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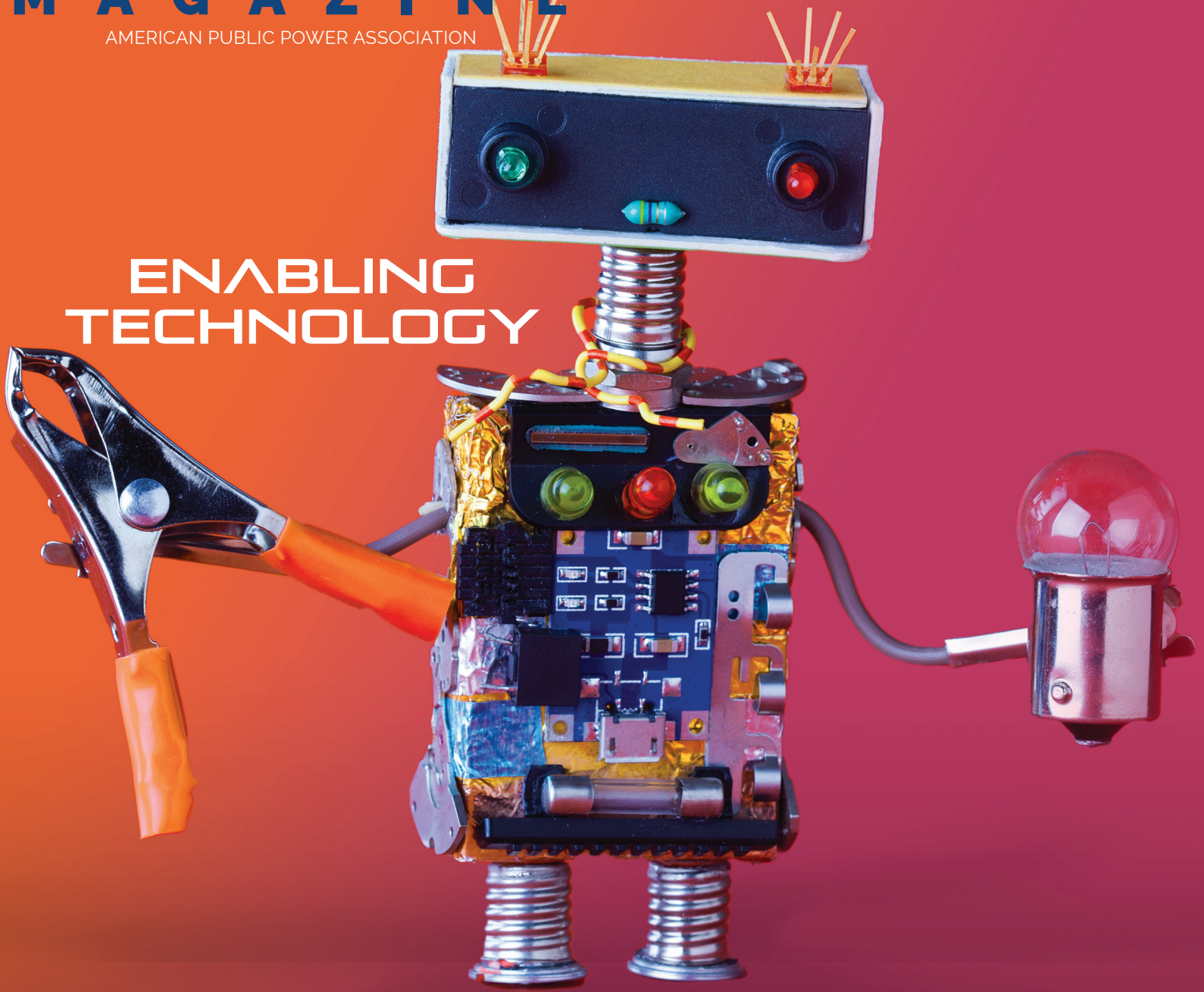
PUBLIC POWER MAGAZINE

AMERICAN PUBLIC POWER ASSOCIATION

ENABLING TECHNOLOGY



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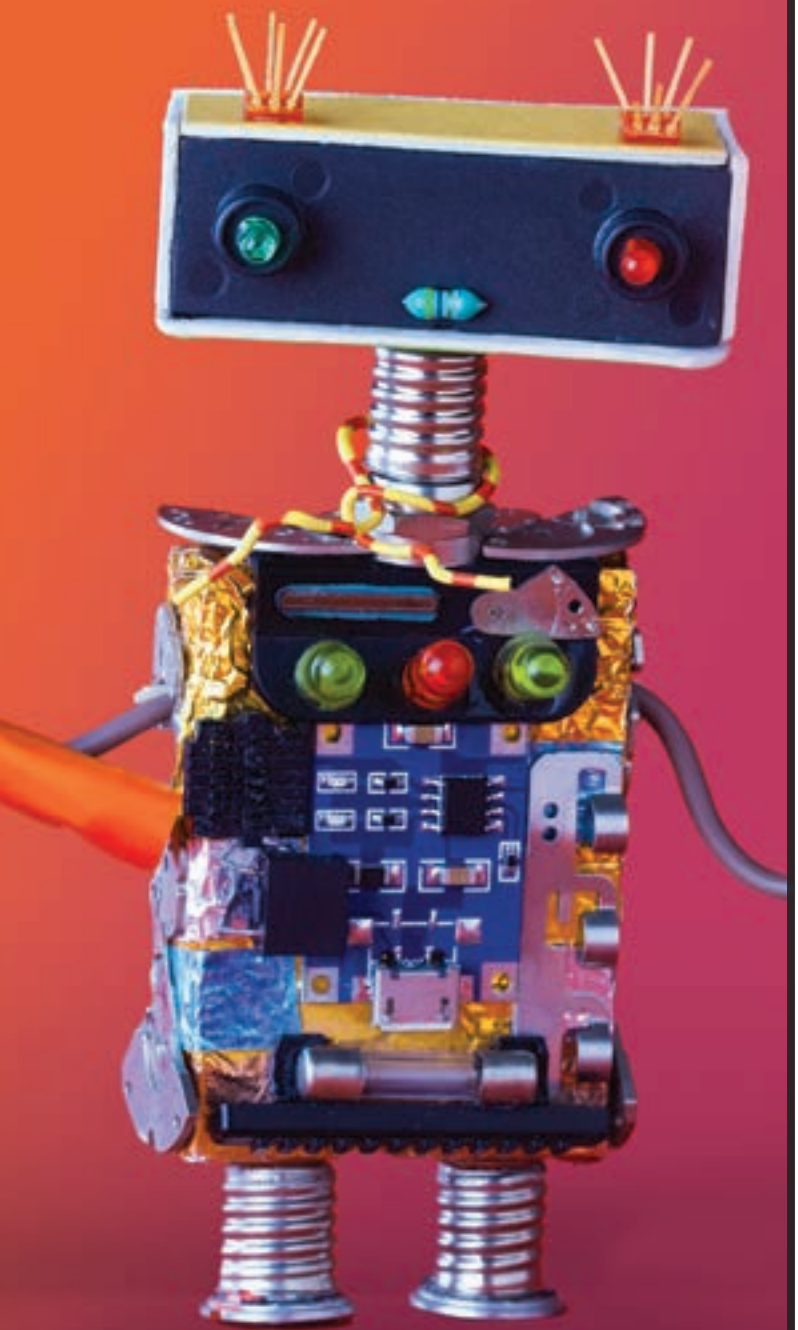

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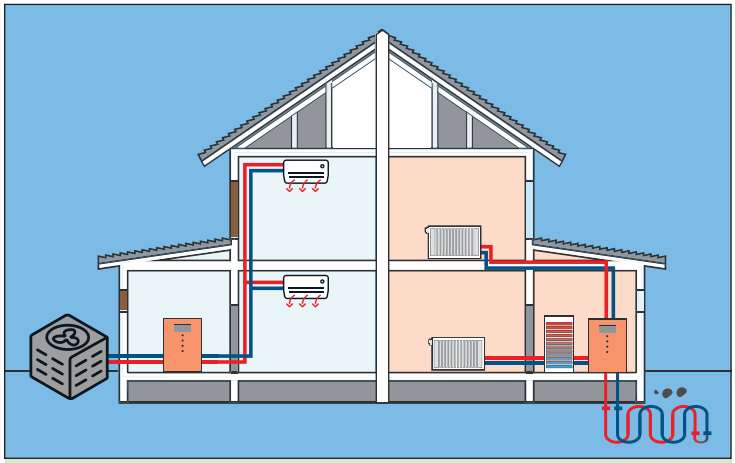

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AMERICAN PUBLIC POWER ASSOCIATION
Powering Strong Communities

ABOUT THE AMERICAN PUBLIC POWER ASSOCIATION

The American Public Power Association is the voice of not-for-profit, community-owned utilities that power 2,000 towns and cities nationwide. We advocate before the federal government to protect the interests of the more than 49 million customers that public power utilities serve, and the 93,000 people they employ. Our association offers expertise on electricity policy, technology, trends, training, and operations. We empower members to strengthen their communities by providing superior service, engaging citizens, and instilling pride in community-owned power.

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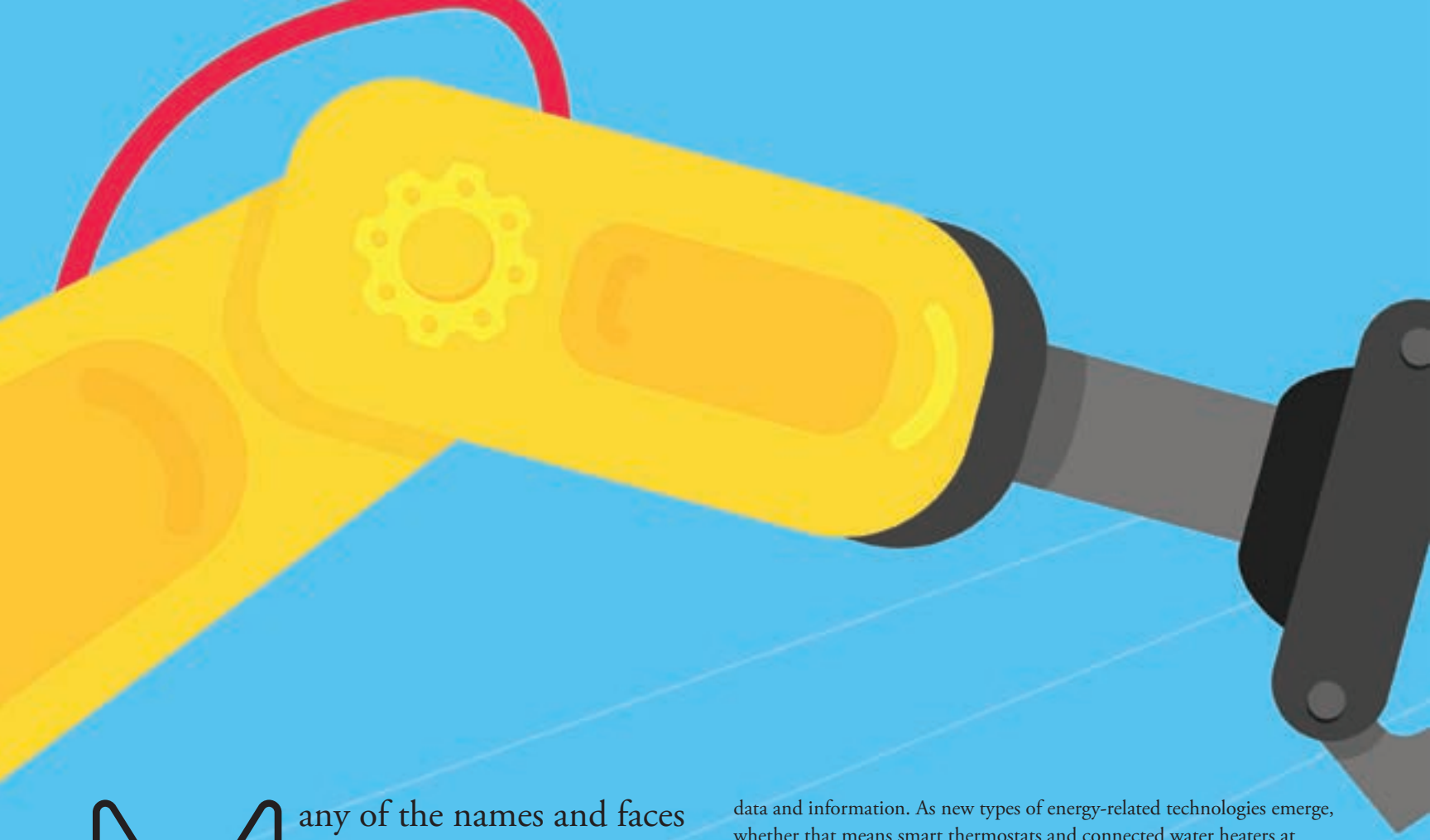


Many of the names and faces working in public power have stayed the same for decades. It is a pleasure to see everyone from year to year at our conferences and other industry events, to know we can rely on long-held partners and vendors to deliver the services and supplies we need, and to join together on advocating for issues of importance.

