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PUBLIC POWER MAGAZINE

AMERICAN PUBLIC POWER ASSOCIATION

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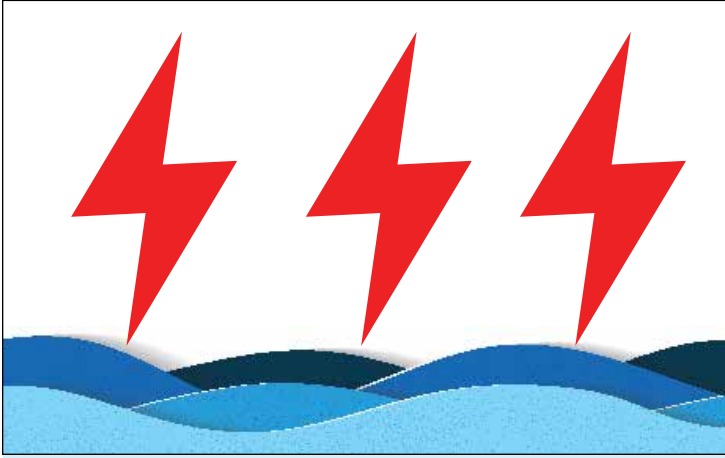
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The American Public Power Association is the voice of not-for-profit, community-owned utilities that power 2,000 towns and cities nationwide. We advocate before the federal government to protect the interests of the more than 49 million customers that 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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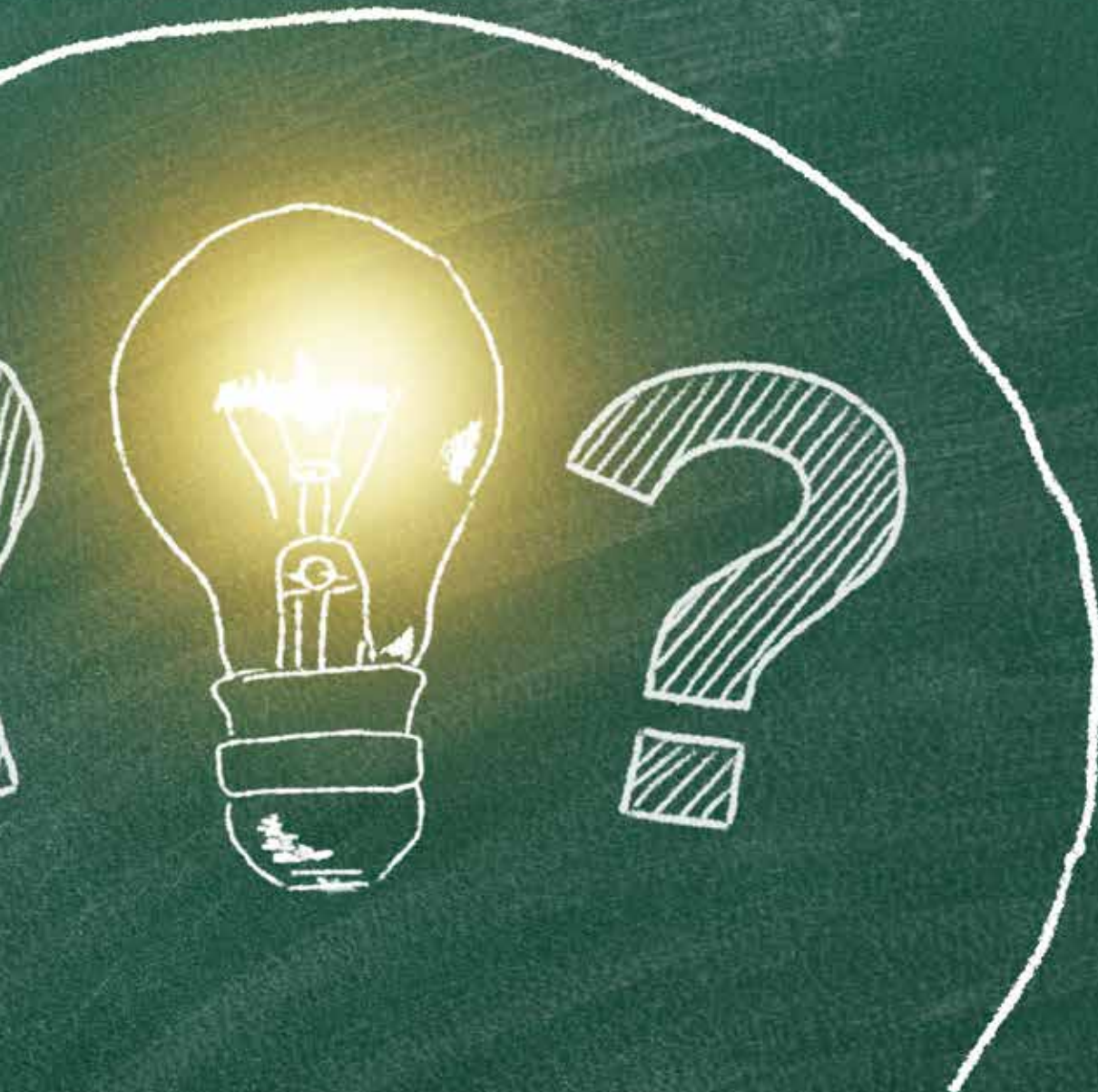
Planning in Uncertain Times

Utilities do a lot of looking into the future – and past – to carefully plot out their paths forward. From securing a reliable power supply to building resilient systems and ensuring sound financing and rates, utilities are often looking at how decisions today will affect generations tomorrow.

This kind of long-term view is made easier when there are clear solutions and choices. However, today's challenges — from a strained supply chain to changing regulations and emerging extreme weather patterns — provide little clarity. All this uncertainty means that predicting the needs — and requirements — for tomorrow is all the more difficult.

As exemplified throughout this issue, public power is facing this uncertainty by finding ways to build flexibility and allow for change within the planning process. And there are examples of how the planners of the past have helped paved the way for smoother operations today. Amid prolonged drought facing much of the country, utilities are rethinking the models they use to forecast water levels for the future while continuing to build on robust conservation efforts and technologies to reduce





the reliance on water for electricity generation (see pages 14 and 18). As energy prices have been volatile, public power has deployed and relied upon a variety of risk management tools, including futures contracts they entered into years ago as a strategy (see page 6). While many items, including distribution transformers, remain difficult to acquire during the supply chain crisis, utilities have reworked their procurement processes and updated their policies (see page 20). Deployment of new generating resources has ramped up, adding to the queue for interconnection with transmission (see page 36). And as market trends and policies increasingly shift favor to greater transportation electrification, utilities are working to understand how to make sure their systems can keep up — and crediting robust energy efficiency efforts in easing the transition (see page 26).

A common theme that shines through is that utilities are not on their own through this process and in confronting these challenges. In addition to pointing to the American Public Power Association as a resource and convener, the authors and people interviewed for the stories in this issue offered up various tools and sources for help. In particular, as utilities seek

support for projects from funding available through the Infrastructure Investment and Jobs Act, the article on page 32 offers guidance for helping make the grant writing and submission process go smoothly.

Many public power providers have enjoyed long-term continuity in their leadership and workforce. As these leaders approach retirement, they have seen the fruits of their past planning efforts and the valuable lessons they have gained along the way. Accordingly, we're pleased to launch a new recurring feature, Public Power Leaders, that captures some of this wisdom in a Q&A with long-time leaders in public power. See page 12 for the Q&A with Tom Heller, president and CEO of Missouri River Energy Services.

Within the spirit of planning and inclusion, please let our team know if there is a topic you would like to see covered — or a leader who you think we should profile — in a future issue. We welcome your ideas and feedback on how we can ensure Public Power provides you with useful information — reach our team any time at News@PublicPower.org.

Rising Energy Prices Not Upending Long-Term Planning – Yet

BY JOHN EGAN, CONTRIBUTING WRITER



As 2023 begins, public power utilities and joint action agencies are facing tough scenarios for fuel and electricity prices. Russia's invasion of Ukraine in February 2022 triggered shock waves throughout the global energy ecosystem. As the world, particularly Europe, aimed to distance itself from Russian energy products, demand for liquefied natural gas shot up, bringing prices with it.

Natural gas has been the fuel of choice for electric generation in the U.S. for many years. But sharply higher prices did not lead to commensurately higher gas production, because drillers followed the gospel of "capital discipline" that Wall Street had been preaching for years: Rather than using surplus cash flow to expand drilling, most of the incremental cash generated by higher prices went to investors. All of that drove up electricity prices and injected an unwelcome level of volatility into public power planning.

The run-up in prices for electricity and natural gas is expected to continue, at least for the first part of 2023. According to the December 2022 Short-Term Energy Outlook produced by the U.S. Energy Information Administration, all U.S. regions are expected to see higher and more volatile wholesale electricity prices for December 2022–March 2023. Price increases are expected to be particularly acute in New England, New York, and the Mid-Atlantic, as those states and regions lack natural gas pipeline capacity, the EIA noted. Potentially making a difficult situation worse, the agency predicted that the October 2022–March 2023 period would be colder than the same period a year ago.

JAA leaders and public power utility executives are using a combination of supply-side and demand-side tools to manage price volatility, reduce disruption, and minimize the economic pain.

Managing Costs in a Volatile Market

"A 40% year-over-year price increase is the kind of thing that creates challenges for mayors and council members," commented Jacob Williams, general manager and chief executive officer of the Florida Municipal Power Agency. Florida relies on natural gas to generate about 80% of its

electricity, and Floridians use the most electricity, per capita, of any state in the country, he said.

