

PUBLIC UTILITIES FORTNIGHTLY[®]

The Sustainable Resilient Affordable Debates

OCTOBER 2023

Fortnightly Top Innovators 2023
Selected From Twelve Utilities

**Arizona Public Service
Avangrid
CenterPoint Energy
CMS Energy
Duquesne Light
Exelon
PNM Resources
PPL Electric Utilities
Puget Sound Energy
San Diego Gas & Electric
Southern Company
Xcel Energy**

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The Sustainable Resilient Affordable Debates

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CenterPoint Energy team

Lewis Latimer Top Innovator in Design:
Avangrid team

George Westinghouse Top Innovator
in Leadership: *Southern Company's
Chris Cumiskey*

Bertha Lamme Top Innovator in Generation:
*San Diego Gas & Electric's
Cam Carroll and team*

Charles Steinmetz Top Innovator in Grid Ops:
Exelon and PPL Electric Utilities teams

Nancy Fitzroy Top Innovator
in Environment & Safety:
*Arizona Public Service's Scott Alford
and Xcel Energy team*

Maria Telkes Top Innovator
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and Puget Sound Energy teams*

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*CenterPoint Energy's Kevin Bryant,
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*CMS Energy's Derek Belote, Chris McNalley,
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*Exelon's Ankush Agarwal, Vlad Anderson,
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PNM Resources' Omni Warner, Jason Jones

PPL Electric Utilities' Sal Salat

*San Diego Gas & Electric's Cam Carroll,
Joaquin Sebastian, Nisha Menon*

*Xcel Energy's Andrew Brown, John Miller,
Kirk Olsen*



Front cover: Fourteen teams of Top Innovators and two individual Top Innovators at these twelve utilities were selected for the Fortnightly Top Innovators 2023 awards in reliability, design, leadership, generation, grid ops, environment & safety, distributed energy, analytics, electrification, energy transition, storage, and transmission tech.

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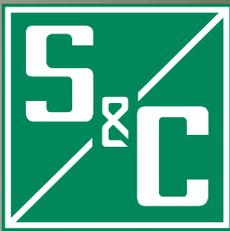
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Why They Wanted to Innovate?

Because It is There

BY STEVE MITNICK, EXECUTIVE EDITOR

When asked why he wanted to climb Mount Everest, George Leigh Mallory (and not Edmund Hillary) famously said, “because it is there.” I thought of that inspiring line when wondering why this year’s Fortnightly Top Innovators wanted to innovate. Is it because the challenge, and the fruits of conquering it, were right there before them, beckoning them?

And if so, which mattered the most? That the challenge was so tall? That the fruits from the conquest were so rewarding? That the challenge was so close to you, you could taste it, yet distant to others?

This construction of why the Top Innovators wanted to innovate, however, supposes climbing to the peak is a choice, made with considerable enthusiasm, but a choice, nonetheless. Though it is, I think, better thought of as this. That innovating in today’s utilities isn’t a choice. Utilities are compelled to innovate. As if, Hillary not ascending to Everest’s peak would have significantly diminished him.

That utilities these days consider it a necessity to innovate is quite evident. The Public Utilities Fortnightly team

witnessed this, this summer, when so many Top Innovator nominations arrived at our doorstep. And witnessed this again when our Top Innovator selections were announced with celebrations by the awardees and their colleagues.

Some say if our utility does not innovate, continually and fervently, it literally cannot reach its climate change and other strategic goals. Some say if our utility does not innovate, it will fail to create a credible culture of innovation that is mandatory in the roaring twenty twenties to attract and retain the best



Steve Mitnick has authored four books on the economics, history, and people of the utilities industries. While in the consulting practice leadership of McKinsey & Co. and Marsh & McLennan, he advised utility leaders. He led a transmission development company and was a New York Governor’s chief energy advisor. Mitnick was an expert witness appearing before utility regulatory commissions of six states, D.C., FERC, and in Canada, and taught microeconomics, macroeconomics, and statistics at Georgetown University.

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workforce talent. Some say if our utility does not innovate, it shall be downgraded by markets, partners, and the public.

So, utilities very much want to innovate. And so, stars at utilities can be sure to strive for new developments that

reimagine utility service, transform the customer relationship, strengthen resilience and reliability, while at the same time slashing emissions, and all the while maintaining customer affordability.

This year's Top Innovators, from fourteen different utilities, exemplify the courage, grit, and creativity of contemporary energy explorers. Reminds me of those that made the first climbs of Everest. 

Fortnightly Top Innovators 2023

EDITH CLARKE TOP INNOVATOR AWARD FOR RELIABILITY

CenterPoint Energy

Resilient Digital Substation

LEWIS LATIMER TOP INNOVATOR AWARD FOR DESIGN

Avangrid

Cybersecurity Simulation in Metaverse

GEORGE WESTINGHOUSE TOP INNOVATOR IN LEADERSHIP

Southern Company

Elevate Future Fund

BERTHA LAMME TOP INNOVATOR AWARD FOR GENERATION

San Diego Gas and Electric

Wildfire Next Generation System (WiNGs)

CHARLES STEINMETZ TOP INNOVATOR AWARD FOR GRID OPERATIONS

Exelon

Automated Drone Initiative

PPL Electric Utilities

Distribution System Series

NANCY FITZROY TOP INNOVATOR AWARD FOR ENVIRONMENT AND SAFETY

Arizona Public Service

Innovations in Predictive Maintenance

Xcel Energy

Drones and Robotics in Nuclear Inspections

MARIA TELKES TOP INNOVATOR AWARD FOR DISTRIBUTED ENERGY

Arizona Public Service Company

Virtual Power Plant

Puget Sound Energy

Virtual Power Plant Software Platform

FRANCIS UPTON TOP INNOVATOR AWARD FOR ANALYTICS

CMS Energy

Automated Analytics for Renewable Generation

WILLIAM HAMMER TOP INNOVATOR AWARD FOR ELECTRIFICATION

BGE

Fleet of the Future

Puget Sound Energy

Clean Buildings Accelerator

JOHN BEGGS AWARD FOR ENERGY TRANSITION

Duquesne Light Company

Advanced Grid Solutions

MABEL MACFERRAN TOP INNOVATOR AWARD FOR STORAGE

PNM Resources

Battery Energy Storage Systems at Solar Sites

FLORENCE FOGLER TOP INNOVATOR AWARD FOR TRANSMISSION TECH

PECO

Underground Automatic Transfer Switch

Fortnightly Top Innovator Awards 2023

And Best of the Rest

By Steve Mitnick, Executive Editor



team of seven at Avangrid was selected by Public Utilities Fortnightly for this year's Lewis Latimer Top Innovator Award in Design. Led by CIO Carl Young and the Director for IT Architecture, Digital and Innovation, Mansur Ali Mohammed, the team created three virtual meta worlds to simulate cybersecurity events. Latimer, who played a major role in making electric lighting practical, would have appreciated the inventiveness.

A team of three at CenterPoint Energy was selected for this year's Edith Clarke Top Innovator Award in Reliability. Led by the VP for Grid Transformation and Investment Strategy, Eric Easton, the team developed a substation protection and control system to better stand up to high-impact low-frequency events with components that can be supplied by multiple diverse vendors. Clarke, who made long-distance transmission resilient in the early twentieth century, would have been impressed.

A team of seven at Duquesne Light was selected for this year's John Beggs Top Innovator Award in Energy Transition. Led by the Director for Advanced Grid Systems and Grid Modernization, Elizabeth Cook, the team demonstrated the value of transmission dynamic line rating, developed an interactive network of customer behind-the-meter systems, and built a distributed artificial intelligence platform for the grid edge. Beggs, who was a top business leader in the country's first wave of electrification in the early twentieth century, would have encouraged these advances.

A team of three at PECO was selected for this year's Florence Fogler Top Innovator Award in Transmission Tech. Engineers Dustin Nace, Dave Reino, and Luke Benedict installed a submersible underground automated switch for a thirteen-kilovolt feed improving its reliability with flexibility in cable fault detection and isolation. Fogler, known in our industry in the early twentieth century as the Grand Lady of Heat Transfer, would have wanted to see the team's accomplishment.

Chris Cummiskey, CEO of Southern Power, which is Southern Company's unregulated competitive company, was selected for this year's George Westinghouse Top Innovator Award in Leadership. He played a key part in forming the Elevate Future Fund, a hundred-twelve-million-dollar initiative of Energy Impact Partners to drive diversity in the energy transition by investing in new minority-owned businesses. Westinghouse, the industry founder who made feasible and popularized the alternating current standard, would have undoubtedly invested some of his fortune in the Elevate Future Fund.

Omni Warner and Jason Jones, Directors of Distribution Engineering and Utilities Operations Technology, respectively, at PNM Resources, were selected for the Mabel MacFerran Top Innovator Award in Storage. They installed battery energy storage systems on feeders from two solar sites, bringing them back within design limits, allowing several solar interconnections on hold to proceed. MacFerran, who was instrumental in the design and construction of the Hoover Dam, would have been fascinated by today's technologies for storing electrical energy.

A team at CMS Energy was selected for the Francis Upton Top Innovator Award in Analytics. Engineers Chris McNalley and

Chris Cummiskey, CEO of Southern Power, which is Southern Company's unregulated competitive company, was selected for this year's George Westinghouse Top Innovator Award in Leadership. He played a key part in forming the Elevate Future Fund, a hundred-twelve-million-dollar initiative of Energy Impact Partners to drive diversity in the energy transition by investing in new minority-owned businesses.

Jason Ugartechea and data scientist Derek Belote put together and into use algorithms to detect non-alarming trends on wind turbine drivetrains that would lead to failures, and to analyze the performance of solar module strings. Upton, Thomas Edison's mathematician, would have savored today's analytic and computational power as employed by the CMS Energy team.

San Diego Gas and Electric's IT Digital Innovation group manager, Cam Carroll, and the Wildfire Mitigation team was selected for the Bertha Lamme Top Innovator Award in Generation. They created the Wildfire Next Generation System, dubbed WiNGS, a cloud-based visual representation of the company's infrastructure, which when combined with real-time weather data enables wildfire modeling, analysis of public safety power shutoff scenarios, and resilience investment like undergrounding. Lamme, who co-designed the first large-scale alternating current generation station (at Niagara Falls), was a recognized expert in her day as Westinghouse's first female engineer, but she could not have imagined the complexity of today's generation networks.

A team of five at PPL Electric Utilities was selected for the Charles Steinmetz Top Innovator Award in Grid Ops. Led by

VP for Distribution Operations, Sal Salet, the team is pioneering dynamic line rating sensors and data analytics on its twelve-kilovolt distribution system. Steinmetz, known as the Forger of Thunderbolts, a world-recognized mathematical and electrical engineering genius in the late nineteenth century and early twentieth, who discovered hysteresis and developed much of the math underlying alternating current systems, would have been fascinated by the science and technology of dynamic line rating.

Also selected for the Charles Steinmetz Top Innovator Award in Grid Ops was a team of three at Exelon. Led by the Director for Advanced Analytics, Ankush Agarwal, the team combined synthetic defect images with manually labeled drone images to enhance defect detection performance with a high level of accuracy. Again, Steinmetz would have been fascinated as are we.

A large team at Puget Sound Energy was selected for the Maria Telkes Top Innovator Award in Distributed Energy. Led by the Senior IT Project Manager, Bob Caplan, the team created a Virtual Power Plant software platform making it possible to forecast, control, and readily dispatch consumer-owned resources like battery storage and demand response. Telkes, known as the Sun Queen, who studied thermal storage at M.I.T., and assisted solar startups and U.S. Department of Energy solar initiatives, would be so pleased at today's progress in renewables.

Also selected for the Maria Telkes Top Innovator Award in Distributed Energy was a team of three at Arizona Public Service. Led by the Director for Customer to Grid Solutions, Kerri Carnes, the team scaled the distributed resources portfolio into a virtual power plant that can shed more than a hundred and ten megawatts of energy demand. Telkes would be pleased too we imagine, by this innovation.

A team of three at Xcel Energy was selected for the Nancy Fitzroy Top Innovator Award for Environment and Safety. In a nuclear power plant, the team replaced divers with remote operated vehicle submarines, a snake-like robot on treads, and an acoustic monitoring robot to identify any plant integrity concerns safely and effectively. Fitzroy, incidentally, headed a major GE energy and environmental business in the nineteen seventies and eighties, and before that participated in the development of nuclear-powered submarines under the legendary Hyman Rickover.

Also selected for the Nancy Fitzroy Top Innovator Award for Environment and Safety was Scott Alford at Arizona Public Service, its Supervisor for Predictive Maintenance. His twenty-six-person team is now using a "Spot the dog" robot, a forward looking infrared/first look "tank," hot stick mounted cameras, and drones for highly effective and safe non-contact inspections of substations, transformers, and underground structures. As for Fitzroy, undoubtedly, she would have selected this Top Innovator nomination too.

The final two selections this year were both for the William

Hammer Top Innovator Award for Electrification. First, a team of four at Puget Sound Energy led by the Supervisor for Energy Management Engineering, Beth Robinweiler, was selected for creating the Clean Buildings Accelerator program. Accelerator aims to help the seven thousand commercial buildings in the service territory comply with a new state law, comprehensively and cost effectively, to reduce greenhouse gas emissions, minimize waste, and invest in energy efficiency.

Second, Andrew Hedrick and Joseph Byrd have pioneered BGE's Fleet of the Future initiative, including jobsite EV charging (with a unique portable charger), and heavy-duty all-electric and hybrid tractors and trucks. The goal is to electrify thirty percent of the fleet by 2025 and half of the fleet by 2030.

At Entergy, we received two impressive Top Innovator nominations, one for Dillon Allen, Senior Manager for Nuclear Project Management, and for Jacob Claes, a Senior Nuclear Engineer. Allen is leading efforts to deploy advanced nuclear reactors. Claes and his team established a universal communications gateway for nuclear plants, eliminating the barrier to entry to collecting big data and using artificial intelligence to assess plant performance and equipment reliability.

Who is William Hammer, the man this award is named for? In charge of testing electric lighting "globes" for Thomas Edison in the early eighteen eighties, Hammer discovered the "Edison Effect" that led to the development of rectifiers, radio wave detection, and diode vacuum tubes, the basis for all electronics. Hammer also built the first lighted advertising signs, the first central power station in London (before the famous Pearl Street Station was constructed in New York City) and collaborated with Marie and Pierre Curie on applications of radium. It was Hammer who first proposed radium for cancer treatment.

And there were so many Top Innovator nominations this year, it was particularly challenging for the Public Utilities Fortnightly team to put those aside that we did not select. Let's look at some of the "best of the rest."

For example, Chuck Marshall, the VP for Transmission Planning at ITC Holdings, is bringing to the grid high-temperature low-sag conductors for upgrading existing transmission

structures. Lon Huber, SVP at Duke Energy for Pricing and Customer Solutions, is championing new rate designs to encourage energy efficiency. Theresa English, Senior Product Manager at Evergy for DSM Income-Eligible Programs, is delivering energy efficiency information and assistance through multiple channels to Kansas City's underserved communities.

VELCO's Chief Innovation and Communications Officer, Kerrick Johnson, developed a high-resolution value of lost load model to help make infrastructure investments and operational improvements to improve system reliability. At Entergy, we received two impressive Top Innovator nominations, one for Dillon Allen, Senior Manager for Nuclear Project Management, and one for Jacob Claes, a Senior Nuclear Engineer. Allen is leading the efforts at his company to develop and deploy advanced nuclear reactors. Claes and his team established a universal communications gateway for the nuclear plants, eliminating the barrier to entry to collecting big data and using artificial intelligence to assess plant performance and equipment reliability.

Two Exelon utilities, Commonwealth Edison and Pepco Holdings, sent in very interesting Top Innovator nominations. ComEd's nomination for a team of nine was for the Bronzeville Community Microgrid. November's issue of Public Utilities Fortnightly will include an extensive article on this significant innovation. Pepco Holdings' nomination for a team of five was for their putting together a new capacity planning guidebook to navigate the company through the complexity of supply and demand side options and technologies toward the future grid.

The Public Utilities Fortnightly team received some excellent Top Innovator nominations from large public power utilities. A team of six at Salt River Project led by Bobby Olson, Associate General Manager and Chief Planning, Strategy and Sustainability Officer, designed the new Copper Crossing Energy Research Center complete with solar, some natural gas for flexibility, and energy storage, all on site. Ryan Braas, Senior Program Manager at Sacramento Municipal Utility District, put the home EV charging rebate offering onto the SMUD Energy Store and now ninety-nine percent of EV charger purchases have been with a rebate.

Among the fourteen utilities that had an individual or team earn a Top Innovator Award, or two Top Innovator Awards, several of these utilities also submitted other impressive Top Innovator

nominations. For example, a San Diego Gas and Electric team implemented the Public Safety Partner Mobile Application, a one-stop shop for local government, fire agencies, and other critical partners to assess real-time information prior to, during, and after a Public Safety Power Shutoff. CMS Energy's Executive Director for Strategy, Craig Degenfelder, and Senior Strategy Manager, Neal Dreisig, created the first partnership in Michigan between a regulated utility and the dairy industry to produce renewable natural gas. Alaric Babej, Principal for Customer Energy Solutions at PNM Resources, designed the Solar Direct and Community Solar and Transportation Electrification programs.

The PUF team received excellent Top Innovator nominations from large public power utilities. A team of six at Salt River Project led by Bobby Olson, Associate General Manager and Chief Planning, Strategy and Sustainability Officer, designed the new Copper Crossing Energy Research Center complete with solar, some natural gas for flexibility, and energy storage, all on site.

There were two other excellent Top Innovator nominations from Arizona Public Service and two others from Xcel Energy. From Arizona Public Service, a team of four implemented the entirely digital Advanced Rod Control Hybrid project at the Palo Verde nuclear plant. And a team of three launched the Green Power Partners program offering customers flexibility and optionality to reach their own sustainability goals.

From Xcel Energy, Senior Engineer Dave Carlisle created a new repair option to temporarily seal leaks in nuclear plant pressurized pipe. And Dylan Wojchowski, Performance Improvement Manager, reduced by twenty percent the number of required nuclear plant corrective actions with a set of artificial intelligence capabilities. ○

46.2 percent of the hundred and thirty million occupied households in the country heated their homes in 2022 with natural gas utility service. 41.3 percent heated their homes with electric utility service. This data just came in recently from the U.S. Census. It also broke out owner-occupied and renter-occupied homes. Owned homes were 50.9 percent gas heated versus 34.7 percent electric heated. While rented homes were 37.5 percent gas heated versus 53.7 percent electric heated.

Electric heating was much less prevalent a dozen years ago. Across all occupied households in the country, as much as 49.5 percent heated their homes in 2010 with gas service and just 35.4 percent heated with electric service. In 2010, owned homes were 53 percent gas heated versus 29.8 percent electric heated. While rented homes were 42.9 percent gas heated versus 46.1 percent electric heated.



Edith Clarke Top Innovator Award for Reliability to CenterPoint Energy team, from left, Ryan Marietta, Eric Easton, and Kevin Bryant.

EDITH CLARKE TOP INNOVATOR AWARD FOR RELIABILITY

CenterPoint Energy

Resilient Digital Substation

Kevin Bryant, Eric Easton, and Ryan Marietta

PUF's Lori Burkhart: Eric, describe the innovation that led to the Edith Clarke Top Innovator Award for Reliability, how it works, and what its benefits are to CenterPoint Energy.

Eric Easton: The innovation is focused on our substation protection and control. Our goal was to make our practices more agile and resilient. To sum it up, we switched over to a digital platform for substation protection and control, compared to the hundreds or thousands of copper cables that we would have used in the past.

Our new solution enables us to complete construction more efficiently. For example, we can deploy this type of technology and construct a substation control house in a matter of months instead of years.

PUF: Ryan, what was your role in the innovation's development?

Ryan Marietta: I am the Manager of Distribution Planning Computer Support at CenterPoint Energy. In this capacity, I assessed how the technology could benefit us in terms of capital

and cost efficiencies. I also worked with colleagues to develop a program through which CenterPoint will deploy the technology.

PUF: Kevin, talk about your role in the development of innovation.

Kevin Bryant: I am the Engineering Consultant in CenterPoint Energy's System Protections Group. My responsibilities included the detailed design of the digital substation portion, as well as the physical design of the equipment.

Together with my teammates, we developed the sizing and testing of the equipment with EPRI for Electromagnetic Pulse mitigation purposes, as well as for digital design using a 61850-communication protocol and other digital technologies. We developed the testing specs for the equipment, as well as the drawings and designs.

PUF: Talk a bit more about working with EPRI on the EMP.

Ryan Marietta: We collaborated with EPRI for about five years. CenterPoint Energy was part of a program with more than fifty utilities. We sent them equipment components to test, and

the completed digital substation module. EPRI did an RS 105 test, which is an EMP pulse on the module to ensure the design exceeded all minimum design standards.

We tested approximately ten to twenty pieces of equipment with EPRI. The efforts included working with them side-by-side and evaluating each test result. EPRI also came to our facility to perform tests. Working with EPRI on the EMP was a great experience, and it enabled us to develop and confirm our specs for this innovation.

PUF: Eric, talk about your role in innovation's development.

Eric Easton: I am Vice President of Grid Transformation and Investment Strategy. In this capacity, I focus on our long-term plans and strategic investment decisions. I also keep a close eye on the impact of evolving business and industry conditions on our plans.

Along these lines, we have identified opportunities to replace or upgrade our system's assets. The digital substation enhances our ability to make improvements, while also allowing us to address any potential system issues.

In its upcoming rulemaking, the Public Utility Commission of Texas will allow all utilities to have a resiliency plan. We are well on our way to filing a comprehensive resiliency plan with the PUCT that will include investments in modernizing and hardening our grid infrastructure.

The digital substation is a multi-faceted solution that will benefit our ratepayers by addressing multiple scenarios with one investment. This includes the efficiencies related to the design, materials, fabrication, and construction.

In addition, our solution will enable us to store the units in our warehouse if we have an issue on our own system. It also creates opportunities to loan these devices to other utilities during requests for mutual assistance.

In effect, if another utility had a control house that was damaged, CenterPoint Energy could potentially provide the company with one of these units. In turn, the utility could program it to their standards, but the hardware would be the same.

PUF: Ryan, what's been most rewarding in working on this innovation?

Ryan Marietta: The most rewarding has been taking what we do in our normal day-to-day to that next level. Along with the solution to equip our company to address potential issues, it allows us to provide more valuable digital data to our engineers.

From a data analytics perspective, we can do a lot more with the incoming data from devices in the field. The data will advance our position from a time-based to a reactive-based approach so we can use analytics to proactively change the equipment, as

well as determine when a piece of equipment could potentially fail and take steps to address it.

PUF: Kevin, what's been most rewarding working on this innovation?

Kevin Bryant: The most rewarding parts are saving costs, reducing engineering time, conserving the number of cables used, and achieving a standard design for nearly all our substations. With the compact space of the module, we are able to fit the equipment in a compact four-foot by three-foot cabinet.

The cost reductions, as well as the efficiencies related to building the substation, relay protection, and controls in such a tight, compact manner that is repeatable, will support our long-term performance.

PUF: Eric, what's been most rewarding for you?

Eric Easton: That it has been a long-term project. Most of the reason why we do what we do is for our customers, but it is also

We switched over to a digital platform for substation protection and control, compared to the hundreds or thousands of copper cables. Our new solution enables us to complete construction more efficiently. We can deploy this type of technology and construct a substation control house in a matter of months instead of years.

– Eric Easton

for our colleagues. When I reflect on this project, I think about both stakeholders. There are tremendous benefits for our customers in terms of reliability and efficient use of ratepayer dollars.

Houston is rapidly growing. Anything we can do to make the work more efficient – whether for our engineers, the master technicians who are commissioning the substations or the fabricators – enhances our employees' experience.

It has also been rewarding to drive standardization through technology. By standardizing, we achieve better outcomes in terms of reliability, cost-effectiveness, and efficiency.

Our team had incredible support from many colleagues across CenterPoint Energy. I believe our solution is another milestone in our journey to drive innovation across our enterprise. ○

Register for the inaugural Fortnightly Top Innovators Conference, October 10-12, 2023, in Washington, D.C. to be held at the historic Willard Hotel. The conference will celebrate innovation. Find out more at pufinnovators.com

LEWIS LATIMER TOP INNOVATOR AWARD FOR DESIGN

Avangrid

Cybersecurity Simulation in Metaverse

Mansur Mohammed and Carl Young

PUF's Lori Burkhart: Describe the innovation that led to your team winning the Lewis Latimer Top Innovator Award for design, how it works, and its benefits to Avangrid.

Carl Young: This innovation is about a simulation in the metaverse, simulating cybersecurity events, and how we can react to them. For this innovation we created three virtual meta worlds, an electrical substation, the emergency communications center or ECC, and a cybersecurity collaboration meeting room. The latter is an event room for us to operate out of, while we're dealing with a cybersecurity attack.

The intent was to simulate, in a safe environment, a cybersecurity event occurring, which impacts a substation. It triggers physical damage to that substation. Then how do we handle and react to that?

How do our different teams mobilize under our incident command structure to safely and securely, isolate and minimize that damage, and then restore and recover the electric operations back to normal activity? That is the purpose of simulation, bringing those teams together, our cyber, electric operations, and emergency preparedness teams, and with our incident command structure, dealing with an event such as a cyberattack.

PUF: Mansur, what was your role in the innovation's development?

Mansur Mohammed: The origin of the innovation came from when I saw different teams working in silos. Our cybersecurity team, every year, doing a NERC GridEx exercise with the different external stakeholders, including federal agencies.

I was thinking about if a cyberattack happens, how do we act? How do we react? These are all happening in emails with coordinated efforts. I was observing one of my team members who was part of that exercise.

Then I met with our environmental health and safety team. They have been developing training materials in virtual environments using augmented reality, virtual reality. This is something they are already doing. I thought, "Hey, why don't we match this together? Why don't we assimilate in the virtual world what our cybersecurity team is doing?"

We already have all the components, so let's bring it together, and create a cohesive environment for repeatable, controllable simulations. We took this on because we have examples from

This innovation is about a simulation in the metaverse, simulating cybersecurity events, and how we can react to them. We created three virtual meta worlds, an electrical substation, the emergency communications center or ECC, and a cybersecurity collaboration meeting room.

– *Carl Young*

cybersecurity exercises. We thought, "Okay, why don't we bring that into the virtual world?"

I brought together the three teams, and our partners, explaining what's happening. How we do that is challenging. This was all my imagination. We said, "Metaverse, we're talking about a meta thing. It is industrial scale. Very few in the industry have developed this kind of simulation."

Bringing this together, as what we were trying to do is a process, so that took a long time. But I assembled a team. Carl was behind me. He was blessing me, "Hey Mansur, go ahead."

Even partners were questioning, "Oh, can we do this?" They did pieces, but not the whole simulation together. That is how we started this, as proof of concept/pilot. It came out well.

We developed the virtual electrical control center, the meeting rooms, and substation. Those are the artifacts, some of them existing in our environment, putting some together, bringing it all together, and creating scenarios.

