use it, and I know there is a lot of cool helicopter work going on nationwide."

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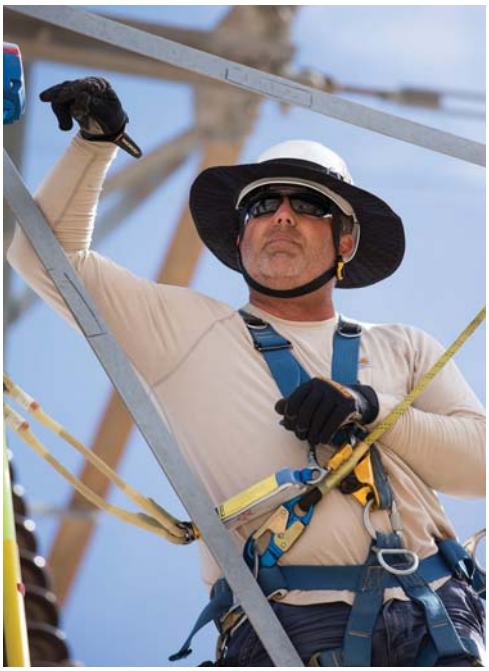
David Katich *of Western Area Power Administration:* **Aerial Patrolman**

Over the last 24 years, David Katich, a journeyman lineman for IBEW 769, has served as a groundman, apprentice, lineman and foreman. Today he works as an aerial patrolman for Western Area Power Administration (WAPA).

In this position, he performs an aerial patrol of 3,100 miles of transmission lines every four months and investigates every transmission line relay event within the Desert Southwest region. He also works with crews doing longline, HEC and Energized HEC.



David Katich of Western Aera Power Administration (WAPA) and IBEW 769 performs aerial patrols.

"A journeyman lineman can work all facets of line work from overhead to underground, transmission to distribution, construction to maintenance, de-energized to energized with rubber gloves, hot stick and barehand methods," said Katich, who completed a four-year apprenticeship program at SRP in Phoenix, Arizona, where he worked for 13 years before coming to WAPA 11 years ago. "Helicopters, cranes and bucket trucks are just the tools used to place lineman in the 'working position.'

Being successful as an aerial lineman requires dedication, work ethic, pride, confidence, leadership and a never-ending desire to learn, he said. Generally, he said the helicopter is just an additional tool that is added to a line work project. To learn how to perform aerial work, linemen must attend WAPA's 64-hr HEC training program to review specific procedural and safety concerns as they relate to the helicopter. For example, they learn how to use a small digital weight scale, which connects via Bluetooth to a phone, to monitor the weight of linemen, tools and equipment.

In addition, linemen must perform the individual HEC work methods and procedures before he or she is qualified to perform HEC work. WAPA has HEC lines for de-energized work and specialized HEC lines for energized work up to 500 kV.

"The HEC equipment has advanced in both technology and materials over the last 10 years," he said. "WAPA now uses dual hooks on its helicopters for additional redundancy."

The safety precautions are the same as any other line crew, said Katich, who serves as the co-chair of WAPA's Fall Protection Committee, Apprenticeship Committee, HEC Committee and Unmanned Aerial Systems (UAS) Committee.

"Working out of a crane basket is the same as working out of an air-chair," he said. "The helicopter has a few specific safety hazards that need to be addressed but it's just a different tool being used to support the line crew."

With aerial work, however, linemen must stay focused and remember that "slow is fast," Katich said.

"The biggest challenges are maintaining situational awareness and being able to anticipate events before they happen," Katich said. "For example, it's very easy for tunnel vision to set in and miss the big picture when making the transfer from the HEC line to a transmission structure."

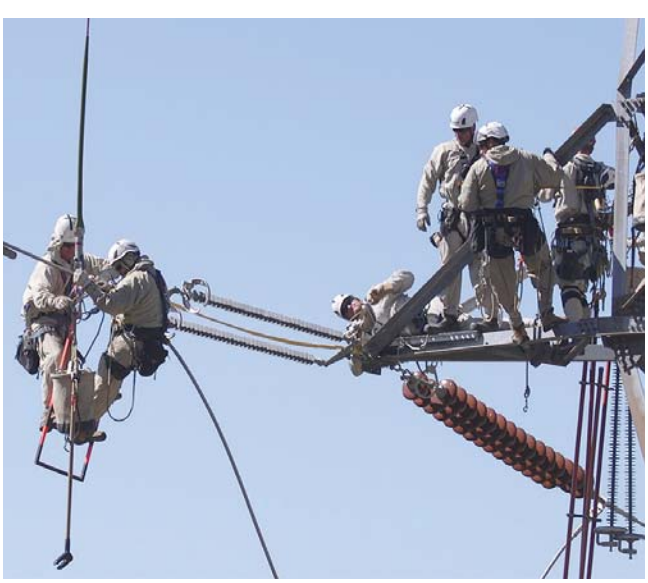
He said being transported in a helicopter to a job site takes some getting used to. "Just imagine four linemen with tools being crammed inside a minivan," he said. "It's much more enjoyable on the HEC line or in the air-chair underneath the helicopter. The favorite part is the few minutes between the landing zone and the work site where you can just enjoy the ride."

During his career, he said one of the most memorable aerial experience was working on a project at Hoover Dam.

"We watched hundreds of tourists visiting an engineering marvel of the world," he said. "They then changed focus and all pulled out their phones to watch the helicopter with the lineman underneath flying back and forth. It's just something that captures people's imaginations."

In the future, he plans to continue to learn new work methods. For example, WAPA has recently developed a UAS program where linemen have FAA Part 107 licenses and can fly drones.

"Integrating UASs with the line crews brings additional capabilities for asset inspections for maintenance crews," he



WAPA linemen replace dead-end insulators on a 230 kV tower using the energized HEC work method.

said. "Being able to inspect the static wire connection on a 500 kV tower from the ground without climbing the tower? Sign me up."

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Jim Schultz *of Los Angeles Department of Water & Power:*

HEC is a Team Effort

Jim Schultz. electrical distribution mechanic supervisor for LADWP's Metro Transmission Headquarters, has worked in the line trade for 36 years. He jumped at the opportunity to work with the helicopter team when he saw all of the benefits the HEC program would have on his section.

The HEC crews consist of pilots, patrolmen and foremen, and they participate in training sessions at one of LADWP's generating stations and a hangar.

"All of our pilots are very familiar with line construction, rigging, tower rescue operations and our work practices," he said. "We work and train together as crew members, not just passengers or linemen. We are very fortunate to have the pilots, journeymen and supervisors that we have in our HEC program, or it wouldn't be as successful as it is."

All crew members participate in an extensive safety tailboard covering helicopter operations, work procedures, emergency operations and risk management.

"We decide as a group to go ahead with the mission or find another way to do it," he said. "Linemen are thinkers and doers. We can always figure out how to get the job done in a safe and efficient manner."

In the transmission department, LADWP performs both short-haul and long-line operations. The pilots also perform long-line work throughout the department for other groups.

To improve comfort and safety for the linemen, LADWP invested in new air chairs, which Schultz said has increased stability when flying doubles. The crews are also always working on and improving safe work practices to perform daily operations.

"We have established a cohesive group between aviation services and the transmission section," he said. "Our pilots do an amazing job and that makes our job that much easier."

An LADWP crew member removes a spacing cart from the line after replacing double bundle spacers.

Participants of the LADWP Overhead Transmission Human External Cargo (HEC) Program.

For those linemen considering aerial work, he said it's important to have a good work ethic, keep safety in mind and always have their crew members' backs.

Retirement is on the horizon for Schultz, but he said he knows the HEC program will be in good hands when he leaves LADWP.

"We all have to keep in mind that it's a group effort to keep the program as tight as it is," Schultz said.