FMPA was paying about \$70 per megawatt-hour of electricity in late 2021, but that increased to about \$120 per MWh in late 2022, he said. He expects prices to decline to about \$90 per MWh in mid-2023.

"When prices were low, we asked our members if they wanted to go with the market or lock in a set price," he recalled. "Back then, they preferred to go with the market. But when prices escalated, they quickly saw the value of stable and predictable prices."

"Customers don't like high prices," commented Dave Osburn, general manager of the Oklahoma Municipal Power Authority. "But they really don't like high prices and volatility."

OMPA has generating assets and buys energy from the Southwest Power Pool market. Osburn said the market prices have "skyrocketed" since April 2022, with the average load price exceeding \$100 per MWh in the summer. Over the past two years, excluding the spike from the winter storm in February 2021, the average cost has fluctuated from about \$20 per MWh to over \$60 per MWh.

Risk management tools, such as locking in the price of gas or electricity through futures contracts, have long been used by JAAs and public power utilities to gain some certainty over what price they will pay for natural gas or electricity in future months. Over the long term, well-executed hedging strategies reduce financial risks and assure availability.

In a futures contract, a buyer contracts with a seller to purchase a certain amount of electricity at a future date at a set price. Both parties give up something in order to minimize risks: The buyer pays to attain price certainty, and the seller gives up the potential for higher prices in the spot market to lock in a set price for some portion of future production. JAAs interviewed all used hedging strategies, including but not limited to the futures market, to lock in the majority — as much as 80% — of electricity or gas in 2022. And they expected that to continue in 2023.

Some JAAs, such as FMPA and OMPA, own most of their own electric generation. Those JAAs focus on locking in prices for natural gas. But other JAAs, such as Delaware Municipal Electric Corporation, which serves eight members across the Delmarva Peninsula, also rely on market purchases of electricity from a regional transmission organization in addition to owning diverse generation assets. In DEMEC's case, nearly 60% of its power is purchased through staggered contracts from the PJM Interconnection, the RTO providing wholesale electricity to an estimated 65 million people in parts of 13 states and the District of Columbia.

"The key is layering the hedges," said Kimberly Schlichting, DEMEC's

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president and chief executive, who acknowledged that “there’s always a chance of a world event that pulls the rug out from under your feet.”

“We were able to capture about \$860,000 in cost savings in a small 5-megawatt contract just before Russia invaded Ukraine,” she said.

Contracts don’t all work out that well, but she said “the key is to structure your hedging instruments so that you’re not locked into one price. You have to actively manage your portfolio.”

“In late 2021, our consultants projected that wholesale power prices in the MISO market would average \$42 per MWh in 2022,” recalled Dave Geschwind, executive director and CEO of the Southern Minnesota Municipal Power Agency, a JAA serving 18 members. “Our consultants told us there was only a 5% chance that prices would average more than \$42 per MWh. We ended up paying about \$85 per MWh for power in early 2022 — two times the upper bound of what our experts predicted.”

"There's always a chance of a world event that pulls the rug out from under your feet."

Kimberly Schlichting, president and CEO, Delaware Municipal Electric Corporation

No Big Changes to Capital or Operating Budgets

Sharply higher energy prices have not, as yet, caused substantial changes to the capital budget plans of the public power providers interviewed for this article. Planned closures of generators are still going forward, and plans to secure new renewable generation continue to advance. Many providers continue to investigate the costs, benefits, and challenges of battery energy storage systems and to assess the need for building new transmission lines.

“Investment decisions need to be made in the 2023 time frame for new transmission lines that will come into service in 2029 or 2030,” commented Geschwind.

Nor have higher prices caused leaders at the utilities and JAAs interviewed to cut staff or significantly reduce other operating expenses, though Geschwind acknowledged holding off on filling a few open positions. Many said there was little fat to trim on the operating side. That may not be surprising: Staffing costs typically are a small fraction of fuel or purchased-power costs.

FMPA’s Williams said his organization is investigating efficiency upgrades at natural gas combined-cycle plants. “Power plant efficiency is a lot more important when you’re burning \$9 gas compared to burning \$3 gas,” he commented.

Those that own generation can benefit from high electric prices. DEMEC’s Schlichting said that, for it, high prices provided rate stabilization through selling generation into the market, creating revenue that could be used to mitigate wholesale power increases to its members.

“Our Warren F. Beasley Power Plant has been our best insurance during periods of high prices,” she said. When electric prices in PJM reached \$2,400 per MWh, DEMEC sold excess generation from Beasley, which had a significantly lower production cost.

Helping Customers

In addition to using supply-side options to manage high and volatile prices, public power utilities and JAAs also are ramping up efforts on the demand side — including educating customers on how high usage contributes to the increased cost for electricity. Westfield Gas & Electric, a combination utility that serves about 18,000 customers in Massachusetts, is increasing its promotion of no-cost, walk-through energy audits for residential customers.

At the end of 2022, WG&E also boosted its residential heat pump incentive to \$4,000 from \$2,500. That program seeks to convert homes that heat with fuel oil or propane to electric heat pumps. A typical residential heat pump installation costs about \$10,000 in WG&E's market. Reducing residential use of fuel oil and propane is part of the utility's plan to comply with Massachusetts' clean energy requirements. But Tom Flaherty, WG&E's general manager, is concerned about where the non-emitting electricity will come from.

"Among the public," he said, "the tide is turning against gas pipelines, transmission lines and onshore wind turbines." Offshore wind "has a great potential in New England," but permitting delays have pushed back the start of construction of several offshore wind farms.

WG&E also is part of a group seeking to import hydropower from Quebec, but that project has been delayed over routing litigation. It had investigated constructing a 2-MW solar and 2-MWh battery storage project, but high prices forced the utility to shelve that. It may revisit solar plus storage in partnership with a local military base.

The utility has a diverse energy portfolio, which includes nuclear, solar, hydro, and wind generation. A portion of Westfield's power needs come from the daily market mix operated by New England Independent System Operator. Roughly 30% of ISO-NE's power comes from nuclear and 50% from natural gas.

The utility has increased its annual retail electric prices by about 15% in 2022. It had not been forced to tap its \$40 million in electric and gas stabilization funds so far, but Flaherty said, "We may have to look at getting into those piggy banks this winter," if the polar vortex makes a return visit or if prices for natural gas and power remain high.

"There are huge unknowns that we can't control, which may have a significant impact on our customers," he said, speaking about both electricity and natural gas.

In Oklahoma, OMPA is working with its members to introduce several new customer programs in 2023, including demand response coupled with smart thermostats, utility voltage reduction and time-of-use pricing. In addition, the JAA will be working with its members to assess community solar in 2023, said Jennifer Smith, OMPA's director of member services.

"We're trying to help our members assess various resources, both on the demand side as well as locally sited solar generation," she said. There's not a lot of rooftop solar in Oklahoma right now, largely because utility costs have been relatively low, but Smith said rising prices could spark an uptick in that option.

Roughly half of the JAA's 45 members have deployed advanced metering infrastructure, and the JAA is helping other members assess the costs and benefits of AMI. OMPA is hoping to capture some funding from the federal Infrastructure Investment and Jobs Act to expedite deployment of advanced meters among its members.

Communication Critical to Managing Expectations

High and volatile energy prices highlight the importance of frequent and effective communications to maintain customer and member satisfaction. Because energy issues have become global, it's more important than ever to keep stakeholders informed about changes that could affect them while also highlighting steps they could take to gain more control over their energy usage and bills.

"Higher energy prices made the news media more interested in covering energy issues and energy efficiency," commented WG&E's Flaherty. "We're trying to capitalize on that by being more proactive with information and providing it in various forms, like press releases, videos on our website, and social media posts."

Schlichting said DEMEC had an outside subject matter expert discuss natural gas prices at board meetings, so its board members were made aware of why prices were rising. "When the cost of everything is going up, from gasoline to food, cars and airline tickets, it's easier for people to understand why electricity prices are rising," she said. DEMEC plans to increase prices by only 2% this year.

"We've spent a lot of time talking with our members about energy prices and energy issues," said SMMPA's Geschwind.

"As prices rose, we ramped up communications," added OMPA's Osburn. "We're trying to keep members, and through them consumers, more informed. We plan to take it to another level in 2023, because we're going to be in this period of price volatility for a while."

"In mid-2022, we started sending our members information and graphics they could use in their social media posts about energy prices," added Smith. "In communicating with our members, we highlighted tools they could use to help customers."

Public Power Leaders: Tom Heller

A

Q&A with Tom Heller, president and chief executive officer of Missouri River Energy Services in South Dakota. Tom is retiring from MRES in June 2023 after spending 47

years working in public power — with 30 years at MRES and 17 years at Moorhead Public Service in Minnesota. He served on the APPA board of directors and currently serves on the Transmission Access Policy Study Group and Public Power CEO Climate Change and Generation Policy Task Force.

HOW DID YOU COME TO WORK IN PUBLIC POWER?

Public power kind of found me. As an engineering student at North Dakota State University, one of my instructors said the public utility across the river in Moorhead was looking for a student to help with some work. So I called, interviewed, and got the job. I worked part time for a year, then when I graduated, a full-time opening became available. It just worked out well for me.

I had other job offers in bigger communities, but I didn't want to live in a big city. I grew up on a farm, so it just fit my lifestyle quite well. After several years, when I was only 31 years old, I had the opportunity to be general manager.

