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Points of Connection

Eight Perspectives on a Unified System

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PUF discusses how to maximize the existing grid for growth, in conversations with Con Edison VP of Distributed Resources Integration Raghusimha Sudhakara, NYPA Sr. Director of Engineering Rajesh Kumar, Eversource VP of Transmission System Planning Jacob Lucas, Rappahannock Electric Co-op. Chief Strategy, Technology, and Innovation Officer Peter Muhoro, Bidgely Chief Revenue Officer Gautam Aggarwal, Clean Power Research CEO Jeff Ressler, CTC Global Chief Policy and Grid Strategy Officer Theodore Paradise, and Burns & McDonnell Project Director Bill Brackmann

The electric utility industry has moved past the era of predictable one percent growth. As we reach the middle of 2026, however, the question is no longer whether new load is coming, but rather how providers can build fast enough to meet the demand. This month, we spoke with eight leaders currently navigating unprecedented growth challenges to discuss the strategies and infrastructure we all need to modernize the grid.

The scale of the current challenge is significant. In Virginia, Rappahannock Electric Cooperative is managing five GW of contracted data center load against a foundation where the current peak is only 1.2 GW. In New York, Con Edison is executing a $17 billion investment plan to ensure the grid remains resilient as the city electrifies its buildings and transportation. However, as Rajesh Kumar of NYPA and Jacob Lucas of Eversource emphasize, a central challenge is the timing mismatch; while large loads can be commissioned in eighteen months, transmission and generation projects require significantly more time to complete.

To bridge this gap, the industry is adopting new physical and digital strategies. Theodore Paradise of CTC Global explains how advanced conductors can double capacity on existing rights of way in a fraction of the time required for new construction. On the digital side, Gautam Aggarwal of Bidgely and Jeff Ressler of Clean Power Research emphasize how they can help utilities move from being data collectors to data orchestrators, using AI and automated workflows to manage the high volume of interconnection requests.

Finally, Bill Brackmann of Burns & McDonnell reminds us that hardware and software are only part of the solution; the industry is also facing a critical workforce talent gap that requires early, integrated partnerships to keep these large projects on schedule.

The following eight conversations offer a comprehensive roadmap for maintaining reliability and affordability while the grid fundamentally modernizes for the future.

Raghusimha Sudhakara

Con Edison VP of Distributed Resources Integration

PUF's Rachel Bryant: Everyone knows the name Con Edison, but the sheer scale of your operations in New York City is incredible. To start us off, how is load growth showing up in your territory and what is behind it?

Raghusimha Sudhakara: It really is unique because we serve nine million customers across the City and Westchester County. While we are seeing load growth like our peers across the country, ours is not coming from data centers or large industrial plants. Instead, it is a steady and long-term trajectory of growth tied to how the city moves and lives.

There are really two main factors driving this. The first is transportation, specifically the shift from gas and diesel vehicles to electric power. We have a massive density of taxis and vehicles like Uber and Lyft that are moving toward electric fuel, and we may even see new technological areas like autonomous driving that bring in new patterns of electric use.

The second factor is building electrification. State policy and local laws are driving a huge amount of all-electric building activity. In fact, almost all new construction in the city is electric, and we are already seeing our seasonal load patterns start to shift as demand picks up at different times of the day.

PUF: Is demand rising steadily across ConEd's footprint?

Raghusimha Sudhakara: It is really a mix of two different patterns. First, we see a very steady and uniform type of growth across our entire territory that generally tracks with the economic health of the city. But we also see very specific pockets of high demand.

We try to strike a balance by looking for investments that bring multiple benefits, asking if an expenditure adds resiliency and reliability while also enabling a cleaner local environment.

For example, we might see a charging station go up with twenty fast chargers or a new ten-story apartment building that is entirely electric. To give you an idea of the scale, just three fast chargers can have the same power demand as a three-hundred-unit apartment building. So, while we are not seeing isolated mega loads, we are seeing these concentrated clusters that require a lot of localized planning to ensure the grid is prepared to accommodate them.

PUF: What does your planned investment look like right now and how much have you had to ramp things up to keep pace?

Raghusimha Sudhakara: We have had to move quickly.

We are currently seeing a compound annual growth rate in load of about one percent. We just had a new three-year rate period approved that started in January of 2026, where the Commission approved a $17 billion investment proposal.

To give you some context on how much things have changed, in the decade prior to the last few years we barely built a single large substation. Now we are building four to five large infrastructure projects all at the same time. We expect this high level of activity to continue for at least another twenty years just to meet the goals for the next few decades.

Our system is already known for being very reliable, typically nine times the national average. In a dense city like New York reliability is not optional. People depend on the electric subways to get to work, and they depend on elevators in high rises to get to their homes. New York also hosts national events and is home to major television studios.

As more people electrify their heating, hot water, and cars, they depend on that reliability even more to power their lives. We are making tremendous investments to ensure the system is not just reliable but also resilient against hotter heat waves and changing weather patterns.

PUF: How are you balancing reliability and affordability?

Raghusimha Sudhakara: We care deeply about both. Affordability is a huge issue because while New York City looks like a wealthy metropolis, forty percent of our customers are in low- to moderate-income brackets. We have a responsibility to care for the most vulnerable people because electricity is a critical public good.

At the same time, our state has been a leader in the clean energy transition. When we survey our customers, they repeatedly tell us they are willing to pay a little more for a cleaner electricity mix. We try to strike a balance by looking for investments that bring multiple benefits, asking if an expenditure adds resiliency and reliability while also enabling a cleaner local environment.

We have a large energy affordability program that provides discounts on electric bills for vulnerable customers who receive assistance from the city. We just recently expanded the program to help protect more customers while making the investments they depend on.

In the decade prior to the last few years, we barely built a single large substation. Now we are building four to five large infrastructure projects all at the same time.

PUF: How are you managing uncertain load growth?

Raghusimha Sudhakara: This is a truly unprecedented time because we are seeing a transition on the generation side and the demand side at the same time. On the generation side, we are moving toward renewables that are intermittent and not controllable. On the demand side, we have long-term load growth from electrification. Our responsibility is to keep the system reliability at the current level every single day through this transition.

We cannot expect the changes to be smooth or perfectly

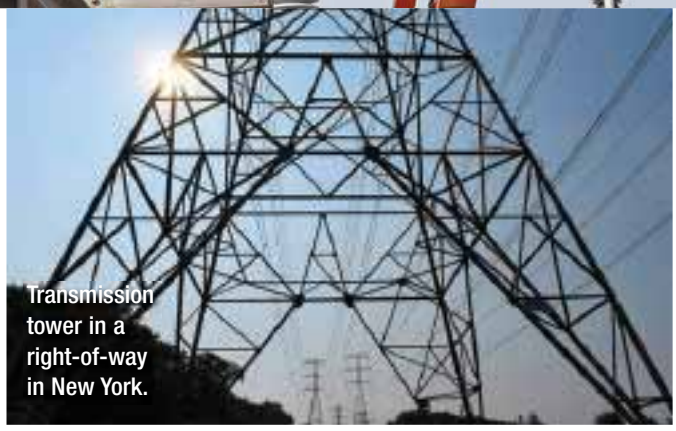
Con Edison worker performing work at the Greenwood Substation in Brooklyn, NY as part of the Reliable Clean Cities Project.

predictable. You might see a sudden spurt of electric vehicle growth because gas prices went up or a slowdown in renewables because of policy shifts. We must use every tool at our disposal to make this an orderly transition.

We have four proceedings right now that are focused on solving these issues. First is the Grid of the Future proceeding, which focuses on load flexibility and how demand-side resources can serve as a cost-effective balancing mechanism for the system.

Next, is the Proactive Planning proceeding. Our regulators recognize there is often a mismatch between the time it takes to build big infrastructure and how quickly a customer expects an electric vehicle charger. This proceeding helps us prepare early so the grid is ready exactly when the customer is ready to plug in.

There is also the New York City Transmission Reliability Needs proceeding. We are looking at transmission security needs for the early 2030s and will be submitting a contingency plan in the middle of June. This is one of the first times a portfolio of solutions is being assembled to solve needs at the transmission security level.


Transmission tower in a right-of-way in New York.

Finally, we have the Coordinated Grid Planning proceeding. This looks at the system from the top down to be proactive about transmission investments, helping the state pick the right sets of lines so electrons can move from new renewable sites to the load centers.

PUF: With all of that in mind, how are you feeling about the pace? Are you keeping up with the growth or are you feeling a lag?

Raghusimha Sudhakara: I would describe my feelings as a mix of optimism and pragmatism. I feel very confident because we have an extremely talented workforce in New York City that can design and build complicated infrastructure in an environment where space is a massive constraint. We are building five major pieces of infrastructure, and we have made unprecedented investments in our internal talent to serve the needs of the city. At the moment we are keeping pace with this load growth.

But the pragmatic side of me recognizes obstacles like long

Raghu Sudhakara is vice president of Distributed Resource Integration at Con Edison, a regulated utility providing electric, gas and steam service in New York. He is responsible for leading company initiatives in clean transportation, distributed and clean technology resources such as storage and solar, and demand management and planning. Sudhakara has held positions of increasing responsibility including E-Mobility, demand management and non-wires solutions. Before joining Con Edison in 2012, he worked as a consultant to power generation companies on power plant efficiencies.

supply chain lead times and sometimes challenging permitting processes. An average substation that used to take four to five years can now take seven to ten years because of these challenges. To avoid falling behind, we incorporate those longer timelines into our planning.

PUF: The New York Commission seems to be taking a very proactive approach. What makes this initiative different from the traditional way regulators have handled things?

Raghusimha Sudhakara: In the traditional regulatory world before the pandemic, everything was a least-cost model where you did the bare minimum needed to minimize the cost burden. But the world has changed and both the supply chain and the nature of the load on our system have shifted.

New York has been a leader in recognizing that proactive investments can actually save money in the long run. Instead of digging up the street every time a new piece of load comes in, you dig once and put in conduit. When the next wave of growth happens, the conduit is already there, and you just have to pull a cable through it.