He said he appreciates not only the linemen, but also their families, for their support of the trade. "Thank you to all the linemen who spend countless hours away from home and their families to keep the lights on," he said. "It's a commitment and a way of life that only a lineman knows. And thank you to the line wives. We couldn't do it without your support." TDW

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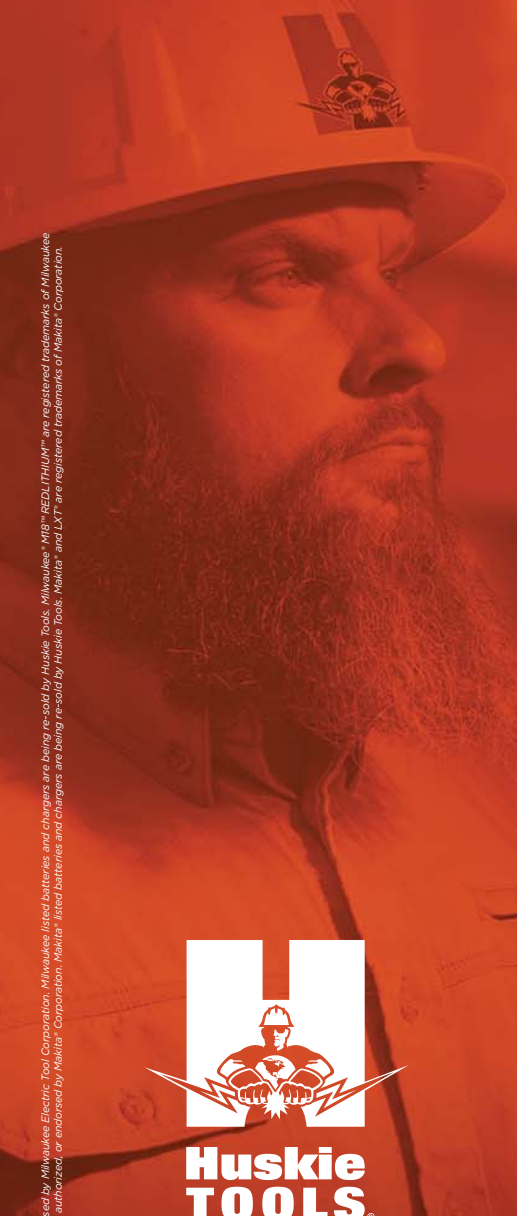

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Women in Line Work

Meet six female linemen with a love for the line trade and the drive and determination to get the job done.

By **AMY FISCHBACH**, Field Editor

Renee Nickles may have worked in the line trade for three decades, but she has seen few other women embrace the adventure of working as a lineman. With skilled labor shortages and opportunities nationwide, however, now is the time for more women to consider line work.

"As many companies seek to diversify the workplace, it's a great time for women to enter the trade," said Nickles, the field operations supervisor for Portland General Electric (PGE). "The line trade is open to women if they want to go into that direction. If women put in the time, are physically fit enough to do the work and have mental stamina, the sky is the limit."

To make it in the trade, women must be mentally strong to weather the ups and downs, not be afraid of heights, be teachable and love the outdoors.

"Some days are overwhelmingly difficult, but you must be willing to stay the course," Nickles said. "At the end of the day, you feel good and have a smile on your face. You can perform tasks most people would never even consider doing in these types of conditions. Linemen are a different breed of people. We go out in the night and storms under the most adverse conditions. It's not for everyone."

Back in 1978, Rosa Vasquez, who was recently inducted into the National Lineman Hall of Fame, was recognized as the first female American lineman. Fast forward to today, and about 4.1 percent or 137 of electric power line installers and repairers are women in the United States, according to the U.S. Bureau of Labor Statistics.

In Canada, women in the electricity sector's trade and technical roles represent 6 percent of the workforce, and women as Powerline Technicians represent 1 percent to 2 percent of the workforce. This means between 76 to 153 women are powerline technicians in Canada, said Lana Norton, founder and executive director of the Women of Power Line Technicians (Women of PLT).

"Challenges in the field often reside with being the only or one of few women in the trade," said Norton, who works for a distribution company in Canada. "Building a network of other women in the field helps women to overcome those challenges by knowing you're not alone, having a supportive network and resources to connect to."

Over time, however, Norton has noticed more opportunities for women in the line trade in her area. "There was a time when I was new in the trade and looking for an opportunity as a woman meant that you had to work harder to have someone to take a chance on you," Norton said. "Increasingly today, women are seen and accepted as capable in the trade, and those without women are often asking what they can do to better attract diversified talent."

Case in point: She recently received a photo from a woman who has been connected with Women of PLT since she was in her first year in the Powerline Technician program.

"The picture was of her and another woman powerline technician working aloft from a bucket truck," she said. "To be at a time and place where we are seeing women powerline technicians working together has been wonderful, because for much of the time past there were simply too few women in the field for this to happen."

Here are the stories of six women in the line trade. They are all at different points in their careers and got into trade for different reasons, but they all share a love for line work and can't imagine doing anything else.

• • •

Corry Ruch *of Hydro One*

In 2019, Corry Ruch became the first woman to win an award at the International Lineman's Rodeo. As part of a senior team from Hydro One, which also included Rudy Kerec and Richard Smedley, she said it was an unforgettable moment to win second place in the senior team division.

For the last 34 years, Ruch has loved all aspects of line work—from getting the power back on after a storm to building lines and making the customers happy.

"Walking across the stage as the first female was one of the best experiences of my life," said Ruch, a power line maintainer. "It made me realize that females can do it, and also, that it's a team effort. At the Rodeo, everyone was so excited and happy and willing to help each other out."

As the daughter of a nurse and a police officer, Ruch had her sights set on sports medicine or forestry following high school graduation. When she walked by a job board, however, a flier caught her attention: "Looking for Females in Non-Traditional Trades."

After closer inspection, she learned that Ontario Hydro (now Hydro One) was searching for job candidates for its power line technician program. "I didn't know what I was getting into, but I wanted to work outside," she recalled.

Out of hundreds of applicants, only 35 got interviews for physical testing and an interview and five were hired in 1988. As part of the interview process, she had to climb a tower, drive in a ground rod and use a grip and chain hoist to prove her tool dexterity. Meanwhile, job mentors walked by the candidates to observe their skills and give a thumbs up or thumbs down. Five women were hired, and one quit before the end of the six-month period, leaving Ruch and three other linemen—Linda Monroe, Laurie Walsh and Janette Smit, who have since retired from the industry. Then in 1990, the utility hired three more female linemen.

When she first started out in the trade, a lot of the older linemen served as mentors, and she and the other women learned from them. During her apprenticeship, she had the opportunity to move around the service territory and learn about the different types of work.

One of the challenges she faced, however, was that she had to prove herself every single day on the job.

"If you are one of the only females in the trade, when people see you, they may think you are not doing the job," she said. "You have to gain the respect of your fellow coworkers and enjoy what you do."

For the last 34 years, Ruch has loved all aspects of line work—from getting the power back on after a storm to building lines and making the customers happy.

"I enjoy being outside and the physical work," said Ruch, who teaches fitness classes in her spare time. "It's important to remember that line work is not just a job—it's a career, and you have to love it. If you are hired into an area, you are responsible for taking care of that area and keeping the power on for the people."

In like work, you also have to get along with other people and troubleshoot problems. "Not everything is black and white," she said. "On a trouble call, you just have to figure it out. While it's great money, you have to want to do it. It's not a 9 to 5 job, and you have to be physically fit because the job is demanding at times, and you are outside all the time, even in a snowstorm."

Working storms, however, is her favorite part of doing line work, she said, looking back to an ice storm back in 1998. "When you go out and see the devastation that Mother Nature can do and know that you can fix it and get power back on efficiently, it's very rewarding," she said "All we need is a thank you to make us feel wanted and good inside."

Corry Ruch became the first woman to win an award at the International Lineman's Rodeo.

Ontario recently had a career fair, which features other females in the trades from brick layers to electricians and construction workers. The women talk to the high school girls, who often haven't heard of the trades. "It opens their eyes that they don't have to go to the university or college," she said. "If they get into the trades, they can earn good money and have great careers."

Other utilities throughout Canada have hired women as linemen, but most are just starting off in their careers.

"It takes about 10 years to see if they will last or not," she said. "It's a very challenging career. If you want to start a family, it's hard to be away from them. It's also physically demanding, which I quite enjoy, but for some ladies, it takes a while."

Ruch has been married for the past 32 years to a retired lineman who knows the ins and outs of the line trade. They met at the Hydro School in Orangeville, Ontario, and the rest is history. While they never worked together during their careers, they both shared an appreciation and passion for line work.

"I stayed in the country, and he stayed in the city during our careers in line work," she said.

They have one son, Brayden, who is now 24 years old and works as an electrical engineer for Hydro One. "I am very proud of him," she said. "He creates the drawings for us to follow when we are going out on a line."

When they both had to go out on a storm when he was young, their friends stepped in to help. "He knew that if there was a storm, we were going to have to go work it," she said.

Now that she has more than three decades invested in the trade, she said she wants to stay in the field. Once she retires, she plans to help the apprentices, teach fitness classes and travel with her husband and enjoy her retirement.

"My career is coming to an end, and I plan to retire in the next year or so," she said. "I'm not ready to go yet. Even after almost 35 years, I still love it."