Over the years, it's been such a privilege to work with the people in public power. From the local utility board to city council, they are truly public servants. Working with them made me want to stay in public power for the rest of my career. Moorhead is a member of MRES, so I still have a connection with them. When I retire, it's the people I'm going to miss the most.

WHAT KEY LESSONS HAS WORKING IN THIS SECTOR TAUGHT YOU?

Two things.

First, the power of local control and local decision-making is so valuable. You get people who live in a community and care about the community, and who pay the power bills, who are elected or appointed to run and manage these local utilities. That's one thing that I really appreciate and the reason why I wanted to stay in public power. One of the things we are focusing on with our members is the value of the local public power system. It provides such an economic benefit to the community: They've got very low rates, and most of them have fairly good transfers to their city general fund. We have to continually inform customers just what a gem they have.

Second, the big lesson I've learned over the years is that you can't do it yourself. You've got to partner with others in public power cities. Joint action agencies can work together not only in building power plants and transmission lines, but also in leading legislative advocacy and training. MRES is one of the oldest multi-state joint action agencies in the country. All of the cities that were first members of MRES relied entirely on hydropower allocations. About 10 years before MRES formed, the federal government said that the hydropower supply would run out, and that the cities would need to buy power supply from another source or build generation of their own. So Moorhead and 60 other cities decided to join together and develop generating resources through MRES. It was truly joint action to make sure these smaller communities could have a reliable power supply.

IS THERE AN ACCOMPLISHMENT YOU ARE MOST PROUD OF FROM YOUR TIME IN PUBLIC POWER?

The number one thing is that I haven't accomplished this alone. We have such low turnover on our staff — people stay and that's because we engage them.

We have long-term power supply contracts with our members. We have extended the term of those agreements five times and we have never had a member try to leave or not sign an extension. That shows me that we're doing something right. In our member satisfaction survey that we do every other year, we consistently get high ratings.

If we continually focus on "what do our members really need," then we will continue to be successful. That's why we're in business. One of the programs that we started is distribution maintenance, in the form of providing lineworkers for several of our member communities. We started it back in 1997, and for well over 20 years it has provided municipal utilities who have a hard time keeping lineworkers the opportunity to contract with us to do the work for them.

WHAT WOULD YOU LIKE FUTURE PUBLIC POWER LEADERS TO KNOW?

You have to network. If you've got a problem you are working on, there's probably someone else who has dealt with the same issue and addressed it. You don't have to reinvent the wheel. Be involved with APPA and come to the meetings. Going to conferences and talking to others is so valuable. There's a group of us joint action agency managers in the upper Midwest that get together twice a year to talk about problems we are facing and how we can fix them.

I have been so pleased and so impressed with how much other managers who have worked with me over the years have been willing to share. You don't have to have all the answers. You just have to have the phone numbers of people who you can call and ask to find out what they've done.

We're all going to have some tough times and negotiations. You may have some issues with people internally or on city councils, but the best advice I have is to be easy on the people, but tough on the issues. Somebody who you may have an issue with today is probably going to be a valuable asset for you to work with in the future, so don't burn bridges.

Lastly, have fun. Try to use humor when you can. It does work if you can find the balance between using it appropriately and not overusing it.



PLANNING FOR LESS

ADAPTING POWER

BY STEVE ERNST,
CONTRIBUTING WRITER

Wide swaths of the U.S. faced drought conditions in 2022, with western states facing years-long drought that saw key reservoirs that feed hydroelectric dams reach historic low levels. In order for public power to adapt to widespread drought conditions, many utilities are changing the models they use to calculate future resources and are joining with their neighbors to help craft plans to help adapt to changing conditions.

Relying on New Trends

Public utilities can no longer rely on long-term historical records to help model future resource needs. The Bonneville Power Administration, a federal power marketing agency that sells electricity generated from 31 federal dams on the Columbia and Snake Rivers to 149 public power utilities and business customers in the Pacific Northwest, has changed a key variable used in its hydrogeneration forecast. This year, BPA started using 30 years of streamflow records (1989-2018), rather than its 90-year historical record (1929-2018) to calculate long-term hydropower generation planning.

PLANNING AMID DROUGHT

ADAPTING POWER PLANNING AMID DROUGHT

“We just don’t see the same types of flows coming onto the system like we did 80 to 90 years ago,” said Ryan Egerdahl, manager of the long-term power planning group at BPA. “All of this is for the sake of climate change preparedness and resiliency. We have seen the climate changing, more and more, and we’re confident in making this change.”

BPA’s analysis showed that over the last several decades, increasing temperatures throughout the Columbia River Basin have contributed to increased average winter and early spring stream flows, with average peak spring runoff now appearing several days earlier, along with decreased summer flows. Bonneville’s climate change study, known as River Management Joint Operating Committee, indicates that in the coming decades these trends will likely continue.

Temperatures in the Columbia River Basin are expected to increase, as the region experiences wetter winters, along with longer summer dry periods, declining snowpack, higher average fall and winter flows, earlier peak spring runoff, and longer periods of low summer flows.

By the 2030s, BPA expects the Snake River Basin will have higher average fall and winter flows, earlier peak spring runoff, and longer periods of low summer flows. The earliest and greatest streamflow changes are likely to occur in the Snake River Basin, although that is also the basin with the greatest modeling and forecast uncertainty, BPA said.

BPA’s study found that using generation from fiscal year 1937, which had very low winter and very high summer flows, was inconsistent with emerging climate change signals and future projections and was unlikely to reoccur.

Because of the lingering drought in Washington, Oregon, Idaho, and Montana, BPA has also increased its budget for managing vegetation along its 15,000-mile transmission network to help prevent wildfires. And for the first time in its history, BPA instituted a policy to shutdown transmission lines when forecasts call for high winds and hot temperatures.

“The last few decades the climate has absolutely been changing, and we are trying to change with it, so our forecasts don’t misrepresent what’s happening,” Egerdahl said.

Par for the Course

In the Platte River Valley of Central Nebraska, the “wetter periods are wetter, and the drier periods drier,” said Devin Brundage, general manager of the Central Nebraska Public Power and Irrigation District.

The district has been managing water for both hydroelectric generation and irrigation since it was launched in 1941. “It’s been dry on the plains,” Brundage said. “But given our history, this is just par for the course. We’ve gotten very good at drought planning.”

According to a recent report from U.S. Drought Monitor, over 98% of Nebraska is experiencing at least moderate drought conditions. Central’s main storage reservoir is Lake McConaughy, Nebraska’s largest reservoir that can store almost 2 million-acre feet of water. But two years of drought

have left the reservoir about 42% full, and inflows into the 22-mile-long lake are some of the lowest levels in the reservoir’s history. Water year 2021-22 was the fifth driest since 1940-41, the first-year water records were kept, and nine of the 10 lowest inflow years have occurred in the last 20 years.

“There’s just been a dry trend that has become the norm over last couple of decades,” Brundage said. The district operates four hydroelectric plants that generate 113 MW, and its network of canals and pipelines irrigate around 110,000 acres of mostly corn and soybeans.

Finding ways to use water more efficiently has been Central’s goal since it was founded nearly 80 years ago. For years, the district helped irrigators facilitate new center pivot irrigation systems, where equipment rotates around a pivot and waters crops. Center pivots have now become one of the cornerstones of water conservation in the district.

“Center pivots have been a huge component to how we efficiently deliver water,” Brundage said. “Irrigators are able to optimize their yields with not nearly as much water as they used in the past. Our irrigations customers treat water like any other input.”

The district has also lined its canals and built a pipeline system to help conserve surface water as it is delivered to the area. And is also at the forefront of helping create a region-wide water plan for the Platte River Valley, for the benefit of both surface and ground water users. The objective is to make sure there’s plenty of surface water for irrigation, but during drought conditions, some irrigators can turn on wells and tap into the aquifer. Most irrigation customers in the region could tap into both surface and groundwater, if necessary, but many irrigators in the Valley don’t have that dual connection.

“We are always planning and looking ahead, and really reevaluating where we are today versus 20 years ago” Brundage said. “Our management technologies have improved, so our ability to model and hold the line has really improved. Irrigators are always concerned about water and we want to make sure we are working together to sustainably manage the water supply.”

Bringing Down Consumption

In the Southwest, the Salt River Project is managing through a 27-year drought that is threatening to curtail hydroelectric generation from a pair of dams on the mighty Colorado River. SRP provides water and power to more than 2 million people in central Arizona. It 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 a political subdivision of the State of Arizona in 1937.

The utility has a diverse generating portfolio that’s anchored by coal,

ADAPTING POWER PLANNING AMID DROUGHT

natural gas, and nuclear power plants, and augmented by hydroelectric, wind, solar, geothermal energy. The utility's fossil fuel and nuclear plants require huge amounts of water, and SRP has secured long-term water rights for the plants, some of which is being supplied by reclaimed water from the Phoenix area.

Michael Reynolds, manager of resource analysis and planning at SRP, said he doesn't "foresee any reliability concerns for a lack of water for the thermal plants." SRP's water conservation programs have been in place for decades. The utility uses less water today than it did 50 years ago, Reynolds said, and has set a goal of reducing water consumption at its energy facilities by 20% on an intensity basis by 2035.

"We have been blessed by the long-term planning of previous decades," Reynolds said. "Think about all the water storage in the region that has enabled us to live in the desert through decades of extreme drought. But that water storage is not infinite. Water storage is low in the region. We need to figure it out as a region, and change the balance of not drawing on water storage resources that have been taxed for so long."