Yet familiarity can breed contentment with the status quo, which, if unchecked, can result in a hesitance — or even resistance — to change. As the technology we use changes the way we do everything in our personal lives, from how we buy groceries to how we view the menus at restaurants and stay in touch with our friends and families, it also means we have needed to (or still need to) update our utility operations. In our sector, the pace of this change is quick — and the scale immense.

How we communicate with our staff and customers is no longer just about the messages we send out, but how a network of utility technologies — from advanced metering infrastructure to system sensors — relays data and information. As new types of energy-related technologies emerge, whether that means smart thermostats and connected water heaters at customers' homes or utility-scale storage options (see page 28), a utility's technological functions and capabilities will determine how much value such technologies can bring our communities — and whether or not we can support local energy goals (see page 40).

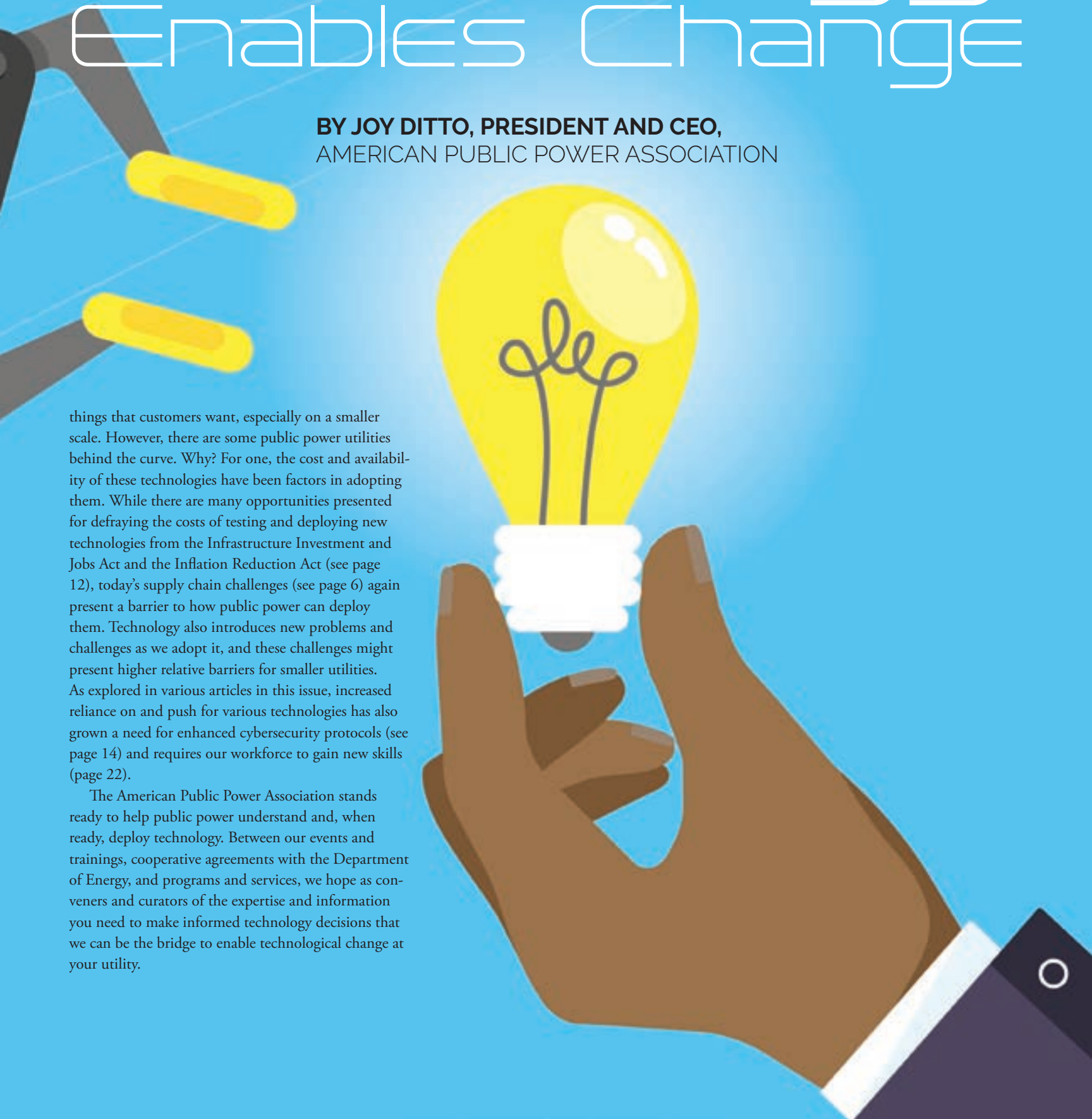
If technology is an enabler, then utilities' adoption of technologies will be the bridge for our communities to change. On a recent podcast, Jeff Lyash, head of the Tennessee Valley Authority, summed it up well: "The difference between aspiration and execution is innovation — it's technology. … If we want to go farther, faster, we need to invest in these technologies and get them at a scale and a cost that can maintain that balance between affordability, reliability, resiliency and clean."

Because of their size vis-à-vis others in the industry, their longevity in the marketplace, or their desire to protect customers from speculative endeavors, public power utilities can sometimes be painted as less innovative, but I would argue against that characterization, especially based on recent history. Looking back even just 10 years ago, the technology central to many utilities' operations today was only just emerging or was nonexistent. Very few utilities had AMI installed (see page 10); only a handful had connected substations and SCADA via broadband networks; battery storage systems were in the early stages or not at utility-scale; and cybersecurity protocols and guidance were not as robust nor particularly sector-specific.

Public power providers have been at the forefront of making all these technologies workable within utility operations, thanks in no small part to Demonstration of Energy and Efficiency Developments, our research and development program (see page 38), as well as a willingness to try

Technology Enables Change

BY JOY DITTO, PRESIDENT AND CEO,
AMERICAN PUBLIC POWER ASSOCIATION



things that customers want, especially on a smaller scale. However, there are some public power utilities behind the curve. Why? For one, the cost and availability of these technologies have been factors in adopting them. While there are many opportunities presented for defraying the costs of testing and deploying new technologies from the Infrastructure Investment and Jobs Act and the Inflation Reduction Act (see page 12), today's supply chain challenges (see page 6) again present a barrier to how public power can deploy them. Technology also introduces new problems and challenges as we adopt it, and these challenges might present higher relative barriers for smaller utilities. As explored in various articles in this issue, increased reliance on and push for various technologies has also grown a need for enhanced cybersecurity protocols (see page 14) and requires our workforce to gain new skills (page 22).

The American Public Power Association stands ready to help public power understand and, when ready, deploy technology. Between our events and trainings, cooperative agreements with the Department of Energy, and programs and services, we hope as conveners and curators of the expertise and information you need to make informed technology decisions that we can be the bridge to enable technological change at your utility.

STALLED TRANSFORMATION: SUPPLY CHAIN WOES LEAVE UTILITIES WAITING FOR NEW TECHNOLOGY

BY STEVE ERNST, CONTRIBUTING WRITER

To meet the clean energy goals set forth by the Biden administration, the U.S. will need to add an estimated 750 million solar panels, 50,000 windmills, 2,000 utility-scale battery storage systems, 32 million electric vehicles, and 380,000 public EV charging ports in the next decade.[1,2] As part of electric grid upgrades and resiliency efforts, utilities will need to continue to install advanced metering infrastructure, with about 30% of utility customers yet to be connected to AMI, and other technologies including sensors and enhanced communications systems.

Many of these technologies rely on similar materials and components that are becoming more difficult — and costly — to obtain. A global slowdown in semiconductor manufacturing, coupled with lingering labor issues from the COVID-19 pandemic and a shipping backlog, have left various industries competing for a limited number of microchips amid a clogged supply chain. This is all on top of the scarce supply of distribution transformers, which are fundamental to keeping the grid modern and reliable – especially amid goals for increased electrification and community growth.

For public power utilities looking to modernize their grids or deploy any new technologies — from AMI to solar panels to battery storage systems — the lack of microchips and other key materials, as well as a swirl of geopolitical unrest, means those deployments may have to wait.

COMPETING FOR CHIPS

The COVID-19 pandemic brought semiconductor manufacturing to a near halt in 2020. As quarantine restrictions started to ease, the Chinese city Shanghai, which is home to some of the world's leading semiconductor manufacturers, went back into lockdown in fall 2021. In March 2021, a cargo ship ran aground in the Suez Canal, blocking a major global shipping artery for nearly one month. The event rippled through the shipping industry, contributing to a backlog of orders that were already delayed by a lack of workers. War then broke out in Europe, energy prices spiked and the world economy started to slip. This means that all utilities and utility vendors are now competing with any industry or technology that uses a microchip.

1. https://www.politifact.com/article/2022/aug/30/reality-check-bidens-renewable-energy-plan/

2. https://getjerry.com/studies/number-of-u-s-ev-charging-ports-will-soon-surpass-gas-stations

AMI is the foundation of the modern grid, allowing utilities to provide remote electric service reconnections, improve outage times and leak detections, and allow for more flexible payment options. It also can allow for giving customers information on their energy consumption in near real-time, along with the ability react to notifications during peak-demand times when the grid is stressed.

SUPPLY AND DEMAND MISMATCH

In December 2022, Snohomish Public Utility District in Washington state planned to begin stockpiling inventory of advanced electronic meters in preparation for installing them across its district starting in January 2023.

The PUD's Connect Up program is an infrastructure and technology improvement project that will install 375,000 new electric and 23,000 water advanced meters at customers' homes and businesses in its 2,200-square-mile territory, located just north of Seattle. However, the utility has only received about 100 meters so far and has been forced to push back its deployment of its Connect Up program until mid-2023.

"The whole supply chain was interrupted. From getting materials, to building components, to assembling the final meter — each step has been impacted by COVID. So, we have a lot of catching up to do," said Kevin Lavering, program manager for Connect Up at Snohomish PUD.

Lavering said the PUD's meter vendor wanted to manufacture more meters to catch up with demand but couldn't access the microchips needed for the AMI components. The microchips in AMI equipment are the same chips that work with cars, computers, and medical devices, and they are in high demand.

The U.S. Department of Commerce reported in January that the median demand for chips was 17% higher in 2021 than 2019, and buyers aren't seeing commensurate increases in the supply. "This is a major supply and demand mismatch," the department said in a press release.

The median inventory of semiconductor products has fallen from 40 days in 2019 to fewer than five days in 2021, the Department of Commerce said. Lavering said its vendor alerted Snohomish PUD at the beginning of 2022 that its supply of chips and other materials needed to manufacture an AMI meter was slowing down.

While it waits for more meters to arrive, Snohomish PUD continued work on two key components of its Connect Up program. Supply chain issues also delayed deploying the network communications equipment needed for the program, but the PUD has over one-third of the 141 Base Stations installed for the project, and Lavering said that piece of the project is on schedule.