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Lorrie Reece *of Southern California Edison*

As the daughter and granddaughter of journeymen linemen, Lorrie Reece had the opportunity to learn about the line trade from an early age.

Lorrie Reece was inspired to go into the line trade by her father and grandfather, who both worked as linemen.

"I was fascinated," said Reece. "I was always amazed by what my father did. My first speech in seventh grade was about a transmission line that he was a superintendent on."

At the age of 30, she started out as a groundman, mostly due to the fact that her dad steered her away from the trade. Once she got through the program, however, and her dad was very proud of her success.

She said she enjoyed being part of the apprenticeship program, and she never allowed herself to be looked at differently because of her gender.

"When a female enters a 'man's world,' you have to be of a certain character to accept that if you are offended by behavior that is common to the position you don't belong there," said Reece, who has met several female journeymen linemen during her career. "I continue to have great relationships with former classmates. The challenges I faced were no different than anyone else faced. Line work is line work. You either have what it takes, or you don't. That knowledge got me through some pretty difficult times."

Reece's whole family is in the trade, from her husband to her stepson. Her cousin also works as a lineman, and her uncle is a telephone lineman.

"I have a very forever marriage with a journeyman lineman who has been very successful and a stepson who is a troubleman for the same company that I now work for," she said. "All has gone well for me, and I am very willing to share what I can with others — male and female — to achieve the same success."

Reece spent 11 years "in the tools," but orthopedic surgeries due to line work and her love for horseback riding led her to move from the field to the office.

"When it came to a point with my really bad knees and other orthopedic issues, I realized in order to be productive in the trade I had to change my avenue," she said. "I went into safety on the contract side during recovery from a wrist surgery. I intended to return to my tools and realized I could make a difference without being on the pole or in the bucket."

Reece is now a technical specialist with Southern California Edison Construction Methods. As part of her job, she answers work method questions around standards, installation and what types of materials to use for projects throughout the utility's 50,000-mile territory.

Since she first started in the line trade, she said the industry is very different, the equipment is more advanced and the safety is improved.

"The PPE is far better than when I started," she said. "The fall protection is incredible. You cannot hit the ground if you use it right."

In the future, she would like to see more journeymen linemen concerned about the duty of a lineman rather than the great pay. She said for women to succeed in the industry, they must think of themselves not as a woman, but as a future lineman.

"Take the woman equation away because separating yourself doesn't do anyone any good," she said. "Opportunities for women are as open as they are for men. Pursue your options yourself not as a woman but as a human being who has a desire to do the work. It's as simple as that."

She said to get more women in the line trade, communication is key. "The only reason I was driven to it was my family, and not everyone has that advantage," she said. "My favorite part of being a line worker is that I can be proud of what I and several family members have chosen because not everyone can do this thing that absolutely everyone needs but I can."

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Renee Nickles *of Portland General Electric*

As a single mom of a baby and toddler in the 1990s, Renee Nickles said she struggled to get by. She even worked as a bellhop carrying luggage. Then, line work came across her radar, and her world changed.

For most linemen, a family member or friend often serves as a source of inspiration to go into the trade, and Nickles was no exception. Her grandfather worked as a lineman for four years before he emigrated from Sweden to the United States.

"He took a boat, ended up at Ellis Island and started a new life in the United States as a carpenter at a local union in St. Paul, Minnesota," she said. "I never forgot his stories, however, about how line work could provide a good income and strong future employment options. If I hadn't had so much struggle at the beginning of my life, I may not have embraced it the same way."

She decided to follow in her grandpa's footsteps and enrolled in a three-month pre-apprentice program through the Spokane Community College. A trades program exposed her

Nickles' grandfather worked as a lineman for four years before he emigrated from Sweden to the United States.

to all the available job opportunities. At the same time, she brushed up on her math knowledge, focused on test preparation and worked on her physical fitness.

"At that point, I remembered what my grandpa had done and all the challenges he had faced," she said. "I knew it was a tough trade to go into, but I fell in love with it." In the beginning, she was challenged with working around tools and getting in shape to handle the workload. Just like her male counterparts, she had to practice until she mastered certain skills. Oftentimes, she practiced on her time off or lunch time.

"I had to work on my stamina and the endurance of the job," she said. "Line work takes a lot of upper body strength, and I built muscles I didn't even know existed."

At the same time, she had to be mentally resilient during the training program. "Quitting was never an option," she said. "I never wanted to take a knee during the training. I had to put food on the table for my children and my family. I learned to dig in my heels until I got it right."

In the late 1990s, she earned her journeyman card, and her adventure as a lineman began.

"It was a great feeling to have," she said, recalling how she was driven to be self-sufficient. "I knew I could take the card and afford peanut butter sandwiches for my kids and the jelly to go on them. I could buy the Kool-Aid and the sugar to go in it."

From the day she earned her card, she wanted to be called a "journeyman lineman."

"I didn't want to create any gaps by saying, 'journeywoman,'" she said. "Because of the history and all the tough work, don't devalue me. I earned it and worked hard for it."

She kicked off her career by working with contractors, and when she had to work storms, her friends from her church helped watch her two sons, John and Josh.

"There's a lot of guilt when you're a single mom," she said. "I couldn't provide them with a father or another father figure, and I had to work long hours. It was hard to come home, and my kids said, 'Mom, I missed you. Can you stay home?' When they got older, they understood why I had to work. I was really blessed with the family and friends who helped me in my journey."

After becoming a journeyman cableman, she left the area and moved south to work for Southern Company. Two years ago, she decided to move to Portland to become a field operations supervisor for PGE.

"When my kids were grown and out of the house, I wanted to go back to the Northwest," said Nickles, whose is now remarried and whose sons are now 31 and 33 years old. "I also wanted to go back into the field of my first love, which was line work."

As the manager of the line center in Portland, her day starts at the crack of dawn. She wakes up at 3 a.m. and arrives between 4:30 and 5 a.m.

"I like to get here before my team to gather my thoughts and look to see if there are any callouts or emergencies," she said.

After reviewing the work scheduled for the day, she meets with the lead working foreman to manage manpower. "If you want to come in the field and be in operations, you have to pivot continuously," she said. "Maintaining safety is a number one priority. There are always emergencies going on."

When Nickles first started out in the line trade, she had to wear men's clothes and custom order specially made work boots. Fast forward to today, and she is having a hard time finding women's flame-retardant shirts that she can wear not only in the field, but also in the office and when meeting with customers.

As the only female in the field many years, she not only had to deal with the lack of PPE designed for women, but also

As the manager of the line center in Portland, her day starts at the crack of dawn.

sensed men in the industry didn't want women working with them.

"The men didn't want to pick up the slack," she said. "They anticipated failure because of the physical part of the job. If given the chance, women who are seeking to be linemen are capable and can do the work."

Even today as a supervisor, she goes into places where they have never had a female boss before. "I came into their world, and I am very sensitive to that," she said. "You want to be a good leader and be able to have the hard conversations and listen to their concerns. I have seen women come into the field who are very demanding, but I think it's very important to connect with those you work with."

When working with men, she said it's important for women in the line trade to show both grace and mercy.

"You have to teach them how to work with a woman," she said. "They have been working for years for each other, and you have to give them a little time to learn how to work with us. If they say something in front of you that you don't appreciate, let them know it bothers you."

Hawco, who won Canada's most powerful women top 100 in skilled trade award for 2020, said in line work, it's paramount to maintain a positive "can-do" mindset.

Once her male coworkers noticed she had a passion for the job and wasn't giving up, they supported her in her career. "They gave me tips and went out of their way to help me," she recalled. "Sometimes when women go into the trade, they shy back from doing that. It's OK to fail, but you have to get up and do it differently, or better, the next time."

She urges young women interested in the line trade to seek out a local power company or union, search for apprenticeship programs and explore different trade schools. To gain experience, women can apply for entry-level jobs to learn skills like barricading and flagging to break into the world of line work and meet line crews. Local groups can also provide support. For example, the local Oregon Tradeswomen group, however, provides outreach to trade colleges, tech schools and utilities.

"From when I started in the trade to now, there has been a huge difference," she said. "When I grew up, I took home economics, and it would be so nice if we could expose girls to more of the industrial arts like welding and plumbing. We still have some culture reflections of women doing the physical tasks, but those options are changing for the better."

Now that she has moved into management and returned to working in the field, she will always remember her beginning in the line trade. To help others, she shares her story with women who are homeless or have been incarcerated in the Portland area.

"I will never separate myself from the single mom in me that struggled to make ends meet and make a career," she said. "I help with the programs that get people back on their feet. I tell them that it is never too late to be self-sufficient. Having that passion for the community is my defining moment because it can give others success."