SRP is working with neighboring utilities on a water management plan to help reduce water consumption in the Southwest. And is participating, along with BPA, in the development of a Western resource adequacy program, where utilities around the West could more easily share power during extreme weather events. Recently, the federal government announced it was preparing to rewrite rules on Colorado River water use, after states failed to file a plan in August to cut water use by 15% to 30%. The goal is to keep water levels at Lake Powell as high as needed to generate electricity at Glen Canyon Dam and Hoover Dam.

"So far," Reynolds said, "power from Hoover and Glen Canyon dams on the Colorado River has been there. But there's less water behind the dams, which is reducing power production." SRP manages seven reservoirs, and thanks to an active monsoon season, the utility said it's in "pretty good shape" heading into the winter.

"The tale of long-term planning is — we don't know what will happen," Egerdahl of BPA said. "But we have to try to model what is likely possible. And looking at data from the past 30 years lines up much more closely with what we can expect from climate change."

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How Much Water O

Making electricity requires a lot of water.



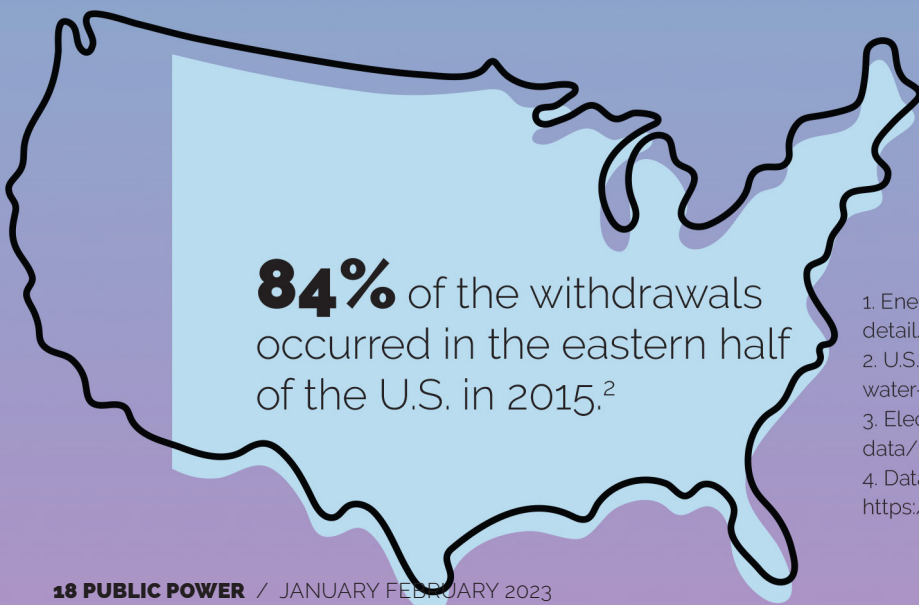
**11,857 gallons
of water**

is used
per megawatt-hour
of electricity produced.



The electric power sector used **47.5 trillion gallons** of water in 2020.¹

This makes power plants the largest source of water withdrawals, though **most of this water is returned to its source** after helping to cool down thermal generating facilities, such as those using natural gas, coal, or nuclear fuel.



84% of the withdrawals occurred in the eastern half of the U.S. in 2015.²

1. Energy Information Administration. <https://www.eia.gov/todayinenergy/detail.php?id=50698>

2. U.S. Geological Survey. <https://www.usgs.gov/mission-areas/water-resources/science/thermoelectric-power-water-use>

3. Electricity Data Browser, EIA. <https://www.eia.gov/beta/electricity/data/browser/>.

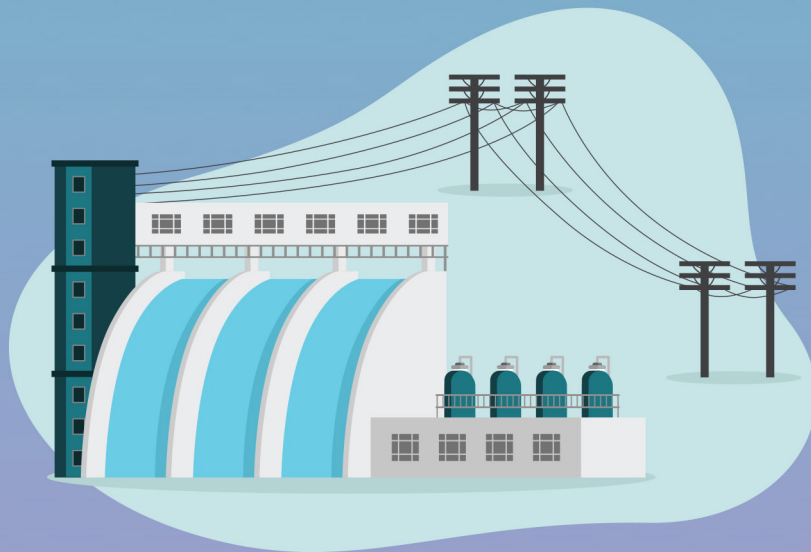
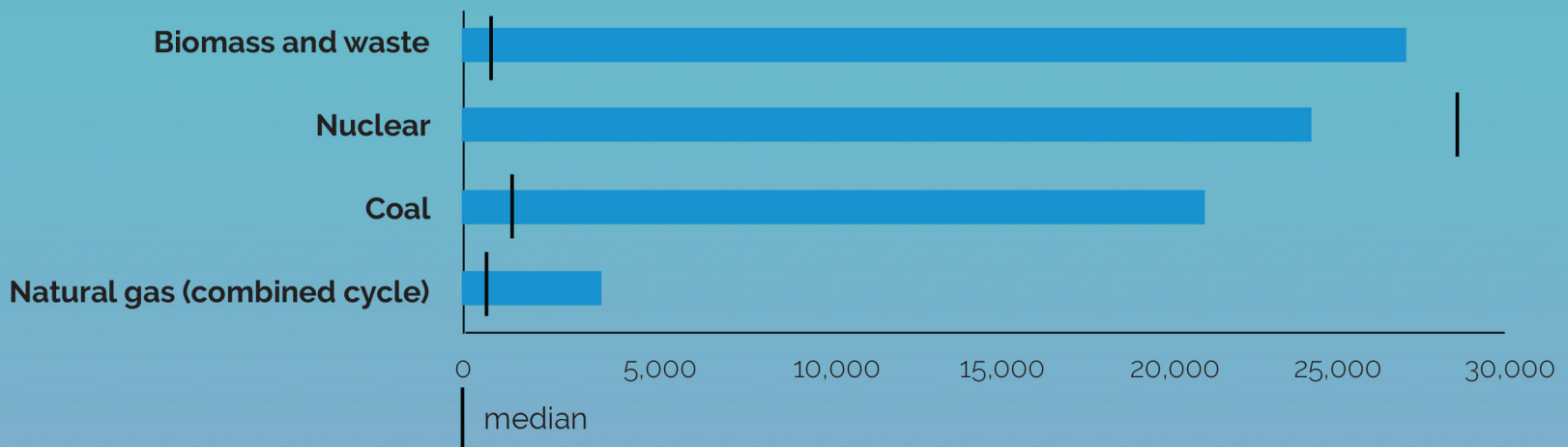
4. Data reflects what was submitted to EIA.

<https://www.nei.org/news/2020/nuclear-solution-for-climate-energy-water>

Our Electricity Uses

Average water withdrawal by generation type, 2020³

In gallons per megawatt-hour



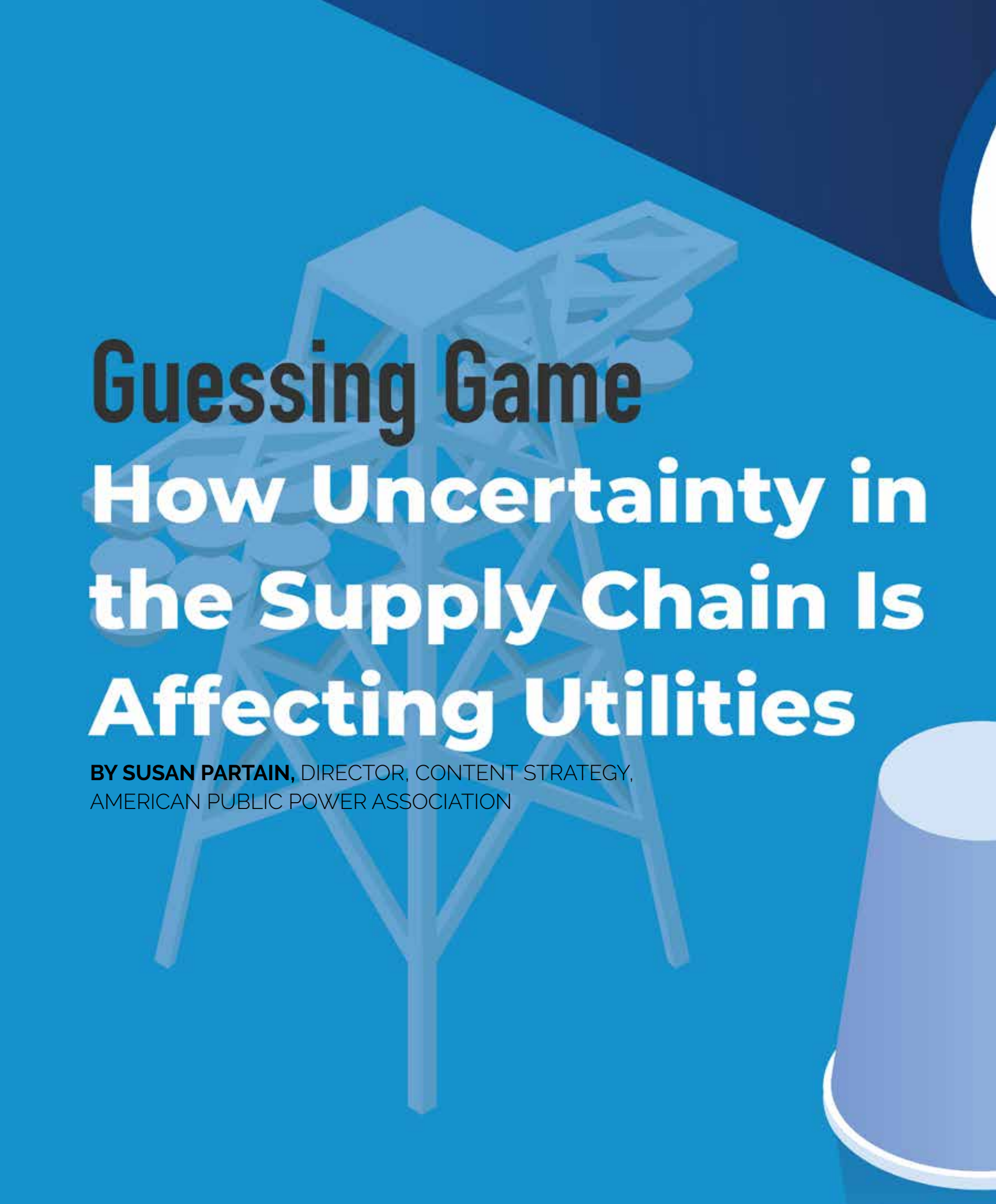
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Using less

