EXPLORING KEY AREAS ON THE JOURNEY TO A LOWER CARBON FUTURE

BY JOHN EGAN,
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Across the country, public power utilities are pursuing a diverse range of strategies and tactics to modernize their systems and reduce their environmental impact while keeping electricity affordable and reliable. These efforts are in response to policy decisions and changing economics, and in alignment with the wishes and expectations of their customer-owners and key stakeholder groups, and therefore they are unfolding in different ways and at different speeds across the country. While the lack of a uniform path allows public power utilities to investigate various approaches that leverage local conditions in pursuit of a lower-carbon future, several areas and technologies will be key for reaching these goals.

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MATT BABBITTS,
CLEAN ENERGY PROGRAM MANAGER,
CLARK PUBLIC UTILITIES, WASHINGTON

The Public Power Energy Transition Community, an initiative funded through a cooperative agreement between the Department of Energy and the American Public Power Association, is developing a series of briefs in 2024 that provide high-level considerations and guidance on these key areas, including electric vehicle charging infrastructure, load management, energy storage, and emerging generating technologies.

As community-owned utility leaders decide which technologies and programs to pursue to help reach energy transition goals, lessons from others' explorations can inform these choices. The following is a closer look at three public power journeys in the energy transition.

Shaping New Behaviors

Clark Public Utilities, which provides electricity to over 225,000 customers in Washington state, has a smaller decarbonization challenge than many utilities, because around 60% of its power comes from carbon-free hydroelectric generators.

Still, utility leaders and customers feel strongly about using energy as wisely as possible, and the community has a high interest in electric vehicles. Rather than building new infrastructure to meet the demand created by a future with more EVs, Clark Public Utilities is experimenting with a demand response program for EVs.

"As a nonprofit, at-cost utility, offering a voluntary demand response program for EVcharging will help us avoid passing additional costs on to our customers and demonstrates good stewardship of their resources," commented Matt Babbitts, clean energy program manager with Clark Public Utilities.

"We started considering residential demand response programs over a year ago. Because today's residential EV owners are 'early adopters,' we felt they were a great demographic of customers to begin with, primarily due to their advanced understanding of electric grid complexities."

The community-owned utility signed a contract with a vendor in late 2023 and launched a pilot EV managed-charging program fin February 2024. The utility hopes to build on the success of its Level 2 EV charger programs, and aims to enroll 800 EVs in the managed charging program, which will run through December.

Clark Public Utilities understands some customers may not want to install a Level 2 EV charger, which can entail expanding a home's electrical panel to accommodate another 240-volt load. That's why, with the help of the vendor, Clark implemented an EV telematics-based managed charging program that can enable the utility to send signals to enrolled EVs, rather than through an internet-connected Level 2 charger. Participating EVs will not charge when plugged in during a handful of periods of high demand in the summer and fall.

Babbitts said demand response and load shifting programs "will be crucial to our utility's success in decarbonizing the electric grid." He also noted that Washington's Clean Energy Transformation Act requires utilities to create demand response programs.

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As EV adoption grows in Clark's service area, the utility expects to use the lessons learned this year to develop best practices for future managed-charging and demand response programs.

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BRAD BICKETT, GENERAL MANGER,
HENDERSON MUNICIPAL LIGHT & POWER, KENTUCKY

"Decarbonizing the electric sector is complex work that requires complex solutions," Babbitts acknowledged, "but piloting different programs with small subsets of customers, like we are doing with our EV managed-charging program, allows us to learn valuable lessons and do so with a customer group that is willing to be patient during the growing pains of creating new programs."

"Those lessons will allow our utility to integrate more broad programs in the future while also improving customer satisfaction," he said.

The Future Is Not Like the Past

Henderson, Kentucky, has a long history with coal. For over a century, the city relied on the black rock to affordably and reliably produce electricity.

"Historically, coal sustained a lot of jobs in our community," commented Brad Bickett, general manager of Henderson Municipal Power & Light, which provides electricity to about 12,000 customers. The utility has closed two coal-fired power plants over the last 15 years, as environmental regulations made them less and less economic to operate.

After completing its first integrated resource plan in 2018, the public power utility joined the Midcontinent Independent System Operator, began purchasing power from the wholesale market, entered energy and capacity contracts, and explored two other recommended options: building a natural gas-fired reciprocating engine peaker plant and pursuing a solar-plus-storage project. Ultimately, a bid was awarded for a 50-megawatt solar project. The bids for the 36-megawatt natural gas peaker plant came in about 50% higher than the utility expected, and the economics of a solar-plus-storage project weren't particularly compelling either.

Following closure of its second coal plant in 2019, the economics for solar-plus-storage began to improve, and developers came out of the woodwork with renewable energy projects, Bickett said. The Inflation Reduction Act improved the economics of renewables and storage even further through hefty federal tax credits that allowed developers to lower their project prices.

HMP&L's most recent solar-plus-storage request for proposals, in 2023, confirmed its strategic direction: On an all-in basis, solar-plus-storage penciled out to be about 15% less expensive than a natural gas reciprocating engine plant.