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Rae-Lynn Hawco *of Valard Construction*

Rae-Lynn Hawco happened upon the line trade. She was enrolled in another college program when male friends in the powerline course encouraged her to apply.

"There was an opening, and I made the switch and have never looked back," Hawco said. "That decision was the best thing to happen to me." Her grandfather, who worked as a red sealed heavy equipment technician, encouraged her to consider a career in the skilled trades.

"He always encouraged hard work in order to reap rewards and was a huge influence in my upbringing," she said. "I also received tremendous support from my family and instructor, who gave me the confidence to excel in the line career.

Hawco, who won Canada's most powerful women top 100 in skilled trade award for 2020, said in line work, it's paramount to maintain a positive "can-do" mindset. "I learned it is important to give and take, have fun and ensure those around you have confidence in your abilities," she said.

Her career-defining moment was obtaining her red seal journeyman certificate. Looking back, however, she describes her apprenticeship as challenging and intimidating because line work is a male-dominated trade. For example, as a woman, it was challenging for her to have the strength for heavy lifting, which required her to find a technique that worked for her. Also, when she started in line school, she had to learn things the old school way. For example, when drilling holes, she had to use a brace and a bit. Now that she is in the trade, she has access to top-of-the-line power tools to complete job tasks.

Another challenge was finding the proper footwear and work clothing. She finds it's still hard to find climbing boots in women's sizes or personal protective equipment for women. To meet this challenge head-on, she is teaming up with

She is teaming up with MWG Apparel, an FR clothing company in Canada, on an advisory committee on women's PPE.

MWG Apparel, an FR clothing company in Canada, on an advisory committee on women's PPE.

"I'm hoping to improve and expand on PPE for women in the line trade," she said.

Over the years, she said she has witnessed marked improvements in the health and safety aspect of line work. "Line work can come with dangers, but I am reassured the appropriate checks and balances are in place," she said.

Currently, she works as a journeyman lineman and quality analysis/quality control inspector for Valard Construction. In this role, she is working on a 230 kV H-frame transmission wood pole line and has a 21-days-on and seven-days off shift. She is responsible for inspecting framing and setting, fixing deficiencies and then performing a walk through with the client for the sign off. In addition, she runs a crew for fixing deficiencies and filling in on framing and setting crews when needed.

For the last eight years, her favorite part of the line trade is traveling for work, seeing new places, meeting new coworkers and soaking in the views working in the air.

"I'm trying new things and challenging myself in parts of the line trade I've never done and need experience in," she said.

Compared to when she was an apprentice, she said there is now more female interest now in the line trade. Women in Canada must complete a powerline program and then work for contractors or utilities.

"I think it takes an interest in the trade and also seeing other women in the trade enjoying it, excelling in it and knowing that they have support," she said.

Social media has been an excellent medium for female line workers to connect with each other, she said. "I participate in a Facebook group, which enables sharing of knowledge and information," she said. "In addition, I am active in Women of PLT, offering funding and mentoring for women in or entering the trade."

She said she prefers to be called a "linewoman" rather than a "lineman" or "power line technician."

"I feel like that word feels strong," she said.

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Paige Spetz *of Evergy*

Paige Spetz, a college basketball player who earned her degree in environmental science from the University of San Francisco, never envisioned a future career in line work. She started her career as an arborist contracted by Kansas City Power & Light (now Evergy), where she now works as an apprentice lineman.

"When I was an arborist, I walked many miles a day, looking at trees around power lines," she said. "I was always curious about what the equipment was doing, and where it was feeding power to," she said. "It was a different transition working with trees and then moving to climbing poles, but it helped me to get into the swing of things."

Once a month, as an arborist for ECI, she visited the operation centers, and the linemen convinced her that line work could be a great fit for her. "I was familiar with the buildings and the people, and I knew some lineworkers who worked at Kansas City Power & Light," she said. "It was a good way for me to find myself a career."

When she told her parents that she wanted to go to line school, her mom was worried about the dangers of line work, while her dad backed her 110 percent, she recalled.

"I have a good support system," she said. "I think my friends are also proud of me."

Paige Spetz, a college basketball player who earned her degree in environmental science from the University of San Francisco, never envisioned a future career in line work.

At MCC, Blaser taught her how to climb low and slow on the pole using a climbing belt and BuckSqueeze from Buckingham Manufacturing.

She enrolled at the line school program at Kansas City Metropolitan Community College, where Susan Blaser, the leader of the program, is the first woman lineman in Missouri.

"I listened to her talk, and her experience gave me the confidence that I could do it," she said. "There's not a lot of women in the field, but I am now talking to other women in the trade and there is a lot of support there. This is how I got into line work."

At MCC, Blaser taught her how to climb low and slow on the pole using a climbing belt and BuckSqueeze from Buckingham Manufacturing. After a few hours, Blaser instructed her and the other students to climb to the top.

"When I look back now, I can't imagine how I looked climbing that pole," she laughed. "It's a crazy experience because you are 40 ft in the air after basic training on the equipment," she said. "That's when you figure out if it is or isn't for you. I'll never forget my first time in the air on my hooks."

She said she fits perfectly in the world of line work. "I loved the physicality of working as an arborist, but I was searching for something more," she said. "It hit me when I was on the pole for the first time how much I loved being in the hooks up in the air. To be outside every day and work on power lines and poles intrigued me."

Ten years ago, she was afraid of heights, but since then, she has climbed hundreds of poles when doing line work and enjoys every minute of it.

"One of my favorite things is like basketball, you can be as good as you want to be in line work," she said. "This trade in my eyes is the same. You may start somewhere, but there is no ceiling. There is so much to learn and love about this trade."

She is now one of two women in the line apprenticeship, and a few female journeymen linemen work at Evergy. As a second-year apprentice, she said she faces the same challenges as her male counterparts.

"You are constantly being evaluated with what you are learning, how you are retaining the information and how you are moving forward with the physical work," she said.

As an apprentice, she said she enjoys the work because she gets to have her hands on every task.

"We work on every job we do by pulling a lot of the material, loading the poles and transformers and driving the big trucks," she said. "It's really cool that we have the chance to learn so much and get to be in the bucket all day every day."

One of her favorite parts of line work, however, is working storms. The Midwest is challenged with intense heat to snow and ice storms, and she loves being out with a crew on a storm.

"It goes back to playing basketball my whole life," she said. "I have the gamer mentality. I love being in the zone and focused on work. When the lights are out because of the weather, being with a crew on a storm is so fun to me. Being in the trench with the guys takes me back to the mental state of playing basketball."

In line work, just like in competitive sports, it's essential to be physically active and in shape to do the job, she said. Battery-powered tools, however, have opened the doors for more women to enter the trade.

"Over a 30- to 40-year career, line work can take a physical toll, but these tools make it so much easier on the body," she said. "If more women knew about the trade and the fact that you don't have to be a bodybuilder to succeed in line work, I think we would have more women."

In addition, apprentices must enjoy the work.

"If it something that is interesting to you, you will work hard and put the time in to get better every day," she said. "It's the same thing for a male in the trade. I think if more women knew about the trade, we would have more success as linemen."

At this point in time, she said so many opportunities are available in the line trade. Linemen can work in any state or anywhere in the world.

"I never thought I would be a lineman, and I think women don't know they can be successful in this trade," she said. "The opportunities are endless in my mind. You can go to a line school, get a degree or a certificate and start a career in line work that can be amazing. I want to spread the word about women being able to do this job."

When she was in high school, she said the trades often weren't talked about, but she is changing this for future graduates.

"I have done a few video conferences and recorded videos for students in tech schools, which was super beneficial," she said. "I want to get the word out to both male and female students about why they should pursue a career in line work."

When she tops out as a journeyman, she said she will prefer the title of "lineman."

"This job has been around for a long time, and it doesn't make sense to change the word just because we are finally getting more women in the trade," she said. "It's up to whoever is doing the job, but what I am totally OK with the word,

'lineman.' Being a woman in the line trade is not any different than being a man. The difference is that there's not that many of us. I'm just trying to be the best lineman I can be."

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Lana Norton *of Women of Powerline Technicians*

As a young mom without a post-secondary education, Lana Norton discovered that the shortest path to securing financial stability was pursuing a career in the trades.

"Through an early exposure to elec-tricity, understanding how electricity moved came naturally to me," she said. "When I realized I would rather be at heights and outdoors than wiring indoors, powerline became the only option."

In 2010, when she was in college, the Powerline Technician program was brand new. Norton became the second woman to graduate from the first college in Ontario to offer the training. Today, she is the chair of the Program Advisory Committee for Electrical Engineering and Powerline Technician programs at Algonquin College.