Since 2015, total water use by the sector has declined more than 10%, and the water use intensity has declined more than 20%. This can be attributed to the changing generating mix and to the deployment of technologies and systems that reduce the need for water at thermal plants.

Certain types of natural gas-fired facilities already have low water use by relying on dry cooling systems — essentially fans — instead of water. Some next generation advanced nuclear systems, such as a small modular reactor project in Idaho with Utah Associated Municipal Power Systems and NuScale, are exploring deploying dry cooling, which could reduce water usage by 90%.⁴

The background is a solid blue color. In the center, there is a faint, light blue graphic of a utility tower. To the right of the tower, there is a faint, light blue graphic of a sand timer. The text is overlaid on this background.

Guessing Game

How Uncertainty in the Supply Chain Is Affecting Utilities

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



Standing in the way of any major utility goal or project right now is a low supply and high demand of a technology or piece of equipment. Particularly acute is the availability of distribution transformers — which are necessary for both the ongoing reliability of the existing grid and for communities to grow.

The uncertainty of knowing when critical supplies will be available — and at what cost — is changing how utilities are approaching everything from the procurement process to supply management, standardization of system components, and communication with customers and other key stakeholders. The wide-ranging effects of this issue are why the American Public Power Association has made addressing the problem a priority. In response to a request for information from the Department of Energy in November 2022, APPA stressed that, “until we can address the shortages and supply chain challenges that are directly impacting reliability, we may not be able to accomplish many of the goals this administration has laid out for advancing clean technologies or expanding electrification.”

The response went on to urge DOE to act quickly to alleviate distribution transformer shortages and to establish longer-term efforts to expand domestic manufacturing capacity for large power transformers and other grid components.

Empty Shelves, Canceled Orders

In Washington state, Roberta Cox, who manages the inventory for the electrical side of Tacoma Public Utilities, said that the public power utility’s highest concern is in finding inventory of distribution transformers, but that other specialty utility materials, especially those that rely on plastics and resins such as insulators, can also be a challenge to keep in stock.

“Of particular concern to us is that we’ve reached out to distributors and manufacturers, and in most cases, we’re getting a rejection,” said Cox. The utility’s go-to supplier for transformers canceled an existing contract early and informed TPU it could no longer supply the utility under its existing agreements. As of December 2022, Cox projected that the utility had a sufficient inventory of transformers to last through the first half of 2023, but was still working on securing sufficient inventory for the remainder of the year.

“We have delayed all noncritical work, knowing that we don’t have enough,” she said. TPU has been doing more refurbishment of transformers in its asset management.

Cox said that since the utility’s usual sources for some materials have become unavailable, it is taking a lot of time to focus on sourcing new vendors and researching potential new suppliers. In response, TPU has brought in an additional staff member whose sole job is to source materials.

TPU has also changed up its ordering process, including projecting out needs and ordering items with longer ranges, about three times as long as it used to, said Cox. The shortage of supplies also means that TPU has shifted to purchasing many items as spot buys instead of via contracts.





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GUESSING GAME: HOW UNCERTAINTY IN THE SUPPLY CHAIN IS AFFECTING UTILITIES

Chad Edinger, electrical services manager at TPU, said the utility's standards had also "boxed itself in" to using one manufacturer, and so TPU worked to broaden materials standards to open to the possibility for using other manufacturers.

Growth on Hold

Maria Garcia, vice president of supply chain at CPS Energy in San Antonio, Texas, noted how homebuilders and developers are particularly impacted by the shortage. "When we don't get transformers, we can't give them jobs," she said. A developer might have "millions of dollars just waiting to be energized. We feel the pressure they are experiencing."

San Antonio is one of the fastest growing cities in the country, and so the delays in energizing new homes affects this growth and puts pressure on an already tight housing market. To size the increase in demand, CPS used about 1,500 single-phase pad mount transformers through the first six months of 2019. By comparison, in the first half of 2022, it used almost 2,200 – a 46% increase, before delivery delays began in the third quarter.

"We were fortunate to only have one hurricane [in 2022]. If we had a strong one, it could have seriously depleted our emergency reserve," she said. "Regardless, we are now getting into winter weather, so I'm glad we have that reserve set aside."

And while CPS Energy faces increased demand, it is seeing lead times for key items grow. Before the pandemic, Garcia said a typical lead time for transformers was 10-16 weeks from the date of order to delivery. Now, that time is 48-62 weeks, and even higher for some specialty types of transformers. Wires and cables used to take about 6-8 weeks to deliver, and now the utility waits between 26-43 weeks for those materials. Times to receive wooden poles, insulators, and crossarms have also increased exponentially.

Growing Pressure and Prices

Garcia recalled how in the late 1990s, utilities would manage equipment inventory using a "just-in-time" strategy. Now,

with all of the delays, she said utilities are just trying to find and bring items in as quickly as possible and are relying more on salvaging and repurposing older materials.

Adding to the pressure is the influx of funding for all kinds of technology and equipment from the Infrastructure Investment and Jobs Act. While the funding offers opportunities for supporting many types of energy projects, the injection of funding is adding to the demand for already scarce materials, including across different sectors. Garcia mentioned that utilities are in essence now competing with the electric vehicle industry and communications providers for raw materials.

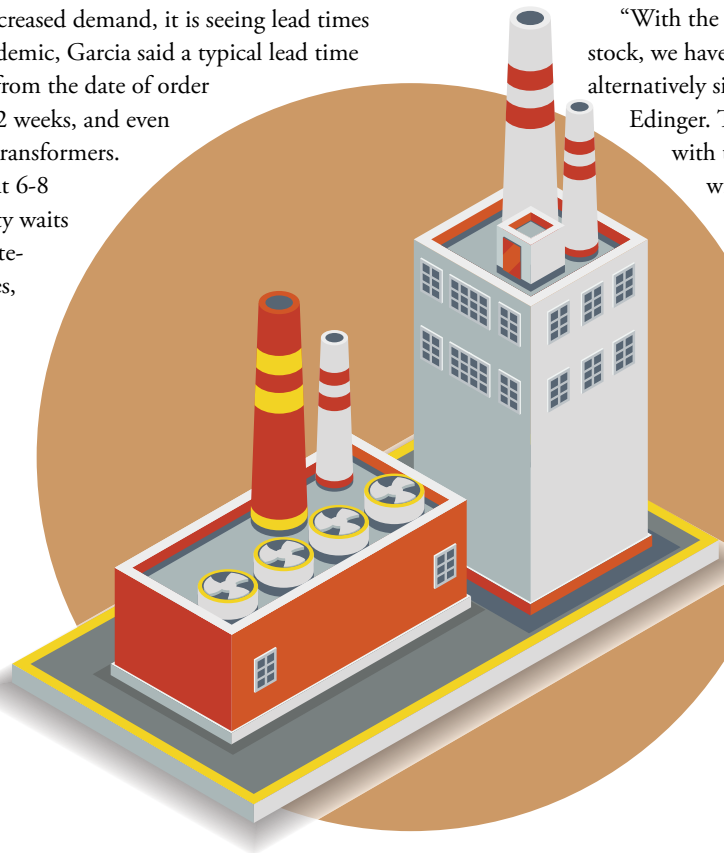
The added demand is contributing to increasing prices for many materials as well. TPU's Cox estimated that the utility is facing transformers prices that are 40%-60% higher and at least 50% higher for many materials usually stocked in the warehouse. Garcia gave one example of the increasing cost of PVC conduit, which she said has increased from \$1.25 to \$5 per linear foot — a 340% increase.

Better Coordination

Working within this constrained environment requires increased communication and flexibility — across the utility and with suppliers and customers.