PUF: Carl, talk about your role in the development of this innovation.

Carl Young: As CIO, my role is to empower and guide my team, and foster innovation in an industry where we work with real life constraints. It is difficult to be completely innovative in a regulated utility environment.

We must work closely with our technical partners and ground ourselves with real life problems. I'd love to do innovation for innovation's sake, as an IT professional. However, as a utility



Avangrid Team, top, from left, Carl Young, Robert Antonellis, James Fox. Bottom, from left, Crispin Gathuru, Mansur Mohammed, Jada Pinto.

professional as well, and I've worked in utilities for twenty-five years, it's about grounding ourselves and looking at real life use cases and problems that we can solve.

I try to encourage and push my teams to consider what these use cases could be, and what are the issues we need to be looking at. Then how can we work with partners in a low-cost, collaborative way for solutioning.

Now, it's using some of the new technology stacks available to us, because by using them, we can start to break ground. Even though we are constrained as a regulated industry, we can look at changing how we operate, and how we use the tools available to us to make a difference in our environment and in our business.

PUF: Jennifer, you and your team at Avangrid have benefitted from this innovation, so explain why that is.

Jennifer Pearce: I'm the Vice President of Reliability Assurance and Emergency Preparedness. Reliability assurance is all the NERC compliance, but on the emergency preparedness side specifically, this kind of simulation has a lot of future value.

A lot of what we do is coordinating across different disciplines in a geographically diverse service territory. Coming up with creative and innovative ways to bring our people together, in virtual environments, which are more real world like the metaverse, helps enable and simulate that in-person contact.

As an emergency manager by trade, I'm always inclined to say, "Everyone in-person in the office," because you lose something when you can't just walk out the door and go talk to someone that you need. By creating these virtual spaces that aren't just Teams meetings but simulate that ability to walk next door and find someone, gives us that same touch and feel of being in-person.

There's a lot of value in being able to respond more quickly when you have that connection for an event. I see that helping us in real world events if we get to the point where we can use places like the metaverse to do that coordination.

But also in preparedness, because what we do is designing trainings and exercises to practice our employees before a real event happens. You want to do that in as real a scenario as possible.

For example, in exercises, typically what the emergency management community does is we build an exercise that's written down on paper, and we might have up a few maps, some of our tools and technologies. But to simulate it in the metaverse and say, "Okay, you've got a substation attack," or "You've got several poles down and wires that needs to get strung back up," then you're creating an environment you can't create easily in the real world.

It's potentially lower cost to do it in a virtual environment. Imagine the wide destruction a hurricane or substation attack can have on the power grid. It's too costly and impactful to recreate that in the real world. But to simulate it, you give that hands-on experience for folks, that they might not get until a real emergency.

This is the direction the future of society is going, in that people are living and working in different places, but we still must work together. This is how we do that using innovation in a more efficient way.

PUF: Mansur, what was most rewarding for you in creating and working on this innovation?

Mansur Mohammed: The team believing what we can do. Initially, when I explained this to different teams, they didn't believe we could bring it all together, move from one space to another, and see a virtual world.

Bringing the imagination to virtual reality, it's amazing. Now we can see a future in this virtual world. We can add artificial intelligence into that. In the future, we can add deep learning

and machine learning models for fast action, and we can bring them here in the virtual world, have systems automatically do it, or we can guide them to do it.

This is the first step, but we can do a lot with this, bringing in many different teams and departments. That's amazing to see what we can do now and in the future.

PUF: Carl, what was most rewarding for you, working on this innovation?

Carl Young: Mansur touched on the team success. Getting people to buy into a common goal, and work hard to make this a reality, was great to see, across different disciplines within our organization. Also, working with our technology partners, which was fantastic.

The ability to take this type of application, and develop and apply that to other scenarios, to create a training or simulation environment, which is a safe space for people who work in an extremely dangerous industry. To simulate these types of events, understand and test out our emergency procedures, it's a huge opportunity for us to expand this.

That's probably the most rewarding is proving out that this technology, having a digital twin in the metaverse that can be used and consumed from different offices, in different geographic locations, and people experiencing that simulation, has great capabilities for future use cases to expand this and make our workforce better prepared for things that may happen, in a much safer way. ○

BERTHA LAMME TOP INNOVATOR AWARD FOR GENERATION

San Diego Gas and Electric Wildfire Next Generation System (WiNGs)

Cam Carroll, Nisha Menon, and Joaquin Sebastian

PUF's Lori Burkhart: Cam, describe the innovation that led to your team winning the Bertha Lamme Top Innovator Award for generation, how it works, and the benefits to San Diego Gas & Electric.

Cam Carroll: Almost two years ago, we started on this journey out of our Innovation Engine Team, which is essentially an innovation lab, a rapid prototyping team. We're seeing an explosion in the value of data science and models, and we needed a way for users and the business to be able to utilize and interact with those models.

We started with a prototype that we ultimately called the Community Impact Platform, and that initial innovation was for an advanced analytics visualization platform. That has transitioned and been scaled to what we now have with our Wildfire Next Generation System, WiNGs.

When we hear about wildfires in other parts of the world, this effort is a reminder of how meaningful and impactful our work is toward the greater goal of keeping our communities safe.

– Nisha Menon

PUF: Nisha, what is your role in the development of the innovation?

Nisha Menon: I'm the Wildfire Mitigation Program Strategy Manager. The Wildfire Next Generation System (WiNGS) is a platform and a product of innovation, collaboration, and teamwork.



Bertha Lamme Top Innovator Award for Generation to San Diego Gas and Electric team, from left, Cam Carroll, Joaquin Sebastian, and Nisha Menon.

That initial innovation was for an advanced analytics visualization platform. That has transitioned and been scaled to what we now have with our Wildfire Next Generation System, WiNGs.

– *Cam Carroll*

I manage the partnership between the Wildfire Mitigation Program team and other stakeholders from business units across the company (Enterprise Risk Management, IT, Fire Science & Climate Adaptation, Electric Engineering, et cetera), to address the company's top risk, wildfire, to keep our communities safe, and address the regulatory requirements associated with our Wildfire Mitigation Plan.

PUF: Joaquin, what was your role in the development of the innovation?

Joaquin Sebastian: I'm the Team Lead of Advanced Risk Analytics under the Enterprise Risk Management (ERM) group. Within the WiNGS product, my role has entailed two core responsibilities.

Firstly, I've led the development of models, ensuring they align with regulatory requirements, and provided guidance to both internal and external teams in the creation of the necessary analytics platforms for developing and implementing the risk

models. Simultaneously, I've taken on the role of advocating for advanced analytics and promoting risk-informed decision making based on the insights of this model.

At the beginning of this journey, we struggled to promote understanding of this new tool, and that's why we partnered with Cam's group to create an interactive visualization platform that allows users to identify and prioritize risk-based decisions. This shift was necessary because it became apparent early on that our stakeholders were struggling to engage with the model's insights. We recognized that our users were not fully adopting the results of our models due to challenges in navigating the model's findings.

In partnership with Cam's team, and with the support from Nisha's team, we started building this platform so that users can access real-time data and navigate and interact with our advanced models to help and support decision making.

PUF: Cam, what was your role in the development of the innovation?

Cam Carroll: It's about bringing people and ideas together. There was this business need, they had these great models, but how do we increase adoption, increase utilization of those insights?

In leading our innovation lab, we were able to bring two different sides of our organization together to create this vision of what WiNGs could be, to help elevate it in our efforts for wildfire mitigation.

PUF: Nisha, talk about the need for wildfire mitigation.

Nisha Menon: Over the past decade, there has been a rapid increase in wildfires in California and across the globe causing an extensive amount of damage and great personal loss. With this growing risk of wildfire due to climate change and its associated challenges, how do we use the advances in data science to develop better data-driven risk models to inform efforts to mitigate the risk of wildfire and reduce the impact of a public safety power shutoff (PSPS), when we have to proactively turn off power for safety reasons, to our customers?

PUF: Is there anything, Joaquin, you'd like to add to that?

Joaquin Sebastian: We want to be transparent in what we do and how we do it. Given the significant wildfire risk, not only in California but potentially across the United States, it is imperative that we approach our short- and long-term decisions with a sense of responsibility.

We recognize the value of data analytics in our decisions and operations. While we acknowledge that our models may not be entirely perfect, we are dedicated to their ongoing enhancement and refinement.

We believe in a culture of continuous improvement, and that's why we dedicate a significant amount of resources to developing these models. We're learning more and more. We are partnering with industry leaders, academia, and other investor-owned utilities to continue evolving this space.

PUF: Cam, what was most rewarding for you working on this innovation?

Cam Carroll: I have a couple of charters within my role leading the Digital Innovation group. The first is bringing groups together, helping them think about different and modern ways of working. That's rewarding to see that journey with partners.

The second piece, we're out in front trying to accelerate digital and cloud technologies. Being able to apply cloud technology to solve an important problem is rewarding.

It marries what I do on the technology side with our business initiatives. Wildfire is our single biggest risk as an organization and being able to apply cloud technology to that is rewarding for me, as is bringing the people and technology together.

PUF: Nisha, what is most rewarding for you?

Nisha Menon: Three things come to mind for what's most rewarding about this effort for me.

Working with a motivated team with the drive to address our company's top risk and promote community safety.

As leaders in this space, we are sharing best practices and collaborating with other utilities, academia, and industry partners on addressing wildfire risk. When we hear about wildfires in other parts of the world, this effort is a reminder of how meaningful and impactful our work is toward the greater goal of keeping our communities safe.

I've witnessed a substantial shift in how we perceive and manage data, emphasizing data governance and embracing a forward-looking vision for the utility. We are transitioning into a more data-centric organization, and this evolution is fascinating.

— Joaquin Sebastian

PUF: Joaquin, what has been most rewarding as you've worked on this innovation?

Joaquin Sebastian: I emphasize the internal drive within our utility to resolve the wildfire problem. It's truly gratifying to witness the motivation within our internal teams, their dedication to understanding, quantifying, and striving for growth and improvement.

Another noteworthy aspect is the transformation of how our utility approaches data and risk assessment. During my four-year tenure with the company as a data scientist, I've witnessed a substantial shift in how we perceive and manage data, emphasizing data governance and embracing a forward-looking vision for the utility. We are transitioning into a more data-centric organization, and this evolution is fascinating. ○

DTEK is the largest private investor in Ukraine's energy sector. DTEK's employees have died, are missing, in captivity, or been wounded. DTEK CEO Maxim Timchenko is determined to keep the lights on.

Some may be surprised to learn that Timchenko is moving forward with clean energy. He said in March 2023: "We brought an initiative called, Thirty by 2030, building or having thirty gigawatts of renewable capacity in our generation mix by 2030. Half of thirty gigawatts can be exported to European countries."

He announced in September completion of a wind power plant sixty miles from the frontline. Tyligulska WPP is providing energy for up to two hundred thousand homes from nineteen turbines. DTEK is seeking funding to install another sixty-four.

CHARLES STEINMETZ TOP INNOVATOR AWARD FOR GRID OPERATIONS

Exelon

Automated Drone Initiative

Ankush Agarwal, Vlad Anderson, and Po-Chen Chen

PUF's Lori Burkhardt: Talk about your innovation that led to you and your team winning the Charles Steinmetz Top Innovator Award for Grid Operations, how it works, and what the benefits are to Exelon.

Ankush Agarwal: Thank you so much for this recognition. I was the director of advanced analytics at Exelon when our team developed this innovative solution. Po-Chen Chen managed our internal data science team, and Vlad Anderson, our principal quantitative engineer, led the project.

We collaborated with various teams including BGE Smart Grid & Innovation, BGE Drone Inspection, BGE Distribution Standards, BGE Regional Electric Operations, NVIDIA solution architects, 3D modelers and data scientists at Deloitte, with contributions from team members like David Barnard, Andrew McCauley, Reddy Mandati, Bishwa Sapkota, Pavel Dimitrov, Eren Aksu, and many more.

The problem we tackled was how to streamline and speed up the process of identifying defects in drone-captured images for proactive grid maintenance, enhancing reliability and resilience. Drones already offered faster and safer equipment inspections, but manually reviewing images and identifying defects took time. Our project automated this process.

From a data science perspective, to create effective models, you need lots of images. BGE has a robust drone program and plenty of asset images, but not enough of the defects we wanted to identify. So, we needed a scalable solution.

We turned to synthetic images, partnering with NVIDIA and Deloitte. Deloitte's expertise and NVIDIA's Omniverse platform helped us generate realistic 2D and 3D models, complete with backgrounds and defects.

Our data science team collaborated closely with BGE's subject matter experts to curate a library of sample images and distribution construction standards, to help Deloitte's artists and modelers create two thousand synthetic images, which looked real. This was an iterative process, but it paid off. We achieved a ninety-two percent accuracy in detecting crossarms and received a lift of sixty-seven percent in detection of crossarm defects, a significant improvement.

The benefits were substantial. Our innovation improved defect detection, reduced manual labeling hours, and enabled us to create realistic images of rare defects where real-world data

Our innovation improved defect detection, reduced manual labeling hours, and enabled us to create realistic images of rare defects where real-world data was scarce. It gave us a scalable methodology to apply this across various assets. This innovation paves the way for more drone deployments, reducing field hazards for crews, and accelerating defect resolution for better grid reliability.

– Ankush Agarwal

was scarce. It gave us a scalable methodology to apply this across various assets.

This innovation paves the way for more drone deployments, reducing field hazards for crews, and accelerating defect resolution for better grid reliability. We've also built a user-friendly tool for BGE users to review and validate our AI model's results, making the process even more efficient.

PUF: Vlad, what was your role in this innovation's development?

Vlad Anderson: I am the product owner for this project and had over ten years of experience at Exelon on the engineering and analytics side before joining this project. In the product owner role, I act as a liaison between the BGE teams and our Data Science team with the primary goal of making sure the project delivers tangible benefits to our business stakeholders and meets their requirements.

I work to bring in business subject matter experts' perspectives to the problem either based on my knowledge or directly interfacing with business stakeholders to make sure that the synthetic data deliverable from Deloitte was targeted at solving the core business need of detecting asset defects in real-world drone images.

PUF: Po-Chen, talk about your involvement in the development of this innovation.



Charles Steinmetz Top Innovator Award for Grid Operations, from left, Vlad Anderson, Ankush Agarwal, Po-Chen Chen.

We are moving on to the next phase of the project that will involve taking the work done for the crossarm defect detection and scaling it to other assets on distribution poles. The synthetic image data produced by Deloitte contains labeling information for other assets and will be valuable for us in supporting this next phase.

– Vlad Anderson

Po-Chen Chen: My role in this innovation was all about connecting the dots and making sure everything came together seamlessly.

One of the major challenges we faced was assembling various components to create a complete system. It might seem like a straightforward process from drone image to data to use, but it's more intricate than it appears.

People often think that training the images and building the model is the end of it. In reality, there are numerous moving parts, including the platform, end-to-end data flow, GIS front end, model training, and labeling.

We took a pioneering approach by incorporating synthetic images into our training. This was a significant risk we undertook.

As we developed our algorithm and model, our focus was twofold: identifying assets and assessing the extent of damage to those assets. This involved a lot of trial and error.

In fact, at one point, we had to overhaul the entire image labeling process because accurate labeling is crucial for the algorithm to identify assets and defects. Sometimes, the benchmark for the model identifying the exact position of a defect in an asset might be less critical than simply identifying the defect itself.

Additionally, we compared our approaches with those of our industry peers, even though much of the core development

information in our field is proprietary. Gathering this information involved attending conferences and networking to access valuable insights, which was another challenge in our research process.

PUF: Vlad, in working on this project, what was most rewarding?

Vlad Anderson: The most rewarding piece was being part of the journey from a novel innovative idea to a solution which delivers value to the business stakeholders. As part of this project, we had to think outside the box and work through several challenges to come up with the solution to address the lack of training defect images.

In addition, I am happy that we made sure that the synthetic data deliverable addresses future use cases, such as asset and defect detection beyond crossarms. We are moving on to the next phase of the project that will involve taking the work done for the crossarm defect detection and scaling it to other assets on distribution poles. The synthetic image data produced by Deloitte contains labeling information for other assets and will be valuable for us in supporting this next phase.

PUF: Po-Chen, what's been most rewarding?

Po-Chen Chen: The most rewarding aspect was navigating through a challenging project with tight deadlines.

We collaborated with Deloitte and NVIDIA on the modeling component while simultaneously working with our internal partners. The success of the project depended on the seamless flow of information among all these teams, which was quite a task.

Our hearts and minds were fully invested in the project, with uncertainty about its ultimate success. It's a bit like a chicken or egg problem. You need to know what data to feed the algorithm to create a successful model, but how do you determine what you need to create in the first place? We had to design specific assets that the algorithm could identify, and this presented an intriguing challenge on the data science front.

PUF: Ankush, what was rewarding during work on this innovation?

Ankush Agarwal: The most rewarding aspect was taking this ambitious vision, which appeared unattainable initially, and rallying our experts from various teams and partners to bring this innovation to life.

Another rewarding aspect was the strong leadership support in the analytics and operations teams. They all shared the same sentiment: "Let's do it, despite the risk, let's invest in it."

We are grateful for the encouragement from our leadership teams, enabling us to take on high-impact projects like this one. This includes the leaders in the BGE Utility of the Future Council, our sponsor Ajit Apte, BGE VP Technical Services and the analytics leadership at Exelon, under the guidance of Isaac Akridge, SVP Operation, Analytics, and Business Investments. Their support, funding, and guidance were crucial.

Earlier this year, NVIDIA recognized our innovation,

It's a bit like a chicken or egg problem. You need to know what data to feed the algorithm to create a successful model, but how do you determine what you need to create in the first place? We had to design specific assets that the algorithm could identify, and this presented an intriguing challenge on the data science front.

– Po-Chen Chen

showcasing us at their GTC conference and inviting us to contribute a technical blog. This recognition holds importance as it acknowledges the dedication and hard work of our team and partners.

We've been sharing the news of this Fortnightly innovation award within our organization, and it garnered praise from the CEO of Baltimore Gas and Electric. This is seen as a model for collaboration and innovation, both within and outside Exelon.

As our team emphasizes, "Analytics is a team sport." We were successful because of the exceptional teamwork among our various groups. ○

CHARLES STEINMETZ TOP INNOVATOR AWARD FOR GRID OPERATIONS

PPL Electric Utilities

Distribution System Series

Sal Salet

PUF's Lori Burkhart: Describe the innovations involving the distribution grid that led to the PPL team winning the Charles Steinmetz Top Innovator Award for Grid Operations, how they work, and what the benefits are to PPL Electric Utilities.

Sal Salet: At PPL, our goal is to be the best utility in the world. We want to provide safe, reliable, cost-effective, power to our more than 1.4 million customers.

Our industry is under a lot of pressure to change how we operate to meet major challenges such as aggressive decarbonization targets, severe weather events, and wildfires. In order to meet these challenges and continue to provide safe, reliable, and affordable power to our customers, we have to be innovative.

Our role as leaders is to create the culture and environment that enables employees to innovate. In this culture, diversity is appreciated, all ideas are heard, and employees feel safe making mistakes and learning from them.

At PPL, there are many examples where this approach to innovation was applied and generated great results. The first example that comes to mind is the predictive failure sensors project. This project started with a request from our leaders to figure out a way to identify failing equipment before it fails. Immediately, a diverse team was assembled and was given the needed resources, and the autonomy to figure out a solution.

Within nine months, the team identified ways to detect failing



Charles Steinmetz Top Innovator Award for Grid Operations to PPL Electric Team, from left, Ian Mears, Bashar Jarrah, Aliesha Dombroski-Diamond, and Arun Doodnauth.



Sal Salet

equipment using sensors and relays. Fast forward another six months, and now we have partnership with a sensor provider, a successful pilot implementation, and a plan to deploy sensors across our grid in two years. The deployment will potentially save millions in operating costs and provide a significant reliability improvement.

Another innovative project is our DER management pilot. PPL received PUC approval in 2020 to manage DERs behind the meter and became essentially the first utility to gain approval to do it system wide. At the start of the pilot, there were no packaged

The team successfully connected six thousand solar systems to DERMs using our existing AMI Mesh network. We also successfully tested and approved two hundred inverters to be installed on our grid, using DERMs active management to reduce costs of interconnection by upward of six million dollars.

solutions on how to control and manage DERs behind the meter.

We had to build these solutions ourselves. To do so, we used the same approach. A diverse team was assembled and given the autonomy and resources required to succeed.

Two years later, the results are amazing. The team successfully connected six thousand solar systems to DERMs using our existing AMI Mesh network. We also successfully tested and approved two hundred inverters to be installed on our grid, using DERMs active management to reduce costs of interconnection by upward of six million dollars.

PUF: As you guided your teams working on these innovations, what's been most rewarding as you've been developing these projects?

Sal Salet: What was most rewarding was seeing how the team members developed and grew to be promising leaders with bright futures. When you put someone in a different or new role and give them the tools to succeed, it's amazing seeing how successful they become. It was great to see how the team members grew dramatically during the projects. ○

NANCY FITZROY TOP INNOVATOR AWARD FOR ENVIRONMENT AND SAFETY

Arizona Public Service Innovations in Predictive Maintenance

Scott Alford

PUF's Lori Burkhart: Scott, talk about the innovation that led to your winning the Nancy Fitzroy Top Innovator Award for Environment and Safety and its benefits to Arizona Public Service.

Scott Alford: Our Predictive Maintenance strategy includes twenty-six team members who are trained and certified in numerous inspection technologies, including a Boston Dynamics Spot the dog robot, a Forward Looking Infrared (FLIR)/Firstlook Tank, hot stick mounted cameras, and drones to ensure highly effective and safe non-contact inspections.

We're one of the only Transmission & Distribution groups doing predictive maintenance with advanced robotics, which allows us to do added work more effectively and efficiently, and it creates a safer environment for our workforce.

The Predictive Maintenance team no longer uses a single person to inspect substation ground grid integrity, network transformers, and critical underground infrastructures, which can be dangerous and hazardous sites. Instead, the team now deploys a two-person crew consisting of one qualified electrical worker and one Predictive Maintenance technician to oversee the inspection executed by one of their robotic tools.

These technologies allow us to do more detailed inspections in confined spaces, vaults, and other sites that may be tedious and time consuming and allows us to optimize the tools in ways we never imagined were possible even five or ten years ago.

PUF: What was your role in developing this innovation for Arizona Public Service?

Scott Alford: As Supervisor of Predictive Maintenance, I support my team's growth in the industry and champion the



I support my team's growth in the industry and champion the innovative use of asset monitoring equipment to improve the safety of our employees, the effectiveness of our equipment monitoring, and to ensure we're supplying reliable service to our customers.

innovative use of asset monitoring equipment to improve the safety of our employees, the effectiveness of our equipment monitoring, and to ensure we're supplying reliable service to our customers.

There's a lot that must happen to implement innovations like this, from hiring and training skilled team members to working with our IT partners to meet business needs, and ultimately,

servicing our customers. From that perspective, we were able to have successes and wins, while we were going through the implementation process.

PUF: What was most rewarding for you during your work on these innovations?

Scott Alford: It's the most rewarding to know that we're able to do this work using technology to create a safer working

environment. There are places that are inherently more hazardous than others within transmission and distribution infrastructure.

My team understands we play a significant role in delivering reliable power to our customers when they need it most, like during the record-breaking heat wave we experienced in Phoenix this summer. I'm most proud of our group because they love their jobs as much as I do, and that's a big deal. ○

NANCY FITZROY TOP INNOVATOR AWARD FOR ENVIRONMENT AND SAFETY

Xcel Energy

Drones and Robotics in Nuclear Inspections

Andrew Brown, John Miller, and Kirk Olsen

PUF's Joe Paparello: Kirk, describe the innovation that led to you and your team winning the Nancy Fitzroy Top Innovator Award for Environment and Safety, and how it's made a positive impact at Xcel and on its customers?

Kirk Olson: Our innovation is our drone robotics program. We saw a need in the nuclear industry to reduce costs and improve safety. Having high safety margins and a great safety program is the first cornerstone of nuclear, and what can be safer than removing people from the equation of the safety hazard?

We've implemented a multitude of drones and robotics to replace people in hazardous environments, have eliminated that safety hazard, and the equipment is relatively low cost compared to the amount of savings. It's been a win-win.

We've used robots in replacement of divers. We've put the spot robot in high radiation areas where we wouldn't have done that before with a person, so we developed new capabilities.

We've done a lot of aerial missions eliminating helicopters or scaffolding. These are high-risk evolutions, and we eliminate that risk completely with aerial drones.

We have several indoor drones also that take care of the same tasks. It's been a good program for eliminating safety hazards – not just slightly improving it – but there's zero risk.

PUF: What has the response been like at the company, and with the staff typically involved in those situations?

Kirk Olson: As a worker, not putting yourself in a hazardous environment is always a benefit. Now, divers make a lot of money in that job, and that's part of the risk, but generally it's been positive, workers can come to work, and not put themselves in a hazardous environment.

They still get paid and do other work that they're more useful for. We haven't seen any negative aspects. It's been positive, taking away that risk.

Todd Hurlee: There is more adoption. Users are calling us to

come and look at things they want to look at. Otherwise, they would've not had that opportunity before.

We've also got examples where workers will choose not to go into areas where we've been able to use drones to successfully do inspections, where otherwise we wouldn't have been able to do inspections at all.

Molly Strasser: We're getting more and better data. We've got retention and pictures, and people are asking for things to be inspected that we wouldn't have before.

High winds come to mind, so if we've got high winds coming, we've gone out and looked for debris that could cause an issue. That's something we might've walked around and done, but it's a much quicker and a better evolution if we can do it with a drone and just fly over and take a survey.

PUF: Are there any takeaways in terms of how well the innovation is working?

Kirk Olson: We track our missions, kind of a saving compilation, where we track the amount of savings. We're getting hard dollar savings, and we're quantifying the amount of risk or hazard that we've eliminated. We have been able to track quite a few things. The exact dollar amount, we're not sharing that. We've had a lot of big wins. Just replacing divers, that's been a huge cost savings and a safety improvement.

We've also established relationships with the nuclear plants, where it's a low barrier to get ahold of us, so they can just call us or get us on Teams, and we're responsive. We're making that seamless in that they don't have to submit a work request.

Molly Strasser: It's not just nuclear. Kirk, John, and Andy have done inspections for the entire Xcel enterprise, which includes other types of power plants.

They inspected a dam for energy supply last year. We've created this for nuclear, but we've got the tools to help other divisions, which has been great.



Nancy Fitzroy Top Innovator Award for Environment and Safety to Xcel Energy, from left, Andrew Brown, Kirk Olson, and John Miller.

We saw a need in the nuclear industry to reduce costs and improve safety. We've implemented a multitude of drones and robotics to replace people in hazardous environments, have eliminated that safety hazard, and the equipment is relatively low cost compared to the amount of savings. It's been a win-win.

– Kirk Olson

PUF: What was your role in this innovation?

Kirk Olson: I'm the end implementer. Molly governs my actions, but we are self-managing as far as the projects, what's coming up with scheduled activities, and then there's also the, as needed. We've been qualified to fly the drones indoors and outdoors, drive the submarines, implemented the Spot adoption program, been the end user on all that, and been an operator.