This is a shift in the typical paradigm to look for long-term cost saving possibilities. It keeps the system ready for customers when they are ready to electrify. We are very focused on making sure we deliver the reliability our customers expect while moving toward these clean energy goals.

It is a challenging task and there is no way to sugarcoat that, but we have the team and the vision to get it done. The transition is well underway, and we are excited to be part of the solution for New York.

Rajesh Kumar

New York Power Authority Senior Director of Engineering

PUF's Rachel Bryant: What is the New York Power Authority, and how does it operate within New York State's energy system?

Rajesh Kumar: The New York Power Authority operates as one of the largest public utilities in the United States. Our mission focuses on providing reliable, affordable, clean energy to New York State customers. We own approximately 40 percent of the high-voltage transmission system, which serves as the backbone of the state's power grid.

Our generation portfolio is anchored by the Niagara Power Project – the largest electricity producer in the state and the third largest nationally – and the St. Lawrence Power Project, which stands as New York's second-largest hydroelectric facility. Our assets also include multiple combined-cycle power plants near New York City, two pumped-storage plants, and several small natural gas power plants in New York City and Long Island.

Beyond managing our physical assets, our mission extends to providing energy solutions to businesses, nonprofit organizations, and government entities.

PUF: Do you operate across the whole state?

Rajesh Kumar: Yes. We operate throughout the state, offering our customers the lowest-cost electricity in New York sourced from our hydroelectric power plants. Our transmission lines span the entire geography of New York, from the Niagara Frontier to New York City and Long Island.

One primary difference is that investor-owned utilities generally have a franchise territory where they serve retail load within a boundary. We serve the entire state, including government, not-for-profit organizations, and private businesses; however, we do not have a retail service territory. NYPA's economic development power programs provide low-cost power to businesses creating jobs and making investments in New York's economic future.

Our stance remains focused on reducing unnecessary work to streamline the process. Shorter schedules generally lead to lower costs, which ultimately benefits ratepayers through the broader market.

PUF: How is load growth showing up across New York, and what is driving it the most?

Rajesh Kumar: There are two parts to that answer. One is large-load growth, while the other is gradual retail load growth. Our focus remains on the high-voltage system, which provides a unique vantage point for observing shifting energy demands.

Large-load growth is primarily driven by hyperscalers coming onto the grid – inclusive of data centers and large manufacturing facilities. While those hyperscalers may not receive power from NYPA, the Power Authority will have to plan to interconnect their loads. When a customer requires 100+ megawatts, they typically must connect to a 345-kV line, or at least to 230-kV lines. We own the majority of the 345-kV lines in the state, so we receive many large-load interconnection requests.

There is also additional load growth resulting from the increase in electrification of vehicles and buildings. These local shifts eventually roll up to the wholesale level.

For example, five EV electrification project locations

converting a bus fleet to electric buses may add up to a substantial load. While there may be a smaller load at each site, together the projects still increase the total load at the wholesale level. These smaller electrification projects may require transmission upgrades or changes to deliverability, creating a broader impact on the entire grid.

PUF: Where are you seeing the greatest strain today? Is it generation, transmission, or distribution?

Rajesh Kumar: These elements are intertwined. New York's grid is built to be resilient and reliable in the face of growing load and transmission needs. That's why we are making significant investments now – such as with our Propel NY Energy project that is in permitting – to fortify the bulk transmission connections downstate to and from Westchester, New York City, and Long Island.

Transmission is a constant challenge and the surge in load growth is arriving at the same time as much of our infrastructure is aging, increasing pressure on the grid.

The NYISO queue contains nearly ten gigawatts of large-load requests, although not all of that will materialize. Factors such as permitting, land acquisition, and high upgrade costs can prevent projects from reaching completion. While we assume only a portion will be built in the near term, the long-term outlook could shift.

Rajesh Kumar is Senior Director of Engineering–System Studies and Interconnections Standards at the New York Power Authority. With nearly two decades of utility industry experience, he brings deep expertise in high-voltage transmission and grid interconnection, having led more than $3 billion in electric infrastructure projects throughout his career. In his current role, he has overseen interconnection of over three gigawatts of renewable generation and one gigawatt of large load to the New York system, while advancing a statewide pipeline exceeding ten gigawatts of new generation.

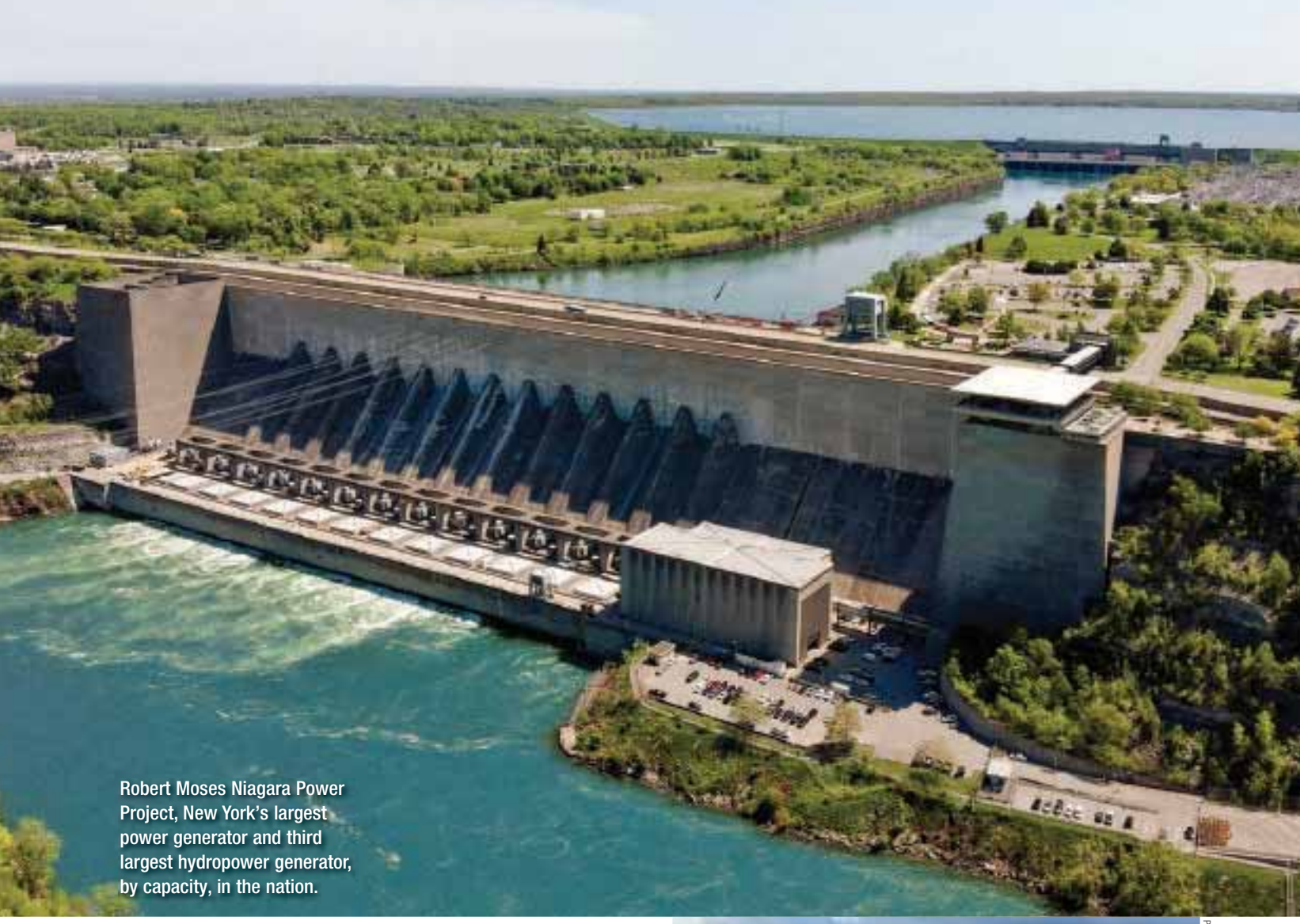
Regarding generation, New York is expanding its clean energy capacity rapidly. We expect at least 2,000 megawatts of new clean generation to come online this year on NYPA-owned lines, including projects near New York City and in Western NY. Thousands more megawatts are currently under construction.

The central challenge is a timing mismatch: Large loads can come online much faster than new generation and transmission projects can be built. Generation and transmission investment must align with the rising demand.

PUF: You mentioned that transmission investment slowed for decades. What does that mean as large loads accelerate?

Rajesh Kumar: Transmission is a constant challenge and the surge in load growth is arriving at the same time as much of our infrastructure is aging, increasing pressure on the grid.

NYPA is addressing this through projects like our Central East Energy Connect 345-kV project with LS Power that went online a few years ago and Smart Path Connect with National Grid as our partner scheduled for completion in June. That project will add roughly 1,000 megawatts of transmission capacity.



Robert Moses Niagara Power Project, New York's largest power generator and third largest hydropower generator, by capacity, in the nation.

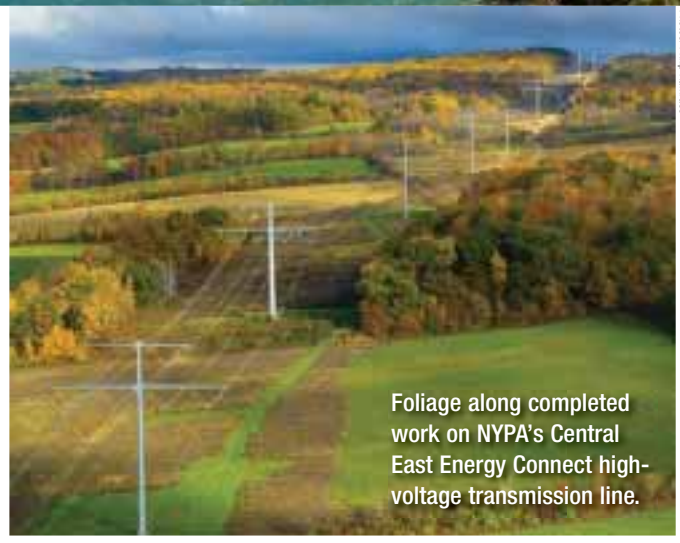
We are also partnering with New York Transco on our Propel NY Energy project, which is currently progressing through permitting. The project is a 345-kV 90-mile line that will improve grid reliability and resiliency for Westchester County, New York City, and Long Island.