"With the developers, if we don't have a transformer in stock, we have been working with them to install an alternatively sized transformer in the meantime," said Edinger. The alternative size could provide developers with the electricity needed to do construction, with the hope that "by the time the building is ready to occupy, they have the right size transformer."

Tacoma is also feeling the pinch on its planned deployment of advanced metering infrastructure, and while it had ordered sufficient stock to switch over its commercial customers, is paying close attention to how it can meet the supply needed for its residential customers, particularly for growth areas, such as several multi-family developments under construction. The water side of its operations faced similar struggles in sourcing meters because of the microchip shortage affecting many industries.



GUESSING GAME: HOW UNCERTAINTY IN THE SUPPLY CHAIN IS AFFECTING UTILITIES

Garcia mentioned that the CPS Energy team has a regular cadence of giving updates to customers about the status of various materials so that they are aware of the timelines and any constraints.

The problem, said Garcia, is that “it’s not just one item that is out, it is 10.” While transformers are the items most affected right now, she said that other items, such as poles, surge arrestors, and cables can also be tough to obtain in a timely manner.

Garcia’s team takes weekly snapshots of what items they are having difficulty locating and looks at the status of orders placed to see how delayed they might be. The weekly reporting helps the team identify trends to see if anything has changed or is starting to show a positive trend in availability. They also track deliveries and how often staff are unable to find an item on the shelf in the warehouse. Garcia said that stock outs are occurring five times more often than they did before the pandemic.

Edinger noted how Tacoma historically managed its common stock alongside its maintenance stock, but now has separated the two to better ensure supplies needed for building and growth are fulfilled to match projected lead times. He noted that TPU’s policy has always been to provide transformers based on who is first ready for service, but the utility hasn’t had to explicitly state that policy until now.

“Coordination has been much more necessary,” stressed Edinger, who said his team has set up a more regular cadence of meetings with the warehouse team, engineers, economic development partners, and others.

Externally, the CPS Energy team also has more frequent meetings with suppliers and manufacturers — what used to be a quarterly check in is now a weekly meeting to discuss how any issues upstream might affect the utility’s plans and orders.

Garcia’s team is also working with the utility’s engineering team on how it might be able to modify specifications to allow for more flexibility in the materials and subcomponents it can use. As such, the number of suppliers and contracts CPS Energy is managing has expanded, with some equipment having three suppliers contracted to try and keep pace with the demand.



Signs of Relief

Some acknowledged that concern about constrained supply has set off a cycle of increased demand, where utilities are placing orders for more, knowing that some items are hard to come by or will take longer to receive, increasing the total backlog of orders.

“The challenge is that everyone panicked ... and we don’t have a good sense of how much is because of uncertainty,” said Trish Rhay, who manages the warehouse supplies for the water side of Tacoma Public Utilities. For its part, Rhay said that TPU is “seriously evaluating how much we need on the shelf at any time.”

“Tacoma was fortunate that we recognized the potential issues early, focused on shoring up our inventory, placing strategic orders, and identifying new supply sources. On the customer side, we focused on defining and refining the demand forecast, setting clear priorities, and strategic scheduling of requests,” said Rhay. “As a result, TPU was able to weather through these issues without any major delays or impacts to our customers.”

Garcia is hopeful that the situation will turn around, but believes estimates of relief happening within the next two years might be too optimistic. She noted that there is escalating pressure at the federal level — including from trade associations, manufacturers, and utilities — to address the underlying problems creating the backlog.

“Our hats off to [manufacturers], they are doing their best right now,” said Garcia, who noted that a couple of manufacturers are working on expanding their facilities in an effort to catch up. But, getting a new production center online takes time, from building the physical facility to training staff.

“As soon as we hear relief from manufacturers, that they are starting to catch up with orders, then it’s downstream from there,” said Garcia.

“We will eventually see the light at the end of the proverbial tunnel... I just wish we had the crystal ball to say when,” added Garcia. “We need to continue to be proactive. Where we can work together, we have that door wide open.”



ZERO-EMISSION VEHICLES

BY BETSY LOEFF, CONTRIBUTING WRITER



**AS SALES
RISE, SO DO
NEW CHALLENGES**

ZERO-EMISSION VEHICLES: AS SALES RISE, SO DO NEW CHALLENGES

The U.S. has reached a tipping point for electric vehicle adoption, having surpassed 5% of new vehicle sales. Analysts at BloombergNEF found that EV sales in 18 countries skyrocketed after those nations reached a 5% penetration rate. In the U.S., state adoption goals may nudge the curve to move even faster. In 2022, California and New York ruled that by the end of 2035, all new car sales must be zero-emission vehicles, and other states might follow suit. This rapid adoption will bring utilities face to face with new issues to manage.

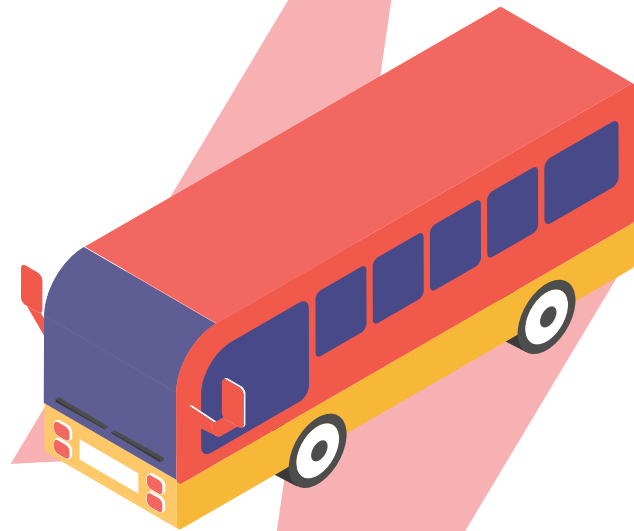
FAST UPGRADES FOR FAST CHARGING

EV sales mean more electricity sales, and some utilities already face capacity constraints. One big investor-owned utility in California did a study in 2021 and found 19 megawatts of capacity constraints at that point. “It may be even worse right now,” said Bryan Jungers, director of e-mobility at E Source, a utility research organization and consultancy.

Jungers mentioned having recently spoken with someone from a small California public power utility that is looking at bringing a new transmission line across its city, a very urban environment. “It’s hugely expensive, and construction is a nightmare. It’s going to take years to do that,” Jungers noted.

Power system infrastructure could also be an issue for John Markowitz, head of e-mobility for the New York Power Authority. New York already had plans to mandate zero-emission vehicle sales by 2040, so the governor’s decision to move that up to 2035 didn’t change the utility’s planning much, Markowitz said. However, New York Gov. Kathy Hochul also issued aggressive goals for transit authorities to convert their fleets to electric buses.

“In the early transit bus depots we worked on, we were putting in the same fast chargers we would put on an interstate highway: 150 kilowatts apiece,” Markowitz said. That means a 10-bus charging depot draws 1.5 MW. “From a utility standpoint, a bus depot used to look like a small warehouse in terms of load. Now it looks like a skyscraper,” he explained.



“From a utility standpoint, a bus depot used to look like a small warehouse in terms of load. Now it looks like a skyscraper.”

John Markowitz, head of e-mobility,
New York Power Authority

“There will be multiple transformer upgrades needed over the next 20 years to get those bus depots to full electric, because some of them hold 250 buses or so,” he continued. Even charging buses at 75 kW per bus, which would mean keeping the bus off the streets for 12 hours, Markowitz sees the depot pulling multiple megawatts off the grid. “It raises all sorts of regulatory questions,” he said. “Do you build the huge transformer you’ll need in 2035 now or put in multiple modular transformers every few years? We’ve been doing that kind of planning.”

Making matters even more complicated for NYPA, Hochul added school buses to the zero-emission vehicle mix, mandating no more diesel bus purchases after 2027 and working toward a 100% zero-emission fleet by 2035. Unlike transit buses, which often are in urban areas, school buses may be parked in more rural sites with less infrastructure in place. “We’ve come across school bus yards that are single-phase,” Markowitz said, adding that it might be necessary to retire depots and build all new ones.

On the residential side, Markowitz also sees the potential for utilities to grapple with transformer issues. “The worry is that you’ll have one suburban cul-de-sac where one neighbor gets an EV and then everyone gets one, too. If they’re all on the same transformer, you have one hot pocket of load,” he said.

ZERO-EMISSION VEHICLES: AS SALES RISE, SO DO NEW CHALLENGES

OPPORTUNITY FROM EFFICIENCY

Pasadena Water and Power isn't seeing a problem with infrastructure, and utility staff credit the city's long-standing commitment to energy efficiency and sustainability as part of the cause. The utility has been encouraging adoption of EVs, solar and efficiency for years, said Jonathan Sun, customer relations and programs manager for the utility, which delivers electricity to more than 65,000 customers in southern California. "The new rule in California helps us because it gives us a blueprint of where we need to be at a certain time, which allows utilities to prepare and plan accordingly," Sun explained.

Another reason Pasadena is in good shape is because the electric load of its commercial customers have steadily decreased over the past two decades due largely to efficiency efforts and behind-the-meter solar installations. "We now have added capacity on the commercial side of

our networks," said Evan Johnson, electrification program manager. "That helps us add public charging stations without a huge impact to our grid."

Pasadena Water & Power's five-year plan has \$10 million dollars committed to public EV charging infrastructure. The utility has already built several large charging facilities, including the Marengo EV Charging Plaza, the largest public DC fast charging facility in the country that supports all three DC fast charging standards. It has been a learning experience, particularly on the operations side.