Molly Strasser: Kirk, Andy, and John have done the work, and I provide support. If they come and need things, we'll work through funding requests, training, and support, aligning it both at the site and then across the enterprise. This is a grassroots effort with support as needed from leadership, but we're getting the adoption from the workers at the site.

Todd Hurlee: I get the pleasure of working with innovative people. They are stretching the boundaries, and it's fun to watch.

PUF: What has been most rewarding for each of you in working on this innovation?

Kirk Olson: Working with the plants, and when they have a

need, being able to address that in a smart manner that's quick and effective. Then being able to get their needs met without boundaries and complications. Making their work better so they're able to adopt technology and this process, and we can implement new things as they come, and their approach to it is favorable.

Molly Strasser: There are two things. It's a bit like Christmas when the guys get a new tool. The little kid comes out, and it's fun to watch how people learn and adapt to it.

The second one is creating believers out of pessimists at the site. There have been a lot of people that weren't sure that robotics could do the job as well as a human.

We've had multiple people come back and say, I can't believe how well that worked. It got me the information, things along those lines.

Todd Hurlee: Customer service. Being in operations, a lot of people can call me, and I just turn them over to the team to go and do the mission as they need, and they're so happy with their results. ○

MARIA TELKES TOP INNOVATOR AWARD FOR DISTRIBUTED ENERGY

Arizona Public Service Company

Virtual Power Plant

Jason Delaney, Kerri Carnes, and Elizabeth Lawrence

PUF's Lori Burkhart: Jason, describe the innovation that led to your team winning the Maria Telkes Top Innovator Award for Distributed Energy, how it works, and what the benefits are to Arizona Public Service.

Jason Delaney: Arizona Public Service Company delivers reliable, affordable and clean energy for approximately 1.4 million customers in Arizona. The Customer to Grid Solutions team at APS serves as the bridge between what our customers want and what the grid needs by providing exceptional service and expertise to integrate innovative technologies.

The programs in our demand response portfolio help customers manage their energy use by participating in programs, while impacting the grid. Our DR portfolio includes a variety of technologies like smart thermostats, behavioral DR, and storage devices.

The team has been responsible for scaling our DR portfolio, which has grown into a Virtual Power Plant (VPP). With almost eighty thousand thermostats enrolled in Cool Rewards – a smart thermostat program for residential customers – we're capable of shedding more than one hundred ten megawatts of energy demand. That's the equivalent of a small power plant, or fifteen thousand homes. This year, we achieved more than one hundred seventy-five megawatts of capacity from our entire DR portfolio.

It's remarkable how much we've grown in the past five years and how we continue to do so by working with customers to manage energy use in ways that meet their needs even during the record-breaking heat wave we experienced this summer.

PUF: Kerri, what is your role in the development of the innovation?

Kerri Carnes: As the Director of the Customer to Grid Solutions team, our team is responsible for designing programs to benefit our customers, providing them with energy-saving options while helping to advance a cleaner, more reliable grid. We collaborate with our partners to provide customers with devices, assist customers in installing their devices, and then call on the devices for events.

Events can pre-cool homes, shifting load to our high-solar production period, and use the thermal properties of customer homes as a battery to curtail HVAC load to reduce peak demand.

Connected ENERGY STAR® products such as thermostats, heat pump water heaters, and battery storage play especially important roles because they enable both customers and APS

The team has been responsible for scaling our DR portfolio, which has grown into a Virtual Power Plant. With almost 80,000 thermostats enrolled in Cool Rewards – a smart thermostat program for residential customers – we're capable of shedding more than 110 MW of energy demand. That's equivalent of a small power plant, or 15,000 homes.

– Jason Delaney

to not only reduce energy use, but also to shift load and reduce peak demand on Arizona's hottest summer days, and shift energy demand to when more solar power is available.

The APS Cool Rewards program is leading our DR portfolio. The program aggregates residential customer-owned thermostats into a growing and strategically important resource during the extreme Arizona summers, providing incentives at enrollment and an annual bill credit to participating customers.

Starting in 2018, Cool Rewards enrollment was just six thousand devices, or approximately five thousand customers. The program has scaled significantly over the years to nearly eighty thousand devices, at approximately fifty-six thousand customers, and was able to shed one hundred thirty-five megawatts of 2023 summer capacity. This energy avoidance saves customers money, benefits the environment, and builds a smarter electrical grid.

My role is to challenge the team to continue thinking about innovating the program inside the business and externally with stakeholders while keeping our customers at the center of everything we do. At the end of the day, it's always about our customer.

PUF: Elizabeth, what is your role in the development of the innovation?

Elizabeth Lawrence: I've been in a fun position as this virtual power plant has grown up. Prior to moving into Customer to Grid Solutions earlier this year, I served on our state regulatory affairs team and partnered with the customer to grid solutions



The Maria Telkes Top Innovator Award for Distributed Energy, from left, Jason Delaney, Kerri Carnes, and Elizabeth Lawrence.

We collaborate with partners to provide customers with devices, assist in installing devices, and call on the devices for events. Events can pre-cool homes, shifting load to our high-solar production period, and use the thermal properties of customer homes as a battery to curtail HVAC load to reduce peak demand.

– Kerri Carnes

team as we sought regulatory approvals and enhancements to program design that allowed us to get to where we are now. I have a front row seat to this program's growth and help guide us into expanding this virtual power plant.

I started my career APS in one of our natural gas power plants. Our units at that plant ranged from fifty megawatts up to five hundred megawatts. The ones we started and stopped most frequently sat at about eighty-three megawatts.

The fact that we are delivering with smart thermostats and megawatt savings that exceed one of the units at the power plant I used to work at is exciting. This summer we've dispatched our thermostats in a way that is different from what we've done operationally in the past.

We'll stagger dispatch of some thermostats at five o'clock and then dispatch another group at six o'clock. This lets us treat the program like a power plant and extend the contribution this technology can provide to the grid.

Being part of the team that's developing how these programs bring the most value to the grid and our customers has been amazing.

PUF: Kerri, what's been most rewarding during the development of this innovation?

Kerri Carnes: I'm proud of how quickly we've scaled this program because we have intentionally kept our customers in front of everything we do when we design a program. We don't just deliver it and walk away. We check back in with customers and evolve the program with them.

After we call events, we run surveys to get just-in-time feedback from customers about their experiences and on how we can make the program better. I'm proud of the success we've had in integrating our DR portfolio as a resource with our operations teams.

I've worked at APS for over twenty years. In addition to being the former manager of state regulatory affairs, I used to lead real-time trading operations. I understand what it's like to sit at the trading desk, dispatch power plants, wait for them to come online, and ensure that all resources are lined up to meet customer demand on the hottest days of the year.

Summer's our season at APS and we're preparing year-round by sitting down ahead of the summer season with our operations teams to talk about different dispatch models. We are intentional about plugging in on a daily basis with the operations team as we're going through the summer because system conditions are ever evolving.

It's cool to see how we've evolved, how we view this as a true resource, and how these partnerships with our customers are producing one hundred thirty-five megawatts just with thermostats. Our Cool Rewards program is the biggest part of our portfolio right now and we're thinking about how we can leverage the program's successes in the future.

For example, electric vehicle adoption is growing, and we can apply what's been successful about the Cool Rewards program to the development of a managed charging program.

We get to be in this cool space inside the utility to start with the customer first and understand their challenges and needs. Then we take that art and apply the science of the reliable operation of the grid and find a way to develop mutually beneficial programs that continue to keep our customers satisfied and enrolled.

PUF: Elizabeth, what's been most rewarding in working on this innovation?

Elizabeth Lawrence: Seeing how we can supply reliable energy without starting a traditional unit. Not everyone realizes we can start our VPP and call on our customers to help meet the demand.

When I first went to school for engineering, I wanted to work in renewable energies. Now, I feel like I'm getting to work in the coolest type of energy, which is helping customers figure out how to manage their energy use in ways that work for their lifestyles while helping ensure grid reliability.

That has been rewarding in a way I didn't know was possible

This summer we've dispatched our thermostats in a way that is different from what we've done operationally in the past. We'll stagger dispatch of some thermostats at five o'clock and dispatch another group at six o'clock.

This lets us treat the program like a power plant and extend the contribution this technology can provide to the grid.

– Elizabeth Lawrence

ten years ago. It's been great to see how the program has grown and to see what we can do next.

PUF: Jason, what's been most rewarding working on this innovation?

Jason Delaney: Our mission at APS is to serve our customers with reliable, affordable, and clean energy. With our demand response portfolio, we check all those boxes. What's most rewarding is we're just getting started and have so much potential for what we can do to power our customers and Arizona forward. ○

MARIA TELKES TOP INNOVATOR AWARD FOR DISTRIBUTED ENERGY

Puget Sound Energy

Virtual Power Plant Software Platform

Gilbert Archuleta, Ryan Murphy, and Laurent Sayer

PUF's Lori Burkhart: Describe the innovation that led to your team winning the Maria Telkes Top Innovator Award for Distributed Energy, how it works, and its benefits to Puget Sound Energy.

Ryan Murphy: A Virtual Power Plant is a software platform that acts like an aggregator of distributed energy resources, making it possible for utilities like PSE to forecast, control, and readily dispatch consumer-owned resources like battery storage systems and demand response programs within our service area. Through the implementation and usage of the VPP, PSE will gain a better understanding of which DERs are the most reliable and effective at delivering results to support our clean energy goals.

Laurent Sayer: Over the last couple of years PSE implemented a Virtual Power Plant. The VPP helps coordinate the use of distributed energy resources during peak load hours.

DERs can be thermostats, battery systems, building energy management systems, electric vehicle chargers, all types of appliances, which when pooled together can be called upon to help reduce load by hundreds of megawatts. It is similar to starting a traditional generation power plant when you need more power.

PUF: What was your role in the innovation's development?

Ryan Murphy: The System Operations team supported the development of the measurement and validation data from the system peak load offset contributions. As we move from development into implementation, our team will establish the DER forecast and schedule events.

Laurent Sayer: I am the IT implementation manager for this project. My role is to ensure IT resources are identified and available to support the goals and timelines of the project. The IT team worked closely with our multiple business partners – load



The Maria Telkes Top Innovator Award for Distributed Energy, from left, Ryan Murphy, Laurent Sayer, and Gilbert Archuleta.

The System Operations team supported the development of the measurement and validation data from the system peak load offset contributions. As we move from development into implementation, our team will establish the DER forecast and schedule events.

– *Ryan Murphy*

office, system operations, trade floor, energy efficiency programs, new product development – and vendors to define the objectives and implement the technical solutions for the project.

Gilbert Archuleta: PSE has been involved with the Clean Buildings Law since the rulemaking process started in 2019. We quickly realized how much of an impact it was going to have on thousands of our customers, and that the requirements of the law weren't something that could be understood and implemented after hearing about it once.

Our experience with Strategic Energy Management programs allowed us to blend SEM principles with the requirements of the Clean Building Law to create a program to help our customers get on their path to compliance. In 2021, we launched our first Accelerator cohort, and have since built out a team to help spread awareness about the Clean Buildings Accelerator Program and support our customers going through the program.

We continue to innovate with the program, to speed up the time to get our customers benchmarking, experimenting with sector-based cohorts, and finding ways to bring equity into our recruiting strategies.

PUF: What was most rewarding for you during this project?

Ryan Murphy: As Director of Electric Operations, moving

from concept to a functional tool which initiated a load offset on our system.

Laurent Sayer: There are so many exciting aspects to this project. First, this is where IT meets clean energy. The fact we can use a VPP just like a power plant is fascinating.

It helps PSE meet its renewable energy goals and engages our customers like never before as they can participate directly in helping reduce load. Also, from a technical standpoint, the VPP is a new concept and we had to build this system from the ground up and involve so many business teams.

It pushed all our teams to think with innovation in mind and it took a village, a lot of discovery and creative thinking to make it happen. The collaboration and engagement from all teams was amazing. This is just the beginning of the story for this technology.

Gilbert Archuleta: The most rewarding part has been the partnerships and leadership role PSE has taken. We wanted this Clean Buildings Law to be successful – so many of us in Energy Efficiency are here because we are trying to help save the planet – and reducing GHGs in buildings is one of the reasons.

So, leading ongoing working sessions with other utilities, inviting them to share in our program design, and seeing some

of them adopt the Clean Buildings Accelerator program model feels like it is doing the most good across the state. We've also deepened the engagement we have with the Department of Commerce and continue providing the utility's perspective on how to make this law successful.

Finally, we've been given the go-ahead to pursue awards like this one, to increase visibility of our program both locally and nationally, especially with the increase in benchmarking and building performance standards across the country. As Director of Customer Energy Management, it is rewarding, as we want to share our experience with others so that folks don't have to recreate the wheel. ○

This is where IT meets clean energy. We can use a VPP just like a power plant. It helps PSE meet its renewable energy goals and engages our customers like never before as they can participate directly in helping reduce load.

– Laurent Sayer

FRANCIS UPTON TOP INNOVATOR AWARD FOR ANALYTICS

CMS Energy

Automated Analytics for Renewable Generation

Derek Belote, Chris McNalley, and Jason Ugartechea

PUF's Lori Burkhardt: Chris, describe the innovation that led to you and your team winning the Francis Upton Top Innovator Award for Analytics, how it works, and what the benefits are to CMS Energy.

Chris McNalley: There are two parts to the renewable side of what we do, engineering and data analysis. These groups must work hand in hand. The overall engineering group handles wind, solar, and battery storage technology. The two pieces that come into play are for wind generation for drivetrains specifically and solar module performance.

What it does is the system of analytics we have created is a dashboard screen for an entire site. We could expand that to an entire fleet. By pre-alarmed on a wind turbine, the display will indicate an anomaly through statistical analytics, "Hey, we've got an anomaly or it's trending upward," and will flag that and count the number of flags on top of that. Allowing for inspection and repair prior to the unit coming offline for a fault.

So, if you see a little anomaly versus a big anomaly from a scale perspective, it'll count those. If you see a temperature excursion happen often rather than one big one, it will indicate that, or if you see an exception to the performance of the specific site, the fleet turbines will also pop up and say, "Hey, we may have a problem that's trending up here."

Similar, but slightly different because it uses managed machine learning, the solar side historically has not had much monitoring capability on the direct current side of the solar arrays or modules. That means there's not a lot of technology to look at

module string performance. There is more now than there used to be, but it's still sparse.

We've taken the direct current performance from the input side of the inverter and done a similar measure where it compares expected performance against peers. If you've got a site with – I'll use an example of ours – string inverters with one hundred twenty-five units, it'll look at the collective group and say, "On average this is the expected performance, this is what we're getting," and compare them and say, "These are my top ten underperformers. And ask why that is?"

That way you can statistically develop something that's underperforming that you don't have a lot of monitoring on in its current capability.

That's all built in-house on our PI Historian with Python programming for support, and then it's pushed into Microsoft Power BI for visual management. We've done a couple sites, we're still working through a couple others, but overall, the system's working.

The engineering team has access to it, as do the O&M folks who operate and maintain the turbines. Those folks also have access to, at a glance, because functionally they're our eyes and ears. There are a lot more operations and maintenance specialists than our engineers.

We're trying to get it in front of everybody, and so far, we've done a good job of that. The big aspect is its scalability. We can take that on our small solar fleet or our larger turbine fleet now and expand that as we continue to grow and build out a renewable fleet for Consumers Energy.



The Francis Upton Top Innovator Award for Analytics, from left, Derek Belote, Chris McNalley, and Jason Ugartechea.

The two pieces are for wind generation for drivetrains and solar module performance. The system of analytics we have created is a dashboard screen for an entire site. We could expand that to an entire fleet. By pre-alarmed on a wind turbine, the display will indicate an anomaly through statistical analytics. Allowing for inspection and repair prior to the unit coming offline for a fault.

PUF: Talk about your role in the development of the innovation, as well as that of your team, Derek and Jason.

Chris McNalley: I've been in renewables for about ten years now, most recently as engineering manager. Originally, I was a production engineer, responsible for day-to-day production metrics and firefighting for the fleet.

I saw issues as we built out our renewable fleet and when I had a team in the last four years, Jason became part of that and supported the vision from the engineering side. I realized we had gaps in our visual management that needed to be accommodated from a programming, analytics, and engineering perspective. Derek was added to the team as the data scientist who brought in the analytic programming skillset.

I helped with idea generation, with input from Jason and Derek. Both helped develop the vision into reality. Jason took on the wind turbine side of it, primarily. Derek pursued development of the solar side.

Analytical work tends to be a team effort because you must have engineering support to understand what the data means, and you must have data analytics to program these algorithms.

I didn't take much programming in college, and that's where the data analysts come in, but they don't always understand what the data means. They can come up with, "Hey, this is an anomaly," but generally it takes engineering support to figure out what it's telling you.

PUF: What's been most rewarding working on this innovation?

Chris McNalley: I started at Consumers Energy when it was still primarily a fossil generation fleet. It's been a long road to educate people about renewables and to build the current and future renewable fleet.

It has been great to educate people that, "There's a place for renewables. It might not be the only answer, but we need to embrace all forms of electricity generation." And educate them how it's different from traditional fossil generation or even hydro.

It's been good. At times, it's been challenging. You've got a fuel source you can't control. Doing this, putting things together that makes it easier for people to understand how this is different and how we can still operate and maintain the utility has been very rewarding. ○

WILLIAM HAMMER TOP INNOVATOR AWARD FOR ELECTRIFICATION

BGE

Fleet of the Future

Joseph Byrd and Andrew Hedrick

PUF's Lori Burkhart: Describe the innovation that won the William Hammer Top Innovator Award for Electrification. Talk about how it works and the benefits to Baltimore Gas and Electric.

Andrew Hedrick: This is the innovation award for our Fleet of the Future, which involved quite a few moving pieces. Job site EV charging started in 2021, as we had an issue with EVs in the utility field with our crews needing to work long hours on a job site due to a natural gas leak or an outage. The EVs may not have the range to make it back to a charging station.

The solution we found is a mobile DC fast charger that is portable and compact. You can carry it in the trunk of a Chevy Bolt out to a job site for rapid charging of another EV to get it enough range to make it back to the depot, a public charger, or even the operator's house for recharge.

It is a quick charger advertised as fifteen miles in fifteen minutes. Because we've heard of similar products with similar capabilities that did not perform, Joe and I visited the company in Massachusetts to see the product firsthand.

When we left that day, we realized we had to bring these mobile DC chargers into our fleet due to our electrification goals of thirty percent of the fleet by end of year 2025 and fifty percent by 2030. This includes one hundred fifty-plus light-duty EVs by

2025. The EV fast charger is a valuable tool in our fleet due to its ability to fast charge an EV on a job site.

One of our heavy-duty fleet innovations is the Kalmar Ottawa T2E Terminal Tractor. This started as a diesel model, but the EV model was something new and we pursued this instead.

The T2E Terminal Tractor is used by our shop to move the fifth wheel trailers, which are in excess of one hundred thousand pounds. In the event a transformer is lost at a substation, these need to be deployed quickly.

Being able to move them in and out of the shop has saved downtime on the mobile substation trailers. As a result, maintenance downtime on mobile substation trailers has been reduced.

Joseph Byrd: We're at the forefront of using idle mitigation systems, primarily the Altec JEMS System. We're using that on five, six, seven, and eight weight class trucks.

We started with the idle mitigation systems because EV options are limited on medium and heavy truck chassis – they're starting to get there – but they're still way behind light-duty vehicles. With the aggressive goals we have by 2025 and 2030, we had to find another way to achieve those targets and the idle mitigation systems count toward the goals.

We started with bucket trucks where we would have the idle mitigation system to provide cab comfort, which is heating, air conditioning and electronics to the cab with the engine off. But they also provide power to the boom when the operators are up in the bucket.

At the same time, we started exploring options for trucks that

We started with idle mitigation systems because EV options are limited on medium and heavy truck chassis. With the aggressive goals we have by 2025 and 2030, we had to find another way to achieve those targets and the idle mitigation systems count toward the goals.

– Joseph Byrd





I have done studies on the mileage they're driving in current internal combustion engine vehicles. If you plan it right, have proper parking locations in the service territory to make the EV work within its mileage range, that is rewarding when the operator doesn't want to go back to an internal combustion vehicle.

— Andrew Hedrick

didn't have an aerial device, like dump trucks and compressor trucks, to provide only cab comfort. So, when they're idling on the job site with heating and air conditioning going, you could use battery power versus having the diesel engine running.

That was a first with Altec. I don't think any other companies were doing this yet. Everyone was going toward the EPTO options. But we started putting that on different types of trucks and expanding it across our fleet with dump trucks, weld trucks, and compressor trucks. Anywhere we saw an application involving idling, we started installing the systems.

Another topic involved overloading and using safety and efficiency tools. It's load monitoring system technology on bucket trucks and digger derricks. This is a valuable product because until recently, operators could be doing things in the field like lifting too much or doing work that could cause damage to the equipment or injury to themselves.

This could be happening in the field, but the service center or technicians wouldn't know. Now, with the load monitoring system, it cuts the function off when the operators are doing what they shouldn't, and it also sends alerts to the shops so everyone at the fleet service centers or whomever is set up to receive notifications are aware of what's happening in the field.

If a truck needs to be inspected because something was overloaded, you're now aware of this, whereas before only the operator would know. That's a big improvement with new technology.

PUF: Andy, talk about your role in developing and implementing these innovations.

Andrew Hedrick: Joe and I both are Senior Governance Equipment Compliance Specialists, and our number one responsibility in the fleet is vehicle procurement and design. We oversee different classes of equipment. I oversee the light duty fleet and vehicles like F550s or international MVs with enclosed bodies.

It's working with our internal customers to see what their needs are, and then rolling in the clean fuel technologies, whether that's BEV or plug-in hybrid, to reduce fossil fuel or carbon emissions from our fleet. At the same time, we're deploying the EVs, we're also working with our facilities team to plan for charging infrastructure, so that it's in place by the time the vehicle arrives.

That way it's not parked for a year waiting to be plugged in. We also work on the charging process in general, to determine the best strategy for depot charging and public charging to best support our fleet needs.

PUF: Joe, talk about your role on the innovation side.

Joseph Byrd: I have the same responsibilities with vehicle design and procurement, but my area of the fleet is aerial equipment, like bucket trucks, digger derricks, and cranes, as well as dump trucks, weld trucks, and mechanic road service trucks.

As far as innovation is concerned, one of the neat things about our role is we get to attend conferences and expos to see new technology. Also, when we're having vehicles built, we go to

the vendors' plants to look at products and see what's being used throughout the industry. This is where we get examples and ideas.

It's not always us starting from the ground up, but seeing what other utilities are doing and improving off those ideas or taking that and putting a spin on it. We have a neat tool at Exelon we call Reinvent. It's an internal website where we can submit innovative ideas, see other employees' innovations, and comment on each other's innovative ideas. From there we can start working together, building off these ideas, making them better.

PUF: Andy, what's been most rewarding as you work on these innovations?

Andrew Hedrick: It's been most of the EV deployments, where there's been operator or user group pushback from the start. I have done studies on the mileage they're driving in their current

internal combustion engine vehicle then replacing these with the proper EVs that meet the operating need of the business.

If you plan it right, have the proper parking locations in the service territory to make the EV work within its mileage range, that is rewarding when the operator doesn't want to go back to an internal combustion vehicle.

PUF: Joe, what's been most rewarding as you work on these innovations?

Joseph Byrd: There are a lot of pushbacks from our internal customers because people don't always like change or embrace change. Sometimes when we want to change a design, it's hard to get people to accept that. It's most rewarding once we go through that, get acceptance, they see the final product that is better, and you change that mindset. ○

JOHN BEGGS AWARD FOR ENERGY TRANSITION

Duquesne Light Company

Advanced Grid Solutions

Elizabeth Cook, Samuel Levinson, Sabrina Nguyen, Daniel Rodgers, Alex Rosenblatt, Richard Saporito, and Jessica Valentine

PUF's Lori Burkhardt: Talk about the innovations that led to your team winning the John Beggs Top Innovator Award for Energy Transition, how they work, and benefits For Duquesne Light Company.

Elizabeth Cook: We submitted three projects, but the vision behind all of them is to enable situational awareness to the edge of the grid. When we're thinking about how we're setting up and preparing for the new energy economy that's being enabled by distributed energy resources, we need to know the real-time performance of assets we're in charge of, to ensure safe, reliable, affordable power.

The idea behind our innovation is thinking outside the box and looking to the larger industries to unlock new ways of doing things. That is embracing data and data analytics.

One project, Smart Electric Energy Districts (SEEDs), came from a perspective of seeing how our grid became one of the largest machines in the world. However, as innovative technologies start to be incorporated on that machine, we must start enabling the grid to perform in smaller pockets.

Instead of microgrids, how do we look at our system holistically, and start identifying areas of our territory or customers and how we serve them, provide novel solutions, and embrace the edge capability?

SEEDs are a concept of service we want to provide to our customers, so we're doing this work together, enabling their side

of the meter, as to how they use energy, and then allowing us to understand, prepare, and then advance that technology cohesively.

The other project, dynamic line rating, was from the understanding of the system from a transmission perspective. Everything we do as an industry comes down to, will the asset, aka, piece of equipment, handle the current flow and/or the voltage thresholds?

Knowing that our transmission system has a significant amount of technology or innovation that wants to connect to it, we were using static numbers in a dynamic world. Again, embracing a tool to unlock or uncap underutilized assets by understanding the true dynamic rating of our transmission conductors.

Last, are HEROS or the Smart Grid Chip. We're still debating the terminology, but it's high computational power at the edge of the grid, creating an open-source platform to start bringing in that data in real-time. Not new data to us, because we have advanced meter infrastructure that gives us the watts of our system, but it's in historical, latent data.

This tool, this capability, will allow us to embrace and engage real-time data, which then will enhance and optimize how we utilize our assets. That's the innovation. It comes from the mindset of unlocking the potential for current assets, using data, and then seeking those solutions with the industry together.

PUF: What was your role in the development of the energy transition innovation as part of the Duquesne Light Company Advanced Grid Solutions Team?



The John Beggs Top Innovator Award for Energy Transition, from left, Alex Rosenblatt, Daniel Rogers, Jessica Valentine, Elizabeth Cook, Sabrina Nguyen, Sam Levinson, and Richard Saporito.

With the Smart Electric Energy District projects, I make sure the models are properly constructed based on DLC knowledge. I also tangentially support these projects through real-time digital simulator studies. The goal of this testing is to enable newer projects by looking at signals and controlling devices such as relays for when we want to interconnect DERs onto our grid and see how they would impact our systems.

– Sabrina Nguyen

Jessica Valentine: I am an Advanced Grid Engineer. My role in our projects is as the project manager and technical point of contact.

For example, with our Smart Electric Energy Districts, we have a set of pilot projects that involve deploying battery energy storage systems as one of our first steppingstones to achieving the SEEDs vision. In these projects, I have been collaborating with our vendors and our internal stakeholders, trying to connect all the right parties, as we work to deploy a new and innovative technology on the grid. I play the role of coordinator and drive the project to keep it going as we encounter challenges along the way.