Upon graduating from the Powerline Technician program, a local distribution company hired her as an apprentice powerline technician, and she has been with the company ever since.

"I accomplished what I set out to do in the beginning, which is providing financial stability for my daughter," said Norton, who is now pursuing a bachelor's degree in business administration.

Upon graduating from the Powerline Technician program, a local distribution company hired her as an apprentice powerline technician, and she has been with the company ever since. Over the last decade, she has had various trade and technical roles in distribution operations. As a field operator, she responded to electrical emergency situations to safeguard people and assets and operated high- and low-voltage distribution systems. She then moved on to the role of a field technician, and as a member of distribution engineering and asset management, she ensured construction projects adhered to business performance and scheduling timelines and were ready for execution by field crews.

Currently, she serves as the supervisor of metering field services and oversees a team of meter technicians. In this role, she is responsible for the day-to-day execution of all metering equipment operation, metering equipment installations, maintenance and renewal of the assets.

Every morning she prepares her team for the jobs of the day and reviews jobs, timelines and resources available to complete the work. She said it's her favorite part of her day.

"I get to hear about challenges they see in the field and then I do my best to help them overcome the challenges through collaboratively working with stakeholder groups, refining processes, or preparing for upcoming projects to keep the work going and the team happy and appreciated," she said. "During the day, you'll also find me attending meetings related to upcoming metering work and out on the job site checking in with my team."

Norton also serves as the executive director of the Women of Powerline Technician, which she founded in 2016.

"After graduation as my peers and I went onto work across the province, they would reach out to me as they met other women working in the trade," she said. "Over time, the network grew."

Norton describes the organization as "the voice from the field committed to increasing women in trade and technical roles in Canada's electricity sector and beyond." The mission of the national not-for-profit is to have women as equal participants in trade and technical roles in the electricity sector.

"People and the pursuit of advancing the future of the electricity grid is my passion," she said. "There is camaraderie with women PLTs, and the best way to find it is connecting with Women of Powerline Technicians. We are an organization built on supporting women in all their diversity in the electricity sector and line trade."

The group advises leaders through a gender equity lens on how to advance their diversity and inclusion goals. Secondly, the group offers programming open to both men and women.

"We have a focus of supporting women in early, mid, and late careers in the trade and technical roles," Norton said.

For example, the group's programming includes mentoring, 24/7 Peer Group, career postings, networking events, Bursary, and The Illuminate Blog, which features interviews of women lighting the electricity sector.

As she enjoys today and all she has been able to achieve, in the future, she would like to contribute in a larger way to multilateral grid sustainability and energy policy.

"We exist in a place where power has become a necessity and time without it is measured in minutes," she said. "This speaks to the astounding reliability of our electrical systems and to the people who we are accountable to, our customers. As we look to the future, I am excited by the possibilities distributed energy resources bring to our grid capabilities and the ways electricity will evolve to meet the expectations of our customers." TDW

Eye in the Sky

Drones provide an aerial view of storm damage, giving linemen a head start on restoring power and rebuilding infrastructure.

By **AMY FISCHBACH**, Field Editor

From hurricanes to ice storms—and everything in between—linemen have seen their share of severe weather over the last few years. Fortunately, new technologies have not only expedited storm response, but they have also improved safety during the restoration process.

For example, many utilities and line contractors now have a new technology in their toolbox to more accurately pinpoint damage and assess the amount of destruction in the aftermath of a severe weather event. Unmanned aircraft systems (UAS), commonly known as drones, have reached new heights in the electric utility industry due to their portability and versatility.

"The drone world is in its infancy, and we are primed and ready for the growth and continuous expansion in the realm," said Chris Sorrentini, project superintendent and head of the drone division for BHI Energy in West Palm Beach, Florida. "The sky is the limit."

The following companies have used drones to slash the time required to get the lights back on and ensure their linemen come safely to their families every night.

FirstEnergy: Analyzing Aerial Data

FirstEnergy is leveraging the technology of drones as an additional tool for storm response. After major storms, the team uses drones to help assess damage, looking for downed wires, broken structures or problems challenging to detect from the ground. Because drone crews are on the ground instead of a helicopter or bucket truck, the utility minimizes safety risks during the assessment process.

Drones give the team a much closer view of storm damage more quickly than traditional methods.

"We have been able to use drones to access areas that were inaccessible by foot," said Randy Inman, supervisor of the drone program at FirstEnergy. "In the past, this would have made the process of assessing damage much more difficult. With drone technology, however, our team is able to capture images from a safe, accessible distance. This gives our crews valuable information, expediting the restoration for customers."

Drones give the team a much closer view of storm damage more quickly than traditional methods. The bird's eye imagery in modern drones helps the team better determine what repairs are necessary and what materials are needed to make those repairs.

In addition to a live view, drones take still photos that can later be used to analyze and assess potential problems. This saves time, allowing the utility to dispatch the correct tools, equipment and crew members to repair the lines and expedite the restoration process.

"In an emergency, the safety of our customers and first responders is our top priority, and drone technology is an important resource," Inman said.

Before drones, FirstEnergy often used helicopters to get an aerial perspective. Though helicopters are well suited for a rapid, wide-scale assessment, when an area of concern is targeted, the bird's eye view a drone provides can help the utility to better understand the outage.

According to Don Bernier, captain of flight operations for FirstEnergy, drone technology is an effective way to get data back to event decision makers.

"The time saved is dependent on the event, but drones are a safer, faster way to collect data necessary to assess problems and make repairs," Bernier said.

As drone technology has evolved, so has FirstEnergy's processes for selecting which equipment to use in a given situation.

After major storms, FirstEnergy's in-house team of licensed pilots use drones to help assess damage—looking for downed wires, broken structures or problems challenging to detect from the ground.

"Certain drones are rated for weather resistance and others are more stable in gusty weather," Bernier said. "We carefully assess the conditions before dispatching crews and equipment for storm response."

FirstEnergy has assembled a team of 15 licensed drone inspection pilots prepared to assist in storm response, all of whom receive ongoing training and field experience to help ensure the team is prepared to meet customer needs. Though storm response is covered in the utility's comprehensive two-week drone pilot course, those who would report in the field complete additional damage assessor training.

In addition to traditional personal protective equipment (eye protection, hard hat, appropriate footwear, first aid kits, and fire extinguishers), drone pilots involved in storm response are equipped with flame-resistant rated clothing and personal voltage detectors to help ensure their safety.

FirstEnergy relies on solid program standard operating procedure processes for every flight. For example, storm response is specifically identified in FirstEnergy's pre-flight risk assessment process. Before each flight, the team goes through a checklist to review goals and assess risk.

While Inman and Bernier say the industry is pushing for more autonomous operated drones, FirstEnergy's methodology is driven by the need for situational awareness in a dynamic environment. For that reason, the utility requires a drone crew of more than one person.

"A two-person team is better able to perform this work, because the pilot in command is focused on safely flying the equipment while a sensor operator is responsible for data capture," Bernier said. "This helps each focus on the task, improving the quality of the assessments."

Ameren Illinois: Expediting Restoration

At Ameren Illinois, a blend of linemen, operations, vegetation and safety supervisors and engineers serve as drone pilots. As the utility moves into the fifth year of its drone program, it is looking to add operations field personnel to the mix, said Paul Stegmaier, supervisor, Construction Services, Ameren Illinois.

Currently, 42 pilots across Illinois are on a call list to be dispatched wherever they are needed. Pilots will provide live streaming data to key operations personnel in areas blocked by debris or not easily accessible by conventional methods.

Typically, in a storm-specific setting, operations supervision or crew general foremen will directly review the incoming live data to assess all safety concerns, identify the need for any specialized materials and strategize their approach based on the first-hand perspective the drone provides, Stegmaier said.

"In less than an hour's time, high-level data can be evaluated to determine how many poles we will need to source, what obstructions are in the way requiring specialized equipment and what sort of manpower will be necessary to seamlessly facilitate the restoration of customers' power," Stegmaier said.

Over time, as the utility has continued to refine the program, the use of drones has specifically grown in line with advancement of drone technologies.

"Weather resistance, zoom capabilities, interchangeable sensors, ease of deployment and use, are all contributing factors to widespread acceptance and integration," he said.

Wes Burris, senior safety supervisor, Ameren Illinois, recalls one particular storm in which drones helped to expedite restoration. In the utility's northern region, near Ottawa, Illinois, a crew from outside the area had responded to an outage in the country.