The utility is also progressing with the system integration work needed for the AMI program and is testing the system, with the goal of having it ready by the second quarter of 2023.

The PUD now plans to begin installing advanced meters for residential customers in summer 2023 and commercial and industrial meters in fall 2023. In June 2023, the utility hopes to install about 40 advanced meters to begin testing its equipment in various locations around the district. Installation of advanced meters on the homes of PUD water customers should start ramping up July 2023, the PUD said.

SOLAR BACKLOGS

AMI deployments aren't the only new technology that is being impacted by supply chain constraints. Solar power installations are running about 20% behind schedule due to the supply chain and other issues, according to the U.S. Energy Information Administration. Developers had planned to install 17.8 gigawatts of utility-scale solar photovoltaic generating capacity in 2022, according to the EIA's June 2022 Monthly Electric Generator Inventory. However, over the first six months of the year, only 4.2 GW of capacity came online, less than half of what the industry had planned to install, EIA said.

"Our preliminary data from January through June 2022 show that PV solar installations were delayed by an average of 4.4 GW each month, compared with average monthly delays of 2.6 GW during the same period last year," according to the EIA. In most cases, the reported delays are for six months or less, the EIA added.

Although the utility-scale solar deployment reached 17 GW of capacity in 2021, utility-scale additions are expected to fall by 14% this year, thanks to a combination of project cancellations and delays from 2022 to 2023, according to a report by the Solar Energy Industries Association and analysis from the consulting firm Wood Mackenzie. For the 2022 pipeline, developers are said to have postponed at least 8% of planned utility-scale capacity to 2023 or later and canceled at least 5% as supply chains continue to face backlogs and delays, the report said.

As if global breakdown in the supply chain isn't enough to worry about, many utilities developing solar projects are also keeping an eye on the Department of Commerce's investigation into whether Southeast Asian solar manufacturers, which produce about 80% of the solar panels imported into the U.S., are circumventing U.S. tariffs by using prohibited Chinese parts in their solar panel components. The department's investigation is expected to conclude in spring 2023.



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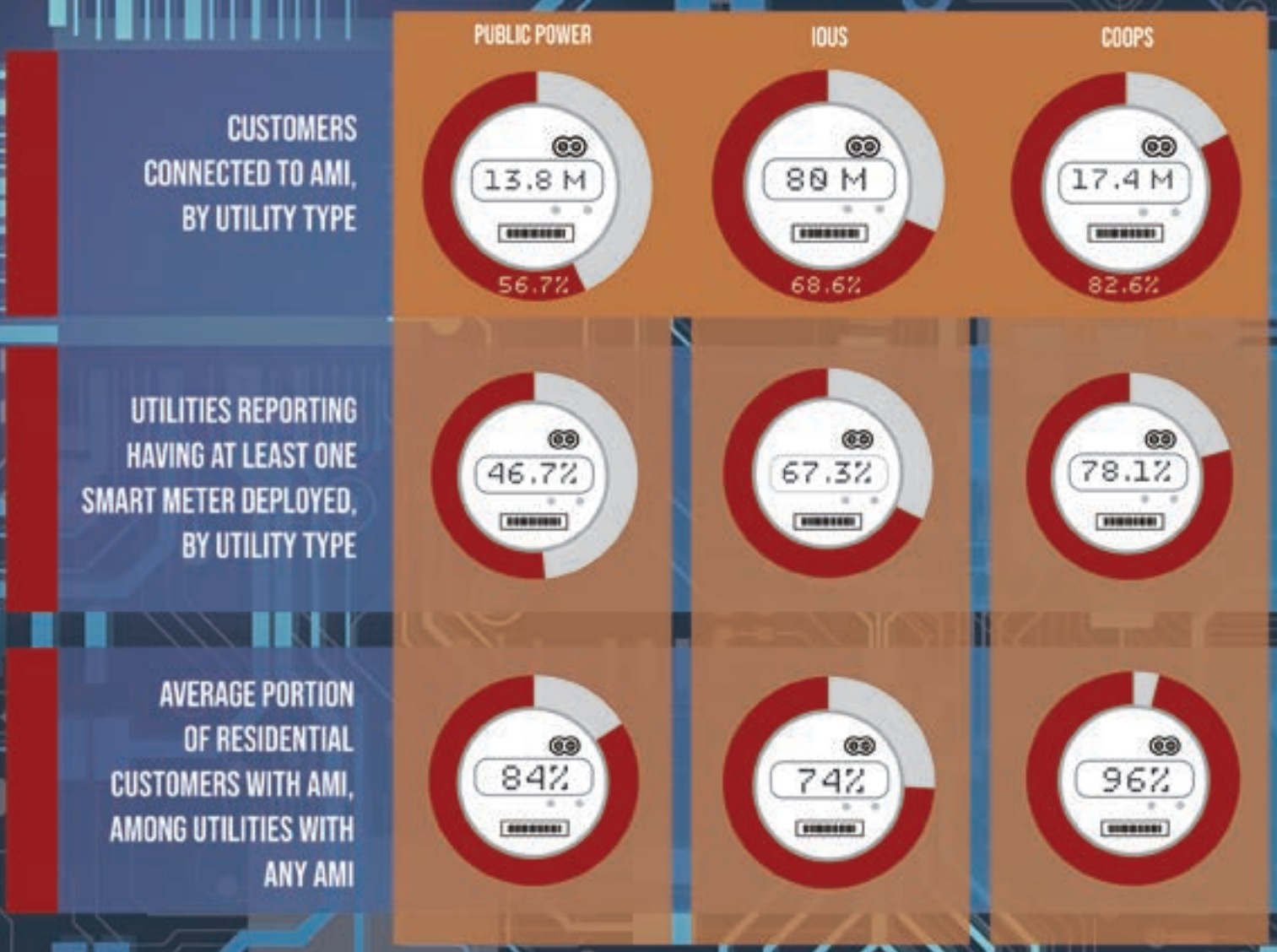
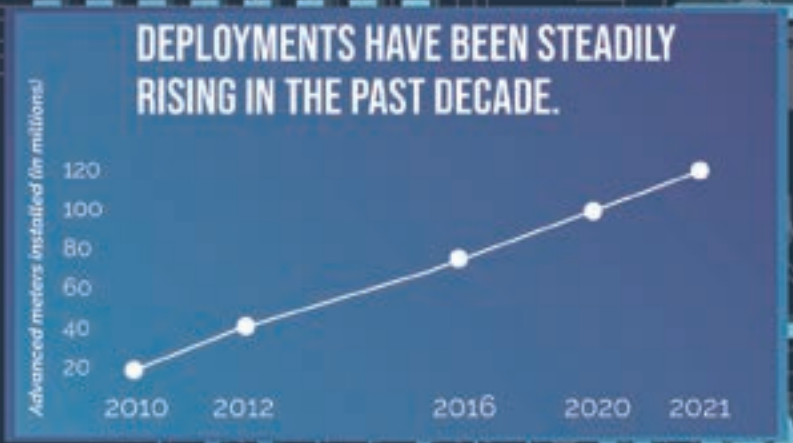
Nationwide, more than **111 million** households and businesses are served by advanced metering infrastructure, or smart meters. That's about 68% of all electric utility customers. The Infrastructure Investment and Jobs Act allocates $3 billion for smart grid deployments, to help utilities in reaching the remaining customers without AMI.



ALL OR NOTHING

About 400 public power utilities report having all residential customers on AMI – or 61.5% of utilities with any residential AMI deployed, compared with 10% of IOUs and 76% coops. Conversely, about 14% of public power utilities with any AMI have less than 25% of residential connected to the meters, including about half who only have AMI for commercial and industrial customers.



Source: Energy Information Administration, 2021 Annual Electric Power Industry Report, Form EIA-861. Utilities serving less than 200,000 megawatt-hours annually are not required to complete the full EIA-861, which includes more detailed information on AMI and other statistics.

FINDING SOLUTIONS

The American Public Power Association conducted an initial survey on supply chain impacts in public power in November 2021, which identified constraints among all types of components, from smart meters to bucket trucks, conduits, and bolts. A more recent survey of APPA's members, conducted in August 2022, focused on the top concern identified by all electric utilities, which is the shortage of distribution transformers. That survey found the average lead time for transformer delivery has expanded beyond a year, up from a three-month norm that had been the average prior to the pandemic. Public power utilities have reported being quoted even longer lead times or not even getting bids from manufacturers they have relied on for years. The survey also found that one in five respondents have canceled or delayed projects due to the shortage. The demand for distribution transformers is only going to continue to grow, meaning the problem is not temporary.

In a recent op-ed, Joy Ditto, APPA's president and CEO, highlighted how a lack of access to essential grid components is hindering clean electricity production and electrification goals. At the federal level, one solution could come from spurring manufacturing via the Defense Production Act. "A step in the right direction is first to clarify the use of the Defense Production Act, as invoked by President Biden, and to expedite the distribution of funds to use the DPA. We urge the Department of Energy to take the critical next step — convening transformer manufacturers to develop concrete solutions to the shortage so that the DPA can be used as a tool to help implement those solutions," Ditto said in the op-ed.

Other options require the public power industry to convene to determine how it can collaborate on solutions. As such, APPA is hosting a supply chain strategic discussion immediately following its CEO Roundtable in March 2023 in Savannah, Georgia. The discussion will explore the viability of and interest among public power entities to pursue solutions such as pooling bids, developing a public power manufacturing facility, adopting increased standardization in transformer classes and styles, revamping procurement laws, and refurbishing equipment.

Federal Funding for Energy Technology in Two Acts

The Inflation Reduction Act included $369 billion toward "energy security and climate change" and the Infrastructure Investment and Jobs Act included $77.5 billion for power and electric vehicle infrastructure. The related funding will support different aspects of energy technology development and adoption — from how electricity is generated to how customers use it. Here are a few key technologies each act supports.

Inflation Reduction Act

Generation

Transmission and Distribution

Electric Demand and Use

- Allows nonprofit utilities to get directly payable credit for installing utility-scale solar/wind production
- Extends and increases credits for installing home power systems, including solar
- Offers incentives for individuals and businesses to get energy efficient appliances and efficiency upgrades
- Extends tax credits for individuals buying new and used EVs

Infrastructure Investment and Jobs Act

- Supports RD&D on various energy technologies, from advanced nuclear to hydrogen and carbon capture and storage
- Provides incentives for updating hydropower facilities
- $11 billion for states and utilities to increase grid resilience – such as for weatherization equipment, monitoring and control technologies, advanced conductors, advanced modeling technology, and microgrids
- $505 million for energy storage demonstration projects
- $3 billion for Smart Grid Investment Program, allowing utilities to deploy AMI to build in more flexibility
- Funds states to create a National Charging Network and authorizes community charging grants for off-highway chargers

CYBERSECURITY ALLIES ENABLE ACTION

BY BETSY LOEFF, CONTRIBUTING WRITER

Bad actors are out there, probing utility systems thousands of times each day. Yet, to counter these threats, many public power providers have too few employees to make cybersecurity anyone's full-time job. On the upside, utility staff who are juggling cybersecurity with multiple demands can get involved in the many industry groups and government programs designed to help them address cybersecurity efficiently and tackle their guardian duties.

Public power utilities may have operational technology (OT) – which gives the ability to automate or operate our grids remotely and with greater situational awareness – in addition to their information technology (IT) – which gives the ability conduct business with our customers and others through platforms such as websites, billing systems, and databases. Partnerships help utilities prioritize the vital tasks involved in keeping critical systems and assets protected.

BRIDGING THE GAPS

Stowe Electric in Vermont recently hired a new IT person, and the people managing cybersecurity to bridge the gap between the new IT person and the previous one are looking forward to onboarding an expert on staff. Michael Lazorchak is the utility's manager of regulatory affairs, and Trish Waugh is the business and customer manager. They've been devoting about a third of their time to cybersecurity, and they've linked up with several organizations to help them get up to speed.