Sabrina Nguyen: I am a DER Engineer on our team. I help construct models for current active projects. With the Smart Electric Energy District projects, I make sure the models are properly constructed based on DLC knowledge and provide additional data to execute any additional studies for projects.

I also tangentially support these projects through real-time digital simulator studies. The goal of this testing is to enable newer

projects by looking at the signals and controlling of different devices such as relays for when we want to interconnect DERs onto our grid, and to see how they would impact our systems.

Samuel Levinson: My title on the team is Load Forecasting Engineer. I'm one of the more data-focused people, working on improving our forecasting capabilities, and many times, in thinking about data more as a constant time series rather than a worst-case scenario, or a winter scenario, or a summer scenario. Thinking about it holistically and using all the data we have at our fingertips in more exciting and advanced ways.

We've had a lot of data for a long time, but we've only used a small slice of it. The first step is using all the data I have, and then as we're building this new infrastructure to get more data at the edge, how do we start using that?

Richard Saporito: I'm an Advanced Grid Consulting Engineer on the team. I've been with DLC for fifteen years, thirteen of which were in Distribution Planning. My role in Advanced Grid Solutions uses that distribution planning experience to



We submitted three projects, but the vision behind all is to enable situational awareness to the edge of the grid. When we're thinking about how we're setting up and preparing for the new energy economy being enabled by distributed energy resources, we need to know real-time performance of assets, to ensure safe, reliable, affordable power.

– Elizabeth Cook

provide technical expertise in each of our projects. This comes in the form of system analysis, circuit performance evaluation, battery sizing, and scoping everything that we do.

Daniel Rodgers: I'm an Advanced Grid Engineer, and I started here three months ago. My primary focus is modeling our 4kV circuits in CYME. They can be used to do hosting capacity studies, so we can figure out how much distributed energy resources you can put on each point in the circuit. That'll be crucial going forward as solar and electric vehicles ramp up.

Alex Rosenblatt: I'm an Advanced Grid Senior Engineer. I've been with DLC for about seven years. I take a lot of the data we are using and I'm working on building the backend systems such as DMS and DERMS to connect from the mothership to the edge.

This is so they can communicate with each other, and eventually so we can pull the data back, and have two-way communication flows between Duquesne Light and the edge, which is something currently we have, but not to the real-time effect that we want and need to effectively perform the data analytics and system reliability levels we believe are plausible.

It's all the systems that are coming into play; they'll be coming in '25, '26, '27, '28, but we're starting to build them up now. It's going to take time as part of the ADMS project.

Elizabeth Cook: I am the Director of Advanced Grid Systems and the Grid Modernization Program. My role is to help facilitate the internal and external stakeholder engagement to drive innovation.

The concept of innovation is thinking of improving our product, which is delivering electricity and offering energy services and products to our customers. With everything happening at the grid edge, are there ways for us to think of it differently, so we can be a trusted energy partner, regarding the services, to teach, and educate, and drive this new type of technology?

We're ensuring enablement, standing up, or identifying opportunities to enhance processes across the organization, funnel ideas, and then engaging all the stakeholders that make it happen.

We're within the corporate strategy realm, where we're working continuously with operations and every facet of engineering, ensuring they're aware, identifying where the pain points

are, and creating tools to provide value to them. Same with IT and customers.

Trying to drive the vision of understanding grid modernization is holistically embracing the idea that IT, operations, and customers should be synergistically working together, and identifying how all those threads pull and tug at each other, so we are moving innovative new processes through the organization. That's my role.

PUF: What was most rewarding for you during this innovation

project, which led to winning the John Beggs Award for Energy Transition?

Sabrina Nguyen: For background, I'm currently a PhD student at Pitt. My perspective is a bit different, because being in school for so long, it's hard to see where the payoff comes, and why go through all this education? Why get your degree?

Being a participant in these projects, I push myself to learn new technologies and studies, like the Real Time Digital Simulator project where I can apply classroom knowledge in the field. With our Smart Electric Energy District project, seeing the real impact on people and meeting the communities where we're making these projects happen, is rewarding.

These are areas I drive through and interact with in my free time, so knowing how we are being change agents there feels impactful. It shows that work, the effort, the heartache, the headaches, all have a reason and a purpose. Even the small achievements are to be celebrated.

Samuel Levinson: It's rewarding because I know the energy system is rapidly changing and I want to help enable that transition to support our climate sustainability goals. As a utility, you're the last stop sign to implementing a lot of these technologies. Being a part of the group that is helping to push these things forward, and not being a block in the way to transforming our energy grid is rewarding.

Richard Saporito: The most rewarding aspect of my work is getting to collaborate with Elizabeth. She was my manager in Distribution Planning. When she transitioned to Advanced Grid Solutions and posted an open position, I jumped at the opportunity.

She has a unique style of leadership that encourages free thinking and adaptability, which is ideal for furthering DLC's vision of a clean energy future for all and implementing the technology to get us there. That vision is truly Elizabeth's, and I have been excited to adopt it, embrace it, and use my skills to drive it.

Daniel Rodgers: The most rewarding thing is simple; it's working as a team aiming for a common goal to better the world around us.

Alex Rosenblatt: It's great to see what this innovation is going to become and how this is going to benefit our customers, our community, and everything around us.

Jessica Valentine: What's most rewarding is being encouraged to think differently, to imagine the grid will be more sustainable and efficient in the future and believe that we will be part of that transition as a team.

Elizabeth Cook: The most rewarding part is to be a part of a collaborative, engaged team, to love what I do, and to share that with these individuals, but hopefully continue to educate, teach, and inspire those all around us, within DLC, as well as externally. I truly believe if we change utility, we can change the world. There's so much weighing on how we use energy.

We've had a lot of data for a long time, but we've only used a small slice of it. The first step is using all the data I have, and then as we're building this new infrastructure to get more data at the edge, how do we start using that?

– Samuel Levinson

I also love the opportunity that's been given to me by DLC to have the platform to educate, communicate, and drive the vision. It's not just our vision, it's everyone's vision that we have to understand the grid as it is today and teach that to everyone.

I didn't even know what the power system was with a four-year degree in electrical engineering. We all have a responsibility as to how we see and use energy, and how we transform individually. Also, show the industry there is hope, we can make change. That continuously brings me joy in the job I do and hope to extend it across this team and the organization. ○

The data show that the decreasing share of gas heating and increasing share of electric heating was due to population growth in the south, where electric heating is most common, rather than household switching from gas to electric heating. Look at Florida. The Sunshine State had about seven million occupied households in 2010. It had nearly nine million in 2022. That's nearly two million more households in Florida predominantly heating with electric service. Only 4.6 percent of Florida households, owned and rented, heated with gas in 2010 versus 92.3 percent heated by electric. This split wasn't much different in 2022. 5.4 percent were gas heated and 90.2 percent were electric heated.

Now look at New York. The Empire State had about seven million households in 2010 as did Florida. It had seven and three quarters million in 2022. The increase in number of households was about six hundred thousand as opposed to nearly two million in Florida. Only 9.4 percent of New York households, owned and rented, heated with electric in 2010 versus 55 percent heated by gas. 28.7 percent heated with fuel oil. This split wasn't much different in 2022. 15.3 percent were electric heated, and 58.4 percent were gas heated. Fuel oil heating's share fell to 16.5 percent. There was evidently switching from fuel oil heating to both electric heating and gas heating.

MABEL MACFERRAN TOP INNOVATOR AWARD FOR STORAGE

PNM Resources

Battery Energy Storage Systems at Solar Sites

Omni Warner and Jason Jones

PUF's Steve Mitnick: Describe the innovation that led to you and your team winning the Mabel MacFerran Top Innovator Award for Storage.

Omni Warner: Being award recipients of the Mabel MacFerran Top Innovator in Storage signifies achieving groundbreaking innovation in the realm of energy storage, for which we are truly honored.

We demonstrated ingenuity by successfully tackling a formidable challenge – the installation of distribution batteries alongside two of PNM's solar sites, with a remarkable total capacity of twelve megawatts, so six megawatts on each site, on two different distribution feeders.

This has been an extraordinary project that not only shows out-of-the-box thinking but also emphasizes the company's unwavering commitment to prioritizing customer needs, while creating a solution with far-reaching benefits for the energy sector.

PUF: Notably at the distribution level, which is distinctive. What was the thinking of where you put it, why it should be distribution, and what is it going to do?

Jason Jones: We have several of our distribution feeders that are a hundred percent connected solar on the distribution feeder. Today, we don't have any way of energy management on the distribution feeder, so the battery storage will enable us to do energy management on those distribution feeders.

Those feeders have been closed to additional solar interconnects, as they're configured today. We will be able to increase the amount of solar that we can interconnect onto the system once we have the battery storage and we're able to do energy management on the feeders.

PUF: Jason, you're the director of utilities operation technology. Omni is the director of distribution engineering. What role did each of you play in this?

Jason Jones: It gets more interesting. I've only been in this operational technology role for a few months. Prior to that, I was the director of generation engineering.

In my role, we managed the solar fields, we managed the



We demonstrated ingenuity by successfully tackling a formidable challenge – the installation of distribution batteries alongside two of PNM's solar sites, with a remarkable total capacity of 12 MW, so 6MW on each site, on two different distribution feeders.

– Omni Warner

utility scale, and any utility storage as well. We were presented with this issue with all the customer-connected solar and were running into lots of political issues.

So, Omni and I worked together, and with the collaboration, came up with the solution all the way down to the filing at the New Mexico Public Regulation Commission, where I file and testify to certain benefits, and he files and testifies to others.

PUF: Omni, what did you testify on certain benefits, and did you have good benefits? Then Jason, how did that go?

Omni Warner: My testimony covers a lot of the customer benefits, the distribution planning, and the distribution capabilities. That's probably the simplest way to summarize my testimony.

Jason Jones: Yes, mine were more of the system benefits and how batteries at the distribution level provide total system benefits.

PUF: You said a little about where it should go, but what does it look like? Was it expensive? How was it installed and how does it work?

Jason Jones: It's controlled by distribution. There're a few other aspects to the project, and some of it's new to even PNM. Some of the questions you're asking, we're still figuring out who does what, how, and when.

Anybody who's familiar with storage understands that you always install it with one use case in mind, and then you end up using it for a different use case. We're still learning.

PUF: You're going to see how it cycles and how it wears over time. Omni, did you want to add anything to that?

Omni Warner: In complete transparency, this is a project we have in flight right now. It's not fully in service and operational today.

Jason's been successful with finding partners to help us uncover future use cases of this project. We are starting a study with Veritone, New Mexico State University, and PNM to study ancillary services of distribution connected batteries.

We think we're going to be able to unlock what our future is going to look like. This project is the first step of many more distribution connected battery installations.

PUF: What was most rewarding about working on this project?

Jason Jones: The most rewarding part was breaking down some of the barriers between the different planning teams, because as we've gone through the project, we've run into internal barriers that you didn't even know were there. Dispelling the traditional beliefs of, "that's not how we do distribution, or that's not generation."

PUF: Storage is a perfect example because it's breaking the traditional mold.

Omni Warner: Jason and I were able to break the traditional utility mold through this process. Don't think that this was Jason and me alone. There's a whole team behind this project.



We have several of our distribution feeders that are a hundred percent connected solar on the distribution feeder. Today, we don't have any way of energy management on the distribution feeder, so the battery storage will enable us to do energy management on those distribution feeders.

— Jason Jones

It's the collaboration of the group pulling the project together, then it's delivering solutions to stakeholders, to customers, to people who were constantly asking, "where're the solutions?"

I think we were finally able to bring a solution forward that brought all the stakeholders to the table. With our regulatory filing, there hasn't been any opposition to our distribution battery project. That's a testament to how it's bringing New Mexico stakeholders together and the utility bringing solutions to customers. ○

To find out more about the Fortnightly Top Innovators Conference, go to pufinnovators.com

FLORENCE FOGLER TOP INNOVATOR AWARD FOR TRANSMISSION TECH

PECO

Underground Automatic Transfer Switch

Luke Benedict, Dustin Nace, and Dave Reino

PUF's Lori Burkhart: Describe the innovation that led to your team winning the Florence Fogler Top Innovator Award for Transmission Tech, how it works, and what the benefits are to PECO.

Dave Reino: The device is essentially an underground automated sectionalizing switch that we use on our system for PECO. As it stands right now at PECO, we don't have much underground automation or automatic sectionalizing on the primary portion of our distribution circuits. It's all manual switches.

The innovation idea was centered around trying to bring something on system that PECO could have line of sight between the field and our Operations Control Center, something that could restore customers more quickly, and is obviously safe for our crews to be able to use.

That was the concept for what brought about this equipment.

The device is a fifteen-kilovolt rated, three-way switch with vacuum break interrupters, so it uses air to extinguish an electrical arc. In addition, it has control equipment with it; relays that we can perform testing on, and do the settings ourselves, so it can operate in a way that can work on our system. The specific switches that we put on our system are automatic transfer switches.

The idea is that if you lose the feed to the customer from one way of the switch, it will sense that and automatically transfer to the alternate feed. This allows a customer to be restored automatically, experiencing a minimal outage.

That is opposed to maybe a longer outage when a crew would have to be dispatched to restore those customers. Instead, they would see a one-to-two-minute outage and have their power restored.

A lot of utility equipment is above ground and pad mounted. Operating in an underground environment is different. The equipment must be rated differently, must be able to function in fully submerged environments, and be reliable to do that, so this equipment was built with that idea in mind.

We are still piloting it, there are issues we are looking to improve before we can say it's a full go, but this is the first iteration of our being able to get one installed on system, have it communicate back to the OCC, and become actively a part of our system. We're going to see how it goes from there.

High level, that's essentially what the equipment is and the pilot we're working through. We have two on system, we have

Operating in an underground environment is different. The equipment must be rated differently, must be able to function in fully submerged environments, and be reliable to do that, so this equipment was built with that idea in mind.

— *Dave Reino*

a third one installed, but it needs to be placed in service, and that'll probably be done next month.

That was the goal of the pilot, to install those three, and see how they do in the field for a couple years. As they get subjected to that environment, we will see if they perform as we believe they will. That's what we're working through now.

PUF: How did the idea of utilizing an underground automated switch come about?

Dave Reino: This switch was birthed from a project where we wanted to develop a communicating underground automated switch for one of our PECO service buildings. Once the idea of the device was conceived, Dustin took the next steps into how we could utilize this in more of a system-wide application for a pilot.

PUF: Dustin, talk about your role in the innovation's development.

Dustin Nace: The history of this innovation predates this pilot project. This isn't the first time that an auto transfer has been attempted on the PECO system.

I'm an underground standards engineer and responsible for underground switches. I had been considering a replacement for our underground switch for a while, but I wasn't ready to bring a new switch on system. When the project wanted to install an older switch design, I told them, if you're in a pilot phase, let's investigate a replacement switch design.

In my role, I developed the specifications, construction standards, and procedures. I work closely with the vendor and PECO personnel for drawing approvals and resolution of any equipment or operational issues.

It has been a team effort to work with the entire organization to



The Florence Fogler Top Innovator Award for Transmission Tech, from left, Luke Benedict, Dustin Nace, and Dave Reino.

We've gotten further than ever before. It's on SCADA, we have communication, we've seen an operation where it's proven the technology, as far as being able to transfer and pick up load in a short period of time. That was always the intent of the system.

– Dustin Nace

implement this change. There have been many face-to-face meetings to talk about the equipment with the field and operations teams. We have also made sure we are on site for the installations.

PUF: Dave, talk about your role in the development of this innovation.

Dave Reino: Dustin is with underground standards, and I'm with the grid automation team. My responsibility was developing the plan for the pilot, as well as making sure we could set up and execute the rollout of the new switch. In addition, I am responsible for programming and testing of the equipment, and then working with the crews to in-service the device to make sure it functions properly in the field.

From an automation engineering perspective, each switch has a relay associated that programs automatic capability to it. So, I would review the settings that were provided to us by the manufacturer, update some of the programming so that it applied more to our system, and then test it.

We set up one of these switches at one of our service buildings for training purposes, from a standards perspective for the crews, and from a settings testing perspective.

We would test the settings, and once they were documented

and approved, we would go out in the field, install the switch, in-service it and make sure it's communicating with our OCC, so we felt confident that it was going to have line of sight and be able to operate in the field.

PUF: Dustin, what's been most rewarding working on this innovation?

Dustin Nace: The most rewarding part is we've gotten further than ever before. It's on SCADA, we have communication, we've seen an operation where it's proven the technology, as far as being able to transfer and pick up load in a short period of time. That was always the intent of the system.

We had good radio communication, even in an underground environment. A lot of learnings, but so far, the response has been decent with the trouble crews and underground crews.

PUF: Dave, what's been most rewarding during your work on this innovation?

Dave Reino: It was the collaboration of the different stakeholders who were involved and getting their perspectives. Dustin mentioned this is a project that predates this iteration of the switch. It has existed for a while, and this is the farthest we've gotten.

(Cont. on page 71)

Innovation Across Power Cooperative Community

Roundtable with Holy Cross Energy's Bryan Hannegan;
SECO Energy's Gregg Morrell;
Rio Grande Electric Cooperative's Abraham Vasquez;
Block Island Utility District's Jeffery Wright;
NRECA's Angela Strickland



ur nation’s electric cooperatives have a lot happening on the innovation front. The National Rural Electric Cooperative Association supports its nine-hundred-plus member cooperatives with innovation as they serve growing suburbs and local communities in navigating the changing electric industry.

NRECA has a Business and Technology Strategies Department to engage with cooperatives and provide insights, as well as recommendations, on trends affecting operations, tech planning, research, and anything having to do with innovation. That expertise is much needed as all signs point to innovation as required moving forward to ensure the success of all involved in the energy and utilities industry.

To discuss the latest on cooperatives and innovation, Public Utilities Fortnightly brought together here NRECA’s Senior Vice President of Business and Technology Strategies Angela Strickland, along with four senior cooperative executives, Block Island Utility President Jeffery Wright, Holy Cross Energy CEO Bryan Hannegan, Rio Grande Electric Cooperative Program Manager Abraham Vasquez, and SECO Energy Chief Corporate Service Officer Gregg Morrell.

PUF’s Lori Burkhardt: Why is utility innovation important for Block Island Utility District and all cooperative members?

Jeffery Wright: Block Island is a small co-op. We’ve only got sixteen hundred members, and a couple of thousand meters. What’s unique about Block Island is we were an investor-owned utility until 2019, and the owners wanted to sell.

The town provided bridge financing for the utility district to get up and running. When we took the company over, innovation wasn’t even a thing. All they had done was install smart meters, which are a form of innovation, but all the other tools weren’t there to use those smart meters and provide that member-facing experience that our members today thrive on.

The days of just keeping the lights on and being a utility, that’s not what our members expect anymore. Our members, when they go to the airport, can load their boarding passes on their iPhone and check schedules almost in real time.

So, the live outage maps, the live messages through OMS that we now use, have turned heads on Block Island. But that’s what the co-op members want, is for us to be current with the times and technology and providing tools other than just keeping the lights on.

PUF: Bryan, why is utility innovation important for Holy Cross Energy and all cooperative members?

Bryan Hannegan: All utilities, not just electric cooperatives, are focused on safely providing reliable and affordable electricity and services. Increasingly, we’re being asked to do that in a more sustainable way.

These four pillars of safety, affordability, reliability, sustainability, are things that society, our members, their communities, are increasingly asking us to become better at. At the same time, we’ve got all this innovation happening in the broader economy with new technologies of various shapes and sizes.

We have electric vehicles and battery storage now, as well as smart buildings in the future. We have a lot of things happening to us, as well as with us. So, we almost by definition have to stay

At NRECA, delivering innovative solutions for our members and working with them to navigate the changes in our industry is one of our top priorities. Our team includes subject matter experts across the country to provide tools and resources to our co-ops.

– Angela Strickland

innovating to keep pace with the world around us and ideally get better at those four pillars.

There are always ways to learn new technologies, to employ new practices to share. To me, innovation is the lifeblood, it’s the DNA, and it’s got to be an essential trait of any utility, not just electric cooperatives. Because we are challenged in so many ways by our nature and small size, innovation is our ace in the hole and can create our advantage to stay competitive and relevant in a changing world.

PUF: Gregg, why is utility innovation important for SECO Energy and all cooperative members?

Gregg Morrell: We say we’re one SECO and we have a mission statement, which states that as a not-for-profit cooperative, SECO Energy safely provides reliable and innovative energy services to our members and communities.

In today’s fast-paced world, technology is ever-changing, and our membership expects the electric utility sector to be up to speed and updated on those changes. That’s a big shift for our industry. There was a time, not so long ago, when the only thing that was expected of SECO and other utilities was to provide affordable and reliable electricity.

But today, the members expect us to be innovative. They



The Executive Leadership team at SECO Energy, from left, VP, Corporate General Counsel Tracy de Lemos, VP of Growth, Smart Grid and Operational Technology Ben Dawson, Executive Administrator for CEO and Board Geri Helms, Chief Corporate Services Officer Gregg Morrell, CEO Curtis Wynn, COO John LaSelva, and VP, Financial and Administrative Services Anh Reynolds.

The only way to keep up is to have a culture shift. SECO, in the past several months, created a separate department that will be focused exclusively on growth, smart grid, and technology. It will have its own executive leading a department to help with that culture shift.

– Gregg Morrell

need us to be involved in how they control their costs. Smart metering, smart thermostats, smart water heaters, EVs, all those are expected now by the membership, and they no longer consider those items as add-ons.

It is a challenge obviously, to keep up with that and be progressive. Innovation is essential to our existence today and even more essential to the future.

There is a growing interest from our membership regarding the environmental impact and footprint that we have as a utility. We're seeing a much more concentrated effort in that regard and an interest from our employees and memberships. That's something that innovation helps address, as well.

PUF: Abraham, why is innovation important for Rio Grande Electric Cooperative and all cooperative members?

Abraham Vasquez: When I came to the cooperative, I heard stories of some seventy-five years ago when Rio Grande Electric brought electricity to locations that did not have it. I cannot imagine that. Growing up with electricity was a normal, everyday thing.

Even back then, the cooperative had the innovation to reach out and get electricity to the members. When that happened, I heard stories of the members being ecstatic to have electricity in their homes.

Those days of members being ecstatic just to have electricity have long passed. Now, it's an expectation that we not only maintain reliable electricity, but also create new innovative offerings.

What can we do to increase the overall quality of life for the members, enhance reliability, and keep the cost down? It is using innovation to maintain that for the members and take the next

steps with new technologies, to maintain that reliability. That's important.

PUF: What innovations has Block Island Utility District been developing that may be most impactful for your members?

Jeffery Wright: We're known for being the host of the nation's first offshore wind project. That's not about us as much as it is Rhode Island and the community. On Block Island, with the help of the cooperative network, we started with nothing and today we utilize every tool that NISC provides.

We've got outage management, their customer information system, MDM, and the systems all mapped. We've got technology in terms of helping our employees provide the best service they can. The member-facing tools like SmartHub, these folks here probably all have it, but that was a big change for our membership and employees.

We're fortunate that we've got significant philanthropy efforts on the island. One of the items that was donated to us is an electric bucket truck. A number eight right off the assembly line was given to us. My line crews are driving around the island in a Terex fifty-five-foot Boom that's powered by a battery.

When we took the company over, our newest bucket truck was twenty years old. That's changed the employees' outlook on what they do and given us a new brand with our members.

The tools that the cooperative network provides are what makes me successful. I could not do that without the cooperative network, and I always say we're a little co-op that uses big co-op tools.

The other cool and innovative thing that we've got is an electric school bus that was donated to the school, but the philanthropist sat down with me and wanted to make sure it had benefit to the co-op. It's got a bidirectional charger, and I'm going to be honest we're having some startup issues with it.

The bus works well, it charges well, but we're having issues with the discharge during the peak times. But that's another example of some of the cool stuff we're doing. We're lucky to have those tools donated. My team and the members on the island embrace it. It's been a wild ride for a few years.

PUF: Bryan, at Holy Cross Energy, are there innovations your utility's been developing that may be most impactful for your members?



In addition to regular tree trimming rotations, we're moving toward a risk-based approach informed by satellite flights over our service territory that can tell the health of the tree, location of the tree, proximity to electric lines, and relative risk the tree poses to our system.

– Bryan Hannegan

Bryan Hannegan: We have innovations across the enterprise and it's like asking me to identify my favorite kid out of my family, but I'll pick two. The first is that we have been investing in developing programs and partnerships with a wide variety of vendors for distributed energy resources, namely battery storage and electric vehicle charging in the home.

We've developed a platform for managing and controlling the rate at which those batteries charge and discharge to the grid. This is different than bidirectional charging, where the vehicle



On the Fort Bliss Army Base, they are looking for increased reliability and we are exploring different ways to help with innovative ideas.

We need to always keep the power on, so at one of the mission ranges we're looking into utilizing capital credits to fund a fully turnkey microgrid system.

— Abraham Vasquez

can exchange power with the electric grid in both directions, which we're eager to see happen.

With today's vehicles we can modulate the rate at which a plugged-in vehicle can charge from twelve amps to forty amps and then back down again. We've shown an ability to make demand response happen on a large scale on our system using multiple connected devices.

That's super important because by this time next year, we will have a system powered by more than ninety percent carbon-free

energy, most of which will be variable wind and solar resources. Instead of matching the available supply to whatever folks are demanding, as we've traditionally done in the utility space, we now must deal with the variability of the supply and try to match our demand to what's available from our renewable resources.

It flips the utility operating paradigm on its head and has required us to develop a whole lot of innovation to make sure that we could influence our members' usage at different times and at different places with all these new technologies. We had to figure out how to communicate to them, how to get the response verified, how to execute the payments for the services, how to integrate all that with the user's needs because obviously they want the cars to drive and want the batteries for their own resilience.

The second is out in the West, we're concerned about wildfire, and one of our leaders in this space is our tree trimming foreman. Inside of him is this innovation leader and he's getting called on to give talks all around the country about our wildfire mitigation plans and particularly how we approach vegetation management.

In a nutshell, in addition to regular tree trimming rotations, we're moving toward a risk-based approach informed by satellite flights over our service territory that can tell us the health of the tree, the location of the tree, the proximity to our electric lines, and the relative risk the tree poses to our system.

We're able to fly drones along our three thousand one hundred miles of rights of way as a second set of data to validate the satellite data. When we do that, we also use a multi-spectral approach, which gives us information on the chlorophyll content in the leaf on the tree, giving us insight into the health of the vegetation.

In addition, we have a platform for incorporating this data, along with landowner reports

and photographs, into our GIS system, so we can track the vegetation growth and health over time to know where's the biggest risk, where do we need to put our scarce resources, because as you've seen, one wildfire can take down an organization.

This is a high priority for us. Thankfully innovation is not just for vegetation management, but also for system operations, so when we have a fault, we're able to act quickly to de-energize the affected line and reduce the risk of a start of a wildfire.

PUF: Gregg, talk about the innovations SECO Energy has

been developing that may be most impactful for your members.