PUF: How are you coordinating across utilities, state agencies, NYISO, and other stakeholders to plan for this level of demand while keeping affordability in mind?

Rajesh Kumar: New York utilizes a public policy transmission-need process for development. This competitive framework identifies transmission needs driven by public policy requirements followed by a solicitation where viable projects are considered for selection, and the NYISO identifies the more efficient or cost-effective project for cost allocation and recovery.

This ensures affordability remains central to transmission planning. The Propel NY Energy project was chosen by the NYISO through this competitive model because it offered the best technical and most cost-effective solution.

We also collaborated with an independent power company on the Central East Energy Connect project, where different components were awarded to NYPA and to LS Power. This structured process consistently allows for the most efficient and economical transmission solutions to be selected.



Photos: Philip Kamrass

Foliage along completed work on NYPA's Central East Energy Connect high-voltage transmission line.

Simultaneously, aging infrastructure must be replaced, which inherently incurs costs. Because reliability is a mandatory requirement, necessary upgrades must be completed to maintain the integrity of the grid while keeping cost in line.

PUF: How does NYPA balance environmental goals, load growth, and affordability when so much of your work is governed by tariffs and reliability standards?

Rajesh Kumar: Much of our work is strictly regulated. We adhere to the NYISO tariff approved by FERC and follow

reliability requirements set by the NPCC and NERC. Because these mandates leave little room for individual discretion, we focus on internal efficiency and rigorous cost discipline.

We are also investigating design choices and equipment standardization, as well as optimal workforce positioning for best practice operations and maintenance of our assets. Transmission projects are capital-intensive, so we consistently manage costs and maintain full compliance. Seeking efficiency gains across every aspect of our operations is a primary focus.

PUF: Interconnection timelines are under pressure for both generation and large loads. What are you seeing on that front?

Rajesh Kumar: FERC issued Order 2023 to expedite the generator interconnection process, which is governed through NYISO. We support this work and have contributed to stakeholder efforts to update the tariff. Our stance remains focused on reducing unnecessary work to streamline the process. Shorter schedules generally lead to lower costs, which ultimately benefits ratepayers through the broader market.

On the load side, the Governor recently directed the Public Service Commission to review the large-load interconnection process to ensure ratepayers do not bear the costs of interconnecting data centers.

PUF: Looking ahead, what needs to change over the next few years to stay ahead of demand?

Rajesh Kumar: Transmission investment must continue to accelerate. The NYISO also has identified the need for additional generation and other resources to serve load reliably in New York in the coming years.

Planning, permitting, and execution of new transmission and generation must move forward while we maintain all reliability requirements. We are constantly seeking efficiency in how we design and build projects, while engaging in stakeholder processes to streamline the NYISO tariff.

Establishing clear rules regarding who pays for load interconnection and upgrades will be vital for affordability and predictability.

Large-load growth moves quickly, whereas transmission and generation projects require significantly more time. Aligning these timelines is one of our central challenges. Establishing clear rules regarding who pays for load interconnection and upgrades will be vital for affordability and predictability.

That clarity would help everyone plan effectively, and it is the direction we are working toward to ensure a resilient, reliable energy future for New York. ❍

Jacob Lucas

Eversource VP of Transmission System Planning

PUF's Rachel Bryant: We have been discussing the high-voltage transmission backbone and load requests in NYPA. Shifting our focus to the neighboring New England region, what does the Eversource service territory look like, and what is your role there?

Jacob Lucas: Eversource stands as New England's largest utility. We serve roughly four and a half million customers across Connecticut, Massachusetts, and New Hampshire. I oversee transmission system planning across that entire service territory.

PUF: How is load growth showing up across your system, and how has that evolved in the last few years?

Jacob Lucas: The data center topic is a relatively recent development in New England, but there is an important starting point before addressing large loads. We are seeing pockets of organic economic, commercial, and industrial load growth. The year 2025 serves as a key data point because we saw load levels that we have not seen in ten to fifteen years.

New England's all-time historic peak was roughly twenty-eight thousand megawatts back in 2006. In the summer of 2025, we reached a peak of approximately twenty-six thousand megawatts. That represents the highest regional load in a long time. In some areas, such as New Hampshire, it was close to the highest load since that 2006 peak.

What has changed is that it is no longer sufficient to plan exclusively from the top down. We must now plan from both the top down and the bottom up.

ISO New England's load forecasting indicates the region is bottoming out of the load decline that began in 2006, which was driven by energy efficiency and other factors. Now, we are seeing load return. Much of what we observe today is traditional commercial and industrial growth in ways we have not seen in decades.

PUF: A lot of people assume the growth is mostly electric vehicles and heat pumps. How do you separate what is happening now from what is projected?

Jacob Lucas: There is a message suggesting that all load growth in New England stems from electric vehicles or space heating through heat pump adoption. That is not accurate for the

We use grid-enhancing technologies and advanced conductors in many projects because we need to maximize the existing system and reduce the need for new investments.

near term. Electrification is expected to ramp more meaningfully in the 2030 to 2035 timeframe. It will become a major driver, but it is not the only story for what is happening right now.

One profound change forecasters expect, largely driven by space-heating electrification, is that New England will transition from a summer-peaking system to a winter-peaking system around 2035. This shift is unusual in the United States, although it is common in Canada.

PUF: Where are you seeing the greatest strain today, and does it look different across the three states?

Jacob Lucas: Each state has its own signature or load shape. From a density standpoint, New England has two major load pockets. One is southwest Connecticut, near New York City. The other is the Boston area.

Many of the first-mover projects are in those regions. In Boston, for example, we see biotech development that is fairly load intensive. These are the areas where operational concerns show up most clearly, especially heading into the summer, when New England still experiences its highest peak.

There are also locations where we have to implement interim operational measures to reliably serve load. We are building battery storage in some areas for the same reason. In some locations, we cannot bring substation transformation online quickly enough to serve the load growth, which creates pressure in real time.

PUF: What is driving those constraints? Is it engineering, permitting, supply chain, or other factors?

Jacob Lucas: It involves all of those elements. These projects require significant time to reach an in-service date, and we see pressure across the entire development process. Equipment lead times are lengthening. In some instances, we have established strategic supplier partnerships because the quantities of equipment we need are so large that suppliers have to expand manufacturing capacity to meet it.

That is why expediting approvals matters. The need is arriving faster than traditional infrastructure timelines allow.

PUF: You lead transmission planning. How are planning processes evolving as the system changes?

Jacob Lucas is the Vice President of Transmission System Planning at Eversource Energy, which is New England's largest energy delivery company. The Transmission System Planning department at Eversource proudly serves as a catalyst for clean energy, decarbonization, and grid modernization. The team is innovating with some of the nation's most cutting-edge projects and deploying grid-enhancing technologies to better serve customers. Lucas also worked at FERC in Washington, D.C.

New steel poles that Eversource installed in Chicopee, MA as part of a project to replace aging wooden transmission infrastructure.

Jacob Lucas: Transmission planning, which FERC regulates, has historically functioned as a top-down process. In New England, transmission planning generally covers facilities of one hundred thousand volts and higher. Historically, the focus remained strictly on transmission needs and solutions.

What has changed is that it is no longer sufficient to plan exclusively from the top down. We must now plan from both the top down and the bottom up. Distributed energy resources, especially solar, have grown significantly. The distribution system is also undergoing profound changes that drive shifts on the transmission system in ways we have not seen before.

This is why I work closely with our distribution system planners. It started with the rapid growth of distributed solar, and now it is much broader. The volume of change occurring on the distribution system now directly affects how we approach transmission planning.

PUF: How does that connect to interconnection timelines and what is getting built in the region?

Jacob Lucas: In New England, large generators go through the ISO New England process, while smaller generators are managed by individual transmission owners, like Eversource. These processes are different.

On the small-scale side, strong state incentives for solar and other distributed resources maintain significant interest in new projects. However, the large-scale landscape has changed.

If you look at what is in the queue, much of it is battery storage. Batteries store and discharge energy rather than generate it, which changes the dynamic of the grid. The region has also seen uncertainty with offshore wind development, and several gas plant projects failed to move forward. New England has difficulty attempting to build large thermal resources.

Crews work on a cross-arm replacement as part of a project on a critical transmission line in Sugar Hill, NH.

At the same time, there is a generation adequacy concern because large-scale generation retirements are outpacing new

additions. That makes timing and coordination between load growth, resource development, and transmission infrastructure critical for the reliability of the system.

PUF: Where does Eversource fit in the data center conversation, and what are you seeing in terms of requests?

Jacob Lucas: Two years ago, there was essentially no data center interest. Now it is here.

Large loads come to transmission owners, not to ISO New England. At any given time, we have roughly five thousand to seven thousand megawatts of large load under study.

To put that in context, New England is roughly a twenty-five-thousand-megawatt system. Individual requests can range from one hundred fifty megawatts to one thousand megawatts. New Hampshire's total load is roughly two thousand megawatts. So, we are looking at spot loads that can be half the load of an entire state.

In considering these requests, new data center siting must be done with a focus on protecting affordability for all existing customers. New England does not currently have sufficient energy supply to support data center demand, and large data centers are among the most capital- and energy-intensive facilities in the economy.

The greatest interest seems to be mostly concentrated in Connecticut right now, although there is interest in Massachusetts and New Hampshire, as well. So far, none of these projects have crossed the finish line, but some have gotten close.

PUF: Some states are trying to slow data center development through legislation. What is the utility role in that, and what can you say yes or no to?

Jacob Lucas: As a transmission and distribution company, we have an obligation to serve customers. That includes interconnection customers. Some policymakers look at utilities as gatekeepers for data centers, but we cannot simply say no. There is a very high bar for denying service. What we can do is study the interconnection and communicate what the cost and timeline will be.

PUF: Eversource is a wires-only company. Why is that structure distinct as load grows?