"We've been learning about the challenges of keeping these stations up and running," Johnson said. "We found out LED screens on the stations don't work well in the sun because the sun blanks the screen out; sometimes stickers on the charger peel off; and level 3 chargers are more repair-intensive than level 2."

NYPA and one of the municipal utilities it serves also had some early

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ZERO-EMISSION VEHICLES: AS SALES RISE, SO DO NEW CHALLENGES



lessons in EV charging. Specifically, Markowitz and the village of Fairport, New York, looked at what it takes to install smart chargers and put them under utility control to achieve various goals. Controlling chargers could help utilities avoid transformer overloading in areas where several neighbors have gone electric, or optimize wholesale purchases of variable generation such as solar and wind by charging when they're available.

The pilot showed that communications technology may present some issues. "The customer's Wi-Fi was not as reliable as having your own cellular network," Markowitz said. "A percentage of customer devices won't be responsive when you call on them because the customer bought a new router or something, and they fell off the network." Despite problems, the pilot proved managed charging can achieve utility goals without customer disruption. "The project was an exercise to learn the skill of deploying this technology," he added.

LEARNING CURVES FOR ALL

Jungers has already coached quite a few utilities on zero-emission vehicle readiness in his role as an E Source consultant. One of the chief lessons he thinks utilities should learn is how to make sure they're involved in regulatory proceedings and rulemaking.

When he first started talking to the California Transportation Commission about Senate Bill 671 — a bill that creates a clean freight corridor to support zero-emission trucks — he said CTC staff knew little about how

"People don't have a great understanding of how the grid works. Education outreach is key."

Evan Johnson, electrification program manager, Pasadena Water and Power

utilities operate. "They did not know what's required for a new substation to be installed or for a line extension to power a new truck-charging depot," Jungers explained. "Utilities need to be at the table when rulemaking is taking place."

Jungers also thinks many utilities are missing an opportunity to support customers with fleet advisory services. "Help customers understand differences in vehicles and charging equipment. Help them upgrade their facilities, plan which vehicles to replace first and find financial incentives. I think utilities that don't have a fleet advisory service yet will be blown away to find out how many customers are ready and interested in working with them," he said.

Utilities aren't the only ones that have a learning curve. So do consumers and business customers. "It's really about customer education and outreach, especially for our disadvantaged communities," Sun said. "Leverage grassroots organizations and work with community groups to make sure

ZERO-EMISSION VEHICLES: AS SALES RISE, SO DO NEW CHALLENGES

people know what benefits [zero-emission vehicles] deliver and how they can be part of the solution.”

Education will be important when utilities go to customers and ask them to engage in load shifting, he noted. California's renewable portfolio standard goal requires all of the state's electricity to come from carbon-free resources by 2045. As a result, utilities benefit when people charge cars during times when renewables are more abundant, or late at night when the electric grid has a lot of capacity, Sun said.

That's going to take some explaining, Johnson added, and he should know. Having come from the transportation sector before he joined Pasadena Water and Power, he'd never heard of load shifting. “People don't have a great understanding of how the grid works. Education outreach is key,” he said.

People also don't really understand charging itself all that well, according to recent research conducted by E Source for the state of Colorado. The study found that 54% of survey respondents didn't realize they could charge an EV from a standard three-prong wall outlet.

Fortunately, there's still time for the outreach needed, even with the ambitious zero-emission vehicle plans in California and New York. Jungers points out that just because states enact aspirational EV adoption rules, it doesn't mean they'll keep those rules intact. He recalls the automaker pushback that California faced with its first EV mandate. “The lobbyists eventually won, and California changed that mandate several times over the years,” he said.

Likewise, Georgia leaders wanted to support EV adoption more than a decade ago, so that state embraced generous incentives for buyers. “For a while, Georgia had the biggest per-capita growth rate of electric vehicle adoption in the country,” Jungers recalled. “Then the incentives went away, and adoption dropped to almost zero.”

The lesson from these two states' experience is that mandates and incentives don't always stand still. “There's a lot of uncertainty about exactly what impact these rulings will have based on how the industry responds,” Jungers said.



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Tips for Writing Federal Grants

BASED ON A PRESENTATION FROM **BROOKE OPEL**, GRANT ADVISOR, BAKER TILLY, AT THE LEVERAGING FEDERAL FUNDING TO MOVE PUBLIC POWER FORWARD VIRTUAL SUMMIT



Through the Infrastructure Investment and Jobs Act, the federal government is investing approximately \$1.2 trillion in our nation's electric grid, broadband access, transportation, and clean water over the next five years. As public power utilities look to benefit from this suite of funding opportunities, there are several key factors to consider when pursuing grants.

Start Early

Because the application period is usually only 30 to 90 days, it is important to ensure you are prepared to apply as quickly as possible. There are many steps you can take well before the application opens, so that your team can focus on preparing the application within the open window.

- All eligible applicants need to have a Unique Entity Identifier, or UEI, to apply for federal grants. The UEI replaces the now retired DUNS number. To get a UEI, you need to register with System Award Management, or SAM, at SAM.gov. Approval can take up to four weeks. If your organization already has a SAM.gov registration, confirm that it's renewed and current.
- Once your organization has a UEI, you can set up an organizational profile on Grants.gov, the most common — but not the only — application portal for federal grants. Individuals/departments can make profiles that connect to your organization's profile. To access Grants.gov, you will also need a Login.gov account.
- Make sure you have access to Adobe Acrobat, as it is necessary to review the PDF forms and materials within the Grants.gov workspace.

TIPS FOR WRITING FEDERAL GRANTS

- Start collecting common grant files, such as resumes for likely key project staff and letters of support from partners or community stakeholders, even before an announcement opens.

Get Organized

Key projects and deadlines can easily be lost within the volume of opportunities made available through the IIJA.

- Define the priorities/projects your utility would like to pursue to help focus your efforts.
- Find and list which available program(s) match your needs and priorities.
- Create a matrix that organizes key information about the potential opportunities (funding amounts, deadlines, etc.) and how they relate to your priorities/projects. This can help you rank opportunities and highlight any potential overlap in application periods, which will help you determine how much you can take on within the various time frames and what might be able to wait.
- Know the terms:
 - o Rolling funds are available until expended with no specific application deadlines.
 - o Competitive grants are awarded based on the merit of the project and proposal.
 - o Formula grants are noncompetitive and often allocated to states and tribes. These grants could still include a competitive process at the state or local level.
 - o Cooperative grants are similar to grants but typically require more coordination and communication with the funding agency throughout the life of the project.
- Stay up to date on application announcements. You can view the opportunities (and synopses) on federal sites, such as Grants.gov and Build.gov, and on the American Public Power Association's Federal Funding Opportunities page.

Do Your Homework

Once the grant application processes open, read the funding announcements carefully, so you understand the requirements, scoring criteria, key words and phrases, and program priorities. Also, determine how competitive the grant is (i.e., how much total funding is available versus the anticipated number of awards) to set your expectations.

- Thoroughly vet each opportunity to determine whether:
 - o Your organization is eligible.
 - o The funding minimum/maximum matches your needs.
 - o A funding match is required, and if so, whether you can support the match.
 - o Your project activities are eligible.
 - o The grant will fund your project(s).
 - o The level of effort required to complete the application is manageable within the allotted time frame, knowing you are not guaranteed to receive competitive grants.
- Compile a list of all the information needed to complete the necessary documents and forms.
- Do not hesitate to ask questions. Each funding opportunity announcement will include a contact. Some agencies will offer assistance or meetings with prospective applicants — take advantage of this help if it's offered.