Those organizations include the American Public Power Association, the Electricity Information Sharing and Analysis Center, or E-ISAC, and working groups with the Department of Public Service for Vermont. "One of the reasons we've tried to be more active in the APPA working groups is because they help with information sharing," said Lazorchak. "I have no background in cybersecurity, but I can ask the group what we need to focus on. These groups are very helpful." Stowe also gets security alerts from multiple agencies, and the alerts come with varied frequency: weekly, monthly, and even daily when appropriate.

Dustin Moore, operational technology superintendent at Riviera Utilities in Foley, Alabama, also values the information he gets from cybersecurity alliances. He uses that information as a tool to be ready for anything. "We want to stay ahead of what's going on in the industry," he said.

Partly, this is because his utility offers a variety of commodities: gas, water, wastewater, internet, and cable TV. If, in the future, regulators decide that any device touching any operational technology network has to comply with standards from the North American Electric Reliability Corporation, or NERC, Moore's utility would be ready. "It's better to be proactive than reactive, so when we set out any of our equipment, we set it out meeting today's requirements. If some regulation comes down on the gas or water side, we'll be able to say we've already checked the box," Moore said.

Riviera Utilities gets support from E-ISAC, the Multi-State Information Sharing and Analysis Center, or MS-ISAC, the APPA's Cybersecurity Defense Community, and a working group with the Alabama Municipal Electric Authority, a wholesale power provider for Riviera Utilities and 10 other cities across the state. Moore values the timely alerts such partners provide. "If they come out and say there's a security patch vulnerability on this type of substation equipment, we can go ahead and upgrade our firmware. Alternatively, if we're getting different hits on our network, we can push that information through our partnerships and inform others," he said.

DANGEROUS DISCOVERIES

Stowe in Vermont has its systems monitored by MS-ISAC, as well, and Lazorchak called the results eye-opening. "Our web domains are attacked on a regular basis," Waugh noted. "Attackers are trying to access or replace PDF files on our website so that when people click on them, they'll get a virus. There are constant phishing attacks, mostly for the purpose of taking our information and holding it for ransom."

The number of attempts a utility routinely sees is surprising, even for a smaller utility like Stowe, which has some 4,400 residential and commercial customers. For instance, the report Waugh reviewed for the week ending July 10 had more than 303,000 hits to the website on it, and a couple dozen of them were malicious attacks. Those are the attacks the utility sends on to its outsourced IT management firm so that it can block malicious IP addresses or take other appropriate action.

The rest, Waugh said, were probes. "A lot of these attempts are scouting, looking for vulnerabilities. They're not trying to attack anything at

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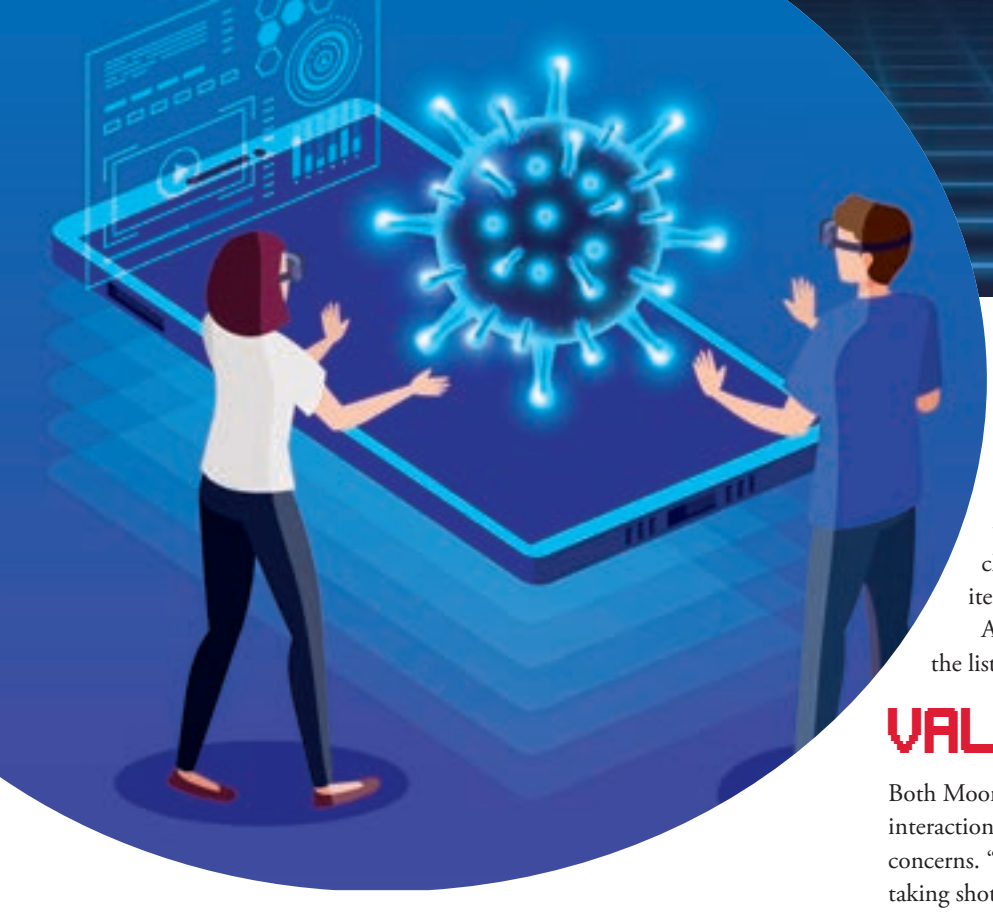


the moment," she said. For those that do pose a threat, Waugh is able to submit the information to her IT management vendor. The things she submits include IP addresses, domain names, the country of origin for the attack, and the IP addresses for the utility domains or devices that have been affected.

Moore also uses some of the alerts he has received for training purposes. "We train our users based on the stuff other utilities are seeing because an adversary's biggest asset is an untrained user," he said. "We tell people, 'This isn't just a training [scenario]. It's an actual attack that has happened.'"

SHARED NEEDS

Another way smaller utilities can gain cybersecurity knowledge was trialed through a regional municipal energy agency that offered 24 cities the opportunity to take part in a Shared Cyber Analyst program. To participate, each city had to complete APPA's Municipal Cyber Academy, which covers practices detailed in the public power cybersecurity scorecard. Then, based on each city's needs, a dedicated cybersecurity analyst could split time across the participants to focus on ransomware readiness, scorecard improvements, and incident response.

Twenty-three of the 24 cities that could participate did. Participation meant meeting with an analyst individually at least twice during the year-long trial to focus on their specific needs, attending a monthly cybersecurity working group for information sharing, honing their incident reporting skills, learning about planning and activities to recover from a ransomware attack, and receiving end-user training to help protect against phishing threats and more.

"Cities mentioned that they did not know where to start," noted a report on the program, which was funded through a cooperative agreement between APPA and the Department of Energy. "Providing a few recommendations at a time gives them a good place to begin and allows them to make positive changes without becoming overwhelmed by a complete list of items to accomplish."

After all, once a city gets one potential vulnerability scratched off the list, other new threats can appear.

VALUABLE LEARNING

Both Moore and the Stowe team have learned plenty from alerts and interactions with industry groups, for both cyber and physical security concerns. "After we learned about a California utility where someone was taking shots at a substation, we reached out to our town police and put more cameras up around town. We learn about things to be aware of so we can design plans for mitigation," Lazorchak said.

Moore noted that his various connections alerted him to the reality that some criminals have been targeting older exchange servers. "Microsoft is one of the best tools an adversary can use," he said. "Breaking into a router or other device is too cumbersome and takes too long, but an adversary can look at the latest patch provided from Microsoft. If it's on an exchange, a server or even an administrative tool, the hacker can reach out and see if anybody hasn't patched against it."

Waugh values the connection with experts at other utilities, people she has met and bonded with via industry groups. "It's great to have utility contacts. If something comes up, you have somebody you can call and talk to," she said.

Beyond colleagues, monitoring and alerts, there are other resources, too. Moore said his utility leans heavily for guidance on the Public Power Cyber Incident Response Playbook, which provides protocols for things such as asset identification, patching, firewall rules, secure system configuration, data recovery, incident response, application security, and more. "A lot of our utility success has come through the policies and procedures that APPA built as kind of a template," he said.

STEP BY STEP

Ed Krieger, power system director for Piqua, Ohio, has been shoring up his utility's systems with help from his joint action agency, American Municipal Power, which provides electricity to 132 communities in nine states. To keep power flowing to Piqua's 11,000 customers, Krieger has used two assessment tools in the past couple of years: the Public Power Cybersecurity Scorecard, which is based on the Department of Energy's

cybersecurity capability maturity model, or C2M2, and CIS Controls, which is a prioritized set of security actions from the Center for Internet Security.

Among the topics covered by the public power cybersecurity scorecard are risk management, incident response, operational resilience, monitoring of cyber systems, supply chain, workforce management, training and more. Experts from AMP led the Piqua team through the assessment.

"It was a very lengthy process to evaluate our posture and existing condition in all 14 areas," Krieger said. To work on this project, he brought in people from his IT department, operations, two technology specialists, and representatives from the water and wastewater utilities. These individuals were interviewed for the assessment and had to pull together information for the assessors from AMP to review. Krieger estimates the process took as much as 200 manpower hours to complete.

After the information was gathered, Krieger noted that the AMP team reported on where his utility stood and offered recommendations for improvement. "They went down through the list and gave us a percentage grade," he said.

Only two areas showed up as real problems. His utility earned a zero on information sharing and communications, which includes talking to both employees and the public about the incident. "We really hadn't thought a lot about that," Krieger said.

The other area where his utility needed to spend some time was in "external dependencies," where the town earned a grade of 50%. "We needed to tighten up how we interacted with the supply chain and how we could be impacted by disruptions with one of our larger suppliers," said Krieger. "What happens if the supplier is offline, like the pipeline that got shut down in a ransomware attack? Do you have a backup?" Piqua does now.

"We're still working toward the finish line on some things, but we're a lot better off than we were when we identified where some of the holes were," Krieger said. Finding those holes was easier for his utility with help from other organizations, including APPA, AMP, and CIS.

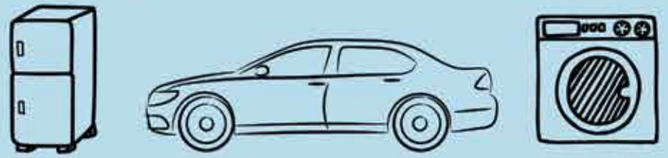
"If you're only looking at ideas from within your organization, you may be missing out," Moore said. "Sometimes it takes an idea outside of your organization to see a procedure, operation, or plan that can help you be more successful."

Understanding Heat Pumps

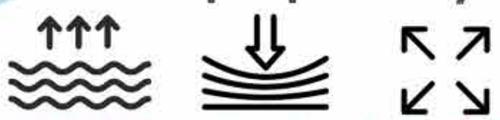
In the U.S., there are two common types of heat pumps for space heating and cooling, both powered by electricity.

At its core, a heat pump is a technology that transfers heat – relying on the principle that heat moves to cold.

The technology is already in refrigerators, cars, and other appliances.