Gregg Morrell: Innovation is integrated in every part of our business. I'll start internally from the call center and front counters, what we have with our interactive voice response, IVR, system.

We have an AI-generated IVR that grows in its intelligence as it deals with members and provides multiple service options that eliminates issues and enhances the member's experience.

We're finding more and more people want to conduct business after traditional business hours. This innovation allows for that and improves the member's experience with the cooperative.

We have SmartHub applications. We are just now getting back into the AMI sector. We did it several years ago, right before I came on board but elected to go another route; but we're going full in on an AMI process now.

Our storm center, we're in Florida, and hurricanes and storms are pervasive in our daily conversations. Summer storms can be just as bad as some of the winds we get from hurricanes, so our storm center application is where members can see where there are outages and where our crews are in the restoration process.

Our ability to provide multiple ways to pay bills for members is important. Because everybody's financial position is a little different, we have different applications for how to make payments.

EV chargers are something we provide to the membership either by purchase or leasing. We have onsite EV charging stations for our employees. Those are just a few of the innovations integrated in the way we go to work every day.

PUF: Abraham, what innovations has Rio Grande Electric Cooperative been developing that are most impactful for your members?

Abraham Vasquez: At Rio Grande Electric Cooperative, we have what I would consider three systems. One is the native system, which is for our rural members. We also have two utility privatized contracts, one on Fort Bliss Army Base and one on Laughlin Air Force Base.

We treat all three the same, but the innovations in each area are different. In the native system, we've installed solar arrays to reduce the cost for members and to have a cleaner, more sustainable resource there. We also have AMI metering, so we are able to track outages for the members and improve our system.

On the Fort Bliss Army Base, they are looking for increased reliability and as our member, we are exploring different ways to



We're known for being host of the nation's first offshore wind project. That's not about us as much as it is Rhode Island and the community.

– Jeffery Wright

help the base with innovative ideas, and outside-the-box thinking.

The mission of Fort Bliss is to maintain ready-to-deploy soldiers. That means we need to always keep the power on, so at one of the mission ranges we're looking into utilizing capital credits to fund a fully turnkey microgrid system.

That way if there are any outages from the transmission side or issues on the line, they can maintain their mission, and keep on with their training. An outage will not interfere with the mission.

That is what we are looking at in Laughlin Air Force Base as well, utilizing the existing system. What are their needs, what are their demands, and seeing how we can improve reliability on the military installations.

PUF: Jeffery, at Block Island Utility District, how have you developed a culture of innovation?

Jeffery Wright: First, you must have a vision. You have to have exposure to what's out there, and that starts with leaders and your organization. First, keep your eyes open, put your money where your mouth is, and invest in innovation.

I remember the first time I handed my line crew iPads, they were like, "What do you mean buying us iPads?" I said, "You'll see." Today they carry them in trucks and at home, and they have live outage information at their fingertips.

We are so lucky we've got the tools at our fingertips today that we do, and it's up to us as co-op leaders to utilize that innovation to better serve our members, but also embrace that innovation for the betterment of the cause on national and worldwide levels. We are only scratching the surface.

It's one big circular partnership that the utilities have with society that's going to keep the lights on once we electrify everything in the world. That's our biggest challenge right now. But we have the technology available.

PUF: Bryan, at Holy Cross Energy, how have you developed a culture of innovation?

Bryan Hannegan: The tone from the top is super important. You have to create a performance environment for your employees where they understand that innovation is not going to be penalized when it doesn't work, but it is going to be rewarded when it does.

At Holy Cross, we've developed our performance measurements around outcomes rather than process. Too many organizations celebrate the way it always has been because it works. As a leader and by extension, your teams, have to question, "Well, can we do better? Can we make it more reliable and resilient? Can we make it less costly?"

When you empower your employees to be creative, celebrate the successes, learn from the failures, share that with everybody, and create this environment where taking smart risks is encouraged, then it becomes amazing. I came to Holy Cross from a DOE National Laboratory, and so at the start of my Holy Cross tenure, I was the innovator-in-chief.

My first year I was constantly asking, "Can we do this? Can we do that?" Now, I'm literally saying to the staff, "Okay, y'all are too much." That's when you've got it ingrained in your culture.

The culture of innovation is the hardest thing to get right. The technologies are there, the policies, the programs, you can take off the shelf. If you don't have the culture in place, you're not going to get as much innovation as you would've hoped. My advice to all CEOs is make innovation okay, and you'll be surprised at the goodness that will come.

PUF: Gregg, at SECO Energy, how have you developed a culture of innovation?

Gregg Morrell: It comes from the simple recognition for the need of a culture shift. There's a culture shift around technology from the membership base and employees. The model has clearly

changed. The only way to keep up is to have a culture shift, to first recognize how the utility must change to meet the current needs of membership.

With that in mind, SECO, in the past several months, created a separate department that will be focused exclusively on growth, smart grid, and technology. It will have its own executive leading a department to help with that culture shift.

By providing our employees and members with innovative products, systems, and processes, we help build a strategy that promotes innovation. That's the paradigm shift that's occurred in the SECO Energy sector.

We're one of the fastest growing areas in the United States now, folks are coming in from every quadrant of the country, they're bringing with them best practices, and when we don't have it, they say, "It'd be nice if SECO offered this service." So, members are pushing that culture shift, as well.

PUF: Abraham, at Rio Grande Electric Cooperative, how have you developed a culture of innovation?

Abraham Vasquez: It does start at the top with the leadership and our CEO's very open-minded, wanting to move forward with innovation, and that mentality. Trusting the personnel, the engineers, as well as technology services and operations.

Of course, with innovation, there're always going to be concerns. Cybersecurity, especially with automation and communications. It is creating innovative ideas to overcome those concerns.

It is also instilling a mindset of, "How can we get better?" And how innovation will help us to complete the mission.

RGEC strives to ensure that the employees are continuously developing, by providing them with proper education and training. It is asking the right questions, "How do we improve to get where we want to be?"

Again, it begins with leadership, but everyone within the co-op has to take that step forward, working together, and making sure no one is left behind.

That's how we're creating innovators at the cooperative.

PUF: Angela, how does the national organization, the National Rural Electric Cooperative Association, NRECA, support members with innovation?

Angela Strickland: At NRECA, delivering innovative solutions for our members and working with them to navigate the changes in our industry is one of our top priorities. Our team includes subject matter experts across the country to provide tools and resources to our co-ops on topics including infrastructure, resilience, cybersecurity, generation, T&D, as well as emerging technology, workforce issues, and safety.

One of the most important opportunities our members have right now is federal funding to fuel innovation through the Infrastructure Investment and Jobs Act (IIJA). While this is a fantastic opportunity for our members, most of them don't have a great deal of federal funding experience. To help ensure

our members can effectively leverage these funding opportunities, we developed resources to support our cooperatives that are pursuing infrastructure investments and innovations.

One of these resources is an online tool that helps co-ops stay informed, evaluate opportunities, and prepare for these funding opportunities as soon as the application window opens.

We've also created guidebooks and other tools and resources, sort of a federal funding 101 to help co-ops understand the requirements, timelines, and other information necessary to pursue this funding.

One of our principles is cooperation among cooperatives. To help facilitate that, we've created five different consortia on various topics to help members that are interested in those areas to ideate, share information and best practices through webinars, workshops, fact sheets, and other channels.

Through NRECA research, we are pursuing some of this federal funding in conjunction with and in consortia with some of our members. We have members that are pursuing this funding on their own or in partnership with others. We've created a grant writer's portal to help support that effort.

PUF: A grant writers' portal is helpful, as there's so much federal funding for innovation available, and many don't know how to apply for funding.

Angela Strickland: That's what we have found. Also, some of our co-ops are small. They don't have the time and additional staff to write these applications and concept papers. We're happy to help provide that resource.

On the innovation front also, we partnered with Federated Rural Electric Insurance Exchange to create a virtual reality safety training platform that can be used for the line personnel to help to engage the younger workers coming in who are used to interacting and learning in that way. We'll be rolling that out in the next couple of months.

As Abraham mentioned, when NRECA was first formed, our member cooperatives were bringing electricity to underserved rural areas of the country. Today, that history is repeating itself as many of our members are expanding into broadband to help bridge the digital divide and bring high-speed broadband service to their members.



One of the most important opportunities our members have now is federal funding to fuel innovation through the Infrastructure Investment and Jobs Act. To help ensure members can leverage funding opportunities, we developed resources to support our cooperatives that are pursuing infrastructure investments and innovations.

– Angela Strickland

To support this, NRECA is standing up resources to help advocate, educate, and provide a forum for co-ops that are getting into the broadband business to learn from and support each other. As our industry continues to evolve, NRECA's mission is to promote, support, and protect the community and business interests of electric cooperatives, and help them to power communities and empower members to improve the quality of their lives. Embracing innovation is critical for us to effectively fulfill this mission. **PUF**

Reindustrialization Matters

Conversation with EPRI SVP for Energy Delivery and Customer Solutions,
Rob Chapman, on a new EPRI report,
“The Impact of Industrial Onshoring on Electric Sector Demand Growth.”



top of electrification, the energy sector is seeing early signs of growing industrial electricity demand – which had been flat-to-declining over the past thirty years – in addition to the electrification of transportation and buildings. Driving this growth are incentives for domestic production from the Bipartisan Infrastructure Law, the Inflation Reduction Act, and the CHIPS and Science Act.

As more manufacturers onshore and expand operations, how will the growth of electricity consumption affect the energy sector? In the new report, EPRI looked at how U.S. reindustrialization could impact energy demand, factoring in additional drivers such as electrification, digitalization, and decarbonization.

Public Utilities Fortnightly wanted to know more about this impactful EPRI report, and went to an expert, EPRI’s Rob Chapman, for a discussion on where this is all going. Listen in.

PUF’s Steve Mitnick: Talk about the top line takeaways from this report about onshoring.

Rob Chapman: To level set, when we look at the industrial portion of electric consumption, it’s about twenty-five percent of total electric load. But what’s interesting about that is it’s been relatively flat for the past thirty years.

As such, from an electric company perspective, there hasn’t been a need to plan for significant growth in manufacturing in the past thirty years. That is because there has been an offshoring of manufacturing.

Now we’re seeing different trends emerging because of supply chain challenges during COVID that reinforced our need to control our destiny going forward. Plus, geopolitical tensions globally have supported this trend.

From a national security perspective, the U.S. government looked at this and decided it should prepare to manage this trend to onshore U.S. manufacturing. That’s when they incentivized significant amount of investment via the CHIPS Act, BIL, and IRA to drive development of manufacturing within the U.S.

So how is that impacting this current trend? What we’re seeing is annualized spending on manufacturing has more than doubled over the past several years.

We’re beginning to see the impact of those investments. There are about a hundred and fifty manufacturing facilities being expanded, under construction, or expected to be completed by 2025. That’s a significant transition from flat to no growth over the past thirty years.

A positive impact is about four hundred thousand new jobs have been created in 2023 alone. These trends open opportunities for the utility industry to plan proactively.

PUF: The report breaks this down by region and industry.

Rob Chapman: There are a couple of items to highlight. One is to look at the manufacturing capabilities, what segments or sectors are within, and two is the regional nuances.

It’s important to highlight that it is diverse by region and note what is going on in the respective regions and understand the point load. As an example, electric vehicle battery manufacturing and charging equipment are having a significant impact in the southeast portion of the U.S., representing about fifty

Companies that are reshoring don’t want to be told they must wait two, three, four years to receive the power needed to support manufacturing development.

percent of overall manufacturing activity.

Semiconductors are significantly impacting Arizona now, plus proposed investment in Ohio and upstate New York. What’s important about semiconductors and a small portion of the overall volume is that loads are significant for these plants.

A couple of other areas to highlight. There are terminals going in the mid-Atlantic

region, which is especially important in terms of exporting natural gas. There’s also the metals industry growing in the Ohio Valley region. Those are the four top manufacturing segments at this point.

PUF: What about the nature of the electric demand? Will it be peaking or smooth?

Rob Chapman: The larger portion of the load is going to be 24/7. Yet, collectively amongst these facilities, there will be a range. Some are going to operate Monday through Friday and shut down on weekends. They’ll have different peaks and vary, but the larger portion of this load will operate 24/7.

The reality in planning for these facilities is it will take infrastructure investment on the grid to support their power requirements. Within the energy industry when infrastructure investment is required, especially to the degree proposed here, it can take years to plan and construct.

The need is for utilities to begin to understand what this impact might be in the respective areas and then to be proactive rather than reactive. Companies that are reshoring don’t want to be told they must wait two, three, four years to receive the power needed to support manufacturing development.

Also important from a utility perspective is to recognize that several issues are going to come into play that haven’t received a lot of attention. One is power quality, and its emergence in the importance of manufacturing.



Power quality is key and there is a resurgence of requests around power quality to ensure that manufacturing facilities are being supported by the utility. The second important area is reliability and resiliency. These plants are expected to operate 24/7. Utilities are expected to provide 24/7 power, even during extreme events.

A momentary outage can impact product and productivity significantly, especially in a semiconductor facility. Power quality is key and there is a resurgence of requests around power quality to ensure that manufacturing facilities are being supported by the utility.

The second important area is reliability and resiliency. These plants are expected to operate 24/7. Utilities are expected to provide 24/7 power, even during extreme events.

The day-to-day reliability and resiliency to manage extreme events are going to be extremely important for the utilities as they

serve these point loads within regions being developed.

PUF: Because of the regulatory system and siting requirements, it may take a while to get a project going. What else should the industry keep in mind around innovation?

Rob Chapman: Forward-looking planning and load forecasting are critical. Keep in mind that there are other factors driving increased load. Decarbonization of the economy is one of them.

That includes, especially near term, some of the larger fleet electrification efforts, including companies like Amazon and UPS as they've pushed to electrify their fleets. And beyond that, heavy duty transportation electrification and the amount of power required to support those charging centers.

Electrification of space- and water-heating is also driving increased load. In fact, in 2022 heat-pump sales exceeded gas powered furnaces.

We also know that hydrogen production is going to be a big topic if the energy sector is going to achieve net-zero. Soon, we expect hydrogen production to have a significant impact, in terms of utilities, on load development.

Beyond onshoring, other drivers are contributing to utilities needing to make sure they're being proactive. They're looking at where these point loads are coming in and are preparing for it because of the timeframe it takes for construction.

There are a variety of issues, from a research perspective, that EPRI is working on with key energy stakeholders, providing the electric industry with the necessary research. A key part is to be prepared proactively in working with utility end-use customers to make sure they understand where these plants or fleet electrification points might be hydrogen facilities and prepare in advance to ensure infrastructure is there.

PUF: Whether at different kinds of utilities, big, small, IOU, public power, co-op, and in different parts of the country, or with regulators, other parties that work in the industry, what should they do?

Rob Chapman: From the utility perspective, at the top of the list are load forecasting and integrated system planning focus. When I talk about load forecasting, I mean looking at these plants and what's required in terms of infrastructure, both grid and supply, to support them and the options to deliver this power to meet their timeline. This includes not only reshoring of industrial but also significant data center expansion going on, and the potential for significant loads there.

Load forecasting is looking at what are the projected increases in load, and the profile of that load. We expect with just decarbonization of the economy, for many electric companies to shift from summer peaking to winter peaking based upon adoption of heat pumps and other electrification technologies.

System operators need to be aware of these significant loads, understanding where they're going to be, assessing their impact on the system, and planning for infrastructure upgrades as needed.

How to make sure the electric companies are updating and refining current load forecasting methods? That is a project EPRI is currently working on which includes higher resolution models to understand operational impacts of these point loads, and of course resiliency and reliability in power quality. Higher resolution models help understand the system impacts and proactively manage for that.

Then it gets broader with integrated system planning, as utilities are thinking forward. It's about being proactive, moving forward into integrated system planning. A key part of that is leveraging potentially some of these resources to support the grid or resource adequacy.

That's where the virtual power plant comes into play. It's looking at integrated system planning, understanding the various potential distributed energy resources out there and leveraging those to support overall grid and energy system reliability and resiliency.

Those are the four areas to highlight for energy companies preparing for this onshoring: load forecasting, higher resolution models around system operations, integrated system planning, and system operations.

PUF: EPRI's homework assignment is big.

Rob Chapman: Much of this work has been underway for many years. The key part of this challenge is that the energy industry is progressing so rapidly that many times it's not new

Those are the four areas to highlight for energy companies preparing for this onshoring: load forecasting, higher resolution models around system operations, integrated system planning, and system operations.

research we're initiating, but the request is, "Should we accelerate this research?"

"Should we establish a timeframe and say in this three-to-five-year period, we want to achieve these outcomes, and by extension we're going to invest more to accelerate the solutions in these particular areas?" It's a matter of accelerating solutions, leveraging what we have today versus starting

from scratch, which is the beauty of the EPRI collaborative model.

There are organizations beyond EPRI working on these areas who we would like to leverage and collaborate with. EPRI's strength is not only technical expertise in these areas but also playing the role as a convener and bringing all these parties together to make sure we have the best and the brightest at the table.

We've done that for many of our industry-wide initiatives, and we look forward to collaborating on this challenge as well. **PUF**

The recent Consumer Price Index report brought good news for residential electric utility customers. Residential electric rates in August, year-over-year, were up by only 2.1 percent. While the overall CPI was up 3.7 percent in the same timeframe. Meaning that electric rate increases on average were less than the rate of inflation.

This was hardly the case in the prior twelve-month period. From August 2021 to August 2022, electric rate increases averaged 15.8 percent. While the overall CPI was up 8.3 percent. It turns out that the 2021-22 was anomalous. During the twelve-month period prior to that one, August 2020 to August 2021, electricity rate increases averaged 5.2 percent. While the overall CPI was up 5.3 percent. So, in that period, electric rate increases, and inflation was almost identical.

During the three twelve-month periods prior to that one, August 2017 to August 2018, August 2018 to August 2019, and August 2019 to August 2020, electric rates fell each year, by 0.5 percent, 0.1 percent, and by another 0.1 percent. While inflation in those three years was 2.7 percent, 1.7 percent, and 1.3 percent.

As a result, over the last six years, from August 2017 to August 2023, electric rates increased 23.6 percent. But inflation was 25.1 percent. Electric rate increases were less than the rate of inflation. Notwithstanding that large increase in electric rates in 2021-22.

Energy is Digital

Conversation with GE Digital General Manager
Mahesh Sudhakaran



The mission at GE Vernova is to electrify the world while simultaneously working to help decarbonize it. Greenbird Integration Technology AS is an international solution and technology company with roots in Norway, and its flagship innovation, Utilihive, is used by more than two hundred utilities across Europe, the Middle East, and U.S.

GE Vernova in February launched GridOS the world's first grid orchestration software, and recently acquired Greenbird, which specializes in data platforms for utilities. That will allow GE Vernova to aggregate information from multiple systems, allowing grid operators to use GridOS to assemble a real-time snapshot of grid conditions.

The acquisition brings a lot together, so Public Utilities Fortnightly went to an expert to explain how it happened and what it means. Listen in as GE Vernova General Manager of Grid Software Mahesh Sudhakaran discusses positive implications for tomorrow's power grid.

PUF's Steve Mitnick: Mahesh, talk about GE Vernova's recent acquisition of Greenbird Integration Technology AS.

Mahesh Sudhakaran: Today, you can't have a conversation with an electric utility that doesn't involve data. But data is something that's highly misunderstood.

Our industry historically operated in silos. There was a time when everything was centralized – including data – and it worked. Now, with the energy transition and accompanying rise of distributed energy resources like solar, wind, and renewables, the grid and the data architecture behind it is becoming more and more distributed. But distributed data is a difficult problem to solve.

Greenbird is a company that's positioned to help solve that problem. Their technology works with highly distributed grid data. It's able to make sense of that data. That's one thing that attracted us to them.

So, let's put that into context. If you look at grid projects today, they're often delayed. Implementing advanced applications like Energy Management Systems, EMS, and Advanced Distribution Management Systems, ADMS, takes more time than you'd think because enterprise-wide utility data is a critical dependency.

It also costs a lot more. For every dollar a utility spends on an application, it's estimated they spend three to five dollars on data integration. With Greenbird's technology, we can reduce both the complexity and cost here.

Lastly, everyone is talking about AI as something that's coming tomorrow, but the capabilities are here today. You just can't do AI without data. If you solve the data problem, you unlock the power of AI to accelerate the energy transition.

PUF: There must be something special about Greenbird. What makes the company so compelling that GE Vernova decided to acquire it?

Mahesh Sudhakaran: If you look at the core problem, there's a lack of data companies focused on utilities. To help utilities solve their data pain points, you need to understand their data models. Without that understanding, you'll only be able to offer them generic configurations, not the unique configurations they require.

Greenbird has solved the problem of data integration models

With the energy transition and accompanying rise of distributed energy resources like solar, wind, and renewables, the grid and the data architecture behind it is becoming more and more distributed. But distributed data is a difficult problem to solve.

for utilities. Everything they do is in service of a utility-centric platform, while still following standards and technology found in general purpose platforms.

The second dimension is that Greenbird has been doing this for ten years. They started with smart metering, which involves very large data. They can bring that experience into the operational software.

But if you look at operational software, the data is all dark. Nobody understands it because it's sitting in an operational system and it is typically not on the customer side, like billing data. But everyone needs access to OT data.

With this Greenbird piece of software, you can integrate OT data and then use it across OT and IT applications. That's at the core of what impressed us.

Greenbird also has strong references and has done a lot of work in Europe. They're strong with data integration and analytics at scale. With us, they can play on a larger stage with the portfolio that we have. There's no question they're going to be an accelerator for our GridOS portfolio.

We're moving toward more unified data access, and Greenbird's capabilities accelerate our GridOS data fabric. This is important because utility systems still are siloed.

Transmission systems operate on their own, as do distribution systems. Neither one shares data with the other. Without a common network model that goes across transmission and



Without a common network model that goes across transmission and distribution systems, you cannot solve use cases that span the entire energy network. With Greenbird, we'll be able to deliver one network model for utilities, which will be a game-changer.

distribution systems, you cannot solve use cases that span the entire energy network. With Greenbird, we'll be able to deliver one network model for utilities, which will be a game-changer.

PUF: How did you start talking about joining forces with Greenbird? Were you in Oslo and ran into them?

Mahesh Sudhakaran: Let me start with the company. What attracted us to Greenbird is their focus on sustainability and their hyper-focus on utilities. Electric utilities are the only game they play.

The second is their proven technology. Greenbird's mission has been to simplify data integration for utilities. They've successfully integrated IT and OT data at scale for utilities.

The third is the Norwegian-Nordic standard of solving problems. That's a strong attribute of their culture and meshes well with our problem-solving approaches at GE Vernova.

Going back to your initial question, we've been in the utility business for a while, so we've had an opportunity to work with Greenbird in the past, attending conferences together and such. But the conversation started with a partnership.

Then we thought, why don't we take the partnership further so we can enable our talented teams to work in tandem? It made sense for both companies to come together.

PUF: What happens next? How big of an impact can this acquisition have on the industry?

Mahesh Sudhakaran: At DistribuTECH in February, we announced GridOS, which is the world's first software portfolio focused on grid orchestration. We believe that to achieve a more sustainable energy grid, the grid needs to be orchestrated, not just managed.

What are you orchestrating? You're orchestrating data. We have three tenets to that. The first is cybersecurity. The second is a common data fabric. The third is the grid orchestration engine.

Greenbird's capabilities fit right into GridOS, accelerating the data fabric and one network model of the software portfolio.

So, what does this mean for the industry as a whole? Well, look at the reach of our portfolio, specifically distribution utilities.

Today, our ADMS serves more than twenty-five percent of global distribution utility endpoints in OECD countries. That gives a little insight into the unique opportunity we have to significantly impact the energy transition journey for a lot of utilities around the globe on a large scale. This acquisition is a significant accelerant.

PUF: What should be the takeaways from this for readers?

Mahesh Sudhakaran: The first is faster data integration for utilities when it comes to installing systems. The second is

(Cont. on page 71)



GE VERNOVA

KEEP EVERYTHING MOVING... WHILE EVERYTHING MOVES

Your job powers the world. Keeps our cities lit, our homes heated, and our factories humming. And so, even as the world changes – as new energy sources come on board, as consumers become producers, as volatility raises new challenges – your job remains the same: to keep the whole world moving. Now, GridOS® is here to help you do it.

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Integrating Gas and Electric System Planning to Facilitate Decarbonization

The Future of Energy Usage

By National Grid's
Karsten Barde, Courtney Eichhorst, and Sandy Grace



limate change is one of the most challenging crises of our time. The states in which we serve, New York and Massachusetts, have both committed to net zero greenhouse gas (GHG) emissions by 2050 (at least eighty-five percent below the 1990 level of emissions). As part of attaining this goal, state and local policymakers are taking important steps to enable future electrification of end uses, especially as it relates to heating in the building sector.

For this deep decarbonization in the building sector to occur, significant new electric grid investments will be needed, as will planning for the long-term future of gas distribution networks, which will play a critical role in supporting the energy transition.

As this work progresses, it is essential that policymakers and stakeholders recognize the integrated nature of today's energy system, which is comprised not only of diverse sources of generation but various delivery systems carrying molecules and electrons, which together form an interconnected system of systems. And, in recognition of this interconnected system of systems, plan for the future of our energy usage in an integrated manner.

Why is this important? Today, National Grid's gas delivery networks serve three times as much energy demand during the coldest hour of the winter as the electric grid provides to the same customers on the hottest hour of the summer. The regions we serve also currently rely on delivered fuels for about twenty-five percent of all building heating systems, representing a significant additional supply of heating energy that must be decarbonized.

In our April 2022 Clean Energy Vision report, we detailed a portfolio of multiple clean heating technologies we believe are required to achieve net-zero heating in our region by 2050, recognizing the potential for complementary roles of decarbonized gas and electricity in transforming the energy systems that keep our customers warm.

Importance of Integrated Energy Planning

Over the last year, we've continued to develop more detailed scenario forecasts of potential future energy demand for both our electric and gas networks in Massachusetts and New York. As a result of this evaluation, we're increasingly recognizing the importance of integrated energy planning as a focus for our business planning and asset management organizations.

State and local policymakers are taking important steps to enable future electrification of end uses, especially as it relates to heating in the building sector.

– *Karsten Barde*

What do we mean by the term integrated energy planning? Fundamentally, it means incorporating and considering critical interactions between our gas, electric, and customer energy systems into our planning processes in the context of long-term climate goals.

Historically, planning for the safe, reliable, and affordable delivery of gas and electricity have been separate processes, conducted by separate teams with different tools and minimal coordination with customer demand-side programs. Looking to the future, we see the opportunity for a new integrated energy planning paradigm to shape the long-term trajectory of infrastructure investment toward both decarbonizing energy and optimizing

Karsten Barde is a Director of Policy & Regulatory Strategy for National Grid's electric & gas utility businesses in New York and Massachusetts. Karsten helped lead clean energy innovation in the utility industry for twelve years, developing business strategy and policy, and launching new initiatives in electric transportation, grid modernization, distributed generation, building decarbonization, and the future of gas. He previously served as a manager in National Grid's New Energy Solutions group and spent three years at Pacific Gas & Electric supporting Energy Procurement and Smart

Grid teams with implementation of state energy and climate policy.