"This area was heavily wooded, and the damage kept our trucks and equipment from getting through and inspecting the line," Burris said. "Rather than waiting for a tree crew to clear a path to get by, we were able to utilize the drone in this situation."

With the drone, the team was able to quickly get it up the air and secure an overview of where the backbone line was

Former U.S. Army UAV Pilot David Sturgill works alongside employees from other departments at Ameren Illinois to operate drones.

and how many ways it branched off.

"What could have taken an hour or more to walk out to drive through was accomplished in less than 20 minutes," Burris recalled. "It also gave the crew on site a sense of how important it was to get this particular span of line rebuilt."

Earlier this spring, he also remembered a time when Ameren Illinois received heavy rain, and the local creeks were flooded near Aviston, Illinois. A line coming out of a substation and crossing through a creek bottom experienced an outage. "This particular creek bottom was flooded out at the time, but the crew needed to somehow visually inspect this area of the circuit," Burris said. "We were able to fly the drone down this span and inspect to determine the problem was located in the area flooded by recent rains. The crews used a boat to make the repairs, but utilizing the drone saved the time of making the trip twice to inspect this area of the circuit."

Currently, 42 pilots across Illinois are on a call list to be dispatched wherever they are needed.

Looking forward, Stegmaier forecasts exponential growth for drones. "There is a direct correlation between the use of drones and infrastructure reliability," he said. "Additionally, more business segments will begin to recognize the potential return on investment, finding creative ways to integrate the use of this still ever-evolving technology."

BHI Energy:
Elevating Damage Assessments

Before drone technology, a ground team of two linemen had to follow a circuit map and walk a section of line to look for signs of damage. Once the assessment was complete, they had to walk back the same way to get back to the truck and ride to the next site. Today, with its six licensed drone pilots, BHI can capture imagery quickly and reliably without stepping foot on damaged areas.

"A team of two linemen walking a section for damage requires walking through debris which could hide hazards." Sorrentini said. "By utilizing drones, you do not have any linemen or damage assessors physically entering the area that could have wires down or other unsafe situations. A drone team can capture the entire area remotely avoiding all hazards while still collecting imagery from above, which can provide details not even seen from the ground."

With drones, BHI can set up shop in one central location and fly multiple segments at once. Sorrentini estimated the time savings can range in the ballpark of 50 percent to 75 percent, which is dependent on various factors.

Through the use of drones, BHI has the capability to quickly and safely scan and data capture any areas of interest through use of various sensors like photos, thermo images and/or LiDAR. The company has developed a platform, which allows the data to be easily seen by all required parties.

"Our platform allows linemen to be able to quickly scan any findings our drone teams may find and accurately plan for required repairs," he said. "Training is as simple as a brief walkthrough of the platform, which is very user friendly."

Newer technologies and increasing demand constantly require continued training to stay ahead of the game and provide the most accurate and reliable data possible, he said. Today, using the drones, BHI can identify damage even prior to storms.

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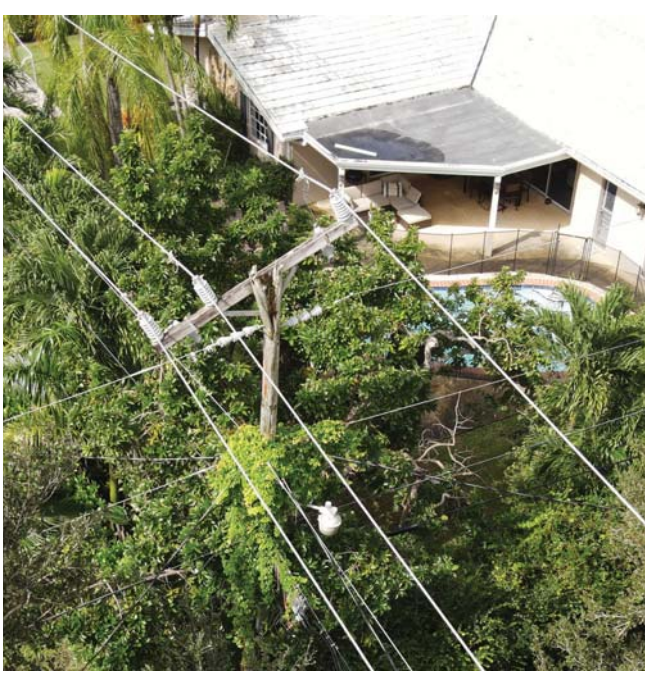
With drones, BHI can set up shop in one central location and fly multiple segments at once.

"These would have been an immediate outage even in the smallest of storms," Sorrentini said. "During storms, drone use can capture all these pictures of an entire line and quickly scan on the return of the drone."

In his view, drones are ever expanding in the realm of possibilities to replace helicopters for safety, cost and productivity purposes. At BHI, he is working on continuously growing the number of drone pilots and further increasing the capability of the drones.

"I see a future where drone flights are scheduled on a routine basis with machine learning to capture the same images of any points of interest and constantly monitor high demand lines and/or other critical infrastructure lines," he said.



Through the use of drones and various sensors, BHI Energy can scan any areas of interest, like the broken pole shown above.

Evergy: Improving Linemen's Safety in the Field

Not only BH, but also Evergy's field workforce once walked the line or drove through the right-of-way as the primary means of damage assessment following storms. Back in 2015, however, the utility first started investing in drones.

"With a drone, you can get is out of the back of a truck after the storm passes and be down the line in less than five minutes," said Mike Kelly, senior UAS coordinator at Evergy. "You can take pictures and videos to have on file and relay information back to the service center so our linemen can pick up materials and get things in line to make repairs in the field."

A few years ago, a snowstorm blanketed the Kansas City area. In turn, Evergy could fly the drones in the urban areas with wet, heavy snow.

"We flew down the lines to see where the branches may have broken off and come into contact with the lines to help identify the issues more quickly," he said. "By using the drones like a scout, we were able to have the linemen focus on repairing issues versus trying to troubleshoot where things were down."

Evergy is using drones in conjunction with line sensors to determine the exact location of a fault or outage. When an object, like a tree limb, strikes a power line and causes an outage, the communications technology alerts the utility, which can then send out a drone team for further assessment.

"UAS is one of the newest pieces of technology we are starting to implement to help in the efforts in conjunction with the sensors on the line," Kelly said. "We are actively looking for what caused the fault or outage with our drones, which is a lot safer than traditional means."

In Evergy's service territory, linemen must monitor and maintain lines running through rural and urban areas. With the drones, the field crews can determine what lines are down and what caused the outage.

"We have a lot of blind runs of lines that go on for miles in our rural areas, and they're sometimes hard to access by foot, and there are no roads," Kelly said. "Drones are perfectly suited for these types of areas. They also work in urban areas with alleyways, and they're smaller and less intrusive than other methods."

When Evergy first launched its drone program, the primary consideration was safety. The impetus for the program grew out of the transmission maintenance department.

"Large, high-voltage lines are sometimes hard to inspect because they are so big and there is a high amount of voltage going through the lines," Baker said. "We are now using drones to perform visual inspections on transmission lines."

When Evergy first started exploring the possibility of drones, the utility reached out to a local university in Salina, Kansas, Kansas State Polytechnic, which has a UAS program.

"They were one of the leading subject matter experts within our area, and they were right in our backyard," Kelly said. "They had a lot of experience in the area of UAS, and they helped to get our program off the ground."

The utility then collaborated with other utilities, which shared their best practices.

"We saw what has and hasn't worked with other utilities, and then we solved those common problems together through industry events and other groups."

For example, Evergy is actively participating in an industry-wide projects like participating in a pilot program to fly drones beyond the visual line of sight. While Evergy does not hold a waiver at this point, the utility is participating in the "Beyond" program through the Federal Aviation Administration.

During its infancy of its drone program, one of the main challenges Evergy faced was regulatory issues.

"It is a lot less restrictive today, but there are still things that do restrict us," Kelly said. "Early on, you had to be a licensed pilot to fly a drone commercially, which was restrictive. They have now relaxed that rule and have a certification process for those of us who want to fly drones commercially."

Evergy has trained eight field personnel, but not lineman specifically; four wind techs, two GIS personnel, and two T&D supervisors.. In the future, Kelly said he wants to get the drones in the hands of those who can use the technology in the field to make their work safer and more efficient.

"We haven't gotten to that point yet where we are training our linemen," he said. "We are actively working on getting a solid training regime in place so we can send our linemen through the program and get them certified and ready to go. Right now, we are training other groups, but when we are ready to pull the trigger and go, we want to get a lot of linemen in our service territory trained so it can help them in their everyday jobs."