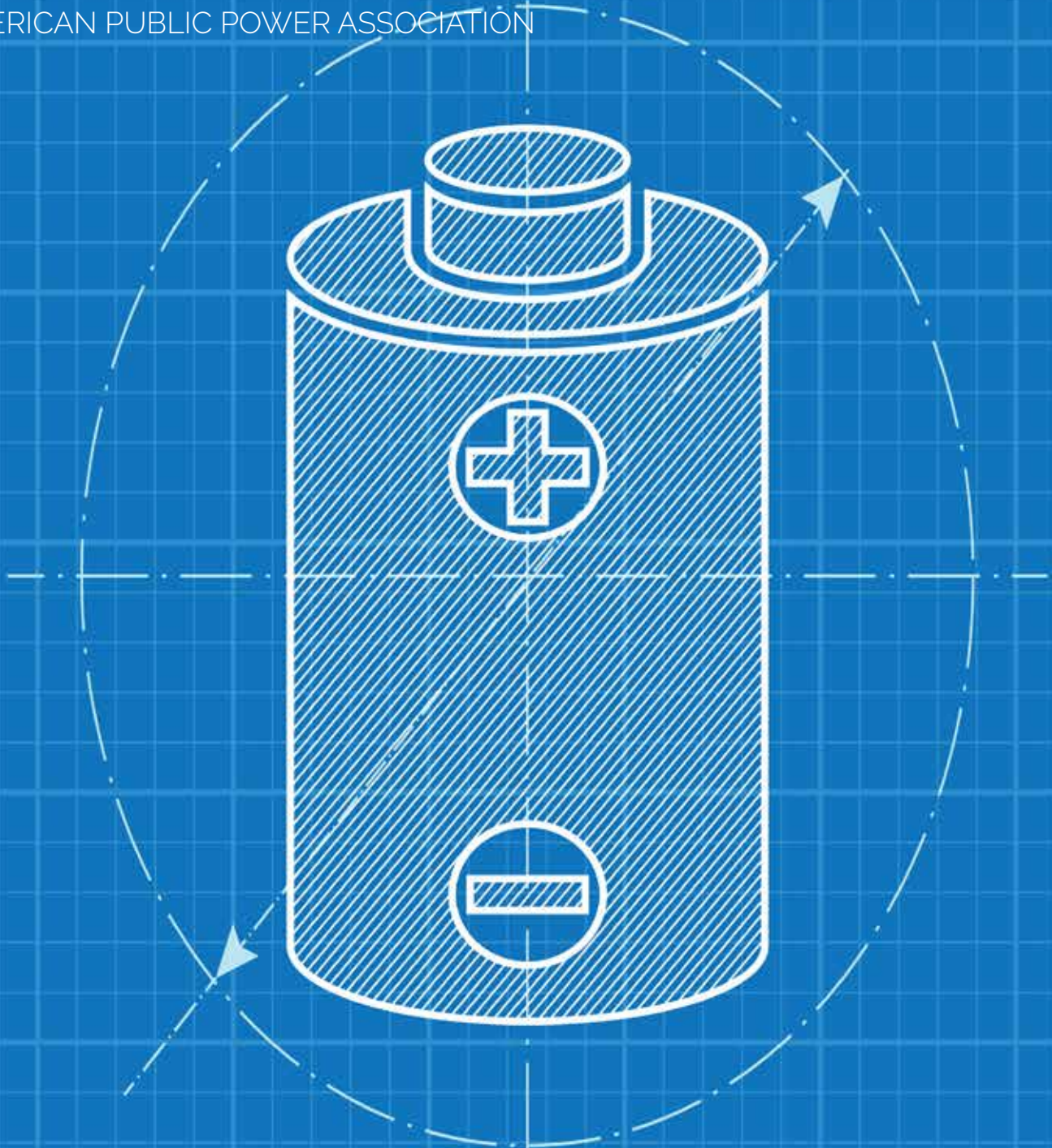
Finish Strong

A few other tips will keep your funding pursuit process on track and make your application competitive.

- When writing the project narrative, be clear with your overall goal (think big), project goals and objectives — set one to three objectives per goal, and make sure they are specific, measurable, and realistic.
- Use priority terms and repeated language found in the announcement in your project narrative, especially in the topic sentences, so the reviewers clearly know what elements of the announcement you are addressing.
- Remember that appendices, if accepted, do not typically count toward the project narrative length.
- Don't go it alone. Collaborate across departments and with third-party vendors and other entities that can support the project.
- Before you submit, carefully proofread the entire application, ensure it meets all formatting requirements, and convert it into a polished PDF.
- Aim to submit your application at least one to two days before the deadline because there can be snags in the process, particularly with grant portals like Grants.gov.
- After submitting, check back to make sure the submission bars within Grants.gov are "all green," meaning that the agency has received your application and nothing else is pending on your part.

When and How to Plan for New Technology

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WHEN AND HOW TO PLAN FOR NEW TECHNOLOGY

Public power utilities face diverse and often contradictory economic, political, and social pressures. With some regional variations, public power utilities are expected to maintain moderate rates while upgrading grid resiliency; reduce emissions of greenhouse gases while managing the growth of electrical end uses, such as electric vehicle charging; develop more centralized renewable power while integrating more distributed resources, such as rooftop solar and behind-the-meter battery storage; and help customers improve their energy efficiency while mitigating peak demand with dynamic pricing and demand response programs.

That is a tall order, and public power utilities are finding new ways to meet the test.

Careful, strategic technology planning is essential to managing this bewildering array of challenges. When public power utilities integrate new technology into their investment decisions as it becomes cost-effective, it will help lower the overall cost of a transition to clean energy. When utilities have the right technology in place, it will promote adaptation to future scenarios where, for example, systemwide electric generation will be more variable, cost signals stronger, and customers have new electric load shapes and demands. This is why technology planning is one of six “lanes” identified in the Energy Transition Roadmap, a resource based on input from some American Public Power Association member utilities.

Technology planning involves a wide range of decisions, from how to plan for, finance and choose vendors for advanced metering infrastructure to the most critical resource planning decisions, such as whether to build utility-owned generation and energy storage. No matter which technologies a utility chooses to deploy, careful review of the business case, opportunities and costs, and requirements to make the operation a long-run success will be important. Taking steps to mitigate risks in contracts upfront and communicating with customers that may benefit from the chosen upgrades are also essential.

One technology public power utilities are exploring as the cost has come down is battery energy storage systems. The U.S. Energy Information Administration estimates that by the end of 2023, 10,000 megawatts

of battery storage systems will be energizing U.S. electric grids — 10 times the cumulative capacity installed in 2019. Battery storage can be deployed in centralized, utility-scale applications and in small-scale, decentralized configurations, usually customer-owned and behind-the-meter. Large utility-scale systems are the most straightforward pathway for public power to increase storage capacity as they seek to mitigate the variability of renewable energy and achieve other benefits, such as peak shaving. These large-scale battery storage facilities are often co-located with new solar- or wind-generation facilities or at substations. They can be utility owned or vendor owned.

Public power utilities generally start with pilot projects to develop expertise in operating and utilizing large-scale battery storage. For example, Salt River Project in Arizona began its battery storage initiatives with two pilot projects — a 10-MW standalone system and a 20-MW system that is integrated with a solar energy plant. SRP has since begun developing a 25-MW battery storage facility at a substation adjacent to its Agua Fria Generating Station and contracted for output from 100 MW of battery storage capacity from NextEra Energy’s solar and battery storage projects in Arizona.

As an emerging technology, large utility-scale battery storage projects require greater due diligence than more traditional capital expenditures and procurement contracts. One California public power utility reported that the capabilities, performance, and efficiency of a large-scale battery storage system did not meet expectations. The utility’s representative attributed the issues to personnel changes and overly optimistic projections from the vendor’s sales team. They recommend involving as many utility personnel as possible from the beginning when contracting for battery storage to lessen the chance that critical in-house expertise will be lost with future personnel changes.

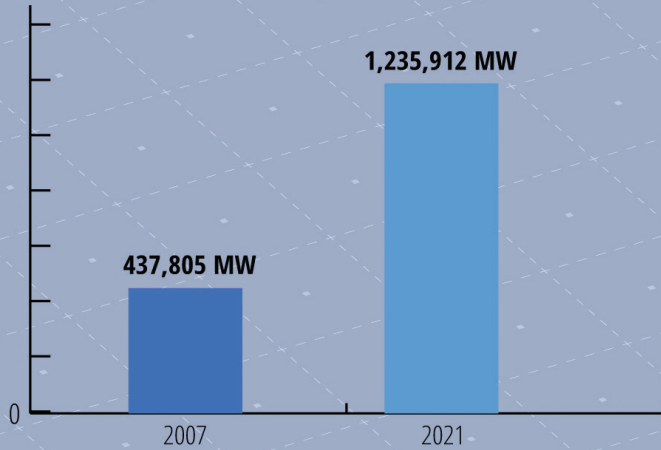
As public power utilities engage in technology planning and integrated resource planning, they might face scrutiny from community members who lack understanding of the limits of these technologies and dismiss the need for existing or additional thermal generation resources. Involving relevant community stakeholders and leaders, such as city councils and town energy committees, in discussions about changing the generation mix as early as possible can help garner buy-in for projects.

The Public Power Energy Transition Roadmap, published in December 2022, explores the challenges public power utilities face, and solutions they can deploy, as the electric grid uses more clean energy. This article is adapted from the roadmap and is based on work supported by the Department of Energy Office of Electricity under Award Number DE-OE0000928.

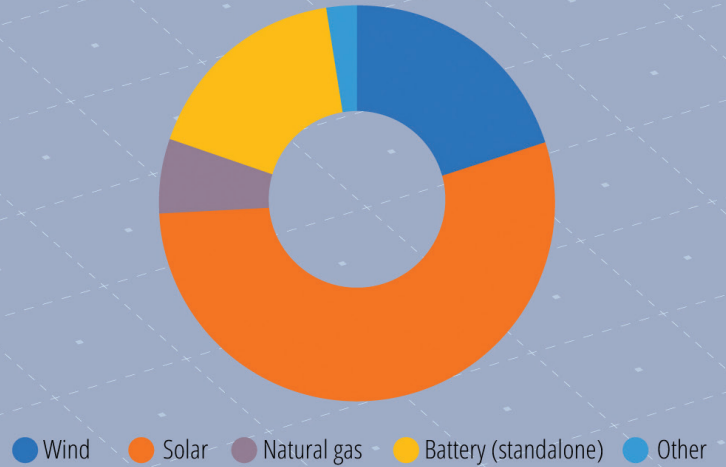
Waiting to Connect

One barrier standing between getting new generating assets deployed is getting those facilities connected into the electric grid. According to the Lawrence Berkeley National Laboratory, there were more than **1.2 million megawatts** of capacity waiting in an interconnection queue at the end of 2021 – about the same as the total capacity of all generating assets already in operation.

This is almost **three times** the capacity in such queues in 2007.



Most of this capacity is for solar and wind projects, including those paired with battery storage.



The PJM Interconnection region had the most capacity in queue of any one region, with nearly 250,000 MW. The parts of the western U.S. outside of an ISO were close behind, with about 235,000 MW waiting to be connected.

Part of this is the amount of capacity getting added each year – which topped 490,000 MW in 2021 – or nearly four times the capacity added in 2011.

As the total projects in line grow, so do the wait times.

Typical interconnection wait times (from connection request to commercial operation)

2000–2010: 2.1 years

2011–2021: 3.7 years

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