Courtney Eichhorst is a Principal Program Manager for the Future of Heat in National Grid's Transformation Office. Courtney has held roles in regulatory and strategy, where she helped lead the development of decarbonization strategies and innovative regulatory models, including outcome-based performance incentives. She earned her MBA from Boston University, with a focus in Energy and Environmental Sustainability, and BS in Economics from Purdue University.

Sandy Grace, Vice President of US Policy and

Regulatory Strategy for National Grid. Throughout her career in the energy and infrastructure industry, Sandy has held roles focusing on policy development, legislative and regulatory strategy, as well as transmission and microgrid investment opportunities. She spent nearly a decade in private law practice on complex commercial litigation and regulatory matters, representing and advising some of the nation's largest energy companies on issues ranging from mergers and acquisitions, compliance, federal funding opportunities, and participation in wholesale energy markets.



We see the opportunity for a new integrated energy planning paradigm to shape the long-term trajectory of infrastructure investment.

– Sandy Grace



Innovative regulatory frameworks may be needed to enable targeted electrification at a scale meaningful enough to impact gas network planning.

– Karsten Barde

spending across the whole energy system, while continuing to keep customer and community preferences in mind.

Evaluating Infrastructure Investment

To explore this opportunity, we believe a good first step is for combined gas and electric utilities to conduct preliminary engineering analyses of sample communities where they provide both services, evaluating the potential for cost savings if new gas infrastructure could be avoided by customers converting all their appliances to electricity.

Many communities have substantial replacement of gas delivery infrastructure still planned to be done. These replacement programs are critically important to continuing to ensure the safe and reliable delivery of energy to customers; moreover, modernization of the system reduces leaks of methane in line with state climate goals.

However, in some communities, a push toward electrification would reduce utilization of new gas infrastructure over the

medium-to-longer term, suggesting a need to evaluate potential alternative asset management strategies.

Based on our early research in this area, below are a few of our insights that we think will be important to test:

First, building up the grid today for fully electrifying an entire town may be prohibitively expensive compared to replacing aging gas infrastructure, given the need for new electric substations and widespread capacity upgrades. However, there are likely to be selected segments where electric network upgrades required to enable full electrification could be less expensive than replacing the gas infrastructure serving that neighborhood.

Second, our customers and communities vary widely in their views on energy sources and energy infrastructure. While some customers are highly interested in the potential for a transition away from gas, others are less ready today for a variety of reasons, including the cost of building and appliance retrofits.

Under the existing regulatory framework, in order to decommission any given segment of the gas system, all customers served



We believe a good first step is for combined gas and electric utilities to conduct preliminary engineering analyses of sample communities where they provide both services.

– Courtney Eichhorst

by that segment will need to voluntarily agree to disconnect from the gas system. Innovative regulatory frameworks may be needed to enable targeted electrification at a scale meaningful enough to impact gas network planning.

Third, municipalities could be potential partners in helping plan for coordinated energy transitions. For example, in some European cities such as Zurich, municipal heat decarbonization strategies developed by city leaders provide long-range signals to

customers about specific neighborhoods targeted for different types of energy solutions in the future and provide generous public (such as taxpayer) support for these customer conversions.

Finally, our system planners need additional tools to conduct integrated energy planning, such as planning software that can incorporate diverse data sources, account for cross-network dependencies, and consider a wide range of future scenarios in developing optimization analyses. We've begun validating and testing a software tool that can support some of these functions but expect to require ongoing technical development as we progress our plans.

Opportunities for Policymakers and Regulators

To chart the course toward more effective energy planning in the context of our shared climate goals, policymakers and regulators could act now to start enabling meaningful integration of energy planning at both the macro and micro levels, by:

Fostering coordination between different gas and electric utilities that both serve the same customers, in order to optimize long-range investment plans;

Supporting investments in new tools and capabilities that allow for integrated energy planning;

Enabling targeted electrification pilots and other non-pipeline alternatives to inform future regulatory frameworks and identify best practices and protocols for data sharing and joint-utility planning and execution;

Recognizing that the current regulatory framework does not facilitate coordinated planning or provide for the cost allocation and recovery mechanisms across customers of each of the currently distinct systems in a manner that recognizes the relationship and value of each of these systems to each other; and

Advancing localized or community energy plans that identify potential long-term optimal portfolios of heating solutions for a given community, together with the policies, incentives and protections needed to support all customers through large-scale transitions.

In conclusion, by embracing the opportunities for integrated energy planning, we can help ensure that our energy delivery remains safe, reliable, resilient, and affordable, while addressing our collective climate goals. **PUE**

The cohosts of the inaugural Fortnightly Top Innovators Conference are EPRI, Energy Impact Partners, EEI Edison Foundation, Exelon, Large Public Power Council, and GTI Energy. Since 2017, Public Utilities Fortnightly has dedicated a fall issue of the magazine to the increasing pace of innovation at utilities and how this benefits our industry and customers. Utilities nominated each year more than a hundred individuals and teams that brought breakthroughs to market in new transmission technologies, drones, microgrids, gas leak detection, customer tools, wildfire mitigation, undergrounding methods, and more.

For three days in October, the historic Willard Hotel, "the Residence of the Presidents," will be the venue for the Fortnightly Top Innovators 2023 conference. A few hundred feet from the White House, the conference will be hosted in Willard's Grand Ballroom and meeting spaces, the first evening reception in the Crystal Room, and the second evening reception in the courtyard.

Where ERCOT Stands Now

Conversation with ICF's
Pat Milligan



or much of the U.S., it has been a long, hot summer. At the end of July, ERCOT and PJM issued heat alerts, which were followed closely by many in the energy and utilities industry, including the energy markets teams at ICF.

One of ICF's specialties is determining what such actions mean, if that heat was in original projections, and what actions system operators/utilities can take when heat advisories are issued. At that time, it seemed the heat would be manageable, and it is always reassuring when precautions are taken to avoid issues.

Public Utilities Fortnightly here takes a closer look at what is going on in ERCOT with an expert on all major markets in North America, ICF Senior Manager Pat Milligan. There is a lot to learn.

PUF's Steve Mitnick: You've been doing research on the ERCOT market, in particular price trends, what's been happening in the last few years and going forward. Give headlines from this work.

Pat Milligan: The biggest story in ERCOT for the past five or six years has been tight reserve margins, a rapidly changing resource base, questions about reliability and market design, and how to ensure ongoing reliability over the short and long terms. Reserve margins got tight after late 2017, early 2018.

Since then, most years have had periods, whether it's summer or winter, where the grid was sort of on the edge of emergency if not in it. Of course, in 2021, there were massive blackouts, so they've been trying to sort out a number of problems all at once.

This summer has been hot – not unprecedentedly hot – but hot for a couple of weeks in a row, and the grid has done well. No blackouts, they haven't gotten deep into emergency actions. That is by design. There's a diversity of opinions about what this means. Does this mean that things are good, and the structure is fine? Does it mean it's still unacceptably close to low reliability?

(Although on September 6, the grid entered stage 2 emergency conditions but just avoided rolling blackouts. Pricing has been very high.)

PUF: The first issue is compensation for capacity. The ERCOT market uniquely has been so-called energy only, with changes after Winter Storm Uri. There've been lots of action before the PUC of Texas, in the legislature, and at ERCOT about some sort of compensation for capacity.

Pat Milligan: The energy-only market structure has been in place since the beginning of the market. But the modern incentive structure has been in place for about a decade, where prices are allowed to go into the thousands of dollars per megawatt hour, and not all capacity has to bid their variable costs.

They're allowed to bid speculatively. In addition to that, there is this concept of the operating reserve demand curve, which artificially blows up prices during real time when things are very tight.

The Operating Reserve Demand Curve (ORDC) has been tweaked many times in the past eight years since it was implemented. There was originally a nine-thousand-dollar cap, which produced such massive costs during Uri that they reduced the cap recently to five thousand.

The other one is various forms of subsidies for gas plants, which now are taking the form of subsidized state loans, which have been approved by the legislature, but are going to the public vote in November to approve funding for it.

They've tweaked the shape of the curve about five or six different times to try to stabilize the signal a bit, while retaining enough incentive, and minimizing overall financial risks. Again, trying to sail between a number of rocks to get a good outcome.

PUF: One of these big issues is the role of intermittent renewables, which have grown in Texas.

Pat Milligan: I'll start with this summer. The weather has been very hot, demand has been very high. Fortunately for the grid, wind power most often has been strong, and that has helped avoid blackouts and emergencies. The question is what defines performance for renewables?

Most days have been very windy. However, there have been a few days so far that have been less windy than expected, and on those days, prices have blown up and ERCOT has gone into near emergency. What do you do with that going forward as somebody who's either a regulator or on the other side as a market participant?

One of the challenges, going back to the price spike issue, is there has been some hesitation on the part of investors to believe price spikes will continue for the long term. So, a year blows up and a lot of investors have been consistent in asking, "Is this going to keep happening year after year, can we invest in it and earn a consistent return?"

Renewables influence that. You can have periods where the wind is blowing, you've got a fast-growing solar basin, so prices are depressed. Then on days where that's not happening, or with high demand outages, things blow up.

But how often does that have to happen, so as an investor you can bank on it?



There was a lot of focus post-Storm Uri on generation performance, and ERCOT made some improvements through some higher technical standards, although we must see how it performs. But no one has addressed the demand side at all. That's one of the problems.

That's the real question, and it's not clear to me what the answer is.

PUF: There've been regulatory and legal proceedings about supporting backup. Maybe gas-fired generation, giving financial support.

Pat Milligan: There've been a number of proposals. The two that have made the most noise have been this idea of a Performance Credit Mechanism, which is for all intents and purposes a capacity market. They don't want to call the PCM a

capacity market because that's sort of a toxic phrase in the State of Texas.

So, they don't call it a capacity market, but it is. It's like the incentives they already have. PCM would measure whether the market has been tight and stressful, and if you've performed well during those times, it pays out more, and if not, then it pays out less. It's kind of a shadow of the ORDC, it's just a lump sum payment at the end of the year and with a bit of a short-term forward look.

That PCM proposal is still live but has been cut down in size a number of times to where there are cost caps that are very low. Not all capacity might be eligible. To me, that's not a big topic anymore.

The other one is various forms of subsidies for gas plants, which now are taking the form of subsidized state loans, which have been approved by the legislature, but are going to the public vote in November to approve funding for it.

If approved, they would tentatively set aside between five and ten billion to provide subsidized loans. One question that we've gotten from our clients is, you have subsidized loans, so you're trying to reduce the cost of financing. But it's the revenue picture that has been the more concerning one.

Yes, okay, I've got this debt that is cheaper than what I could get merchant, but on the equity side, how do I have certainty that I'm still going to earn a reasonable return? There are questions of whether they're solving the right problem. There've been many tweaks to the market structure.

PUF: Will ERCOT ever be more interconnected? It probably is going nowhere, but do you want to say something about that?

Pat Milligan: I think it's unlikely, but there're a lot of rattlings and rumblings, certainly among the set of people who want to prioritize decarbonization. That has always been a forefront topic because if you can shift renewable production more broadly across regions, you can have more consistency and better reliability.

Add onto that the people who are concerned about reliability, because there were studies that if ERCOT had large links with SPP or MISO in place during Storm Uri, Texas might have either not blacked out or not done as badly, so it would've helped them. But there's still enough resistance to inviting federal regulation in Texas that I don't see it as likely, but there's always noise about it.

PUF: Forecast in the short-term, with a number of projects in the works, including transmission, where do you think this is going in ERCOT?

Pat Milligan: It's an important point. It's summer versus winter, so it's tight right now, and ERCOT could have some issues. ERCOT could get into emergency conditions. On September 6, transmission constraints played an important role in contributing to that emergency. The winter is still the bigger risk, despite the reforms, for a couple of reasons.

Number one, the demand in summer is more certain. They under-forecasted, and not through any fault of their own, it's been a hotter than normal summer. Demand is up by about two percent or three percent compared to the weather-normalized expected peak.

Peak has been about eighty-five point something gigawatts and they forecast it just under eighty-three. But that's about as hot as it's going to get. It's never going to be a hundred thirty degrees in Dallas. One hundred nine, ten, okay. You can be off by a bit.

In the winter, your annual peak demand forecast can be off by thirty or forty percent. That's what happened during Storm Uri. The forecast for the peak was fifty-seven gigawatts, but of course, it ended up being close to seventy-seven (had load not been shed), so there was about a thirty-five percent error.

There was a lot of focus post-Storm Uri on generation performance, and ERCOT made some improvements through some higher technical standards, although we must see how it performs in reality. But no one has addressed the demand side at all. That's one of the problems.

Another difficulty is that solar is such a fast-growing part of the resource base, and it's much more effective at meeting summer peak than winter peak. Winter demand peaks early AM and late PM. Those are outside of solar hours, and wind is uncertain in those periods. As you have that shift, it makes it more difficult to meet those peaks.

The third factor is batteries, which are not a huge part of the grid now, but rapidly growing. The summer peak is concentrated in about three, four hours, versus most of the batteries on the grid today are one or at most two hours. That's a little bit of a mismatch. But in winter, when you look at the demand patterns during a cold front, you can have super high demand for eight, ten, twelve hours in a row, even stretching into days.

Solar and batteries are effective during the summer in combination, but more difficult during the winter. They still have some critical issues in the winter. That's not just limited to ERCOT.

PJM has bigger risks, as well, for example.

PUF: Regarding winter, what about the gas delivery system, as the standards got tightened up a bit on generator performance and capability? That was a problem during the winter.

Pat Milligan: For sure. Gas/electric coordination has always been an area of concern, and I doubt it's been fully addressed. The State did form a new commission, the Texas Energy Reliability Commission, to start to address some of those issues.

PUF: Forecast how ERCOT is looking in the medium-term?

Pat Milligan: Fast load growth from multiple sources including the oil and gas industry, and general economic and population growth. The latest wildcard has been crypto

The latest wildcard has been crypto mines, which are significant demand sources. No one is quite sure of their impact and how fast they might grow. They've got a new task force in place to figure out how they're going to operate and treat these issues with crypto mines.

mines, which are significant demand sources. No one is quite sure of their impact and how fast they might grow.

They've got a new task force in place to figure out how they're going to operate and treat these issues with crypto mines. Are they reliably going to drop their load when needed? That's been a critical part of their pitch to the public.

Hopefully they will, but if nothing else, it is a lot of extra energy and strain on the grid. So, fast growing demand, rapid addition of wind and solar, some addition

of gas peakers, maybe more if they pass some of these incentives, but probably within a fairly narrow band of how many are going to get built.

Our most likely forecast right now is for things to remain tight and for them to be still vulnerable to extreme weather. We forecast the likelihood of ongoing price spikes, but super weather dependent. There can be mild years and extreme years, and it's most likely what it has been for the past five years, is our case going forward.

You're going to have an average price depression through solar and wind, but with periods of choppy, spiky prices that provide some incentive. Basically, it looks like a continuation of the current state. Again, it's what is able to respond to that? And is this a situation that the public can support? **PUF**

CAMPUT used to be known as the Canadian Association of Members of Public Utility Tribunals. That lengthy title was dropped in 2011 in favor of the acronym, CAMPUT, which is well recognized. CAMPUT became Canada's Energy and Utility Regulators, akin to the U.S. National Association of Utility Regulatory Commissioners, NARUC. The two organizations are quite friendly.

Buildings' Energy Efficiency Taking Off with Data

Conversation with Power TakeOff's
Kevin Martin and Peter Widmer
with Lime Rock New Energy's Mark Lewis



ower TakeOff, or PTC for short, is a name you need to know. Its mission is to revolutionize the way utilities and businesses participate in energy efficiency through data and software. Lofty goal.

But expect great success. It was founded by two engineers with a vision of creating software allowing business customers to see their data, thereby empowering users to make energy efficient changes in their facilities.

Now, Lime Rock New Energy, which uses growth equity to accelerate the energy transition, has partnered with PTC as it trusts in the energy efficiency paradigm. Public Utilities Fortnightly sat down with the two founders of PTC, Kevin Martin and Peter Widmer, as well as Lime Rock New Energy's Mark Lewis, to dig into where PTC is going as it partners with energy and utilities companies.

PUF's Steve Mitnick: What is it that you do differently with your partners or utilities than anyone else?

Peter Widmer: The market success that we have with small, medium businesses and public institutions is a direct result of our data-first strategy. It's unique in the marketplace, by first focusing on identifying the participants best suited for DSM offerings and knowing with a high degree of confidence they'll likely benefit.

A data-first approach not only delivers a high value proposition to facility managers and building owners, but in providing a customer experience that's unique to each participant, we build confidence and trust in our utility partners' brands, that they're here to help, which is an important part of this energy transition.

Second, our data-first strategy enables us to deliver our DSM services virtually, and we were one of the first to do so in the industry. We were delivering virtual services before COVID, and that expands our market reach beyond the traditional on-the-ground approach to meet the businesses where they are.

There're so many small, medium businesses in contrast to large corporations, which utilities already have as a part of the portfolio. You need a fast, virtual offering that can rapidly meet people without having to drive from location to location.

Underlying our DSM services, our third unique differentiator is our industry leading automated Measurement and Verification (M&V) capabilities, which brings resource investment confidence to a project from the perspective of the participant.

To accelerate participation investment in energy efficiency, a more accurate M&V approach that's available daily, rather than getting results next month or at the end of the year, is critical to driving investment moving forward. It is those three points that make Power TakeOff stand out in the industry.

PUF: Kevin, it's been difficult to do DSM services with small and medium businesses. They're different and don't have a full-time energy expert. Discuss that.

Kevin Martin: Peter talked about the data-first approach. We are using both this large access to data and software automation to bring down what's typically been offered to the largest customers, so it's cost-effective for small and medium businesses.

We automate and do this at scale. It would normally take a lot of labor and time to reach these customers, but through

We are using both this large access to data and software automation to bring down what's typically been offered to the largest customers, so it's cost-effective for small and medium businesses.

– Kevin Martin

continuous software development, R&D, and virtual engagement, that allows us to come to these customers with cost-effective solutions that a lot of the industry haven't been able to do yet.

Our artificial intelligence-led approach allows us to be targeted and reach out with specific actions to these customers. Small and medium businesses don't need to commit to a large engagement.

We're reaching out with specific days, times, and actions to take. We're doing it virtually. This virtual engagement makes it cost-effective; it makes it easy for them.

We have homed-in on the art of what is meaningful to them in a short period of time to get results quickly for small and medium business staff who wear different hats and have other responsibilities.

This is how we find success with them. The key is measurable results. It's fully pay-for-performance. We get the job done and then get paid based on achieved results.

The customers and utilities see it, and it's motivating to see the after-effects of the work they've put in that are often quick changes. There's great feedback.

PUF: Give some examples.

Peter Widmer: There's a wide range from simple examples with the lights being on, to more complex. I'll give a couple here. A simple example is a bank.

Banks close on Sundays, but with interval data, we can diagnose in combination with weather data, what systems may be running and can call and advise them about this usage during unoccupied hours.

In more complicated examples with schools, which have



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– Peter Widmer

variability in scheduling, from summer, the courses, and building review, to if space is rented out, to during the school year with sports activities, and helping facility managers.

First, our job is to educate. We teach facility managers and building owners about energy usage relative to their buildings. This is often the first time they've seen this data or had this level of insight and had a trusted partner without a direct financial gain from their perspective.

Our participants don't pay us anything. We are simply there to

help them, represent the utility, and consult on how to optimize their facility relative to energy usage and the goals for that space.

After we've completed our work with the organization, we refer them to a peer program through our industry partnerships. To be successful in this energy transition, we want them to continue their DSM journey. We need them to take that free cashflow we're generating for them and do that large capital project they may not have otherwise budgeted for.

That benefits everybody. We want to be stewards of this process, get people into the funnel, and involved in energy efficiency. So many small and medium businesses have been overlooked for the last couple of decades that we need to engage and invite them into this process. There are many partners in this industry to help take them on the next steps of larger capital investments.

PUF: How does the process work and where does the utility fit in?

Kevin Martin: We deliver a turn-key program for utilities. We are reaching out as agents of the utility. We say, "this is Kevin Martin with ComEd, I'm calling about this."

That's where we're building goodwill for utilities because here's a customer that has been unengaged, that has someone calling out to them with their best interests in mind. This isn't a gimmicky sales pitch.

They get their money back, because they have been simultaneously heating and cooling this building at the same time. A lot of Frankenstein buildings have additions, and these building facility managers don't know which circuits go to where, what controls what.

They often don't realize there's a parent/teacher event every other week. These systems got put on hold, or this control is calling for heat, this one's calling for cooling.

They're just running and making sure people are comfortable, rather than having time to log in and figure out what makes sense.

What we are finding is customer specific. It's a data-led way to say, this is a flagged opportunity.

It's then human research to find and improve that engagement. We get one first impression and do a good job of reaching out to those customers on behalf of the utility with specific and actionable items that catch their interest and lead to a change that's good for the utility and planet.

Peter Widmer: These aren't our opinions or our ideas. This is data we're bringing; this is what we see in the data, and we're leading with that message.

It is not a sales pitch when somebody knocks on a door with a promise of savings to gain a customer's participation in a program, but we're leading with data, which changes the conversation and gets the facility manager and building owners to open up.

PUF: You've been at it for some years. How big can this impact be three years, five years out?

Peter Widmer: For context, we first launched this pilot, this idea with ComEd in 2017. Virtual Commissioning® is the name of our product.

The Virtual Commissioning product has been our focus of execution for the last five, six years. In 2019, we were a company that had twenty-eight people, and by the end of this year are approaching a hundred.

We see tremendous growth ahead. There're a couple of points we look at for future opportunities, and the first centers around AMI meter deployment. That is the primary mechanism we need in place to run our program. Ten years ago, there was a big rush in capital to increase deployment, and that continues.

Then, general state regulation around energy efficiency policies and support of DSM. From the market perspective, which has those two conditions, we think there's significant opportunity ahead. We continue to see an abundance of energy efficiency opportunity in the data.

Kevin Martin: AMI deployment and data is the lifeblood of our services and company. We're seeing pressure socially from utilities with electrification.

As we decarbonize our environment, there's a larger push for people to switch fuel sources to electric and electric heating



We're always looking for investment opportunities with businesses driving energy efficiency. It's been difficult to find ones to get excited about. I saw a business making a quantifiable difference in energy consumption. PTO has mastered measuring energy savings relative to a quantified, measured historical baseline based on AMI data.

— Mark Lewis

is the largest opportunity for savings opportunities. Those are some of the largest savings we're able to achieve from the Virtual Commissioning program. The more people electrify, the more opportunity to have a larger impact with this program.

PUF: Why is that?

Kevin Martin: A lot of it is the existing infrastructure. There's little AMI minute-by-minute metering of natural gas data. It's not granular, whereas we can get that for electricity. There's the shift.

There are pilots, but it is a blunter instrument versus the



They get their money back, because they have been simultaneously heating and cooling this building at the same time. A lot of Frankenstein buildings have additions, and these building facility managers don't know which circuits go to where, what controls what.

– Kevin Martin

level of granularity with electric data. The more heating with electricity – it varies across the U.S. – but for colder climates the bulk of energy usage is from heating and less for cooling. That’s a large opportunity on the horizon.

PUF: There’s also Lime Rock New Energy. What’s that about?

Mark Lewis: We’re excited to be partnering with Power TakeOff because we’re growth equity investors in the energy transition. Our focus is around businesses that help drive the energy transition.

One of our key verticals is around energy efficiency. We’re always looking for investment opportunities with businesses that are driving energy efficiency. But frankly, it’s been difficult to find ones to get excited about.

I previously was an ESCO CEO and know the space. But it is difficult finding businesses that aren’t reliant on growth coming from more boots on the ground, which is the model of ESCOs, or that are reliant on customers making capital purchasing decisions, which is always a difficult sale. That’s the traditional model.

Let’s upgrade your rooftop unit or the building envelope, insulation, lighting, all those things. But even with rebates, it requires a customer to make a decision around capital expenditures.

When we had the opportunity to meet Kevin and Peter and learn what PTO was doing, I saw a business making a quantifiable difference in energy consumption. That is what PTO has mastered, they’re measuring energy savings relative to a quantified, measured historical baseline based on AMI data.

It’s real data. It’s not an engineering model, it’s not an estimate. It’s based on consumption. They’re delivering verifiable results, and that’s how they get paid for performance.

Power TakeOff was the perfect fit because it fits our mandate. The business is growing rapidly. They’re delivering value to their utility customers and to small and medium businesses to help them save energy and money, reduce their carbon impact, and make the grid more resilient by reducing consumption.

There are only a few options around the continual electrification of our economy. You can build more transmission and distribution, and we know the challenges and capital costs around that. But the cheapest electron is one that’s never consumed and that’s what PTO is about.

We’re only at about roughly sixty five percent AMI penetration in the U.S. and that will be effectively full penetration by 2030. We’ve got a lot of runway to grow in the U.S., but Kevin and Peter have never been outside of the U.S. with this offering.

There’s an international opportunity here. With the energy

challenges Europe has been dealing with, this is ideal for that marketplace.

PUF: What is this company going to look like in five years?

Kevin Martin: Five years out, we will have more than doubled the number of programs we have out there. The Virtual Commissioning will be inside and outside the U.S.

This is a global problem. These are translatable approaches, as are the core competencies that we built, and the trust and

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(Cont. from p. 41)

One of the reasons for that is because we have participation from different stakeholders. Dustin's in standards, I'm in automation, Luke is in Smart Meter Services. That doesn't even include the different crews that were involved, as we had training and OCC involved, so it took a lot to make that happen.

This pilot, this iteration, is over three years of work and we've only gotten three switches in. It takes a lot to get that far and there is still a lot more we would need to see before we would use this technology at scale.

The most rewarding part is getting to this point. Maybe it doesn't sound like a lot, but realizing how much it takes to get to that point is rewarding to have gotten here.

PUF: Luke, what's been most rewarding for you during your work on this innovation?

Luke Benedict: The most rewarding part was learning about the different technologies that make the system work and then seeing it all come together. There are many layers to the control and communication system, such as the automation aggregator,

Energy is Digital

(Cont. from p. 56)

utilities will now have access to a data layer or data fabric for their operational technology, which will help them scale and get to the successful use of AI faster.

How do you deploy an electric vehicle charging use case without having access to substation data? Today, that's a side project. How do you do the simulation and modeling needed to onboard renewables and keep the grid in balance? These are examples of massive data problems that we're tackling now.

Third, there's a lot of data talent out there. Our industry has a lot of electric utility expertise, but you don't often find people who do both. Now, we have a team of utility data experts who do both. We're moving fast to bring these experts to our

relationships with utilities. Utilities are reaching out to us requesting support for data analytics work, greenhouse gas measurement, verification, reduction goals, and engaging their customers more effectively to drive other programming.

We are going deeper on longer engagements. That's what our new program we launched this year, Virtual Strategic Energy Management™, Virtual SEMs, is about. Those are longer engagements where we are coaching, teaching, and improving. **PUF**

Troubleshooting those issues, seeing it work, and then setting up model profiles to be used in future installs was rewarding. If this iteration gets us to the finish line, great. But even if it doesn't, there are a lot of learnings that can be applied to future versions of this equipment.