Jacob Lucas: It is an important point because New England deregulated. Eversource does not own, operate, or plan generation. Thus, interconnecting load does not change our earnings the way it would for a vertically integrated utility. In much of the region, we also have rate decoupling, so sales volume does not drive earnings.

How Eversource earns a return is through investment in transmission and distribution facilities. The return on equity is tied to capital investment in lines and substations under a regulated framework. So, we care about load from a reliability and planning perspective, but we do not benefit economically from load growth in the way people sometimes assume.

PUF: How do you balance the need for infrastructure investment with affordability, especially when customers often experience energy cost pressure first?

Jacob Lucas: There is an energy affordability crisis in New England. For many customers, that is the dinner table conversation.

The balancing act is between reliability requirements, which are non-negotiable, and the public policy objectives that states have set. We need to deliver solutions in the most cost-effective way.

Eversource has put a lot of emphasis on transparency and process discipline. We adopted an independent third-party reviewer for asset condition projects. We are doing analysis of non-transmission alternatives. We use grid-enhancing technologies and advanced conductors in many projects because we need to maximize the existing system and reduce the need for new investments.

We have been doing more outreach to communities where projects are likely to be developed. That improves community acceptance and reduces siting challenges later.

We are also mindful that as a wires-only company, we sit in the middle. The largest portion of customer bills is typically supply, and we do not control that. Still, we work to be a solution provider for the states on the infrastructure side. If a state chooses to pursue a particular public policy transmission project, the ISO process will move it forward through its competitive framework. That is not solely a utility decision.

PUF: What would you most encourage stakeholders to focus on over the next few years to make this work?

Jacob Lucas: We have been doing more outreach to communities where projects are likely to be developed. That improves community acceptance and reduces siting challenges later. Some states have also pursued siting reform to expedite processes that can otherwise take multiple years.

From a planning standpoint, we now have a clearer view of what system upgrades are needed to support load growth and policy goals. The work is identifying the needs and laying out the roadmap. The challenge is executing the development milestones quickly enough.

Load growth is arriving quickly. Thankfully, the roadmap exists. But now we need support from stakeholders to execute it on timelines that match what the system is being asked to deliver and to do so in the most cost-effective manner possible. ❍

DOE estimates the grid must expand by 57 percent by 2035 to maintain reliability.

Peter Muhoro

Rappahannock Electric Cooperative Chief Strategy, Technology, and Innovation Officer

PUF's Rachel Bryant: We have discussed transmission planning and shifting load shapes in the Northeast with Eversource. Turning to the mid-Atlantic and the unique role of cooperatives, how is load growth showing up across electric co-ops today, and how has that landscape changed?

Peter Muhoro: Electric co-ops have gone from a period when efficiency was the main story to a period when capacity is the story. Capacity is now the priority.

Co-ops power approximately fifty-six percent of the landmass in the United States, comprised of nearly nine hundred co-ops. That scale matters because there is significant attractiveness to locate emerging large loads within co-op service territories, where land is often inexpensive. Many co-ops have also been building fiber for broadband services, providing essential connectivity. The combination of available land and connectivity creates a strong environment for development.

In our case at Rappahannock Electric Cooperative (REC), we are a member-owned utility that provides electric service to nearly 185,000 connections across portions of 22 counties in Virginia. Our service territory spans areas just outside Washington, D.C., while extending deep into rural communities that are critical to the Commonwealth's growth.

Northern Virginia is widely recognized as "Data Center Alley," where a significant share of global internet traffic flows. That demand is no longer confined to a single corridor – it is expanding outward into surrounding regions, including REC's footprint, driving the need for scalable, resilient, and forward-looking grid infrastructure.

By requiring large loads like data centers to pay their share up front, we are preventing those investments from being shifted onto our broader membership.

Today, we have about five gigawatts of contracted data center load. That is not speculative; it is contracted. For context, our peak load is about 1.2 gigawatts. We are contracting five gigawatts against that foundation. Furthermore, we have another approximately sixteen gigawatts in the pipeline specifically for data centers, which does not include other incoming loads.

PUF: What other types of load are you seeing besides large data centers?

Peter Muhoro: While data centers receive the most publicity due to their size, many other loads are arriving simultaneously. We have several requests for fifty megawatts, thirty-five megawatts, and similar capacities.

Historically, our largest load was primarily residential. Our historic largest single load was around forty megawatts. Now we have entities that come in at multiples of that.

We are also seeing new types of load, such as hydroponic agriculture. A recently announced project shows that growing leafy greens can represent a six- to seven-megawatt load. That is not a typical rural load profile – it is equivalent to placing several big-box stores into a single facility.

PUF: Are co-ops facing the same challenges as investor-owned utilities, or are there unique rural challenges?

Peter Muhoro: In a structured market, the challenges are similar whether you are a co-op, a municipal utility, or an investor-owned utility. We all face the same constraints around generation capacity and transmission limitations.

PJM is a good example. If you look at total load and remaining reserve margins, the surplus is not extensive. By the end of 2025, PJM had roughly 40 GW of reserves on an approximately 160 GW peak load and about 201 GW of installed capacity. If we add five gigawatts, that represents more than ten percent of the reserve margin concentrated in a single service territory.

There is also the transmission challenge and a general lack of infrastructure across the region. The delivery challenge is not a question of what we can build, but how quickly. The supply chain remains a constraint, and lead times are long.

Peter Muhoro is the Chief Strategy, Technology, and Innovation Officer at Rappahannock Electric Cooperative (REC), where he leads long-term strategic initiatives and technology planning. He also serves as EVP and General Manager of REC's subsidiaries, BrilliT and Vividly Brighter, focusing on cybersecurity, data analytics, and consumer energy solutions. With over 20 years of experience, he has held leadership roles at the National Rural Utilities Cooperative Finance Corp. and Pedernales Electric Cooperative. A dedicated advocate for equitable energy access, he chairs the Board of the Smart Electric Power Alliance (SEPA) and serves on the GridWise Alliance board.

PUF: What does that supply chain constraint look like in practical terms?

Peter Muhoro: Transformers are a clear example. We have placed orders for about sixty or seventy 150-MVA transformers. Those are not short lead-time items. Receipt can require twenty-four months, twenty-five months, or even thirty months.

The challenge is twofold: securing power and capacity while building distribution infrastructure fast enough to deliver it.

PUF: You have five gigawatts of contracted load. That is an enormous opportunity, but it is also risk. How are you managing the risk?

Peter Muhoro: We view it as a major opportunity that must be managed carefully. In the past, utilities considered one percent load growth to be a success. Now, opportunities exist to double load in a short period.

The delivery challenge is not a question of what we can build, but how quickly. The supply chain remains a constraint, and lead times are long.

We focus on de-risking this load. First, for infrastructure, we require the data center to provide collateral upfront. We do not order materials until a contract is signed and payment is received. This is intentional; we will not risk being left with partially built infrastructure if a customer walks away.

Second, from the power supply side, we do have an obligation to serve and must solve for that power. Virginia is interesting because customers above a certain size have retail choice. We created an entity called Hyperscale Energy Services to find market pathways for providing power to these large loads.

We are not using our traditional generation and transmission co-op structure to power the data centers. Instead, we are using a market-based approach through that separate entity.

We also isolate risk customer by customer. Each large-load customer has its own structure under the Hyperscale Energy Services umbrella. If one project fails, it does so independently without affecting the rest of the structure. We also require financial support, such as a letter of credit, to reduce the risk of a sudden customer failure.

PUF: You also sought approval for a large-load rate. How does that rate design help manage uncertainty?

Peter Muhoro: We recently received Commission approval for a new rate designed for large loads that aligns what a customer commits to with what they pay. If a customer commits to a 300-megawatt load, they are billed at that level from day one, regardless of initial usage.

But it goes beyond billing – it's a full risk-containment framework that ensures customers cover the true cost of serving their

REC crews working to enhance reliability by upgrading power lines, replacing aging equipment, and improving system automation to reduce outages and speed restoration times.

We must negotiate firmly and verify if a customer is serious. This may feel different from historical cooperative practices, but it is necessary.

REC is investing in infrastructure across the grid to ensure reliable, resilient service, helping meet demand while maintaining dependable service and supporting future growth.

load, including infrastructure, power supply, and appropriate credit support. It creates a clear incentive to meet commitments, discourages overstating demand, and most importantly, protects our members from the risk of building for load that never materializes.

PUF: How does all this impact affordability for your members?

Peter Muhoro: Our structure is designed to protect our members. In the co-op world, we say we want to protect every member, including the one at the end of the line, and no one should have to choose between paying an electric bill and paying for medication.

By requiring large loads like data centers to pay their share up front, structuring their power supply separately, and aligning costs with their actual commitments, we are preventing those investments from being shifted onto our broader membership. That discipline is critical to keeping rates stable and predictable, ensuring affordability is preserved for all members while still enabling growth in our communities.

PUF: What do co-ops need to manage this effectively over the next few years?

Peter Muhoro: The first need is organizational capacity. These requests are not small. They are demanding and require executive attention and quick decisions.

We created a dedicated division and appointed a chief growth officer to manage the complexity of large loads. Fortunately, the costs for this team are largely recovered from the large-load customers, so the burden does not fall on our members.

The second need is solving for capacity. We believe onsite generation will become more common given the timelines required for transmission and bulk power additions. It may become common to see a 500-megawatt combined-cycle natural gas plant next to a data center.

Electric utilities including co-ops need to be prepared to have those conversations. We created Hyperscale Generation Services to pursue these solutions when the customer provides the funding.

The third need is having hard conversations. We must negotiate firmly and verify if a customer is serious. This may feel different from historical cooperative practices, but it is necessary. Large loads bring opportunity only if the risk is managed and the benefits do not come at the expense of our existing members. ❍

Gautam Aggarwal

Bidgely Chief Revenue Officer

PUF's Rachel Bryant: We have explored how utilities are managing the physical and financial risks of massive load growth in Virginia. As these large loads and distributed resources continue to scale, how does a company like Bidgely fit into the utility landscape to help providers make sense of that data?