Evergy is using the drones for not only storm assessments, but also to identify possible issues on the line during routine inspections. Local supervisors and foremen can analyze the imagery to prioritize the rights of way. Also, Evergy is using drone technology for mapping right of ways before rebuilding the line or doing a larger project.

"It helps us to create better designs of what the ROW was like before we built the line so we can restore it as close to it was before," Kelly said.

In addition, Evergy is using drones to inspect inside power plants. For example, Evergy can deploy drones with a cage around them before it sends in personnel so they can be safer and more efficient. These drones have thermal capabilities and can scan for hot spots.

"They can see anomalies we can't see with the human eye that may become the cause of an outage," he said.

Evergy is continuously finding new use cases for drones. "Almost every week or so, someone reaches out and said, 'We have this idea. How can we do it with the drones?'" Kelly said. "We try to be as open as possible and collaborate with different work groups to leverage the technology better."

Currently, Evergy has about 12 drones in its fleet, and its pilots operate multi-rotor aircraft and quadcopters in a range of sizes. The largest drone is 12 lbs fully weighted down, measures 2 to 3 ft in diameter and has 45 minutes of flight time, while the smallest drone measures about 8 in. in diameter.

Evergy is leveraging the technology of drones as an additional tool for storm response.

Some of the drones owned by Evergy also have a water resistance rating. In the event of a torrential downpour or lightning, pilots must keep the drone safely inside and protected. If it is lightly raining after a storm passes, however, a pilot can safely fly the drone with certain precautions in mind.

"You can get some moisture on the lens, but at the same time, there is still a lot of value in getting power restored as quickly as possible," Kelly said. "If you fly it in the rain and lose it, it's definitely worth it to restore the customers' power more quickly. At this point, however, we haven't lost any drones yet. It proves to be pretty effective, and the technology keeps improving all the time, and drones are more adaptable to different kinds of weather."

In the future, Evergy has plans to repeat its drone program. Kelly envisions having at least one to two drones in each service area for a total from 20 to 50 or more. He also envisions having a drone inside the substation to communicate with devices on the line that knows when to start looking for an outage.

"As time progresses and technology improves, the technology will help individuals in the field," he said.

He said so far, linemen have positively responded to the drone technology.

"They like to see how Evergy is employing new technology to make their jobs safer and more efficient," Kelly said. TDW

A typical line apprentice takes four to five years in this type training to become a certified line technician. To train the new workers, St. Petersburg College (SPC) opened a new Power Florida Training Center at its Allstate Center location.

Bridging the Knowledge Gap in the Line Trade

With more experienced linemen nearing retirement, here's how to transfer the skills to the next generation.

By **AMY FISCHBACH**, Field Editor

Once a journeyman lineman nears retirement, he or she has often climbed thousands of poles, worked countless storms and gained a lifetime of experience about the line trade. But what happens when he or she leaves the trade?

Electric utilities and line contractors are striving to preserve the wisdom and experience of veteran linemen and transfer it to the new generation of apprentice linemen.

Maximo Fuentes, owner of Fuentes Consulting, LLC, and a former journeyman lineman and supervisor for Sacramento Municipal Utility District, believes knowledge transfer is the most critical component in educating and training lineworkers. "You cannot transfer knowledge by just handing the workers volumes of safety and work procedures," he said. "Those items have to be embedded in the coaching and mentoring of the workers—not only the apprentices but also the journey level workers—throughout their entire careers."

Here are the stories of how three companies—Duke Energy Florida, FirstEnergy and BHI Energy/D&D Power—are ensuring the knowledge isn't lost along the way as experienced journeymen retire and new apprentices come on board.

Investing in the Future of the Line Trade

Duke Energy Florida hires about 75 apprentices to replenish the line technician attrition it experiences each year.

"The industry continues to need a steady stream of talent

ments for workers who retire or leave the company," said Barry Anderson, regional senior vice president, senior delivery for Duke Energy Florida.

Duke Energy Florida, which serves 1.9 million customers and 600 line technicians, follows a continuous learning model. When the apprentices come on board, they are exposed to a combination of classroom and instructor-led application training.

"We have dedicated time in the field under our senior linemen practicing the knowledge and skills of the craft on actual work that serves and restores customers," Anderson said.

FirstEnergy's Power Systems Institute (PSI) two-year program combines classroom learning with hands-on training to prepare graduates for potential employment at one of the company's 10 electric utilities in Ohio, Pennsylvania, New Jersey, Maryland and West Virginia.

A typical line apprentice takes four to five years in this type training to become a certified line technician. To train the new workers, St. Petersburg College (SPC) opened a new Power Florida Training Center at its Allstate Center location. In collaboration with Duke Energy and PowerTown Line Construction, the center will serve as the home of SPC's new electrical lineworker program this year.

In an effort to find local and diverse talent, Duke Energy donated $100,000 to develop the training facility, hire an instructor and purchase classroom equipment. Anderson said the partnership is mutually beneficial because it provides students with the best training while reducing training expenses.

"SPC is offering a curriculum that parallels Duke Energy's training requirements, and the instructor is a former Duke Energy employee," Anderson said. "Students can complete the electrical lineworker program in as little as 14 weeks while gaining hands-on, essential lineworker skills and receive additional CPR/First Aid, commercial driver and OSHA 10 training."

From the first SPC linemen class, Duke Energy Florida has already had four new hires and expects this number to grow to 30 annually. Anderson said it will be directed to replenish attrition in the Pinellas County area. To attract local talent, Duke Energy also works with the Pinellas County Urban League.

"The program takes local candidates who want to live and work in our area and trains them for these high demand well-paying jobs available right here in their backyards," Anderson said. "Research shows that if we hire local, they're more likely to stay with us, here at Duke Energy, for the long term. We have also learned that candidates who are placed from other locations into Pinellas County tend to eventually leave and go back to where their families are located."

During their training, the line techs are required to the learn how to climb poles. "In our service territory, we still have back-lot line facilities, which make it difficult to reach with bucket trucks, and require old fashioned pole climbing off gaffs attached to the line techs boots," Anderson said. "The frequency of this type of work has diminished over the years, and therefore our line techs practice pole climbing as part of routine safety refreshers in our pole training yards."

As Duke Energy moves into the future, the utility is working to address labor shortages in the utility industry. The company, as well as hundreds of other utilities, are members of the Center for Energy Workforce Development (CEWD), a national, non-profit consortium of electric, natural gas and nuclear utilities and their associations.

CEWD was formed to help utilities work together to develop solutions to address the expected workforce shortage in the utility industry. "The industry has worked really hard over the last decade to advance career awareness initiatives focused on technical trades, including line technicians, by leveraging CEWD's Get Into Energy resources, which target youth, women, military and transitioning workers," Anderson said.

At a state level, Duke Energy works with organizations like the Florida Energy Workforce Consortium. Locally with its

Duke Energy Florida hires about 75 apprentices to replenish the line technician attrition it experiences each year.

PSI graduates typically spend about six years as an apprentice line worker before earning the position of journeyman line worker, which requires passage of a written test.

D & D Power, a division of BHI Energy, has hired retirees from National Grid and other local utilities to help in the training process with the younger linemen and apprentices.

communities, the utility works with schools like St. Petersburg College and Lake Sumter State College to help fund and support lineworker curriculum programs, in addition to working with local high schools to expose students to careers in energy. "Through these efforts, we have chipped away at the narrative that a four-year degree is the only measure of post-secondary success," Anderson said. "While we've made progress, this will be an ongoing effort to continue to attract highly skilled and motivated talent to the industry."

Training Future Linemen

Like Duke Energy, FirstEnergy has also taken a proactive approach to training the next generation of linemen. Its Power Systems Institute (PSI) two-year program combines classroom learning with hands-on training to prepare graduates for potential employment at one of the company's 10 electric utilities in Ohio, Pennsylvania, New Jersey, Maryland and West Virginia. During their training, students spend 10 weeks in the field with utility crews to gain real-life work experience.

"The need for line workers remains constant across FirstEnergy," said Lance Fry, manager of workforce strategy and planning at FirstEnergy. "Grid modernization has improved reliability, but there will always be a need for boots on the ground—or in air—to maintain and restore power. "

Nearly 2,500 line workers are employed at FirstEnergy's companies. Some have been with the company for decades or have strong family ties to the industry, while others are just starting their careers after completing the company's PSI line worker training program.

"From western Ohio to the Jersey Shore, FirstEnergy's line workers play a key role in delivering safe and reliable power to more than six million customers," Fry said. "In addition to maintaining and upgrading the company's vast electric system, line workers often work in hazardous conditions to restore power to customers after severe weather events, like blizzards, tropical storms and hurricanes."