– Luke Benedict

the individual relays that controlled each switch and the radio and network. If any one of them wasn't configured in just the right way, the comms stopped.

Troubleshooting those issues, seeing it work, and then setting up model profiles to be used in future installs was rewarding. If this iteration gets us to the finish line, great. But even if it doesn't, there are a lot of learnings that can be applied to future versions of this equipment. **PUF**

customers and help them integrate data faster.

PUF: What's most rewarding to you?

Mahesh Sudhakaran: It's the sheer magnitude of the impact we can make. Solving the data problem is a real roadblock to the energy transition that we don't talk about. Having a proven approach to that – one that can overcome that challenge not only for electric utilities, but for humanity – is exciting.

I'm also excited to learn from the Greenbird team. This is a team of logic. They sit in Norway, which is greater than fifty percent renewable energy. Having the opportunity to learn from them and their organization, learn from their culture and way of life, that's fascinating.

And then, of course, Thorsten Heller, the Greenbird CEO, is somebody I've known for the past decade. I respect him. The opportunity to have him as a partner and have his team join us is a pivotal moment for us. **PUF**

Advanced Conductors Arrive Not a Moment Too Soon

Moving the Grid Forward

By retired Tucson Electric CEO
Charles Bayless



As a longtime veteran of the utility industry, I know that I'm biased, but I've also seen enough in this business to say the following with confidence: transmission and distribution infrastructure is the backbone of this country's energy transition.

In all aspects of America's energy leadership, the towers, poles, and wires are crucial. They are vital for grid modernization, reliability, affordability, resilience, decarbonization to reach climate targets, scale our robust renewable energy sector, and meet the needs of the exploding electric vehicle revolution. T&D systems are the connective tissue behind the power that energizes the economy.

And yet, even though we're now more than two decades into a new millennium, T&D conductors remain grounded in technology that dates to the early 1900s, a century ago. It is an area of grid infrastructure ripe for innovation.

If we're going to operate a twenty-first century power grid, we need to vault the underlying conductor technology out of the twentieth century. I'm proud to say that the moment of innovation has at last arrived in earnest.

The Rise of Advanced Conductors

I suspect that many readers of this publication are already familiar with the two types of conductors that dominate T&D systems today. Aluminum conductor steel reinforced (ACSR) dates to the early 1900s. In the 1970s, aluminum conductor steel supported (ACSS) technology came along, improving the original design. These two technologies, and their variants, dominate the conductor market today.

Starting in the 1990s and into the early 2000s, the pages of this publication began covering advanced conductors, defined by the promise of features such as higher ampacity and lower sag.

Now in the 2020s, we're seeing that promise become reality.

Technology vendors such as TS Conductor have brought to market a new generation of ready-to-deploy advanced conductors, while a growing list of grid operators are employing those conductors in the field across an impressive array of use cases and geographies. (Disclosure: this author serves on the board of TS Conductor.)

For the famously risk-averse, we-love-the-tried-and-true utility industry, it is an innovation for which time has come. Advanced conductors are to T&D networks what the switch to fiber optic Internet from copper wiring was for telecommunications.

A Look Inside Advanced Conductors

One of the defining aspects of advanced conductors is their core. It's a classic case of out with the old (steel) and in with the new (carbon). For example, TS Conductor's solution uses a carbon fiber core fully encapsulated in a sheath of seamless aluminum.

The carbon fiber is super strong, ultra lightweight, and has essentially no sag. In tandem, the encapsulating aluminum keeps out moisture and other elements. This prevents corrosion and other problems that plagued earlier generations of advanced conductors, while also allowing line crews to work

Advanced conductors make it possible to deploy big upgrades within existing rights of way, even reusing existing towers for reconductoring projects that can be accomplished with relative lightning speed and for lower total costs that make ratepayers, consumer advocates, and public utility commissions happy.

with the conductor using tools and techniques with which they're already familiar.

Beyond the core, like their predecessors, advanced conductors make extensive use of aluminum stranding, although with some upgrades. Thanks to the high-strength, lightweight core, advanced conductors like that of TS can be wound with trapezoidal strands of the highest-conductivity annealed aluminum. This translates to advanced conductors with triple the ampacity and half the line losses vs. like-for-like traditional ACSR/ACSS conductors.

Many Grid Challenges, One Conductor Solution

It's one thing to talk excitedly about the material properties of advanced conductors, but they shine when we translate that into what it all means for grid operators. Here are a few major benefits:

Grid modernization and transmission system expansion: Let's face it. Much of today's T&D infrastructure is aging and in need of updating. Moreover, establishing new rights of way for needed transmission system expansion faces permitting obstacles and takes many years, even decades, to accomplish.

Advanced conductors make it possible to deploy big upgrades within existing rights of way, even reusing existing towers for reconductoring projects that can be accomplished with relative

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Renewable energy sits stuck behind congestion bottlenecks in transmission networks. Advanced conductoring can unleash a wave of additional, low-cost renewable energy, accelerating America's progress toward power sector decarbonization and national climate targets.

lightning speed and for lower total costs that make ratepayers, consumer advocates, and public utility commissions happy.

Renewable energy integration to decarbonize the power sector: As of earlier this year, more than one thousand three hundred fifty gigawatts of new renewable energy capacity sat waiting in interconnection queues. That's more than the capacity of the entire current generation fleet across the U.S.

In addition, in parts of the country where renewables, such as wind or solar have already become substantial portions of the dispatch stack, we're also seeing increasing frequency and

need to de-energize lines for public safety power shutoff (PSPS) events. On the flip side, in cold climates, advanced conductors are better able to bear the weight of winter icing, keeping the lights on.

Grid Operators Leading the Way

So, have advanced conductors truly arrived? From what I see, the tipping point is here. TS has gained the backing of respected utility names such as National Grid Partners and NextEra Energy, plus it was admitted to Dominion's Energy Innovation

magnitude of renewables curtailment. Both the interconnection backlog and rising curtailment are in part byproducts of a single issue: renewable energy sits stuck behind congestion bottlenecks in transmission networks. Advanced conductoring can unleash a wave of additional, low-cost renewable energy, accelerating America's progress toward power sector decarbonization and national climate targets.

Serving demand from EVs and the electrify everything movement: On the demand side for grid operators, it's no secret that massive amounts of new load are anticipated in the coming years.

The sources are many. Both automotive EVs and trucking electrification are scaling faster than initial market forecasts.

The electrify everything movement is seeing electric heat pumps for HVAC to induction cooktops in the kitchen switch over to the grid from natural gas. And intensifying summer heat waves are seeing regions such as ERCOT set record after record as air conditioning and other loads send demand to new heights. We need advanced conductors to serve that oncoming tsunami of new load.

Reliability and resilience: Finally, thanks to their super high strength paired with low- to no-sag properties, advanced conductors shine in terms of grid reliability and resilience in the face of extreme conditions and severe weather. For instance, during dry, hot summer months, advanced conductors don't sag the way ACSR/ACSS conductors do. This mitigates wildfire risks and reduces the

Center. Earlier this year, TS also won a 2023 Stage 2 CABLE Conductor Manufacturing Prize from the U.S. Department of Energy American Made Challenge.

The biggest proof, of course, is in the field. On that front, too, advanced conductors are getting called into action by leading grid operators.

Consider Tennessee Valley Authority, the largest public utility in the country, serving roughly ten million customers. Transmission line systems engineering & design lead Jeff Phillips and the TVA team have experimented with advanced conductors for more than a decade, but the recent pairing with TS Conductor has been a game changer for TVA's reconductoring projects.

TS technology costs less than other advanced conductors and the total project cost to reductor a line is significantly less than traditional options. As Phillips noted recently, "This project tells the story of how to better use our rights of way."

For another example, consider lead engineer Tyler Tegtmeyer and the team at MidAmerican Energy, a Berkshire Hathaway Energy subsidiary and investor-owned utility serving 1.6 million

customers. MidAmerican has been installing TS Conductor technology for a transmission line reductoring project spanning the Mississippi River. The advanced conductors have allowed them to re-use existing towers, saving valuable time and money on the project.

These are just two stellar examples of a growing number of deployments for advanced conductors in the field. We are hopefully seeing the dawn of the next century of grid infrastructure, with advanced conductors the heir apparent to legacy ACSR/ACSS conductors.

Conclusion

Thanks to technology breakthroughs by companies like TS Conductor – and the leadership and deployment of Tegtmeyer and the MidAmerican team, as well as Phillips and the TVA team – grid operators everywhere are now seeing the true potential of advanced conductors. Following the lead of these first movers, as utilities' confidence with this technology grows, the future for grid modernization becomes ever more promising. [PDF](#)

The extraordinarily comprehensive annual survey by the U.S. Labor Department on what American households spend money on, recently reported that the average residential electric bill in 2022 was \$140.25 per month. That's up eight and a half percent from 2021. When the average bill was \$129.25. But average total expenditures on all goods and services in 2022, across all hundred and thirty-four million American households, was up nine percent. So, electricity's share of total household expenditures remained flat. At 2.3 percent.

As in past years, there are considerable differences between regions of the country. The average residential electric bill in the toasty South was \$160.17 per month. While in the more temperate Midwest it was \$123.33. The averages in the West and Northeast were not much higher than in the Midwest. At \$129.17 and \$130.92 respectively. Heavy air conditioning usage down South really brings up the average bill nationwide.

This is especially the case in what the Labor Department calls the East South Central and West South Central divisions of the South. As opposed to the South's third division, the South Atlantic. Over the two-year period of 2021-22, the average residential electric bill was \$159.67 and \$159.17 per month in those first two divisions in the South Central. And significantly lower, \$147.08, in the third, the South Atlantic.

The regional divisions nationally with the lowest average bills? They are the East North Central with a 2021-22 average of \$118.50 per month, the Middle Atlantic with an average of \$121.50, the Pacific with an average of \$121.58, and the West North Central with an average of \$123.08.

And as in past years, there are considerable differences between regions with respect to electricity's share of total household expenditures. Again, averaging over the two-year period of 2021-22, electricity's share of household expenditures was 3.2 percent in West South Central and 3.1 percent in East South Central. That's Arkansas, Louisiana, Oklahoma, and Texas in the West South Central. And Alabama, Kentucky, Mississippi, and Tennessee in the East South Central.

In contrast, electricity's share of household expenditures was 1.8 percent in Pacific and 1.9 percent in Middle Atlantic. Pacific and Middle Atlantic have some of the highest electric rates in the country. But they have some of the lowest average electric bills. And they have the lowest electric bill shares. That's Alaska, California, Hawaii, Oregon, and Washington in the Pacific. And New York, New Jersey, and Pennsylvania in the Middle Atlantic.

SRP Supercharging EVs

Conversation with Salt River Project's
Terry Rother and Burrell Kilmer



ast month, Public Utilities Fortnightly brought you twelve investor-owned utilities to compare how they are moving forward with electric vehicle goals. Here, PUF brings you a not-for-profit organization, the Salt River Project, which delivers water and power to over two million people in central Arizona.

SRP is made up of two separate organizations: the Association, a private water corporation founded in 1903, and the District, an electricity provider formed as an agricultural improvement district and political subdivision of the State of Arizona in 1937. SRP has established 2035 sustainability goals, including goals of five hundred thousand EVs in its service territory, with ninety percent using managed charging.

Two EV experts from SRP, Terry Rother and Burrell Kilmer, talked with PUF's Steve Mitnick on how that program is moving forward in Arizona. Listen in on this fascinating discussion.

PUF's Steve Mitnick: What is the goal of Salt River Project's electric vehicle programs, both residential and commercial fleet?

Terry Rother: SRP has two overarching electric vehicle goals. In 2019, we held an extensive stakeholder process with many parties to develop our 2035 sustainability goals. That's everything from our water management, forest restoration, greenhouse gas emissions, customer programs, and also EVs.

Out of that came two overarching EV goals, to support enablement of five hundred thousand vehicles in our service territory, with ninety percent being managed charging. Managed charging is a combination of price plans, behavioral approaches, education, passive and active load management.

Burrell Kilmer: The goals were established to make sure we're out there helping our customers and community decarbonize transportation in our region. It was a call to arms for SRP to make sure we're ready.

There are three big pillars we are working on, and what anchors it is we're trying to enable the grid. One is making sure the transmission and distribution systems are ready, and we've got enough generation capacity to serve the load that's coming.

Another is educating and empowering our customers, to help them through the journey. We want to offer them the right tools and where appropriate, incentives. A number of our customer programs involve rebates and incentives.

The other pillar is we want to engage our communities. SRP and our history are rooted in being part of the fabric of the communities we serve. That means partnering with the cities of Phoenix, Tempe, and Mesa, and other emerging groups working to decarbonize the metro area.

PUF: What are goals in terms of educating the consumer, working with them, including commercial and fleet, encouraging adoption and rebates, incentives, and working with the regulators?

Terry Rother: We're not directly overseen by the Arizona Corporation Commission like APS and TEP. We report to a publicly elected board.

When it comes to developing programs and rebate offerings, we have quite a bit of flexibility to balance that between both residential and commercial. Each sector is unique in its own way,

We've not gone down the path of wanting to own and operate or develop our own charging sites. What we've wanted to do was let the market take care of that, and instead worked to support the market development.

– Burrell Kilmer

and has different challenges associated with it. Initially, what we've tried to do is cover the basics with programs.

On the residential side, we have a Smart Charge Rebate Program. We were one of the first utilities to engage in the online marketplace and rebate offering for smart EV chargers. All our activities are based around seeding the market, both on residential and commercial, with smart enabled chargers.

We want to have the ability to access any potential future program offerings, or optimization, with those charging systems down the road as an industry, which is rapidly changing daily, if not hourly.

We realize it's an open market, it's a changing market, so we want to remain flexible and adaptable, as things play out. If customers purchase their charger at the dealership or other retail locations, SRP partnered with Qmerit, an industry expert in the installation of residential and commercial EV chargers.

We know a challenge for many residential customers is, "I've bought the device now, but I don't regularly work with an electrician, what's the process to getting it installed?" Qmerit is recognized by the majority of auto manufacturers, and we wanted to figure out a way we could complement the auto manufacturer's partnership with Qmerit, but also find a route that works well for our customers.

Residential customers can now receive an SRP rebate for a smart charger device and experience a streamlined process with Qmerit for receiving cost quotes and scheduling installation of their home charging unit.



We are looking at ways to support additional training because workforce development is going to be a greater need, especially with the Inflation Reduction Act funding becoming available to customers. Our trade allies are looking for qualified workforces.

– Terry Rother

On the commercial side, SRP's Business EV Charger Rebate program is an umbrella for our approach and it's open to any of our commercial customers, restaurants, workplace charging, et cetera.

For certain segments of non-profits, schools, multifamily, cities, and municipalities, we have an additional rebate to help support some infrastructure costs.

We also have our fleet-charging program, deployed about a year and a half ago, where we started engaging with our large fleet

short. That is a coalition of many organizations and includes SRP, the Cities of Phoenix, Tempe, and Mesa, as well as Arizona State and others.

A couple of NGOs are part of that also, with the collective effort of how that ecosystem helps advance and promote EV adoption and transportation electrification in the valley. We are working with a number of leading consultants on different parts of planning and preparation.

operators on how they transition their fleets to electric. We look at everything that comes with that: charging, infrastructure, timing of vehicles, and the availability of models.

Burrell Kilmer: We've not gone down the path of wanting to own and operate or develop our own charging sites. What we've wanted to do was let the market take care of that, and instead worked to support the market development.

We want to help residential and commercial customers, as well as municipalities, putting in charging for their fleets. We want to help the market evolve by removing barriers and providing financial incentives where needed.

PUF: What groups are you working with, like NGOs and OEMs? What kinds of partnerships are you using?

Burrell Kilmer: The short answer is we're working with everybody and anybody. There're so many dimensions. One significant industry push that we're involved with is EPRI's Electric Vehicles to Scale 2030 (EVs2Scale2030) program.

We're working with the Large Public Power Council. They formed an eMobility Task Force.

The Peak Load Management Alliance is looking at how EV charging can be used as a demand side resource. We're plugged into that. It's hard to find an industry effort related to EVs and how to deal with the load that we're not involved in.

Closer to home, we formed a group we call the Transportation Electrification Activator, or TE Activator for

Terry Rother: My job revolves around the development and deployment of the programs out to our customer base. That involves associating ourselves with trade allies, electricians, manufacturers like ChargePoint, Blink, Enel X, and others. We're engaged in developing direct relationships with many trade organizations locally and our trade contractors.

We are looking at ways to support additional training because workforce development is going to be a greater need, especially with the Inflation Reduction Act funding becoming available to customers. Our trade allies are looking for qualified workforces.

We are also working with our local dealerships on how you talk to customers about EVs and educate on how they'll engage with their electric utility afterward.

PUF: With the tsunami of data that's coming, how do you plan to detect and track EV adoption and usage, with data analytics perhaps, across the utility service territory, geographically, and time of day?

Terry Rother: If you have the silver bullet that would be a big help. The biggest challenge is there are so many points of data owned by different entities.

When we have our residential customers buying a new vehicle, we may or may not know that they bought an EV. We're trying to figure out ways we can get registration data through our Department of Transportation, but that's a trickier task as there're all sorts of data security issues.

Then from the program development side, once we start doing rebate programs and engaging with customers, we know which customers are putting chargers at their locations. The next challenge is working with the various manufacturers, ChargePoints, Enel Xs, and others to get the data, as everyone has a different process.

Soon more vehicles will have telematics. You'll get the data directly from the car via a cloud-supported app and API.

We're all trying to figure out what does that world look like? What is the data going to tell us?



We would like to know where EVs are charging so we can understand grid impacts, and our distribution planning folks are interested in a lot of data. Our load forecasters would love to have insight into all the charging use cases and how much charging will be done at work, home, public.

– Burrell Kilmer

Yes, we can look at our metering data, and make some analysis from that. But that's a big challenge for the utility industry on how do we get our hands around all this data and how can we best utilize that data?

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Idaho National Lab on Distributed Energy

Conversation with Idaho National Laboratory Project Manager
Kurt Myers



here is a functional microgrid at Idaho National Laboratory that is unique in many ways. Dubbed the Microgrid in a Box, it can tie into the electrical grid and coordinate distribution of electricity for a military base, its first intended use, or a small village, or be moved for disaster relief, or has flexibility to manage electricity generation from sources including solar, wind, nuclear, or diesel generators while offering grid services options.

The creators of Microgrid in a Box have loftier goals, to make the grid smarter, as its combination of batteries, inverters, and technology aim to provide ancillary services to the grid, in addition to blackstart and frequency regulation capabilities. That will allow utilities to handle more of the two-way flows and variable generation associated with distributed generation and electric vehicles.

It's complicated and to explain how Microgrid in a Box works, Public Utilities Fortnightly went to the authority and Idaho National Labs Group Lead of Distributed Energy and Grid Systems Integration Kurt Myers. Listen and learn.

PUF's Paul Kjellander: What is your role at Idaho National Laboratory, and what is Microgrid in a Box?

Kurt Myers: I am a Group Lead of Distributed Energy and Grid Systems Integration. In terms of the RAPID - Microgrid, the short name for it is Microgrid in a Box. The long name for RAPID Microgrid in a Box is that RAPID stands for Relocatable/Resiliency, Alternative Power Improvement for Distribution.

PUF: What are you looking at with it? What's it supposed to do?

Kurt Myers: Microgrid in a Box is comprised of grid forming smart inverters, batteries, and microgrid control systems. They're microgrid inverters that work with battery storage. Of course, they can work with solar PV as well or other forms of DC generation.

It includes inverters, battery storage, microgrid controls, shore power auxiliary power provisions, and the control power derivation and systems. We can derive power from both external or internal. We have a shore power converter inside the system.

The way this system was developed and designed was in conjunction with several of our military customers, angled toward their applications, but it's usable beyond their applications. In normal utility distribution space, industrial and commercial applications, disaster relief, it can be used for lots of different things.

PUF: What does it look like?

Kurt Myers: Microgrid in a Box is primarily housed in a twenty-foot shipping container on a flatbed trailer. It contains the grid connect and islanding switchgear for a four-hundred-amp system.

We wanted to make it big enough to be able to carry a sizable building or set of loads on the load port, with some UPS system functionalities, but also possess other advanced functions of microgrid and utility grid storage systems.

PUF: Are there multiple options as far as where it can be plugged in?

Kurt Myers: Yes, it can be plugged in just about anywhere. You would need a step-up transformer for the utility connection. Normally, to try to serve a building with it, but also have it tied to distribution, you'd be between the utility distribution trans-

We have plans for this Microgrid in a Box to integrate in a demonstration test with the MARVEL microreactor that's in development now. It should be in manufacturing here shortly.

former and the building. So, you'd intercept the main service going into the building.

PUF: What are potential utilizations for this beyond Department of Defense, which fit more into a utility system, the existing grid?

Kurt Myers: You could move away from the internal smaller switch gear, do an external switch gear, and then parallel and

stack a bunch of these together to get to larger power levels, and utilities are doing that. It just becomes more complicated on the electrical infrastructure side, but that's doable.

We're envisioning multiples of these being distributed around, say a utility distribution system on a military base, where there is a distribution system tying into multiple feeders around the base. You would have these on individual critical buildings in between service transformers in the building.

These could work together with a distribution management and control system, and multiples of these could be scattered around and used not just for building service. So, not only for the customer side of the meter, but also for the broader benefit of the whole distribution system.

PUF: What kind of power output do you get out of one box?

Kurt Myers: This box now is two hundred fifty kilowatts. It can surge to three hundred kilowatts for about thirty seconds or so and has three hundred twenty kilowatt-hours of battery storage.

These are lithium iron phosphate batteries. We wanted a higher cycle life and better safety profile for military applications.

By putting in NMC lithium chemistry, a little more energy dense and switching the inverter types, it could go up to five hundred kilowatts and a bit more energy content, six hundred

Ribbon-cutting ceremony for Microgrid in a Box for Fall River Electric Cooperative black start demonstration project at run-of-the-river hydro plant. From left, Fall River Rural Electric Co-op Manager of IT Services Shannon Hill, DOE Office of Energy Efficiency & Renewable Energy Acting Ass't. Secretary Alejandro Moreno, Idaho National Laboratory Director John Wagner.



It can be plugged in just about anywhere. You would need a step-up transformer for the utility connection. Normally, to try to serve a building with it, but also have it tied to distribution, you'd be between the utility distribution transformer and the building.

kilowatt-hours or more. Those are the typical ranges for one, twenty-foot container, in the two hundred-fifty to five-hundred-kilowatt size range.

PUF: You connect one to a distribution system and plug in some type of spinning generating resource. What are options for generating resources?

Kurt Myers: We can accept different kinds of generation sources that go through inverters. We have a generator port where we can connect to synchronous generators and then the grid port.

We can connect to synchronous generators over the grid port or over the generator port.

Then inverter-based generation resources, we can connect behind those two ports within the system. That's on the load ports or within the main bus in the system. Almost any kind of generation resource would fit.

PUF: Idaho National Lab is known as the nation's premier nuclear lab. Where does this fit in to that going forward?

Kurt Myers: We have plans for this Microgrid in a Box to integrate in a demonstration test with the MARVEL microreactor that's in development now. It should be in manufacturing here shortly.

We're anticipating getting that constructed and starting to be fueled and initial testing within a year and a half to two years from now. We plan to use the Microgrid in a Box to demonstrate a nuclear, solar, wind, battery storage, electric vehicle loads, data center load-type of a microgrid system, including the overall system controls.

PUF: The MARVEL system is a hundred-kilowatt, tiny microreactor.

Kurt Myers: Right, it's a hundred kilowatts thermal. So, the electrical output's going to be more along the lines of twenty kilowatts going through sterling generators.

PUF: How long does it take to install and move around the Microgrid in a Box?

Kurt Myers: It's quick. We deployed it recently in the Fall

River Electric service territory in conjunction with a run-of-the-river hydro plant. We disconnected it on a Friday afternoon the week before, hauled it up there that Monday morning and we had it connected into the system and ready to go by Monday afternoon.

You're looking at half a day or so. As you do more of this, you can probably speed up that time. Generally, it only takes one or two people to stage the system and operate it.

PUF: Do you envision Microgrid in a Box as helping restore service after a storm going forward?

Kurt Myers: It could. Using systems like this combined with other distributed energy systems. What we're envisioning are microgrid technologies and capabilities extended beyond what are in the market right now, which are mainly focused on the customer side of the meter.

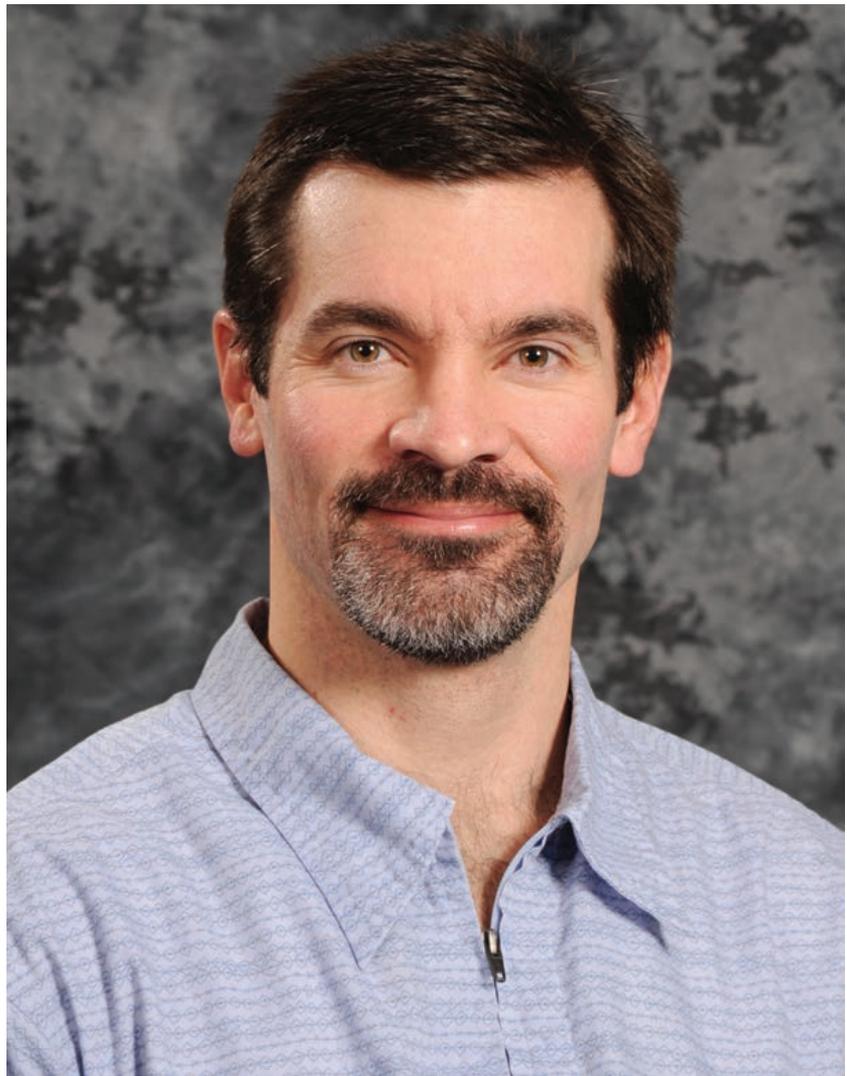
We view that as going to be a growing issue as we get more distributed solar and other generation resources across the distribution system. Then we integrate in electric vehicles and those load changes, along with heat pump systems for water heating and heating and cooling, and grid system management becomes increasingly challenged.