Gautam Aggarwal: Bidgely is really the pioneer of AI-powered energy intelligence. With 17 patents, 50-billion-meter reads, and insights from over 50 million homes, we have built the foundation for the most robust library of energy algorithms in the industry.

More than 45 utilities and energy retailers worldwide use our AI solutions to identify usage patterns and get appliance-level load insights. This helps them optimize nearly every initiative from customer engagement to energy efficiency and demand-side management.

Utilities possess a massive amount of data today. Many have adopted advanced metering infrastructure and have operationalized it in many ways. This data is deep and powerful. It can be applied across the entire utility to serve customers with precise insights while also maximizing the grid assets already in place.

The challenge is bringing that data into an environment built specifically for utilities. This allows them to turn data into precise insights to help both the customer and the grid. Our AI is trained on a combination of metering data, customer data, and demographics. It tells the utility exactly where the largest loads are emerging at the feeder and transformer and premises level before they ever become a grid constraint.

Today, utilities are running digital transformation initiatives electrification programs, and grid-edge technology investments. Bidgely focuses on supporting those different business functions with a consistent set of data-driven insights and an emphasis on accuracy and outcomes that matter.

PUF: From your perspective, how is load becoming more complex or harder to understand?

Gautam Aggarwal: For many years, load growth was steady and relatively predictable. The largest residential loads were typically heating, cooling, and water heating equipment. Utilities utilized models where year-over-year changes remained manageable and within a standard range of deviation that was generally driven by the weather.

The real question is what happens after the data is collected. Utilities do not need to be just data collectors. They need to become data orchestrators.

Then, several dynamics changed simultaneously. Electric vehicles became more common, and electrification goals expanded. Utilities began supporting a variety of programs, such as heat pump adoption, appliance upgrades, and broader weatherization efforts. Distributed energy resources, including rooftop solar, became much more prevalent while weather patterns became less predictable.

Now you have to add in data centers. They are adding load at an exponential rate and driving demand growth that hasn't been seen since the post-World War II era. The supply and demand picture is more complicated than it has ever been for most utilities. It feels like a perfect storm because traditional obligations have not changed.

Utilities must still deliver on reliability, affordability, customer satisfaction, energy efficiency, and in many cases clean energy mandates. They also remain committed to serving income-qualified and vulnerable customers who can be difficult to identify. Those expectations remain, but they are now coupled with a multiplier effect from new loads and increased variability.

PUF: What do you think utilities are missing today when it comes to understanding load behavior?

Gautam Aggarwal: The data is there. Nearly every utility has adopted AMI 1.0, and many are already evaluating AMI 2.0 while starting to deploy against specific use cases. The real question is what happens after the data is collected. Utilities do not need to be just data collectors. They need to become data orchestrators.

From a regulator's standpoint, I'd want to see this data operationalized in every existing program and every new initiative moving forward. That means using data to build trust, identify the right customer opportunities, and enable action across the organization.

PUF: You framed that as trust, identify, and enable. What does that mean in practice?

Gautam Aggarwal is the Chief Revenue Officer at Bidgely. Prior to Bidgely, Gautam was CMO at NSS Labs, a data-driven cyber security company. In his 25+ years of rich strategic and business experience in Solutions, Product Marketing, Product Management and Strategy, and Global Marketing, he also served as Vice President, Product Marketing at FireEye and Barracuda Networks and lined them for their successful IPOs. Earlier in his career, he served as Director of Marketing, Solutions and Management at Cisco.

Gautam Aggarwal: Trust comes first. Customers often assume that if a utility offers a new rate plan, such as time-of-use, it is designed to raise bills. That is a trust problem. Data can address this if the insights are accurate and transparent. If a customer can see that an electric vehicle is charging during on-peak hours and driving up the bill, the conversation changes.

Identify is the next step. Utilities run many programs, from weatherization to equipment upgrades. They cannot approach every customer the same way. The goal is to use behind-the-meter insights and analytics to identify which customers are the best fit for each initiative.

If a utility serves more than a million customers, it cannot market every program to everyone. If the data identifies homes with inefficient heating or those charging vehicles during peak periods, the utility can focus outreach on the group most likely to benefit. This improves adoption, reduces wasted spending, and delivers a better customer experience.

Enablement is about execution. It's not efficient for utilities to add five separate platforms for five separate needs. They need a way to enable multiple business functions on one platform with consistent insights by using the data and assets in which they have already invested.

If utilities build trust through transparent insights, they can welcome growth because they understand where capacity exists and how to manage load effectively.

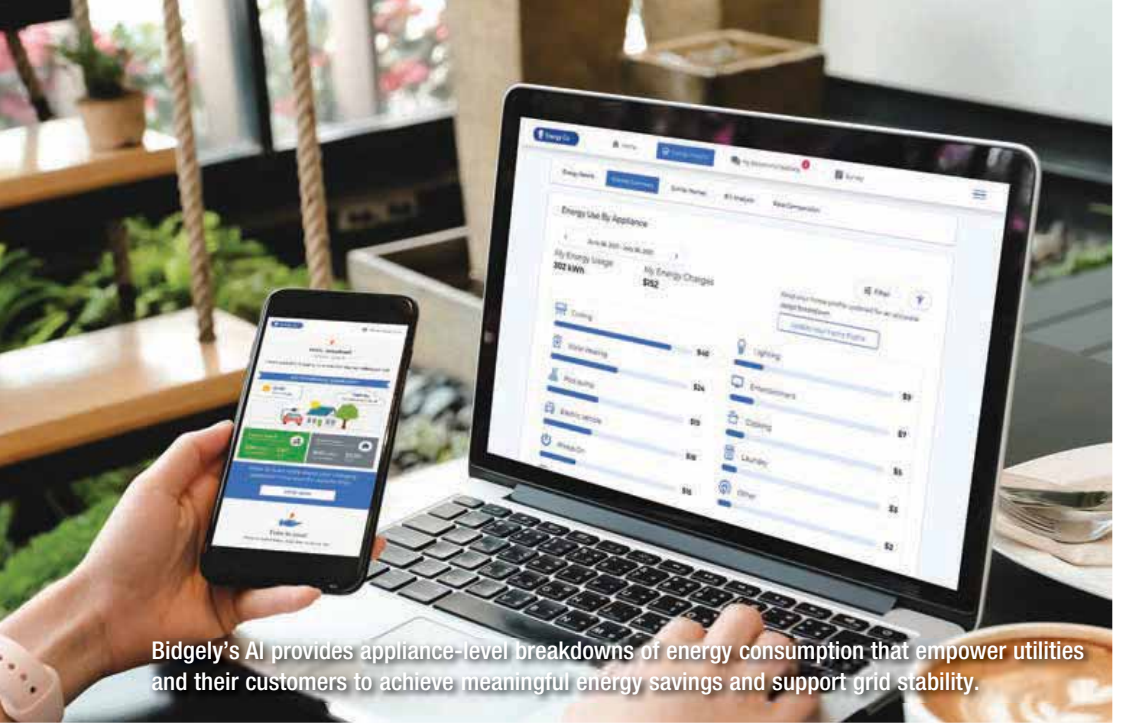
PUF: Utilities also have legacy systems and cybersecurity concerns. How do you fit into that environment without asking for a rip-and-replace?

Gautam Aggarwal: The goal is to be additive rather than disruptive. Utilities have different comfort zones and are in various stages of their technology journeys. Some are comfortable with a public cloud model, while others prefer private cloud environments to keep data within their own boundaries.

There is also a real-time path. As advanced metering technology evolves, analytics can be delivered closer to the edge. For example, when a customer plugs in an electric vehicle during an on-peak period, advanced metering data can help create a near real-time event. A utility can notify the customer, explain the cost impact, and provide guidance to shift charging to off-peak hours.

This is powerful because when utilities can proactively target high-usage customers with the right rate plan to help them save money, utilities are also supporting grid reliability by removing strain on neighborhood-level assets like transformers.

AI allows utilities to understand exactly which EVs and charging patterns are creating that load spike and when that load can be shifted. Not only is this a better customer experience,



Bidgely's AI provides appliance-level breakdowns of energy consumption that empower utilities and their customers to achieve meaningful energy savings and support grid stability.

The best outcome is for a utility to understand the grid at a granular level and make decisions based on trusted data. If utilities build trust through transparent insights, they can welcome growth.

but it's also a significant cost saving for the utility in not having to replace that transformer.

The underlying point is that utilities should not have to rebuild their entire information landscape to get value.

PUF: How can better data and analytics help utilities respond more effectively to load growth?

Gautam Aggarwal: AI-driven data analytics help at the customer, operations, and grid levels. At the customer level, utilities can provide an itemized view of energy use. Instead of citing a hot month for a bill increase, the data can show exactly which appliances drove the change. That level of visibility also allows utilities to move beyond one-size-fits-all programs.

In one large northeastern utility service territory, for example, we worked with the utility to identify customers with inefficient appliances and target them for electrification and efficiency programs. That kind of segmentation makes outreach more relevant and improves adoption.

At the operations level, this same insight enables the call center. A representative can see what is driving a bill and turn a reactive interaction into a proactive conversation about a relevant program.

In another case with a large western utility, customer service teams were equipped with appliance-level insights so they could walk customers through exactly what was driving higher bills. Those conversations often shifted from complaints to solutions, whether that meant adjusting usage patterns or enrolling in a program, which improves both customer satisfaction and operational efficiency.

On the grid side, analytics support better planning and rate design. Time-of-use pricing is a load-shaping tool that can move behavior and reduce strain during peak periods over time.

We've seen utilities use these insights to better understand how new loads, including electric vehicles and large commercial demand, are interacting with the system at a feeder and transformer level. That enables more informed decisions about where capacity exists, where constraints are emerging, and how to manage growth without relying solely on new infrastructure.

PUF: Where does this fit as utilities confront large-load growth from data centers?

Gautam Aggarwal: A data center is a massive load, but the core questions remain the same. How efficiently is the load being used? When is it being served? Granular grid intelligence matters.

If a utility can see which feeders or transformers are near capacity, it can avoid adding load in the wrong places and identify where the system can absorb growth. AI-driven analytics helps utilities delay or avoid unnecessary hardware investments while maintaining reliability.