Besides the higher cost of building the gas-fired peaking generation, Bickett explained, gas-fired power offered a weaker hedge against future gas price volatility in the MISO market because natural gas was frequently to marginal generation in that wholesale market. When HMP&L joined MISO in 2019, it became eligible to participate in the ISO's capacity and energy markets, where it could sell energy and ancillary services and receive capacity credit for the battery energy storage system, or BESS, facility.

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Bickett observed, "The organized market helps make BESS economic because it offers multiple value streams and more liquidity than traditional bilateral power purchase contracts."

Henderson also is home to a significant industrial load, and some of those companies are working to meet corporate sustainability goals. Solar-plus-storage helps those large customers meet those goals.

And gas-powered generation offers less resiliency benefits compared to solar-plus-storage, if there's a loss of fuel or transmission during extreme weather events, he added. A few years back, tornadoes damaged some nearby transmission lines and high temperatures followed that sent power costs skyrocketing — halfd of HMP&L's $2 million-per-month purchased power budget was spent in one week.

"It doesn't take very many of those events to really impact power costs" Bickett said. "Our primary goal is to keep power costs as low as possible. Solar-plus-storage is the best way for us to do that. And if this project works the way we think it will, we may do another."

"As a former power plant engineer, I would have been excited about the potential to build a new thermal power plant," said Bickett, who has been with HMP&L for 13.5 years, the last two as general manager. "But that's not the way the market is moving. Pairing energy storage with an intermittent resource like wind or solar could give the same or better benefits as a gas peaker, at a lower cost. The economics have driven our moving away from coal and gas-fired generation."

Bickett's main takeaways from the utility's energy transition journey is to have local community leaders and members of the community involved in the planning process and to recognize that change can be hard on people.

"Given our history, it is quite a shift for us to move away from burning hydrocarbons for energy," he said. "We need to spend more time to understand the concerns of the community about moving to solar-plus-storage, and then invest time to help them understand all the ways that option would benefit them."

Broadening 'All of the Above'

It has become commonplace to hear utility executives talk about the need to pursue an "all of the above" energy strategy. Sometimes that is said to support development of traditional electric generation options like coal, nuclear, or gas.

The Tennessee Valley Authority is playing on a broader field with a longer time horizon. On the nuclear fission front, where energy is released by splitting atoms, it is investigating small modular reactors, which could be deployed in the next decade. But further out, TVA also sees a possible role for nuclear fusion, where energy is released when hydrogen atoms are fused together. Earlier this year, TVA signed an agreement with Oak Ridge National Laboratory and Type One Energy Group, a developer of next-generation clean nuclear energy, to build a stellarator fusion prototype machine at the site of TVA's shuttered Bull Run Fossil Plant in Clinton, Tennessee.

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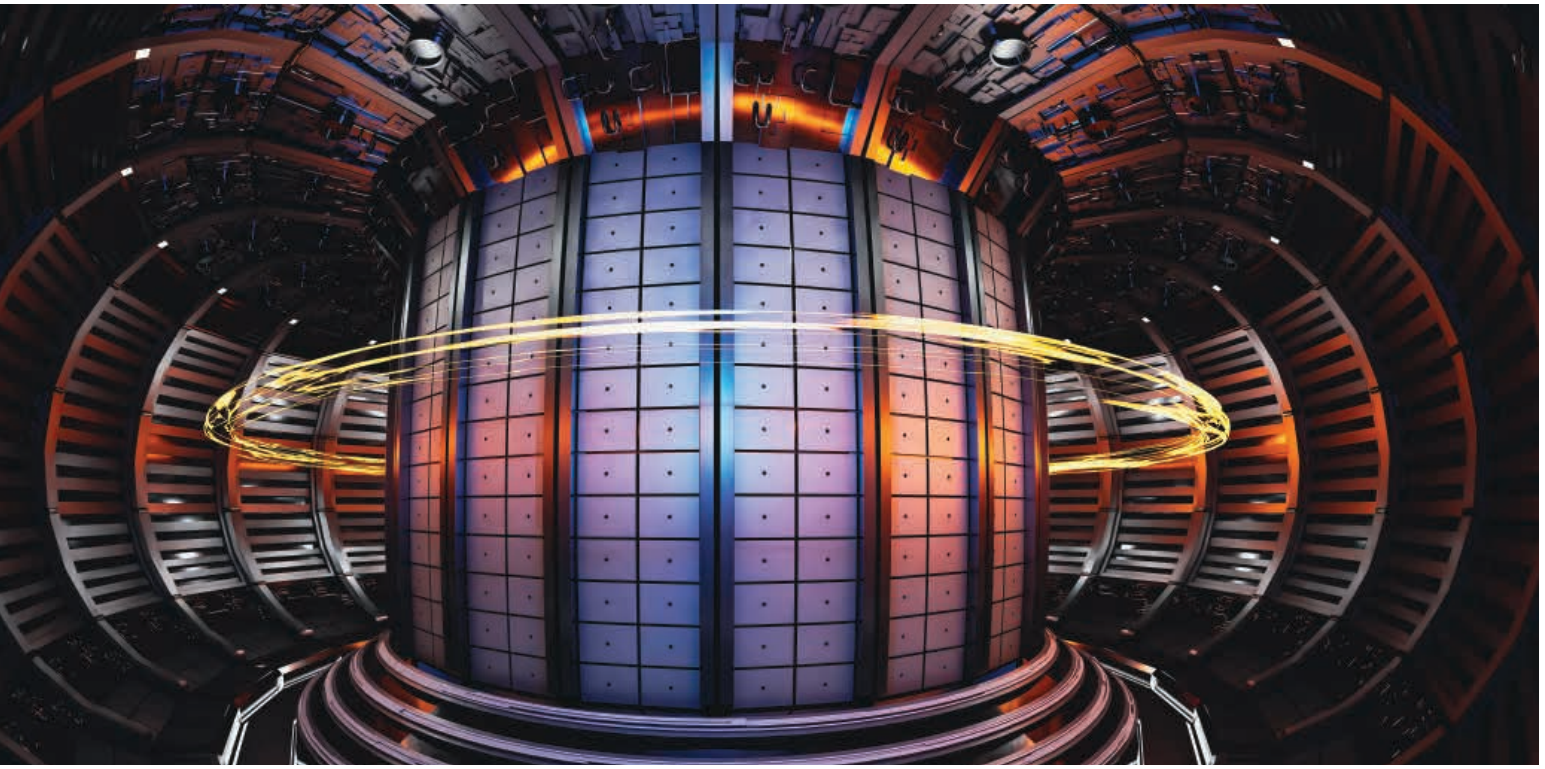
JOE HOAGLAND,
VICE PRESIDENT OF INNOVATION AND RESEARCH, TENNESSEE VALLEY AUTHORITY