This year, FirstEnergy's 10 electric companies have hired 189 new PSI graduates who completed the line worker training program in May. Since 2017, FirstEnergy has hired nearly 900 new line workers into the company. Over the past two decades, PSI has helped more than 2,000 graduates launch their careers in the electric utility industry.

"The program helps fill important fieldwork positions within FirstEnergy's electric companies," Fry said.

The PSI curriculum requires two-and-a-half days each week spent at a community college completing academic coursework, with the remainder of the week spent at a FirstEnergy utility training facility to focus on safe work practices

In the Northeast, utility companies and line contractors are preparing for future opportunities by attracting new linemen into the local union.

and procedures in a controlled, electrical environment. Students who successfully complete the program earn an associate degree in electric utility technology from an affiliated community college in their area.

PSI graduates typically spend about six years as an apprentice line worker before earning the position of journeyman line worker, which requires passage of a written test. As an apprentice, they are assigned to a two- or three-person line crew with a journeyman line worker and/or line leader, which are positions held by individuals who have been in the field for many years and can help train a new generation of line workers.

According to FirstEnergy Line Operations Managers Jeff Doran and Joe Grupp, when a FirstEnergy line worker retires, a fair amount of experiential wisdom leaves the company. "To bridge the knowledge gap between FirstEnergy's seasoned and novice line workers, line operations managers assign them to work together on crews so that younger workers can glean knowledge through observation and mentorship from senior line workers," Doran said.

Placement Challenges

A key challenge is where to place young lineworkers. "They can't all be assigned to a particular reporting location because they must be spread among numerous facilities to receive ample time and oversight from experienced line workers," Doran said.

FirstEnergy's utilities strive for a one-to-one ratio or one-to-two ratio of seasoned line workers to recent PSI graduates to prepare the next generation effectively and efficiently for the job.

"New line workers are taught basic skills in the classroom, but they only learn their craft working shoulder-to-shoulder in the field with highly qualified line workers who can demonstrate why each job is unique, including how to mitigate potential safety hazards," Grupp said. "In addition to the work experience they gain on a job site, young employees benefit greatly from the conversations and wisdom senior line workers bestow upon them through casual conversations on their way to a job site or while discussing plans and tactics for how to execute a job safely."

For example, comprehensive job briefings or tailgate conversations are a key strategy to keep young line workers safe on the job as they tackle new tasks and build their capabilities.

"It is too late for instruction when an apprentice is in the air facing a problem or hazard that should have been anticipated and avoided," Grupp said. "That's why FirstEnergy's experienced line workers have detailed pre-job conversations on the ground with apprentices, walking them through tasks precisely, move by move, always pointing out potential safety hazards along the way."

Case in point: Line workers will be asked to hang a transformer countless times during their career. While the skill is learned through repetition, experienced line workers can point out to their younger charges why no job is alike.

"One pole may have other attached facilities that must be considered when installing a new transformer," Grupp said. "Another may carry a three-phase line overhead that must be cautiously navigated with a bucket truck boom to lift the transformer into place. Yet another job may require climbing a pole and using rigging to haul the transformer from the ground. And in some cases, a pole may have suffered damage during a car-pole accident or severe storm that isn't readily visible but can quickly emerge when hanging a new transformer."

When available and practical, FirstEnergy crews use a two-person aerial-lift truck. This allows two employees to go aloft into the workspace.

"The experienced line worker can instruct the learning employee up close and assist with hands-on demonstrations in

This year, FirstEnergy's 10 electric companies have hired 189 new PSI graduates who completed the line worker training program in May.

employee up close and assist with hands-on demonstrations in a real-life environment," Grupp said. "Only someone who has 'been there and done that' can warn of those dangers not encountered in a controlled classroom setting."

To pass the knowledge on, it's critical to leverage the knowledge of experienced line professionals. "They take enormous pride in their craft and are dedicated to getting the job done safely," Grupp said "They are proud of the work they do and want to pass on their knowledge to the next generation before they retire. Seasoned line workers are trusted and respected by their younger peers. They listen closely when someone who has been there countless times says, 'Here's what happened to me and I don't want this happening to you.'"

As development continues throughout the FirstEnergy footprint, there is a growing need to upgrade the distribution infrastructure to handle accompanying load growth. Fewer veteran line workers remain who are proficient at reconductoring existing lines with wire larger-sized wire with more capacity. Reconductoring lines without interrupting electric service to customers is akin to changing oil in a car while it is being driven.

"Before that knowledge forever walks out the door, FirstEnergy is having those employees show the rest how to remove existing facilities and build new ones in their place and operate wire- pulling machines, as well as other key aspects of the job," Grupp said. "Instructors set up mock demonstrations—sometimes with transmission facilities where they climb towers generally used to train PSI students—so even veteran line workers can practice skills that may be new to them in a safe, simulated environment."

Safety is a core value at FirstEnergy. Doran and Grupp agree that when apprentices know that their leaders in the field and the classroom care about their safety, communication becomes easier and more fluid.

"Working with electricity is inherently dangerous, so understanding the safe way to perform work in the field is at the center of that knowledge transfer," Doran said. "When leaders in the field and in the classroom are using a consistent message, the transfer of knowledge happens naturally. Having a consistent message does not happen without preparation. FirstEnergy is intentional about equipping both leaders and apprentices with the necessary skills and resources to do each job safely every time."

Mentoring the Apprentices

In the Northeast, utility companies and line contractors are preparing for future opportunities by attracting new linemen into the local union.

"We are trying to train up and get linemen acclimated to the way we work with the demand coming up in the future," said Rich Kroll, general foreman for BHI Energy/D&D Power. "Utilities are beefing up their infrastructure for storm hardening purposes and to be more responsive to power outages as people continue to work from home."

When it comes to transferring knowledge to the new apprentices, he said it's important for the veteran linemen to take them under their wing and look out for one another. "It is a team effort, and we all have to work as a team," said Kroll, who has been with BHI/D&D for four years and in the line trade for 15 years. "We try to mentor and help them, and we make sure they go home every night with no safety problems or issues."

A generational gap did form within the local union due to a slow-down in work from the utilities. "We didn't put more linemen or apprentices on, so there was a lot of lost knowledge with that," he said. "If you weren't around with the old timers

stepped up and had more training, and now it is covered well."

For example, a lot of the linemen with 30-plus years of experience know how to perform tasks in more ways than one. For that reason, the apprentices are moved around to different supervisors and departments from transmission to distribution to underground. Through the Northeast training apprenticeship program, they spend a certain number of hours in each department, and then when they get to BHI/D&D, they evaluate what they know and don't know. "No two linemen are the same, and every lineman out here has a different way of doing something," he said.

Currently, Kroll's group has six apprentices, and company-wide, about 25 to 30 future lineworkers are just entering the trade. Oftentimes, they learn from those linemen who decide to leave the field but opt for another position.

"A lot of guys find another avenue, and they'll still stick around," Kroll said. "They will keep going because they like the job, and they are of the generation who doesn't want to quit. They may retire, but they will still stay within the trade."

For example, BHI/D&D has hired a few employees who have retired from National Grid, the local utility. "They have knowledge of the circuits, and they know the areas well, which is always a benefit," he said.

With their skills, they can train the new line apprentices, especially those who are open to learning. "Some are closed minded and don't want to listen, while the open-minded apprentice is willing to try things. They can pick things up and don't have to have it repeated over and over again."

Kroll has found that it's often best to show the apprentices how to perform tasks and keep them moving in a positive direction. "A lot of them are hands-on," he said. "If you take them up in the air and show them how to do it, they will get the body mechanics and repetitions down. A lot of them absorb it faster that way. Some guys can watch you work in the air, and they absorb it like a sponge. The next thing you know, they are in the air copying you. Most guys, however, need hands-on experience. You need to show them exactly how to do it and get repetition."

A lot of the knowledge is captured through safety meetings and talks. For example, the veteran linemen put together safety briefs, in which they talk about what to do and what not to do. "We do have incidents that occur in line work, and they are learning lessons for everyone else," Kroll said. "It is a wake-up call when you hear about something that happens, and it lets them know that there is a potential for a mistake. Many linemen spend 30 years here and then go into safety, and they are the ones writing the briefs. They want to do what they can to make sure it doesn't happen again."

By having the veteran linemen teach the younger apprentices, it helps to improve safety.

"We must work together and try to be a fully functional team," he says. "We need to be our brother's keeper, watch out for our apprentices, and put in our equal amount of effort." TDW

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