PUF: How do you see the role of AI evolving in this space?

Gautam Aggarwal: A strong foundation is essential, as inaccurate data produces inaccurate results. Once that foundation exists, generative AI can add value by improving access to insights. Instead of searching through dashboards, an employee can ask a natural language question about why a bill is higher and receive a data-backed explanation. The goal is scale and moving faster with fewer manual steps.

We're also seeing a trend where utilities are hiring executives specifically focused on AI adoption and implementation. This shows they understand the opportunity AI represents and are actively strategizing when and where to best adopt it.

PUF: Looking ahead, what needs to change over the next few years in how utilities use data?

Gautam Aggarwal: Utilities need to move from reactive to proactive and predictive. Electrification, data centers, and distributed resources are all growing.

The best outcome is for a utility to understand the grid at a granular level and make decisions based on trusted data. If utilities build trust through transparent insights, they can welcome growth because they understand where capacity exists and how to manage load effectively. Data is the lever that allows that shift. ❍

Jeff Ressler

Clean Power Research CEO

PUF's Rachel Bryant: We have explored how data orchestration can turn meter insights into actionable trust with customers. As utilities move from identifying these opportunities to executing interconnections and managing complex processes, where does Clean Power Research enter the picture?

Jeff Ressler: We are a software-as-a-service company that has been in operation for a significant period. The company traces its roots back to 1998, when Tom Hoff founded it after his tenure at Pacific Gas and Electric. In the early days, our focus was on thoughtful consulting and program design, particularly around solar and incentives when that technology was first ramping up.

Over time, utilities and state agencies became more interested in software solutions. They needed both a program design and a functional way to execute it. That demand drove our shift into software.

Today, we offer solutions for two markets: first, utilities and energy agencies and second, the solar industry. For the utility space, we offer solutions that automate and scale critical business processes such as generator interconnection, load connection, and service requests. We also provide solutions for DER data and insights.

On the solar side, we provide data products centered on solar irradiance that optimize solar project planning, development, and operations. These solutions help answer questions regarding where solar resources are strongest, what has occurred historically at a site, and what might happen operationally or in the future. These insights are vital for prospecting, operations, and forecasting.

I should note, many utilities license our solar data solutions for irradiance planning and operational forecasting.

PUF: Load growth is now a headline topic. How is data center- and electrification-driven demand showing up in the work you do with utilities?

Jeff Ressler: It is showing up in a dramatic way. A significant portion of large-load growth is tied directly to data centers and the artificial intelligence boom. This creates massive practical challenges for utilities. We have extensive experience helping automate workflows around interconnection, electric vehicle programs, and other electrification initiatives. This has made us a natural partner for utilities when their volumes increase, and their internal processes become strained.

While spreadsheets can represent data, email becomes the primary way that data moves, which creates problems like lost records, data entry errors, or missed deadlines.

In raw numbers, the volume of large-load requests is still small compared with the number of distribution interconnection requests for rooftop solar, but the impact is enormous. When you are discussing hundreds or thousands of megawatts of new load, it changes the system planning conversation immediately.

PUF: What are the most common pain points you hear from utilities dealing with these large-load requests?

Jeff Ressler: There are several pain points. First is the number of stakeholders involved. A large commercial and industrial customer, such as a hyperscale data center, is handled with great care by a utility because it is a valuable customer. This means business development and customer management teams are engaged alongside distribution and transmission teams. Planners, engineers, and program managers must all work together to understand what the load will look like over time.

The second factor is the uncertainty and complexity within the load profile itself. Data centers can look like baseload because they operate continuously, but they can also exhibit spikiness depending on the workload. Training workloads and inference workloads have different characteristics that affect how much compute is running, how much heat is being generated, and the resulting cooling requirements.

The third factor is that this is not limited to large investor-owned utilities. Co-ops and municipal utilities are seeing these requests as well. The large-load customer seeks a location where they can interconnect quickly, at a reasonable cost, and with fewer permitting hurdles. This means utilities of all sizes are dealing with problems that are both large and complex.

PUF: When a utility is straining under volume and coordination, what does software realistically change for them?

Jeff Ressler is the CEO of Clean Power Research. In his 16 years at the company, Jeff has overseen the inception of the SolarAnywhere® and WattPlan® software families and grown PowerClerk® into a powerful energy program automation solution. Jeff's career includes stints at Oracle and Disney in addition to more than 10 years at Microsoft. During his tenure at Microsoft, Jeff served as Director of Product Management for Exchange Server and Lead Product Manager for SQL Server. For over two years, he was the speech manager for Bill Gates.

Gross load matters for distribution planning. It affects how utilities assess feeder capacity and whether capital investments are needed, especially as electric vehicle charging and other electrification loads grow.

Jeff Ressler: The first benefit is visibility and transparency. Without purpose-built tools, these processes often rely on spreadsheets and email. While spreadsheets can represent data, email becomes the primary way that data moves, which creates problems like lost records, data entry errors, or missed deadlines. There is no single version of the truth and no shared view across stakeholders.

A system designed for workflow automation gives stakeholders a shared view. It manages permissions, assigns work, and tracks exactly what stage a project is in. It reduces the time spent on manual coordination and increases consistency. It can also support transparency to regulators. If a utility chooses, regulators can be granted read-only access to see what is occurring without changing any data.

PUF: Utilities have many legacy systems and complex IT environments. How do you integrate without asking them to rebuild everything?

Jeff Ressler: We are a software-as-a-service company, and our software runs in a cloud environment. We pride ourselves on being a company that plays well with others. Utilities already possess customer systems, billing systems, and mapping systems, and we integrate with those existing tools.

Some utilities will adopt software without deep involvement from information technology teams, though we prefer when those teams are involved because integration creates more automation. The core point is that software can be additive. It does not require a utility to discard its existing core systems.

PUF: You have worked with major utilities in hotspots for both solar and data center growth. What do those partnerships show about large-load interconnection and process design?

Jeff Ressler: We have worked with many utilities that initially focused on distribution interconnection for residential rooftop solar and on transmission interconnection. As large-load requests have increased, these utilities have found that the same workflow automation processes used for distribution and transmission interconnection are also highly effective for managing large-load interconnection.

Many aspects of managing a large-load interconnection program are like managing a transmission interconnection program. There are multiple stakeholders and phases of development. A project may ramp over time, and the utility must align infrastructure and supply planning with that ramp.

A key benefit of workflow automation is adaptability. The utility operates in a world of change where rules and processes evolve. Software should allow utilities to adjust programs without needing to become software developers.

PUF: There is a lot of discussion about "phantom projects" in interconnection queues. Are you seeing those on the large-load side?

Jeff Ressler: We hear about phantom projects extensively on the generator interconnection side, but we are not seeing it as

Jeff Ressler (center) and members of the Clean Power Research team at DTECH 2026 where they presented solutions for utility workflow automation including large load and utility-scale interconnection.

dramatically on the large-load side. One reason is that data center demand comes from well-resourced companies with significant capital and large teams.

Generation developers may not have that same level of resources and often chase specific wind or solar resources, which creates broader optionality and more projects that enter queues. For data centers, the variables are different. Electricity prices, permitting, and network connectivity matter. Those constraints narrow the realistic options, which reduces the number of speculative projects.

PUF: There is often a distinction made between capacity concerns and energy concerns. What does that mean for these large-load customers?

Jeff Ressler: Capacity is the question of whether the grid infrastructure can physically deliver the power. Energy is the question of whether enough energy can be produced over time to meet ongoing demand. With data centers, you have a load that is always on, which increases energy needs significantly.

Utilities must think carefully about both the infrastructure and the supply side. This involves utilities, regulators, applicants, and market participants discussing tariffs, timing, and who pays for upgrades.

PUF: You also mentioned that utilities are dealing with "hidden load" because of behind-the-meter solar. Why does gross load matter in this environment?

Jeff Ressler: Solar can obscure what is happening behind the meter. If you know the specifications of a solar system and have high-quality irradiance data, you can estimate what that system would have produced. That allows you to add it back to the net load measured by the utility to get a clearer picture of gross load.

The scale of load growth we are seeing is forcing a reassessment of the electric system. Engineering time inside utilities is a scarce resource. Software can help optimize that.

Gross load matters for distribution planning. It affects how utilities assess feeder capacity and whether capital investments are needed, especially as electric vehicle charging and other electrification loads grow.

PUF: Looking ahead, what needs to change over the next few years to better handle this level of demand?

Jeff Ressler: The scale of load growth we are seeing is forcing a reassessment of the electric system. Engineering time inside utilities is a scarce resource. Software can help optimize that resource. We are using artificial intelligence to automate parts of the review process, such as technical document and site plan reviews, to reduce manual workloads.

There is no single silver bullet, but the broad engagement across the industry is reassuring. Software is not magic, but it can approximate magic if it unifies stakeholders around a single version of the truth and turns complex processes into organized frameworks. That will be essential for the set of solutions needed moving forward. ❍

Theodore Paradise

CTC Global Chief Policy and Grid Strategy Officer

PUF's Rachel Bryant: We have discussed how software-as-a-service and workflow automation are streamlining the "digital" side of interconnection. However, once a project is approved, it still faces the physical reality of the grid. Where are you seeing the biggest constraints in transmission capacity today?

Much of the existing transmission system was designed for gradual, predictable growth, yet today's load is concentrated, time-sensitive, and increasingly tied to firm delivery commitments.

Theodore Paradise: The most significant constraint is no longer simply a lack of infrastructure – it is the growing misalignment between the pace of load growth and the speed at which the grid can adapt.

Geographically, the United States is seeing its most severe transmission constraints concentrated in a few key regions. The Midwest and Great Plains face generation delivery issues, while Texas and the Mountain West deal with persistent intraregional congestion. In dense demand centers like California, New York, and the Mid-Atlantic, limited transmission drives both high prices and reliability concerns.

Further, we are entering a period of sustained, non-linear demand driven by AI, hyperscale data centers, electrification, and domestic manufacturing. This is a structural shift, not a temporary surge. Much of the existing transmission system was designed for gradual, predictable growth, yet today's load is concentrated, time-sensitive, and increasingly tied to firm delivery commitments.