Heat pumps work by



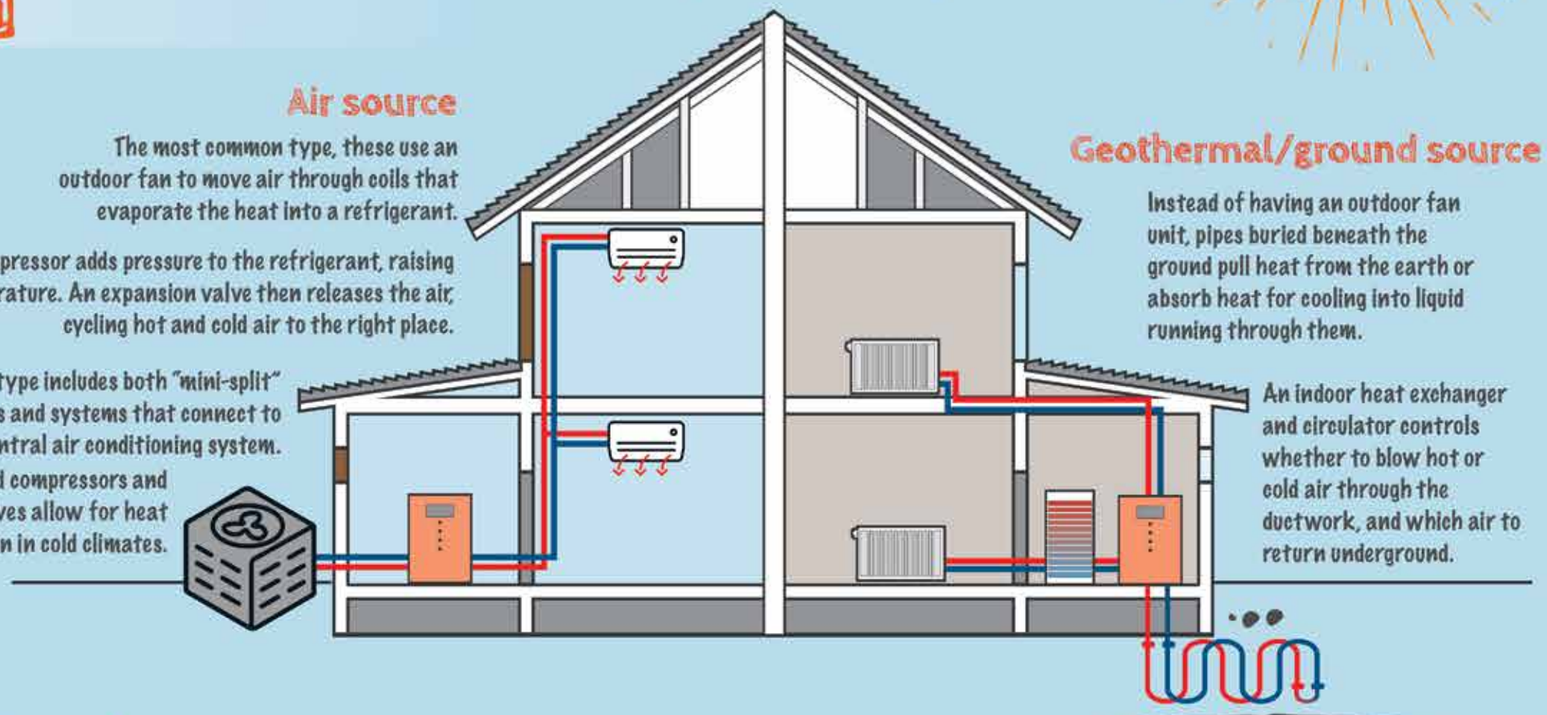
evaporating compressing and expanding heat.

Air source

The most common type, these use an outdoor fan to move air through coils that evaporate the heat into a refrigerant.

An indoor compressor adds pressure to the refrigerant, raising its temperature. An expansion valve then releases the air, cycling hot and cold air to the right place.

This type includes both "mini-split" ductless systems and systems that connect to ductwork, like a central air conditioning system. Modern, enhanced compressors and expansion valves allow for heat pumps to work even in cold climates.



Geothermal/ground source

Instead of having an outdoor fan unit, pipes buried beneath the ground pull heat from the earth or absorb heat for cooling into liquid running through them.

An indoor heat exchanger and circulator controls whether to blow hot or cold air through the ductwork, and which air to return underground.

How much energy do heat pumps use?

Since heat pumps don't create heat, they are more energy efficient than traditional heating and cooling and can produce **two to four times** as much heat energy as they consume.

Just like any heating or cooling system, heat pumps are more efficient in spaces without air leaks and when properly installed.

Air source pumps rated for colder climates cost more. Geothermal heat pumps are typically the most expensive to install, due to the cost to dig the pipes.

How much do they cost?

Consumer Reports reported an average cost of **$7,791** for installation or about **$1,000** more than the average cost for a gas furnace.

Starting in 2023, the Inflation Reduction Act authorizes a **$2,000** tax credit (and up to an **$8,000** rebate for income-qualified households)

https://rmi.org/clean-energy-101-heat-pumps/
https://www.consumerreports.org/appliances/heat-pumps/heat-pump-federal-tax-credits-and-state-rebates-a5223992000/
https://programs.dsireusa.org/system/program/detail/1274/residential-energy-efficiency-tax-credit

ENABLING A TECH-DRIVEN UTILITY WORKFORCE

BY JIM PATERSON, CONTRIBUTING WRITER

The United Nations reports that digital technology has advanced more rapidly than any innovation in the history of the world, and those advances are streaming into the utility industry. From top to bottom, public power utilities have been buffeted and bolstered by new technology solutions, such as communications devices in the field to automated systems, but sometimes it can be hard to keep up with the changes — especially across the workforce.

Work at every level requires more advanced digital skills, and, increasingly, employees want to gain those skills, which can be significant in meeting the need.

"With today's workforce, we are seeing a desire to transition from paper-based processes to digital-based processes. The ease of use that smartphones have ushered in over the last 15 years is now the expectation," said Jonathan Jakub, manager of enterprise solutions at Lincoln Electric System in Nebraska, where leadership works hard to keep its 500 employees well versed in digital skills.

"I can make a haircut appointment online, see the wait time, be texted when I should leave for the salon — and then they keep information about the clipper they used for the next time. That is the sort of digital atmosphere we are working in and the sort of expectations our customers and employees have about technology and processes."

It is not only these customer expectations for service, but also employee desires to advance and the efficiencies technology creates that mean utilities need to keep employees digitally literate, noted Jakub. It means public power utilities must acknowledge the potential problems, pinpoint the specific skills gaps, and commit resources to training and removing those gaps.

DEFINING DIGITAL LITERACY

"Digital literacy" considers both the range of interactions between employees and the growing array of digital functions they need. The definitions are almost as varied as the skills the phrase describes.

Researchers studying it define digital literacy as the ability to "use information and communication technologies to find, evaluate, create and communicate information" or an "awareness, attitude and ability to appropriately use and interact with digital technology to easily and effectively access information in different formats in a digital environment."

Put more simply, it is a person's skill level when it comes to using digital tools to gather information, communicate, and do their job.

A recent report from DigitalUS, a coalition of nonprofits, businesses, and educational institutions, noted that 80% of midlevel jobs require digital skills, and even positions that had been nontechnical often require use of new technologies, especially as the pandemic "catalyzed many organizations to shift to digital provision of services, requiring employees at all levels to learn new digital skills." For utilities, that has included a shift to teleworking for some types of employees, using a broader array of devices to securely share information, and the technical and analytical expertise to harness and make sense of an increasing mountain of data.

"Digital skill gaps occur across all industries, and the energy sector is no different," said Amanda Bergson-Shilcock, a senior fellow and researcher at the National Skills Coalition and the author of several reports on the topic. "I think it is fair to say that the gap they face is similar to what we have found generally — that one in three workers lack foundational digital skills."

Meanwhile, The World Economic Forum projects that within just a few years, the core tech skills needed to perform most roles might nearly double. There is often an assumption that the problem will diminish as younger, tech-savvy employees enter the workforce, but Bergson-Shilcock's research shows that isn't necessarily the case.

"Younger workers are far from immune to digital skills gaps," she reported. "Indeed, individuals under the age of 35 make up fully one-quarter of workers with no digital skills, and 29% of those with limited skills."

RECOGNIZING THE GAPS

Bergson-Shilcock said that when employees lack digital skills it can create inefficiency and frustrate the worker. She mentioned a recent report on construction technology that highlighted how construction managers often manually transfer data from one app to another.

"Sometimes people's lack of digital skills leads them to use existing technology products in slow or cumbersome ways that could be fixed with a minimum of training," she said, noting that workers often spend a great deal of time covering for a lack of digital skills. "Fragmented or limited knowledge can be an invisible drag on productivity — and people higher up the food chain aren't always aware of it. They know some function is

difficult or taking longer than it should, but they don't know where the problem lies," she said.

Jakub noted that communication is often critical in a utility, and that can be a problem for some workers, along with collaboration or understanding how the functions intertwine. "There is a complex nature to a lot of what a utility does, and often our own tasks require specialized skills, and we may not know as much as we should about what is happening elsewhere."

However, research from PWC shows that employees want to acquire digital skills. In its analysis of technology at work, it found that one-third of employees want to learn the skills to improve efficiency and teamwork, another third are interested in advancing their careers, and the remainder prefer to stick to familiar routines.

Bergson-Shilcock said that means utility leaders should recognize that workers aren't reluctant to learn new skills but that the availability or cost of training or access to broadband or a computer may limit them. Often, at a smaller utility where an employee can wear many hats, the wide variety of functions requiring digital knowledge may be overwhelming.

"A person who is jack-of-all-trades may have trouble keeping up when some of those functions require learning a whole new online way of working," she said.

GETTING IT DONE

Improving overall digital skills starts with hiring, experts say, and LES makes it a priority.

"There is a high expectation for all employees here to be able to use and adapt to technology in the workplace," said Narin Ehrisman, recruitment and outreach specialist at LES. "In every role, digital skills factor into successful job performance. Having the ability and knowledge to complete business tasks through various forms of technology is a must-have for employability."

Bergson-Shilcock is now involved in research examining thousands of employment ads and whether they specifically seek a detailed understanding of certain technology, some tech skills, or none. She said too often utilities and other organizations don't spell out the digital requirements for

a position. Sometimes that happens because there isn't a specific credential for the skill they are seeking — a problem she attributes to the failure of employers and educators to communicate.

"It means that we default to whether or not a person has a bachelor's degree, when there are a lot of other ways to communicate about the requirements for a job and the skills a worker has."

She said there is movement toward more skill-based hiring, and utilities must consider the actual requirements for a job and be specific about them as they hire. Beyond that, experts say, an organization has to be deliberate about spotting areas where there are gaps in employee skills and be willing to make training available.

Jakub noted that his utility does more frequent training in departments where there is a greater turnover of employees, particularly in customer service positions. Other areas, like the engineering department from where he came, often have "tribal knowledge" specific to their department that employees pass along to each other and to new employees, in addition to periodic structured training.

More formal training can be done online easily today, and most employees will take it on given the time and opportunity, though some experts say collaborative learning is more effective. Research has shown that the resources used for acquisition or development of the training and time off for employees using it will more than pay for themselves in efficiency and employee satisfaction.

To spot the problem areas, Bergson-Shilcock outlined three steps she thinks utility managers should undertake to identify the need for training and carry it out.

1) Identify and then explore pain points to see if they are caused or worsened by digital skills issues. Administrators and managers usually find it easy to name the issues that are costing them time and money and causing worries, but they don't always explore to determine if the root cause of the problem could be a digital skills issue.

   "The real answer to 'Why are our contract solicitations always going out a month late?' might be 'Robert doesn't feel comfortable with the online contracts system, and he pushes the work off on to Jane, who doesn't have time to do it on top of her real job.' It might not be possible to get that blunt a statement in a group setting, but it might be possible to create an environment where employees can say things about gaps in the processes they use," said Bergson-Shilcock.

2) Consider administering a survey or focus group to ask workers which digital skills they think they and their colleagues need. She suggests making the survey anonymous, with an option for employees to share a real-life example of a time when they were frustrated because of a digital skills issue facing their company or a colleague. "Those stories can shine a light on where the trouble spots are," she said.

3) Make sure that digital skill-building solutions reflect how people learn. Bergson-Shilcock said we learn best "in a community with each other." Sometimes this means a traditional classroom setting, but this could also mean scheduling time for people to have a weekly informal "user group" discussion to help people make sense of new information, practice with each other, share advice, or even complain and create constructive changes.