We're going to have a lot of changes on the load profiles and two-way flows on distribution systems. We're going to need systems like this mixed in with those other new generation and load assets to help manage the distribution system.

We're working toward control system advancements, communications, and linkages between utility distribution management and transmission management systems to get these advanced as additional, highly controllable assets. Right now, utilities typically issue basic AGC commands to the different generators on the system to speed up or slow down to help manage frequency on the system.

You can do that in a much more advanced way with these distributed systems, as well as do voltage regulation services. At the same time, you're energy shifting. I'm trying to take that midday solar, store it, and shift it to the evening peak, while also doing other grid services at the same time.

We need to have the controls that are doing multiple things



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at once and interacting with the utility distribution management and control systems, so they can receive updated set points over time, like we do with AGC, but a lot faster and with more system information and resolution, to help them regulate flows and voltages on the system.

PUF: You've taken it from the lab bench into the real world. You did a demonstration project recently with a nearby co-op.

Kurt Myers: Yes. Fall River Electric Co-op. That was to demonstrate a black start with a run-the-river hydro plant and then coupling with a Microgrid in a Box. It demonstrated



Idaho National Laboratory's Kurt Myers inside the Microgrid in a Box explaining its technology.

functionality similar to a grid-forming inverter system or a very fast frequency-watt type of control system to help provide frequency stability in that black start island grid in conjunction with the run-the-river hydro.

That was the first time they've ever demonstrated ability to black start that hydro plant. It was designed to run grid-tied with a bulk power grid. We had to do a lot of work with the utility and project partners to bypass a lot of the typical protections, trip points, and settings to enable that to happen. Then couple up the fast response energy storage to help provide more stability into the system.

PUF: It sounds like you learned a lot in this first demonstration. What more do you want to learn?

Kurt Myers: There were challenges with some of the equipment, the rented transformer trying to connect portions of the system together along with inrush issues and some of the protection components.

As I told the team, "When you do these kinds of things you need to do it two or three times to get everything done that you wanted to do." So, we got a long way down the road, but there is still more to test and demonstrate.

We have tested the capabilities of providing that frequency

regulation service in the lab with our grid emulation system. We simulated the response of certain hydro generation systems and then had the Microgrid in a Box inject and absorb power to cancel out the oscillations. We're confident it works well. We need to get the rest of the things fully connected to do it in the real world.

PUF: How does this technology find its way into the real world and who is going to take this forward?

Kurt Myers: There is a lot of industry interest in what we're doing. We're talking to a lot of potential collaboration and development partners. We go through patent, invention disclosure, copyright, and licensing processes on a lot of these aspects.

We've been developing some custom control programs because these systems come in off the shelf from market offerings, and we've never found an inverter that has all the control modes and operates in all the ways we want it to, so almost every time we have to develop some custom control algorithm and code to operate that inverter the way we want to. It's getting those patented or in licensable type formats.

Then we can go out and form cooperative research agreements or other kinds of strategic partnership projects with industry partners, and work with them to advance capabilities

even farther. Then they can utilize license agreements and turn them into marketable products.

PUF: You've got that first-of-a-kind tech cost, which is always enormous, and then you work your way to that nth-of-a-kind cost. Where does this land from beginning to ready for market?

Kurt Myers: There are a few systems starting to come into the market now that have some similarities to it. They're not packaged or integrated in the same way and don't have all of the same functional requirements that this one did for the military.

This one's able to switch between fifty and sixty hertz grids and everything is contained within the container footprint. There're some in the market that are on a custom trailer or have stuff hanging outside the shipping container box that you would have to remove and put a blank plate over it to enable you to put it on a cargo container and ship it overseas.

This one was designed so you wouldn't have to do all that de-integration and re-integration work. You can slide the air conditioners in, unhook your grid connections, close the doors, lock it, put it on a cargo container and ship it overseas or wherever you want to ship it.

In terms of cost, it's comparable to what is in the market now. Probably slightly more expensive because of some of the custom features like that switchable frequency and a couple of other things.

The other big difference is in the advanced controls we've been developing that weren't in the microgrid controller, which accompanies the system or the inverters themselves. They have some versions of the needed functions, or they are slightly different versions that just don't do what we need them to do.

We want to be able to change set points on the fly. Just like an AGC command, the utility issues that command and the generators respond, we want to be able to move our set points and respond when we get to that point with utilities. We want to be able to change set points while it's running, not have to shut it off, change set points, and then turn it back on.

That on/off approach is not going to work in lot of cases. We need to perform changes while systems are running, and we need to be able to do multiple stacked use cases at the same time.

That's another big issue with a lot of the devices currently in

the market, where you can set it, run it in a particular mode, but it's only in that mode and it's hard to do these other things at the same time or with the resolution or capability needed.

PUF: As you dream about this technology moving forward, what would you like to see it capable of doing? Where do you see it going?

Kurt Myers: I'd like to see us work further with utilities and industry to develop comprehensive systems that are able to work together with distribution management systems, so we're not just using tap changers, switched capacitor banks, and voltage regulators that leads to exercising those up and down, up and down, and wearing them out when system flows are highly variable.

We're going to have a lot of changes on the load profiles and two-way flows on distribution systems. We're going to need systems like this mixed in with those other new generation and load assets to help manage the distribution system.

Or they're not fast enough to respond to the quick changes from solar production output or a bunch of people coming home and plugging in their electric vehicles at the same time. So, helping to be part of the management and control of the whole system.

PUF: You envision Microgrid in a Box as perhaps being permanently located within a distribution system as well as moved around within it?

Kurt Myers: Yes. Some could be permanently located; other ones could be relocatable like this one because optimal locations are probably going to change over time. Right now, it's good to have it at one location, but maybe in a few years more variability has come onto this other feeder and it's going to be better to move it over there. **PUF**

Fusion Center Cybersecurity

Conversation with Kansas Deputy Homeland Security Advisor
Dave Young



Fusion Centers are state-owned and operated centers that serve as focal points in states and major urban areas for the receipt, analysis, gathering, and sharing of threat-related information among state, local, Tribal and territorial, federal, and private sector partners. The national network of Fusion Centers brings critical context and value to Homeland Security and Law Enforcement via the sharing of information.

The Kansas Intelligence Fusion Center was established in 2009 as a joint endeavor between the Kansas Attorney General's Office and the Adjutant General's Department. Its mission is to generate intelligence analysis critical for homeland security policy and relevant threat warning to protect life, liberty, and property in Kansas and the Great Plains region.

Public Utilities Fortnightly spoke with intelligence expert Dave Young, who wears two hats at the Kansas Fusion Center, as to why the energy sector is an important part of the work done by State Fusion Centers. Enjoy this conversation.

PUF's Steve Mitnick: AI is going to be replacing a lot of jobs, but not yours. Talk about what you do.

Dave Young: I'm dual hatted. My first hat is Deputy Homeland Security Advisor for Kansas. In Kansas, the Homeland Security Advisor is the Kansas Adjutant General, who is also in charge of the Kansas National Guard and the Kansas Division of Emergency.

My second hat is the Executive Director of the Kansas Intelligence Fusion Center. There are around eighty Fusion Centers across the country. Every state has one, and some larger cities have them as well, although Kansas' is a unique design.

PUF: Talk about what a Fusion Center is.

Dave Young: After 9/11, there was a lot of thought about intelligence sharing across agency lines, and one of the core questions was: "How do we eliminate some of those information silos that every agency has? How do we make sure that we are sharing what we can to identify concerns, with information that probably spans bureaucratic boundaries?"

The core idea of fusion is the combination of information from a variety of agencies and disciplines. In Kansas, the focus is a multi-agency, multidiscipline approach.

Traditional models of intelligence heavily focus on military or law enforcement. We approach it from a broader viewpoint, integrating subject matter experts from many different fields, such as agriculture, health, transportation, information technology, and critical infrastructure, as well as law enforcement. That has allowed us to find links or commonality of threats and defenses affecting all stakeholders.

PUF: Including energy and utilities?

Dave Young: Absolutely. The energy sector was our first go-to when we stood our center up. Energy is the lifeblood of civilization. Without a consistent dependable power infrastructure, other infrastructure is at risk. So, the energy sector is and will always be a core focus.

PUF: What is the Kansas Fusion Center? What does it look like?

Dave Young: A lot different than what people think of or see in movies. Think of a cube farm full of analysts who describe themselves as nerds. They are extraordinarily talented analysts

All Fusion Centers have access to relevant threat information that gets pushed out by the federal government, so I would highly encourage every utility to reach out to their Fusion Centers and see if there are ways they could partner with them on physical and cyber threats, if they aren't doing so already.

with impressive backgrounds who love doing research, digging into problems, and seeing what they can discover.

We have a conference room where we can bring in stakeholders from partner agencies or companies and senior government leaders for briefs and discussions. The Center is heavily compartmentalized and has no windows.

PUF: What should folks in the Public Utilities Fortnightly community, whether utilities, regulators, or companies that work with utilities, know about their Fusion Centers, what they do, and how to relate to them?

Dave Young: Again, the Kansas model is different from the other Fusion Centers in that we have total inclusion of many of our private sector partners, and we view that as a best practice that results in a much more economically sustainable model. We bring in experts and they can help us think through problems faced by the nation's critical infrastructure owners/operators. This really works well, because of our shared goal of understanding and addressing these threats.

With that said, all Fusion Centers have access to relevant threat information that gets pushed out by the federal government, so I would highly encourage every utility to reach out to their Fusion Centers and see if there are ways they could partner with them on physical and cyber threats, if they aren't doing so already.



By including our owners/operators of critical infrastructure into the analytical process, we build trust with them and can develop more effective solutions or approaches. We bring threat data to the table, and they bring critical vulnerability data. Together, we get a solid risk assessment.

We believe that having our partners cleared and embedded with us allows for a much deeper partnership with them. They know their systems far better than we ever will, so when something concerning comes up, we can immediately utilize their deep knowledge to help assess the risk.

PUF: Threats are increasing and becoming more sophisticated. Does that mean what you do at the Fusion Center and how you work with utilities and private sector partners, is it changing?

Dave Young: Yes. There's a growing awareness of increased geopolitical tension, and an even deeper awakening to the vulnerabilities of a lot of key systems and networks we all depend on.

No matter the defensive efforts, you'll always find vulnerabilities in any system. So, our job is to help quickly identify the most concerning issues, so that we can effectively address them.

By including our owners/operators of critical infrastructure into the analytical process, we build trust with them and can develop more effective solutions or approaches. We bring threat data to the table, and they bring critical vulnerability data. Together, we get a solid risk assessment.

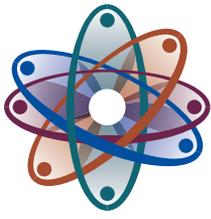
We like this because we get as much out of the partnership as they do, and collectively, we can better safeguard critical infrastructure while keeping people, property, privacy, and civil liberties protected.

PUF: What will the Fusion Center be like, three, four, five years from now?

Dave Young: We discuss this all the time. We ask ourselves "How are we aligned with the emergent threats or concerns that are out there? How can we be more effective in helping leaders and policymakers navigate challenges?" and perhaps most importantly, "What are we missing?"

We know that emergent technologies will shake things up considerably, so we continually ask things like "How will artificial intelligence affect cyber threats and malware development? How will that impact critical infrastructure and our ability to detect threats? What will the indicators look like? Are our state systems and strategies adequate? How do our day-to-day operations need to adapt? How will synthetic biology and other disruptive biotechnologies affect agriculture? What will be the ripple effects on other biosciences, research, and commerce? Where is this all going, and what do we need to do to prepare?"

Whatever anyone thinks of emerging technologies like artificial intelligence, there is little doubt that countries, industries, and institutions will utilize them. A key part of our job is to try and figure out the unseen opportunities and concerns as they do. And as we identify these opportunities and concerns, our focus is to not only help our specific partners, but the entire sector that they are a part of. **PUF**



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Harnessing AI and Computational Speed

The Clean Energy Transition

BY EEI SENIOR VICE PRESIDENT LAWRENCE JONES

What the clean energy transition entails and how it unfolds globally is based on the local context and the operating environment in each region. However, energy security, affordability, resilience, reliability, and electrification across the economy are top of mind around the world.

Artificial intelligence (AI), advances in computational speed, and algorithms can help support the clean energy transition. Our industry is moving toward a greater understanding and utilization of these new technological capabilities that are already impacting our clean energy pathways.

Why will AI and computational analysis be helpful in the current moment? We are in an era of uncertainty and increased complexity. Regions across the world are trying to mitigate similar challenges we face, from geopolitical disruptions to extreme weather events to the fast pace of technological change.

The benefit of these technologies is their capability to analyze large volumes of data and to model increased levels of complexity and scale quickly, providing decision makers with more granular insights to help solve today's most pressing issues that are shaping the energy future.

AI has its limits, and it is important we work to understand them. The clean energy transition will require an array of emerging technologies and their integration into our systems, and AI is only a part of this equation.

Innovations in clean energy solutions across the electricity supply chain are paving the way toward a cleaner future. No technology will enable the clean energy transition on its own. It is the integration and scaling up of all these technologies that are pushing the transition forward.

Many researchers in the field agree that AI cannot replace human ingenuity and our ability to solve problems that require complex decision making. Recall the quote by Warren Buffet earlier this year when asked on AI, "I think old-fashioned intelligence works pretty well."

Instead of asking how AI can compete with humans, we can ask how we might synergize both kinds of intelligence. Bringing together human ingenuity with the speed and processing power of AI is changing how we work.

Generative AI and large language models in particular are facilitating processes across our industry and allowing workers to reallocate their time to other tasks. These technologies have the potential to increase productivity and decrease burnout by curtailing routine tasks for workers.

Artificial intelligence (AI), advances in computational speed, and algorithms can help support the clean energy transition. Our industry is moving toward a greater understanding and utilization of these new technological capabilities that are already impacting our clean energy pathways.

As an industry, we should focus on what this means for the future of work. AI and computational advancements are complex systems with new challenges and opportunities for our global industry.

Computational Advancements in Responding to Extreme Weather

EEI's member companies in the United States and around the world have made significant efforts to advance the clean energy transition while continuing to prioritize reliability and affordability for customers.

As increasingly frequent extreme weather events drive a collective sense

■ **Lawrence Jones** is Senior Vice President of EEI International Programs.

of urgency, electric companies are deploying strategies to reduce carbon emissions and help maintain grid reliability to ensure a smooth energy transition. This is where advancements in AI can prove their value.

AI and digitalization are helping EEI members bridge the gap between the technologies of today and those of tomorrow. The predictive capabilities of AI have the potential to create ripple effects of changes across the electricity value chain – from grid planning and operations to system recovery and more.

With advanced computation, electric companies can quickly analyze multiple scenarios from massive databases. Think about the technology's implications for accelerated learning across our industry. Analytics can quickly be utilized by grid operators, engineers, business leaders, and other key stakeholders to generate more salient insights for timely decision making.

As our workforce changes and we see new generations of workers coming into our industry, our knowledge base is changing. How do we transition from established knowledge bases to those of the future?

The digital cloud can help us capture historical and current knowledge from our existing workforce to better train future workers. Learning from experience is made more efficient when we can extrapolate from these large databases and use predictive capabilities to help inform discussions on the myriad and complex challenges in front of us.

Across the globe, EEI members are investing in the creation of digital twins for their existing grids. These virtual models help workers design and test solutions that anticipate future challenges by drawing on past lessons. Coupling these digital twins with AI, high-speed computing,

and advanced analytics allows us to not only explore multiple scenarios at once but also analyze them so we have more information to help respond to real-world scenarios.

As discussed in our previous column, extreme weather is becoming part of the new normal. Computational advancements in climate modeling and environmental impact analysis help mitigate the effects of these events through predictive capabilities that strengthen resilience by improving planning and emergency response.

As increasingly frequent extreme weather events drive a collective sense of urgency; electric companies are deploying strategies to reduce carbon emissions and help maintain grid reliability to ensure a smooth energy transition. This is where advancements in AI can prove their value.

Using pattern-driven innovation, AI can help create early warning systems for mitigating extreme weather events. These technologies have the potential to enable workers to assess multiple scenarios, accelerating informed decision-making on the frontlines.

New Challenges, New Opportunities

AI will have social and economic impacts across several sectors. Concerns about data privacy, transparency, and algorithmic bias require a holistic approach to manage these data-driven technologies responsibly.

The creation of responsible frameworks will allow us to offset the challenges that AI creates. Increasingly, decision makers across the electricity value chain are considering how advancements in computational and predictive capabilities will impact their companies.

Because of the speed of breakthroughs in this field, it is important

we anticipate the changes that AI will bring to our future. Doing so will enable us to manage risk, bolster transparency, as well as protect privacy and security.

As companies integrate AI into business processes, governance structures will change to ensure that regulatory, financial, and ethical practices are maintained. With engaged human oversight over implementation, the challenges that AI brings can lead us to new opportunities.

Consider how algorithmic bias in

AI can turn from a challenge to an opportunity. We are in control of the inputs for the models we use. The decisions we make as we create and use our programs can result in systematically biased algorithms, sometimes a reflection of human biases. Upon the implementation of responsible AI that accounts for bias, we are presented with new opportunities to augment human decision-making in fields ranging from human resources to renewable energy integration.

Regulators and policymakers are also realizing the potential that these emerging technologies have in reshaping public policy and regulatory approaches. For example, AI's predictive capabilities and ability to analyze multiple scenarios could help accelerate the permitting and siting processes with greater accuracy.

In June, I sat down with Dr. Erica Thompson, statistician at Oxford University and the author of

“Escape from Model Land,” to learn how to better understand the models we are using and navigate our biases. The insights she provides are critical, suggesting we look out for blind spots and assumptions on the data we use every day as we venture to harness AI and computational advances for the energy transition. Our webinar with Dr.

Thompson is free and available on our YouTube channel, @EEIInternational.

Sharing Best Practices Globally

At EEI International Programs, we provide digital and in-person platforms for energy leaders around the world to discuss the critical issues of today. As we move toward a clean energy transition,

it is critical that we share global best practices including innovations in the fields of digitalization, AI, and computational analysis. We encourage you to keep the conversation going. To access to all our webinars, videos, articles, and more, please visit our all-new Engagement Hub available here: bit.ly/EEI-INTL-HUB 

A Legacy of Industry Leadership

(Cont. from p. 94)

technologies and data analytics, transitional project planning and asset management, renewables, electrification, and flexibility and resiliency.

Our annual meeting format is still very much designed to facilitate that “interchange of views and experiences” Edison set out to achieve. The senior executives and operational leaders who participate in our annual meeting are not there to speechify but, rather, to share perspectives and learn from each other.

“It’s instant benchmarking, the ability to be able to go up and ask a question and get some instant feedback, something that I can actually take back to my utility,” says Ben Felton, EVP and COO at Portland General Electric and a member of AEIC’s Board of Directors.

We also enter this year’s meeting with a recently approved five-year strategic plan for the association focused on enhancing our operations leadership role in the industry, raising our profile, and increasing value to our members.

We are launching the AEIC Center for Operational Excellence to provide the electricity industry with authoritative information as a basis for decision making on local, state, and federal infrastructure investments.

To achieve this, we are launching the AEIC Center for Operational Excellence to provide the electricity industry with authoritative information as a basis for decision making on local, state, and federal infrastructure investments. We’ll have more details to share on this initiative soon.

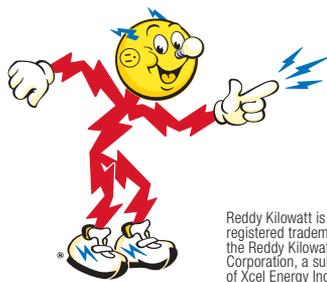
We are also creating new committees focused on emerging issues, adding staff to support our volunteer

committee leaders, increasing member participation and engagement, and enhancing our communications and knowledge-sharing capabilities.

There has never been a more important or exciting time for electric utilities of all sizes to be active members of AEIC. Today’s operational leaders are at the forefront of these dynamic changes in the industry and must be willing to work together and share knowledge to fulfill the promise and potential of grid transformation.

“Now more than ever collaboration is going to be even more needed and even more valuable and AEIC provides a great forum to make that possible,” says Heather Rivard, SVP, Transmission & Distribution at Southern California Edison and AEIC’s Incoming President for 2024. “The groups and companies that are not here, are missing out on a lot of shared knowledge and a lot of collaboration that they could be gaining benefits from if they were an active participant.”

To learn more about AEIC’s annual meeting and membership, visit www.aeic.org. 



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SRP Supercharging EVs

(Cont. from p. 79)

would love to have insight into all the charging use cases and how much charging will be done at work, home, public, to get better at forecasting loads.

In some respects, the challenge is there're all these disparate use cases. There're some intersections of what data is needed to make it all happen. There aren't clear solutions that conquer all that.

There're a lot of new vendor offerings to deal with parts of this. Which ones will be more niche solutions or enterprise platforms we can build around is a little fuzzy. We're exploring the emerging vendor landscape dealing with all this.

We know it's a problem, but we're trying to look at what's the business need for it and focus on what's important. We've not solved that yet.

We know it will become critically important in the future. It's on our radar screen, but we don't have all the answers.

PUF: Where is your program going to be, say, in three to four years?

Terry Rother: A lot of our programs have been developed to support customers being able to install charging, understand it, be educated about the basics, and dispel some of the myths, like range anxiety.

In the next three to five years, we're going to see quite a few advancements. We're going to see more vehicle to home, but it's going to be vehicle-to-grid also called V2G. We're going to see a lot more interactions in that, both commercial and residential. The relationship between customer and utility is going to come closer together once we get to the V2G world.

It's almost going to be a partnership with our customers in how they use their chargers and batteries at their homes. When do they charge, when do they support activities? That's where I see things going. I don't know if it's utility driving that or the automotive industry trying to create more value for their product.

Burrell Kilmer: I think three to five years is going to be a more subtle evolution of what's occurred to date. The interesting question is what's going to be ten to twenty years from now?

Electric vehicle adoption in Arizona has been robust. Depending on what metric you want to use, Arizona ranks in the top ten to fifteen states in EV adoption.

And we have done that without a strong public policy or legislative mandate at a state level. What we do have is an economy and a demographic that gravitates toward and welcomes new technology in EVs.

As Terry said, some of the vehicle to grid stuff is going to start small. I think it's going to be longer term before that. When are

you going to have an impactful virtual power plant we could put our arms around, control as a grid resource, and compensate customers accordingly? Probably not three to five years.

The other thing that I keep an eye on, which has not really taken off yet, is the medium- and heavy-duty trucking sector. That could have significant impacts on emissions, electric loads, and grid impacts for charging.

PUF: That's coming, and they have their 2030 requirements.

Burrell Kilmer: It's coming, and we have the unique situation of not having the mandates but being the next-door neighbor to the state with the biggest mandates. A lot of what happens in California makes its way into Arizona.

One of the challenges as a utility is as deployment of more light-duty electric trucks hits the market, we're going to see more of our commercial customers are smaller fleet operators. That is landscaping companies, small courier outfits, and other smaller fleets that we normally don't have direct engagement with.

– Terry Rother

So, we are trying to understand when and at what pace the uptake in medium- and heavy-duty trucking through the region might occur. In three to five years? Maybe. We're looking at that, trying to understand it and what would be the impact of that?

A lot of freight and goods move through the region, let alone just get distributed within the region. There's a point in the electric vehicle adoption life cycle when that will take off.

That's why I said I'm not sure that fits in a big way in your three-to five-year horizon, but it's going to fit beyond that, and that's when things will heat up and change. It's exciting to see the adoption take off in the region, in the valley, and we want to help our customers be part of that.

Terry Rother: In the next three to five years, Burrell mentioned the medium- and heavy-duty trucks. But one of the challenges as a utility – we're not going to be unique in this aspect – is as the deployment of more light-duty electric trucks hits the market, we're going to see a lot more of our commercial customers are smaller fleet operators. That is landscaping companies, small courier outfits, and other smaller fleets that we normally don't have direct engagement with. **PUF**

A Legacy of Industry Leadership

139th Annual Meeting

BY AEIC CEO STEVE HAUSER

Since 1885, leaders in the electric utility industry have been gathering annually as members of AEIC to discuss the issues of the day, share ideas, and build collaborative relationships. Founded by Thomas Edison to guide the growth of his proliferating Edison Illuminating Companies, AEIC originally existed as mainly a company organization but quickly grew to represent the entire electric power industry.

Right from the start, under Edison's leadership, organizers of the association determined to hold annual meetings at which company representatives would engage in an "interchange of opinions." At that first Annual Meeting in 1885, it was announced that the Association sought, "through the interchange of views and experiences, and by comparison and consultation, [to make] the knowledge of one the knowledge of all, to the advantage of their common interests."

This commitment to the exchange of ideas formed the core of the formal statement of purposes: the Association would continue to "elicit all of the information" needed for advancing the "mutual interests" of the member companies.

The minutes of these annual meetings contained the collective thoughts of the industry's leaders. In them were recorded the annual reports and discussions describing the state of technical operations and projecting future developments. "Printed but not published," the title page of each volume proclaimed, since membership was required to receive the documents. This tradition of privacy was, as an AEIC president declared in the 1950s, a "sacred heritage."

As we gather for the 139th time this

month in Savannah, AEIC is still very much guided by our forebearers' vision to work collaboratively, gather information, and exchange ideas to benefit all members.

Jacob Tetlow, Executive Vice President, Operations, at Arizona Public Service Company and a member of AEIC's Board of Directors, describes the annual meeting this way: "It's that forum and that environment where you can engage with your industry peers and have a genuine conversation that is very sincere and very personal. We talk about what really makes us successful or, frankly, challenged in our jobs."

And, while our annual meeting is still a members-only event, with limited access provided to a select group of industry partners, our industry's reach and influence has grown significantly over the years.

AEIC's roster of member companies is now comprised of more than one

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hundred eighty public and private utilities (holding companies and subsidiaries) with operations in all fifty states, D.C., Puerto Rico, the Caribbean, and three Canadian provinces.

"It's really bringing the utilities together so that we can share openly and transparently about actual projects and issues that are occurring in the field," says Elizabeth Cook, Director, Advanced Grid Systems and Grid Modernization Program at Duquesne Light Company and Chair of AEIC's DER Subcommittee.

The discussion topics on this year's agenda are focused on the key dynamics and trends that are creating operational challenges and opportunities for our members including: policies and funding, decarbonization, new

(Cont. on page 92)

Steve Hauser is CEO of the Association of Edison Illuminating Companies.



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