Policy shifts are starting to begin to address these issues. For example, California's SB 1006 now requires utilities to formally evaluate grid-enhancing technologies and reconductoring with advanced conductors as part of recurring transmission planning. This represents a clear shift from optional grid optimization to real, required analysis.

At the federal level, momentum is accelerating through legislative efforts like the REWIRE Act and the High-Capacity Grid Act. Additionally, DOE has launched the $1.9 billion SPARK program to accelerate transmission upgrades that can be deployed quickly using

existing infrastructure. In the FY27 DOE budget proposal, there is $750 million identified to specifically speed reconductoring existing rights of way with advanced conductors.

But the constraint is neither vision nor capital – it is the process and execution speed of legacy approaches.

PUF: How can existing infrastructure be upgraded to handle more load?

Theodore Paradise: The fastest path to capacity is not building new transmission, but rather unlocking the capacity embedded within the system we already have.

Data centers have a need for speed that traditional infrastructure planning and execution is not meeting. While data centers can be built in 18 months, it's often more than three times as long to add new generation and ten years or more to build new transmission.

Currently, 2.6 TW of energy resources are sitting in interconnection queues that can't connect to the grid, in many cases due to a lack of transmission. Even more, there are tens of gigawatts that have fully completed the interconnection process that are waiting on needed infrastructure.

An example is seen in PJM where future generation shortages pushed the capacity market to the cap of over $16 billion while 57 GW of new generation had cleared the queue and had agreements to connect.

Reconductoring with advanced conductors enables utilities to increase capacity – often doubling it – without new rights-of-way or major structural changes. In many cases, capacity can be doubled while losses are reduced by up to 40 percent and reliability improved.

This approach is firmly supported by DOE's SPARK program, which prioritize projects that can be deployed in months rather than years. At the regulatory level, FERC Orders 1920, 2023, and 881 are moving the industry

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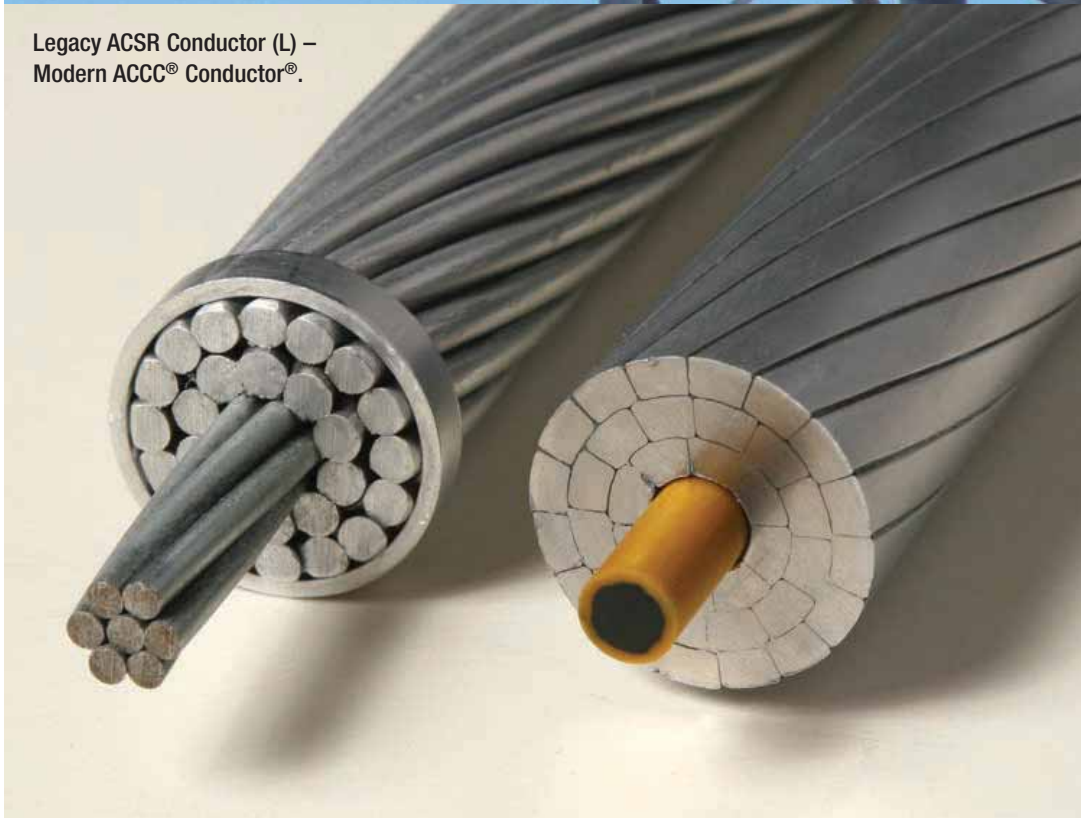

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toward long-term, forward-looking strategies. Furthermore, integrating real-time monitoring allows utilities to move from static planning to dynamic, data-driven operation.

PUF: What roles do advanced conductors or advanced transmission technologies play in addressing this challenge?

Theodore Paradise: Advanced conductors simultaneously address capacity, efficiency, reliability, and deployment speed. Carbon composite core conductor technologies increase ampacity, reduce thermal sag, and lower line losses at existing conductor weight and voltage. This allows more power to be delivered using existing towers in existing rights of way. This makes them uniquely suited to address near-term constraints while improving long-term system performance.

In the past, towers and foundations would have to be torn down and rebuilt to support the larger, heavier conductors with greater sag. This is still a common approach in the United States and adds not only significant expense over reconductoring with carbon composite core advanced conductors, but significant expense and time.

PUF: Where are utilities underestimating available solutions?

Theodore Paradise: In general, we see utilities continue to underestimate both the scale and immediacy of what can be achieved within existing infrastructure.

There remains a persistent focus on either new construction with legacy 1900s conductor designs as the primary path to capacity or on tear down and rebuilds. Yet reconductoring with advanced conductors can deliver step-change improvements – often doubling capacity – without the delays associated with permitting and siting. Choosing advanced conductors for new projects or rebuilds also lowers costs and reduces siting risks because the technology allows for shorter tower height and requires fewer structures overall.

Defaulting to these traditional construction habits is increasingly misaligned with policy direction that seeks to increase speed to power while reducing consumer costs. California's mandate, along with emerging requirements in other states – including Ohio's HB 15 – explicitly prioritizes evaluating grid-enhancing technologies and reconductoring before pursuing new corridors. Federal funding programs reinforce this shift by prioritizing projects that maximize existing assets.

The value of loss reduction is also underappreciated. In a high-demand environment, reducing line losses is equivalent to adding generation capacity without the associated fuel, emissions, or permitting challenges.

Finally, deployment speed is consistently underestimated. Many of these solutions can be implemented in a fraction of the time required for traditional infrastructure, provided they are treated with the urgency current conditions demand.

In a high-demand environment, reducing line losses is equivalent to adding generation capacity without the associated fuel, emissions, or permitting challenges.

PUF: What barriers – technical, regulatory, or economic – are slowing adoption?

Theodore Paradise: The barriers are institutional, not technical.

The technologies are proven and widely deployed. As of 2026, advanced core conductors have been proven at scale, with more than 140,000 miles deployed across seventy countries. The challenge lies in planning frameworks, regulatory structures, and procurement models that remain oriented toward legacy approaches and large, long-duration capital projects.

Progress is underway. Federal transmission reforms, DOE funding programs – including SPARK – and emerging legislation are beginning to align incentives with outcomes. But implementation remains uneven, and integration into standard planning processes is still evolving.

There is also a persistent knowledge gap. Many decision makers are not fully aware of the performance, economic, and deployment advantages of advanced conductors. Legacy technology has at times been repackaged as advanced and legacy providers have worked to oppose performance-based standards and definitions in state and federal laws.

A common misconception is that advanced conductors are more expensive, while in truth advanced conductor projects are 75 percent less expensive than new builds, 50 percent less expensive than rebuilds, and reduce overall project costs where greenfield or rebuilds are needed.

PUF: How quickly can these solutions realistically be deployed?

Theodore Paradise: Speed is where these solutions fundamentally change the equation.

Reconductoring projects can typically be completed in months

Theodore Paradise serves as the Chief Policy and Grid Strategy Officer at CTC Global. He has over two decades of experience in the energy sector and is a recognized thought leader in transmission policy, as well as development and operation of power generation, transmission, and distribution systems. Prior to joining CTC Global, he was a partner at the global law firm of K&L Gates, ranked in the Legal 500, and advised clients on energy policy and legal issues. Theodore held executive roles with a G&T developer, and spent several years overseeing planning, interconnection, and operations regulatory issues at an RTO.

– not years – particularly when leveraging existing rights-of-way and structures. This aligns directly with the timelines required by large load customers, including data centers and electrification-driven demand.

This speed advantage is now central to federal policy. Programs like SPARK are explicitly designed to fund solutions that deliver near-term capacity increases – reflecting a broader shift toward prioritizing speed alongside scale.

While reconductoring projects can quickly be executed, including live line circuit replacement, it appears that institutional process will continue to be the largest limiting factor.

PUF: What needs to change to accelerate transmission expansion?

Theodore Paradise: The industry must move beyond a model centered solely on infrastructure expansion or wreck and rebuilds and toward one that prioritizes infrastructure optimization and augmentation.

Planning should begin with maximizing existing assets – not treating it as a secondary step. Regulatory frameworks must support faster, flexible deployment of advanced technologies, and utilities must be empowered to act with greater agility.

The United States grid is continuously being rebuilt "in-kind" outside of regional planning cycles. Those projects can provide low-hanging opportunities for conductor replacement that can quickly double capacity at the same weight and voltage.

Meeting the demands of AI, electrification, and economic growth will require a grid that is not only expanded but fundamentally modernized. Leveraging advanced conductors, power flow controllers, and power system AI is the path forward.

Meeting the demands of AI, electrification, and economic growth will require a grid that is not only expanded but fundamentally modernized.

That transformation is already underway. Increasingly, it is being supported not only by utilities and regulators, but also by major technology stakeholders. Strategic collaborations, such as our partnerships with Google and Tapestry, signal a broader shift toward integrating energy infrastructure faster with advanced analytics and digital intelligence.