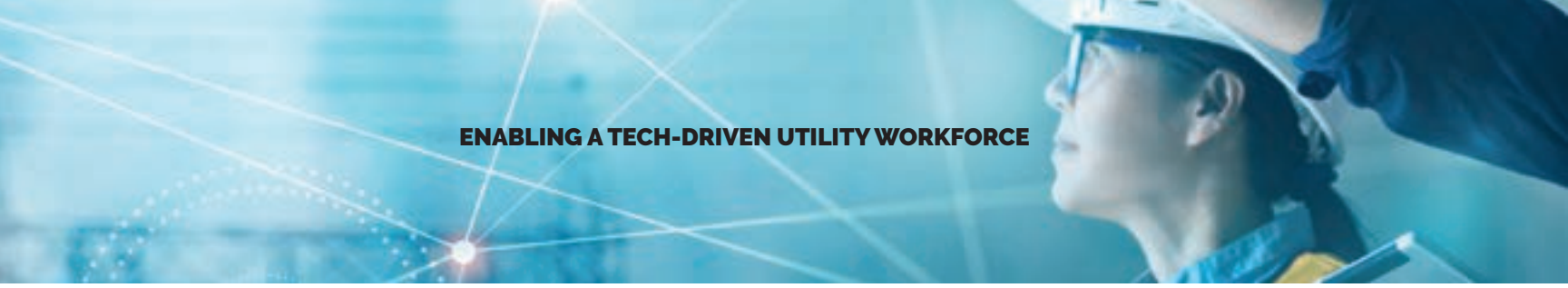
PREPARING THE FUTURE WORKFORCE

Having systems in place to identify gaps in digital literacy and address them will increasingly be important in the future, the Center for Energy Workforce Development said in its 2021 Gaps in the Energy Workforce report.

"We will undoubtedly need to find new ways to train workers in this new world, with a greater reliance on technology such as artificial intelligence and virtual reality," the report said. "We'll also need to meet students where and how they learn. And our ability to do so will impact how well we attract and retain our workforce."

It also recommended that utilities "implement company-specific workforce development strategies, with a commitment to strategic workforce planning."

"With increasingly technical jobs in the industry, preparing for tomorrow's workforce cannot be left to chance or last-minute adjustments," the report stated. "Workforce planning must be a business imperative, prioritized at the highest levels."



It adds that utilities should support statewide efforts to build partnerships between energy employers and local education, labor, and government entities to develop secondary and postsecondary programs specific to skilled energy positions.

"It will be important for industry leaders to understand the knowledge, skills, and abilities of the future workforce and communicate those to community-based partners responsible for educating, training, and upskilling the workforce. The industry will be well served to have easily accessible curriculum available to share with educators, so it is easy for them to prioritize energy education."

A Deloitte report on tech skills needed in the utility industry in the United Kingdom finds that "to take advantage of digital disruption, utilities need flexible organizational structure and must fundamentally change they way they attract, develop and engage their workforce."

It describes the skills needed across the utility workforce, sometimes involving technology that seems far in the future but will impact utilities sooner than might be expected, in the same way some technology today seemed so far away just a short time ago. Field workers, for example, now use tablets, sensors, and drones, which require certain digital skills for software related to their individual functions. The report predicts that workers will increasingly use wearables, such as smart glasses, and will be examining data and analytics to make their workplace safer and "interpret and model asset performance and identify preventative actions before issues arise."

It predicts that with more and more sophisticated data, utility workers will need to "turn data into insight to solve problems and decide on a course of action," and that data will have a dramatic effect on how workers spend their time. The report also asserts that digitization will "revolutionize" some "back office" functions, from using blockchain in accounting to diminishing repetitive tasks to open up workers to make more strategic and analytic decisions, creating a need to know how to use processes like artificial intelligence to complete tasks. Call centers and customer service will increasingly gather, analyze, and use a variety of customer data to improve service and maintain loyalty, all of which will require advanced digital skills.

TAPPING ENERGY STORAGE'S POTENTIAL

BY SUSAN PARTAIN, DIRECTOR OF CONTENT STRATEGY, AMERICAN PUBLIC POWER ASSOCIATION

Energy storage technologies continue to be viewed as a critical component to achieving various grid objectives, whether it is to reduce wasted energy, decrease the need for curtailment of generating assets, increase resilience, lessen transmission congestion, or facilitate increased use of solar and wind generation.

"If you're letting it sit there, it's just a reliability resource. If you are using it, you could possibly displace some of your natural gas facilities or help to integrate renewable resources."

Scott Harding, Assistant Director of Utility Programs, City of Colton Public Works and Utilities, California

As part of a cooperative agreement with the Department of Energy, the American Public Power Association convened a group of public power professionals to discuss how utilities can remove barriers and increase adoption of energy storage solutions. A report from the first year of this effort, Integrating Energy Storage Solutions for Fossil Generation, outlines some of the current challenges public power utilities face in implementing energy storage technologies and offers strategies for implementing it. Members of the working group that contributed to the report provided deeper insight into how their utilities are thinking about storage and incorporating it into their operations.

STAYING COMPETITIVE

The Pascoag Utility District in Rhode Island has a shared savings arrangement with a renewable energy company on a 3-megawatt, 9-megawatt-hour battery storage system that came online in July 2022. Michael Kirkwood, Pascoag's general manager and CEO, said the system helps the public power utility to avoid tregional transmission and capacity costs related to peak load.

Kirkwood said that the solar developer, Agilitas Energy, incurred the upfront capital costs, and the nature of the agreement incentivizes savings for both parties. Kirkwood explained how the system immediately began helping Pascoag save as part of its participation in ISO New England, which levies a transmission charge to participants based on their contribution to the monthly peak load. "They only get paid from us if they help us reduce our costs with ISO-NE. So they have a direct interest in trying to reduce the peak load for both the transmission and capacity markets each month," he said.

The market structure also incentivizes storage. "It does get competitive out there, so you want to be in a system that is reducing load during those critical times," he said. "You wouldn't want to be the last guy in, because as we reduce our peak, those left are picking up a bigger and bigger share."

Even though the project was the first of its kind for Pascoag, Kirkwood typified the installation of the system as "pretty routine" and "fairly easy." He said that the system went through a rigorous interconnection study with Rhode Island Energy to ensure it met all standards, and then Pascoag employees helped with the interconnection. The key work, said Kirkwood, comes in setting up the right automation parameters so that the system knows when it should be charging and when it needs to be ready to dispatch.

Once the system is up, he said monitoring only requires a computer to check in on its performance and status – which can be a learning process in itself. The system is part of the ISO-NE regulation market, and receives dispatch signals from the ISO. Kirkwood said that means the system "swings on and off all the time" as a result. While not disruptive to Pascoag's system, such swings, which can be 3 MW in a matter of seconds, represent a significant share of the utility system needs, which has a peak at 13 MW.

Although a third party manages the system for Pascoag, Kirkwood believes that operating such a system directly wouldn't require too much additional effort since the system is unmanned and self-sufficient once up and running. He estimated that using a battery system for peak reduction, as Pascoag does, would require someone to check on the daily load forecast and maybe spend an hour ensuring the system is set up to be ready to dispatch during the peak hours.

Kirkwood said the utility does not have any plans to add more storage at this time, but would be open to another project, either a standalone battery system or one paired with a solar facility.

UNDERSTANDING VALUE

Scott Harding, assistant director of utility operations for the City of Colton Public Works and Utilities in California, said that the utility is looking into the potential of deploying lithium-ion battery systems in weak spots throughout its system to bolster its ability to switch. Previously, the utility worked with several industrial customers to deploy Ice Bear systems, which are attached to the customers' air conditioning units to help shift energy usage.

He stressed that utilities can get vastly different benefits from storage systems, depending on how they use them. Understanding Energy Storage, a 2018 report from APPA, outlines nearly a dozen potential services that storage technologies can provide, from black start to frequency regulation and energy arbitrage.

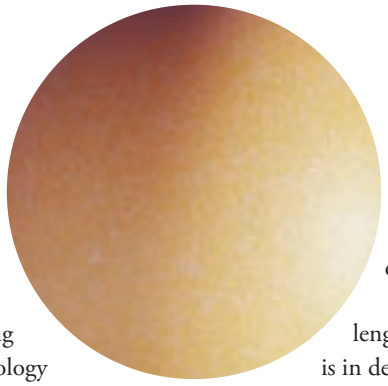
"If you're letting it sit there, it's just a reliability resource. If you are using it, you could possibly displace some of your natural gas facilities or help to integrate renewable resources."

Still, he said, every utility will have different needs and there is no "cookie cutter" approach for deploying storage within a system. Harding previously worked for a much larger utility system where he helped stand up a 30-MW storage project. There, he said, the focus was on how much energy use the battery could muster. At smaller utilities like in Colton, he sees storage getting the most economic value in providing ancillary services and as a reliability resource.

He said the biggest change for utilities in taking on storage is about making sure that employees understand where the value of the asset is coming from and how it can be used accordingly. "When people don't understand how it works, it doesn't get utilized in the most efficient manner."

Harding said this is more of a concern in larger utilities, where different departments within the utility might have different uses for the asset and not be aware of how one use would limit or prevent other uses. For example, if a reliability team expects to have a storage system available as a back-up, then a finance team would not be able to use it for energy arbitrage.

He said that this type of issue can stem from changes that occur throughout the lifecycle of the project development, which can shift from an initial economic analysis through the facility



design. To prevent this type of issue from arising, Harding recommends that utilities ensure that "key people that understand how the technology works stick with the project from cradle to grave."

LEARNING THE ROPES

In North Carolina, the Greenville Utilities Commission began exploring storage as an option for reducing its peak demand. Kyle Brown, electric planning engineer with GUC, said that the utility has relied on diesel and natural gas to help with peak shaving for several decades, and it started looking into storage as battery technology began to advance.

"We're very aggressive in the way we run our load management program, because the demand charge for that one hour is 50% of our wholesale cost," said Brown. "We're always looking for innovative technology or different solutions to help with our load management program, whether it's smart thermostats, AMI, or anything like that. So batteries were another thing that we wanted to explore."

GUC piloted a 1-MW, 2-MWh battery storage system that is connected to one of its distribution substations. The cost of the 2-MWh system was on par with what GUC saw for natural gas generators at the time. The system began operating in January 2021, and Brown said it immediately became part of GUC's fleet of load management tools. While the current system is delivering value, Brown expressed doubts about using the current technology at a greater scale.

"The challenge for us all along has been that with a battery system, you have a finite capacity," he said. "We don't know if the two-hour system is sufficient … Our typical load management runs are about four hours. We haven't had any issues in hitting the peak with our system, but if we were to start transitioning more of our fleet over to that limited capacity system, that would change the calculation a bit, and there would be a lot more risk."

Brown said that GUC had explored the potential of adding a larger battery system, but the cost at the time was significantly higher and didn't make financial sense. He stressed that given GUC's structure and wholesale power agreements, the only service of value that storage can provide the utility comes through peak shaving, as it doesn't have any concerns about generation or transmission capacity or system reliability. He said that GUC is not looking to add any additional storage at this point, but that industrial customers could be interested in installing behind-the-meter systems to reduce their demand charges or for other purposes. Through the pilot, GUC has gained a better understanding of the technical aspects of battery technology to be able to advise customers on the systems when and if they choose to deploy them.

Another challenge, noted Brown, is in defining the project needs and in being as specific as possible about what the system will need to do. "On the engineering side, we didn't have any previous history with batteries. Developing the specifications was one of those 'We don't know what we don't know' situations. There was a lot of effort that went into reviewing the literature and coming up with a specification that got the solution we needed from the operation standpoint." He shared how he has heard from colleagues at other utilities who didn't get the system they thought they were buying because the specifications were written in a way that could be misinterpreted.

GUC currently has a third-party agreement for system maintenance, and Brown said that is a function he would like to eventually move in-house. To get a sense of the skills needed to perform a lot of the routine maintenance, GUC ensures an employee is onsite when the contractor comes out to work on the system. This shadowing has helped the utility get a sense of the scope and complexity of attending to the system's needs.

DEVELOPMENT NEEDED

While public power systems seem to be getting benefits from today's storage options, utilities note the technology still needs to develop to support a transformed energy system.