A stellarator seeks to use a series of high-powered magnets to contain the energy given off by thermonuclear fusion reaction when two atoms of hydrogen are fused together. The stellarator does not generate electricity.

Although not new, fusion technology still is in a nascent state, and it may not work out. But fusion is the ultimate clean energy, said Joe Hoagland, TVA's vice president of innovation and research, because nuclear fusion generates no radioactive waste. And there's no potential for a nuclear meltdown.

Hoagland chooses his words carefully when referring to the project. It is a potential prototype aimed at managing risks. "We're not building a power plant. This isn't a demonstration or a pilot project. We're developing a risk-reduction facility to test the stellarator's containment system," he said.

The project, named Infinity One, will allow Type One Energy to verify important design features of its high-field stellarator fusion pilot plant, particularly those related to operating efficiency, reliability, maintainability, and affordability, the company said.



The project received funding from the Department of Energy.

It will take at least the rest of 2024 for Type One to calculate the costs of building a stellarator. It will be doing that while TVA proceeds with an environmental analysis for the decommissioned Bull Run coal-fired power plant. A construction decision may be forthcoming next year.

"We're doing this for three reasons," Hoagland said. "To help entrepreneurial companies explore advanced technology; to fulfill our economic development mandate; and because it's a cool way to extract value from a shuttered coal-fired generator."

In announcing the partnership with TVA, Type One Energy said it would establish its headquarters in East Tennessee and, over a five-year period, hire as many as 300 employees, including nuclear physicists and mathematicians.

"I'm really excited about the potential of this technology," said Hoagland, who holds a Ph.D. in physical chemistry and has worked on fusion for much of his 32 years at TVA.

"The nation needs 24/7 carbon-free electricity," he continued. "TVA operates seven nuclear fission reactors, and we're exploring SMRs, so we're uniquely positioned to explore fusion. We believe nuclear needs to be part of the energy transition."

Nuclear options aren't the only part of TVA's "all of the above" approach. At a site near Paducah, Kentucky, it is turning a brownfield into a first-of-it-kind green energy generator by placing solar cells that are fixed to a flexible substrate directly on top of a sealed and lined coal-ash pond.

A closed coal-ash pond has very few potential uses, Hoagland noted: A golf course could be built, but probably not a park because tree roots could someday pierce the coal ash pond lining. For the same reason, it would not be possible to construct a building on an ash pond.

TVA is performing appropriate environmental reviews and regulatory requirements at the Shawnee Fossil Plant site, where it plans to build a 100-MW solar generation facility. The project will use photovoltaic cells that are mounted on flexible substrate that can be attached to an engineered turf foundation. The substrate will be placed directly on the ground, rather than mounted in a rigid frame that must be anchored in the ground.

The project is one part of TVA's plan to meet the needs of a growing region by investing in new generation, which includes building 10,000 MW of solar energy by 2035. It would also allow utilities that once burned coal to use otherwise unusable coal-ash ponds. Construction could begin next year.

"TVA has pursued an 'all of the above' energy strategy for a long time," Hoagland said. "We can't just rely on one option to get to a clean energy future."