Despite having technologies that have been around for a while, Harding believes utility-scale energy storage is still in its infancy. In addition to continuing to see the economics of storage improve, he would also like to see developers focus on the flexibility, rather than energy, of the assets and how they can be better paired with solar facilities. He also said that he would like to see storage technology or configurations that allow for facilities to take up a smaller footprint and improve safety. "This is a technology that is going to keep improving."

Pascoag's Kirkwood pointed to a need for long duration storage that can easily ramp up and down as traditional fossil fuel-powered plants close. "One issue with the current storage environment is that they are fairly short. In the future, you are going to need resources that will carry you for a day or several days," he said. While utilities could string together batteries or different assets to pull from throughout the day, such an arrangement would not be cost effective nor practical. "It's got to be cost-effective. … People are aware of the need, but the technology hasn't caught up yet."

GUC's Brown agreed. "I don't know that the current technology is necessarily the silver bullet. Until there's a significant increase in storage capacity, it is kind of standing in the way of large-scale adoption."

Meet Adrienne Lotto

A Q&A with the American Public Power Association's new senior vice president of grid security and technical and operations services. Adrienne started at APPA on Oct. 1.

What interests you about working in public power/the public power sector?

Coming to APPA for me is truly a culmination of all my years working in the public sector. I have been a public servant for most of my adult life. Most recently, I was the chief risk and resilience officer at the New York Power Authority, where I worked to understand the risks and threats that public power was — and is — facing and to help drive mitigation strategies. Before that, I was at the U.S. Department of Energy, first as chief of staff to the Office of Electricity, and then as acting principal deputy assistant secretary to stand up the Office of Cybersecurity, Energy Security and Emergency Response. Prior to that, I served as an attorney at a local municipality, where I was in charge of safety and compliance.

APPA's Technology and Operations Support Programs and Services

	Reliability	Safety	Security & Risk Management	Disaster Response & Resilience	Energy Efficiency	Sustainability & Environmental Services	System planning
Assessments							
Axio 360 for Public Power			●				
Reliable Public Power Provider (RP3)	●	●					●
Smart Energy Provider					●	●	
Guidance and Benchmarking							
Distribution System and Reliability Operations Survey Report	●				●		
Energy Transition Roadmap					●	●	●
eReliability Tracker	●						●
eSafety Tracker		●					
Mutual Aid Playbook			●	●			
Public Power Cyber Incident Response Playbook			●				
Public Power Cybersecurity Roadmap			●				
Safety Manual		●					
Communities and Events							
Cybersecurity Training			●				
Demonstration of Energy and Efficiency Developments (R&D)	●				●	●	●
Lineworkers Rodeo	●	●					
Mutual Aid Network				●			
OSHA Worker Training		●					
Tabletop Exercise in a Box	●		●	●			

Are there any priorities you have already identified for your new role at APPA?

I'm looking forward to connecting with a broad group of members to help public power really thrive and move forward. The programs and education APPA provides offer a lot of value to its members, especially as we return to in-person engagements.

I plan to continue to ensure that APPA focuses on the critically important areas of resilience and R&D, which go hand in hand. We have a robust mutual aid program, and I look forward to advancing it from a perspective of resilience. It will be important for us as an industry to agree on what resilience means and to better understand what it looks like — from preparing for events all the way through responding to them. A third area that we want to expand upon is security — both physical and cyber. Security threats, both from the cyber side as well as domestic terrorism, are unfortunately very real. When we understand the threats to our sector, then we can provide valuable insight to members to make risk-based decisions and take actions to protect their systems. Partnerships in the Beltway and across the industry in this space are critically important.

Given your experience with the DOE, how can public power work best with federal agencies?

APPA works very closely now with the federal government, both on the executive side and on the congressional side. That said, we can always get better. Sometimes the federal government tends to tap the same utilities over and over again, whether in testing pilot programs or even to just discuss policy issues. I would like to see APPA continue to have a robust voice at that table and, for those public power utilities that want to partner with the federal government in a more expansive way, to enable them that opportunity to do so. This isn't just so the same utilities aren't always being tapped, but so that we have a more diverse view when the federal government is making decisions that affect our industry.

Are there opportunities that stem from the public power model?

Public power has an incredible opportunity because they are forms of government — units of state and local government. How they're formed may look different, but fundamentally, at their hearts, they are governmental entities. That means our members tend to have a very close working relationship with the officials in the footprint in which they are operating. That ability to bring together public policy with the resilience of the grid means being able to make risk-informed, smart decisions on behalf of their states or communities. That is incredibly powerful and should not be underestimated. Those relationships are critically important, and public power has a strong foothold in that area.

I would like to see APPA continue to have a robust voice at that table and, for those public power utilities that want to partner with the federal government in a more expansive way, to enable them that opportunity to do so. This isn't just so the same utilities aren't always being tapped, but so that we have a more diverse view when the federal government is making decisions that affect our industry.

When it comes to deploying new technology in their operations, what priorities do public power utilities need to be considering?

Any utility knows its system better than I can speak about it, but a risk-based approach should be utilized whenever a utility is deploying a new technology. Holistically, that means first understanding what the problem is that you're seeking to solve, and then second, how this tool or technology will mitigate that problem. And then third, before you deploy any technology in your system, vetting it in a simulated environment to understand the architecture of what will happen if deployed in your system's footprint. That should hopefully seek to avoid that "red shiny ball syndrome," where people buy a bunch of different technologies and perhaps layer them, but don't really understand whether that technology will fix that issue.

What are you looking forward to discussing with our members?

I'm looking forward to going to our conferences and meeting the members and exchanging ideas. I love to learn from our members, because no two utilities or states are the same. While my last two experiences have been with very large organizations, I would like to better understand what are the restraints/constraints that are impacting members of all sizes and what APPA can do to help or what additional value we can provide.

I am not someone who thinks I have all the answers. Listening is a very important part of the job. From there, we can work together to solve problems, whatever they may be.

WHERE TO FIND UTILITY TECHNICAL ASSISTANCE

Public power utilities are not alone when it comes to figuring out how to implement and understand new technologies. In addition to the various information, training, and support the American Public Power Association provides, public power can access technical assistance from the following array of sources. Note: This list is not comprehensive, and not all public power utilities will meet the eligibility criteria for each program below.

CYBERSECURITY

DEPARTMENT OF ENERGY: The DOE oversees a variety of programs offering technical assistance to utilities, including:

- **ENERGY SECTOR OPERATIONAL SUPPORT FOR CYBER RESILIENCE** program includes technical assistance for small electric utilities for assessing and improving cybersecurity. www.energy.gov/bil/energy-sector-operational-support-cyber-resilience-program
- **RURAL AND MUNICIPAL UTILITY ADVANCED CYBERSECURITY GRANT AND TECHNICAL ASSISTANCE PROGRAM** is a new program established by the Infrastructure Investment and Jobs Act to help rural, municipal, and small investor-owned electric utilities enhance their security posture and increase their participation in threat information sharing programs. www.energy.gov/ceser/rural-and-municipal-utility-advanced-cybersecurity-grant-and-technical-assistance-rmuc
- **CYBER SECURITY FOR ENERGY DELIVERY SYSTEMS** is a program to spur the development of next-generation tools and technologies that would reduce the risk of a cyber incident disrupting the energy system, including electricity generation, transmission, and distribution. www.energy.gov/ceser/activities/cybersecurity-critical-energy-infrastructure/cybersecurity-research-development-and

CYBERSECURITY AND INFRASTRUCTURE SECURITY AGENCY: Offers a variety of assessment tools, training, and support for utilities on cybersecurity. Assistance offerings include having cybersecurity professionals conduct a Cyber Resilience Review assessment, getting regional cyber support, analysis of industrial control system hardware and other assets, and other evaluations. www.cisa.gov/ics www.cisa.gov/uscert/resources/assessments

APPA-DOE COOPERATIVE AGREEMENTS: APPA has several cooperative agreements with the Department of Energy, including those focused on improving aspects of cybersecurity in the public power community, such as the deployment of OT cybersecurity sensors to utilities or to develop training courses and publications. www.publicpower.org/topic/security-and-resilience-cyber-and-physical

DISASTER PREPAREDNESS AND RESPONSE

FEDERAL EMERGENCY MANAGEMENT AGENCY

- **PRE-DISASTER MITIGATION:** This program helps state and local governments to plan for and implement sustainable cost-effective measures to reduce the risk to individuals and property from future natural hazards, while also reducing the need to rely on federal funding for future disasters. www.fema.gov/grants/mitigation/pre-disaster
- **HAZARD MITIGATION GRANT PROGRAM:** This program supports state and local governments in implementing projects that will reduce or eliminate the losses from future disasters. The program is only available after a major disaster declaration. www.fema.gov/grants/mitigation/hazard-mitigation
- **BUILDING RESILIENT INFRASTRUCTURE AND COMMUNITIES:** This program focuses on proactive investment in community resilience, such as through partnerships, shared funding mechanisms, and/or project design. The program has an added focus on infrastructure projects, which utilities could use to increase energy resiliency. www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

Community Development Block Grant Mitigation program is a opportunity for areas that experienced recent disasters to mitigate disaster risks and reduce future losses. www.hudexchange.info/programs/cdbg-mit/

SAFETY

The **OCCUPATIONAL HEALTH AND SAFETY ADMINISTRATION** offers free consultation for small workplaces to identify workplace hazards, advise on compliance with OSHA standards, and assist in establishing and improving safety and health programs. www.osha.gov/consultation

SYSTEM AND COMMUNITY PLANNING

NATIONAL COMMUNITY SOLAR PARTNERSHIP

DOE and the National Renewable Energy Laboratory offer free technical assistance on a rolling basis for those seeking to create and demonstrate practical, effective, and scalable community solar models. Assistance can be for researching policies and regulations, analysis of project financing, developing outreach and engagement strategies, designing a program, or in working through technical issues related to a community solar project. www.energy.gov/communitysolar/technical-assistance-opportunities

U.S. DEPARTMENT OF AGRICULTURE

USDA's Electric Program provides financing and technical support to electric utilities that serve customers in rural areas to develop key electric infrastructure, conduct damage assessments and restoration efforts, implement energy efficiency measures, and more. www.rd.usda.gov/programs-services/electric-programs

U.S. ECONOMIC DEVELOPMENT ADMINISTRATION

The Public Works and Economic Adjustment program supports economic development, workforce development opportunities, and private investment through infrastructure, including technical assistance to economically distressed communities. www.eda.gov/funding-opportunities/

ENVIRONMENTAL PROTECTION AGENCY

EPA offers several technical assistance opportunities for local and tribal governments under its Smart Growth initiative, including the Building Blocks for Sustainable Communities program, Cool & Connected program for broadband, and Recreation Economy for Rural Communities. www.epa.gov/smartgrowth/smart-growth-technical-assistance-programs

WESTERN AREA POWER ADMINISTRATION

The Transmission Infrastructure Program is aimed at expanding and modernizing the electric grid, eligible entities can leverage federal funds and expertise to support the development of critical transmission and related infrastructure. www.wapa.gov/transmission/TIP/Pages/AboutTIP.aspx

R&D Are the Gateway to Utility Technology Changes

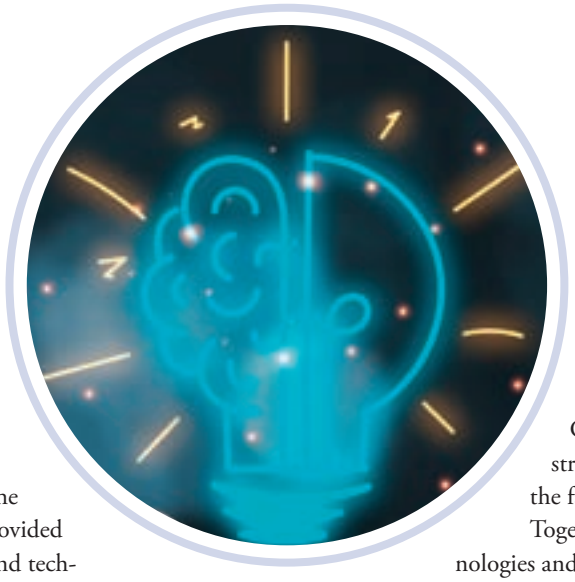
BY PAUL ZUMMO, DIRECTOR, R&D,
AMERICAN PUBLIC POWER ASSOCIATION

The world of electricity is experiencing changes in rate design, our generation capacity mix, energy delivery, grid architecture, and so much more. These developments are altering the way the public views electric utilities and the way utilities interact with their customers.

These changes are not possible without new technologies and new approaches. Research and development are the gateway to change and adaptation, and public power utilities are at the forefront of innovation.

To support public power R&D, for over 40 years the American Public Power Association has managed the Demonstration of Energy & Efficiency Developments, or DEED, program. Made possible by APPA members that join the program, DEED has funded nearly $22 million in grants and an additional $2 million in internships and scholarships since its inception. This funding has not only aided public power utilities in carrying out their own projects but has benefited all those who have been

R&D ARE THE GATEWAY TO UTILITY TECHNOLOGY CHANGES



able to apply the lessons learned from grant recipients and to their own utilities.

Over the years, hundreds of public power utilities have engaged in exploring cutting-edge technologies that have now become proven and well-established. For example, one of the first DEED grants went to Nashville Electric Service in 1980 for a co-generation energy-recovery facility, which burned municipal solid waste and converted the energy to steam and electricity. This facility provided the local government with an "economically and technically feasible solution to the solid waste disposal problems of the community." This was a first-of-its-kind demonstration of a technology that is now widely in use.

Today, dozens of public power utilities are engaged in projects that will pave the way for adoption of technology for our future and enhance the reliability and resiliency of the grid. For example, several projects are looking at electric vehicle adoption strategies, charging infrastructure, customer engagement, and other aspects of support for EVs. The Iowa Association of Municipal Utilities, through a DEED grant, recently developed an Electric Vehicle Planning Toolkit, which can help utilities interested in supporting EV adoption to streamline planning and implementation activities. The Northern California Power Agency and Douglas County Public Utility District have begun research around hydrogen generation. Chelan County Public Utility District used a DEED grant for an energy storage project that enabled it to expand its hydropower resources and to meet peak demand growth. Other projects are investigating applications for technologies related to energy storage, renewable generation, and grid hardening.

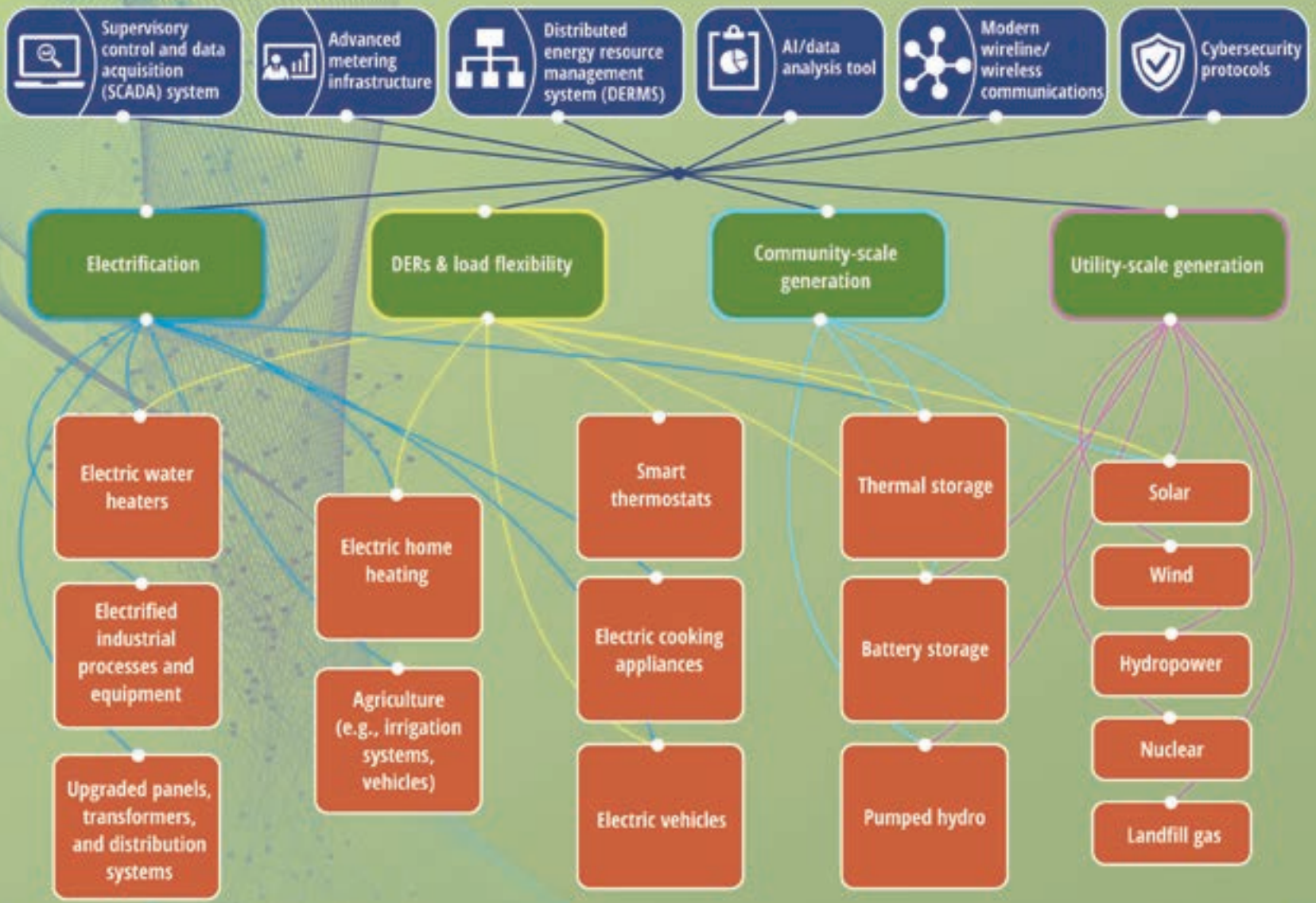
R&D are not limited to adapting new technologies — they also incorporate workforce and community involvement. Sacramento Municipal Utility District in California is working on a pilot program to pair youth with mentors to help develop tools and skills necessary for clean economy careers. WPPI Energy in Wisconsin used an internship to help raise awareness about its energy assistance and other programs to community members with lower income. DEED-funded interns and scholarship recipients have also helped public power utilities in their research. For example, an intern assisted Austin Utilities in Texas in researching its SHINE program, which integrates solar photovoltaics and energy storage in a low-cost manner for its customers.

Energy R&D new and old spread well beyond public power and DEED. The bipartisan Infrastructure Investment and Jobs Act includes more than $21 billion for energy R&D, effectively supporting demonstration and deployment of a host of new energy technologies and applications, such as hydrogen, advanced nuclear, and carbon capture. Across the broader industry, organizations such as the Electric Power Research Institute are dedicated to R&D. Now celebrating its 50th anniversary, EPRI has led initiatives related to efficient electrification and artificial intelligence. Its latest initiative, Climate READi, is a collaborative approach to strengthening the grid to make it more resilient in the face of extreme weather events.

Together, these R&D efforts are fostering new technologies and new ways of thinking about the customer-utility relationship. The world of tomorrow is being shaped by activities taking place today at utilities of every type and size in the U.S. and throughout the world. It takes significant investment and time to make a new technology viable, and we're glad to support public power in being part of this R&D picture, building on our rich history of innovation and continuing to lead through current disruption.

What Technologies Are Necessary for a Clean Energy Transition?

An array of technologies – both those already in use and those needing to be developed – are needed for an economy-wide shift to cleaner energy. First, utilities will need to have six **technological functions** in place. Then, these functions can support **energy technologies** related to **four key areas** for energy transition.

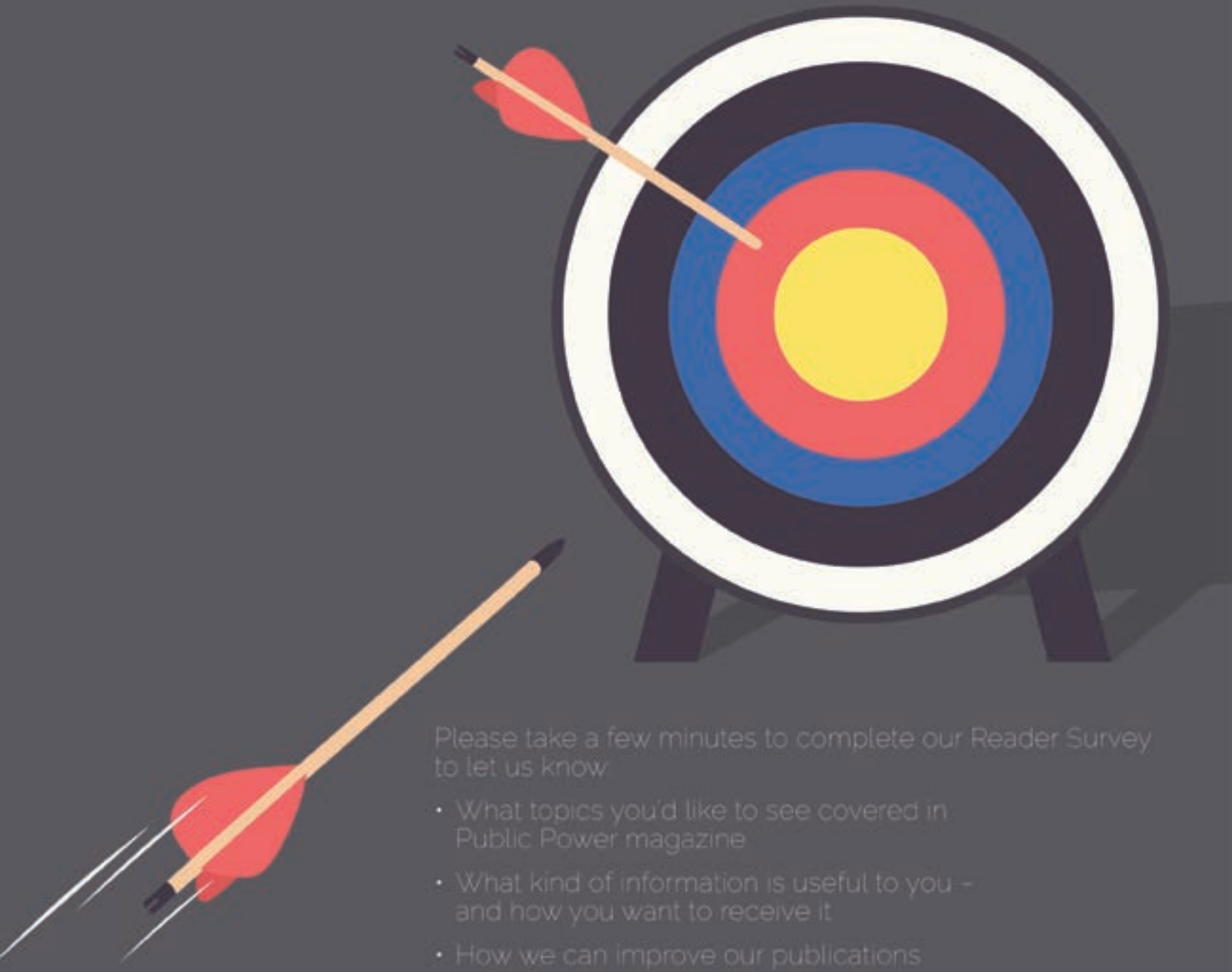


Utilities can support adoption and implementation of these technologies through:

- **Program development** – encouraging customer participation in cost and energy-saving projects
- **Technology planning** – combining new tech with other capital expenditures
- **Tech transfer** – sharing lessons and tools to replicate success
- **Energy purchasing** – seeking lower emission sources from suppliers
- **Pilot projects** – testing rollout of related programs and services
- **Funding** – leveraging local, state, and federal grants to ease costs

Learn more in the Public Power Energy Transition Roadmap.

ARE WE HITTING OR MISSING THE MARK?



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