The path forward is becoming clearer. The remaining question is how quickly we can execute at scale. ❍

Bill Brackmann

Burns & McDonnell Project Director

PUF's Rachel Bryant: We have explored the hardware and technological solutions available to increase grid capacity. However, the physical execution of these projects remains a massive undertaking. From your perspective, what are the primary bottlenecks currently hindering the construction of critical infrastructure?

Bill Brackmann: The challenges we're facing are a combination of several compounding factors that extend the entire development timeline. We are observing significant internal challenges on the client side as organizations struggle to adapt to a rate of growth that far exceeds historical norms.

One of the most obvious hurdles is navigating the regulatory landscape, particularly regarding long-range transmission lines that span multiple jurisdictions. When a project must cross several state or county lines, the permitting and approval cycles become increasingly intricate, which inevitably slows the development process.

The workforce serves as another critical constraint. While utility work grew at a steady pace for much of my career, the recent explosion in volume has stretched engineering and construction resources to their limit. This surge in demand coincides with a period of significant retirements at both utilities and consulting firms that is creating a talent gap exactly when the industry requires the most experience.

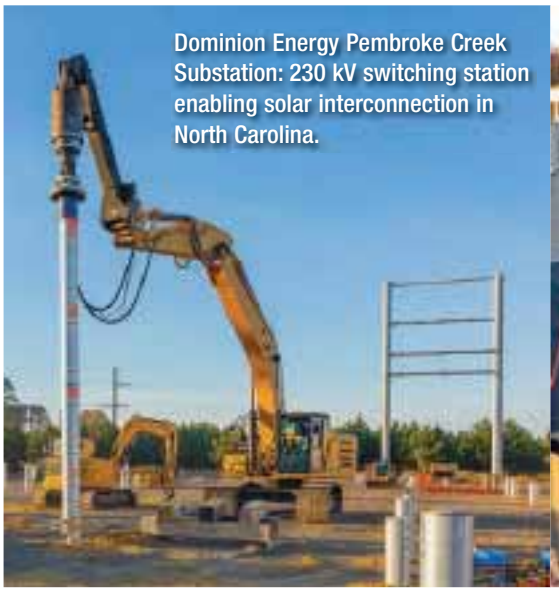
There is now a dynamic where vastly different and sometimes competing goals are in the same room. Our role is to align those disparate objectives into an executable strategy.

Finally, supply chain constraints continue to create hurdles. Lead times for transformers and breakers have been increasing for several years, but we are now even seeing procurement for steel, which was formerly a predictable process, extend beyond one year. Insulators also remain a significant concern for our partners.

When these logistical hurdles are layered with economic pressures and the mandate for rate discipline, the true bottleneck emerges at the intersection of all these factors.

PUF: Who is coming to you with these challenges, and how do the priorities differ across the various sectors seeking your help?

Bill Brackmann: We field requests from every corner of the



Dominion Energy Pembroke Creek Substation: 230 kV switching station enabling solar interconnection in North Carolina.

Duquesne Light Company Watson Substation: New EPC-built substation supporting reliability and growth in downtown Pittsburgh.

The grid is a living system where you have to manage power outages and stability with extreme precision. When you plan and build through a unified team you reduce the risk of delays.

energy landscape. While our foundational roots remain with our utility partners, including investor-owned utilities and cooperatives, the unprecedented rate of growth has brought a diverse range of stakeholders to our door.

We are seeing increased interest from data center developers, hyperscalers, and industrial clients, all of whom are looking for the consulting and delivery experience required to navigate this environment.

The priorities between these groups are often fundamentally different. Data center developers look at speed to market as a key metric of success. Utilities, in contrast, are tasked with a much more complex balancing act. They must attend to every variable: reliability, affordability, long-term scheduling, and the ultimate impact on the ratepayer. This creates a dynamic where vastly different and sometimes competing goals are in the same room. Our role is to align those disparate objectives into an executable strategy.

PUF: You cited workforce limitations as a primary bottleneck. How are these constraints manifesting in daily operations and what strategies should utilities adopt to bridge the talent gap?

Bill Brackmann: Workforce constraints are broad and are hitting every level of the industry from the people in the field to the engineers and project managers in the office. Our workforce is evolving, with a new generation of professionals entering as our more experienced employees begin to retire. The goal is effective knowledge transfer during this transition.

We're seeing a role reversal in the industry. Previously, consultants would execute based on a utility's established standards, whereas now they are often bringing new methodologies and insights to the table.

To help with this, we launched the Burns & McDonnell Construction Academy to give the whole industry a lift. We are bringing in people who might never have thought about a career in infrastructure and training them to move beyond a project-by-project mindset. While this initiative is a great long-term play, utilities still must be proactive to keep their current projects on track.

My best advice for any utility is to bring in your partners as early as you can. Locking in those resources for the whole project instead of just a few months is the only way to keep things moving. You should keep hiring and training your own teams, but you also have to bridge those immediate gaps by leaning on external partners wherever they are available.

PUF: Beyond the initial stages, where are project timelines most frequently breaking down and are these symptoms of a systemic issue?

Bill Brackmann: Permitting often gets the most attention

Bill Brackmann is a project director at Burns & McDonnell, where he leads the global execution of engineer-procure-construct (EPC) projects. With over 27 years of experience, he has overseen large-scale, complex projects and multi-project portfolios, specializing in substation, overhead and underground transmission and distribution. Recognized for his ability to manage intricate EPC initiatives, he leads seamless collaboration among teams and clients while consistently meeting project goals.

because it is the first major milestone. However, the reality is that project timelines depend on a web of moving parts that must stay in sync. It is less about a single step and more about how the timing of one phase impacts the next.

Engineering and procurement teams need certainty before placing major material orders. When initial planning and review phases take longer than expected, it creates a ripple effect. Equipment lead times are already long, and when you add in limited construction resources, the whole schedule starts to shift. These dependencies stack on top of each other.

PUF: How should infrastructure planning and execution evolve to meet this accelerating demand?

Bill Brackman: The industry must shift from a reactive model to a proactive one. Historically, planning began only after a load request was approved. Today, the volume of growth requires us to anticipate needs before they become critical.

We recommend scenario planning to identify likely reinforcement points without overbuilding the grid and hurting affordability. Early engagement allows you to integrate constructability and procurement thinking into the planning phase rather than waiting until the design is finalized.

PUF: Where are utilities facing the greatest difficulty as they attempt to scale execution?

Bill Brackmann: Many internal utility systems were not built for growth at this velocity. Methods that worked for small changes are now major bottlenecks during urgent expansions. While many look to artificial intelligence and automation for efficiency these tools require a strong foundation of data.

We have the talent and the technology to get this done. If we commit to working together and untangling these issues, we can build exactly what the country needs.

Telecom networks are often overlooked but they are the backbone that allows the grid to communicate and provide data for quick execution. Utilities also frequently underestimate the resource shortage. Securing talent through an integrated team or EPC model much earlier than in the past is often the only way to hold a schedule.

PUF: When we talk about early engagement what does that actually look like and how do you get everyone on the same page?

Bill Brackmann: Every project has its own hurdles, but the real value of an integrated team is how it pulls competing goals into a buildable reality. You often have a utility focused on long-term reliability while a developer is focused on schedule. If you do not have that coordination from day one, those goals stay in conflict and create a lot of friction.

Early engagement lets us turn a theoretical plan into something that can be built. By bringing in the builders during the first design phase we can navigate tricky rules and manage long lead times with much better foresight. In one major project this model achieved 25 percent schedule compression. We finished six months early just because the whole team was involved from the very start.

There is also a huge benefit for the grid itself. The grid is a

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about how the problem looks different from our own perspective.

I have spent some time thinking about that old story of the blind wise men confronted by an elephant, and depending on where you were, you thought it was a rope, a tree trunk, or a hose. There are different versions of that story.

The one that I'm promoting is, "Hey, these are wise men. They sat down and talked about what they were seeing and were able to piece together the bigger picture by working together."

I think that's crucial in this complex world that we're living in. The Western Conference is a great way to facilitate those conversations and know that your day-to-day questions and problems could be improved by working with others.

PUF: What are the key issues that are going to define the conversation at this annual meeting at the end of May and what should attendees be looking for as they show up?

Commissioner Pat O'Connell: First, we're going to be coming together to talk about why what we do is important. We're going to be at Tamaya, at Santa Ana Pueblo. Santa Ana sits on the Rio Grande between Albuquerque and Santa Fe.

I didn't want to have a conference where we just hit on the nose all these big topics and keep having the same conversations that happen at utility conferences over and over again.

The conference agenda is inspired by where we're going to be. It's one of the older communities in the United States. Santa Ana was a thriving community long before the Spanish showed up in 1540.

We're in a beautiful place along the river in a very arid land. The concept of how we're setting up these panels is to talk about why what we're doing is important.

We'll bring everybody together who wants to talk about issues like data centers and fire suppression technology, but instead of just saying, "Here's this thing to solve this problem," let's remember why the problem needs to be solved.

When you look at the agenda, what I hope you'll see is the backbone of a historic evolution. We're going to start by talking about what I call the oldest utility. What I'm calling the oldest utility, and historians can tell me I'm wrong, is the acequias, which is the word for community-based irrigation systems that are vital for life in the West.

We'll talk about what elements have been required to make those cooperative systems work for the thousands of years that they've been out there. That's where we're starting.

Then, if you look through the agenda, the last big general session is about AI. So, that's where we're going. Why is it important to democratize the availability of the information that we produce in these regulatory filings? How can AI responsibly be used as a tool to deliver that? So that's kind of the arc of the conference in terms of the content.

If we can take advantage of the diverse geography out West, not just generation opportunities, but load conditions, then there should be a robust marketplace that can help us help each other out in a low-cost way. That's why the push to better markets is happening out West.

We're also very much trying to lean into being in the place we're in. So, we'll break bread on Tuesday night among the cottonwoods along the river.

There's going to be a panel on water supply instead of what you're used to as small water utilities being a feature of these conferences. Ironically, we just had a heat dome. We will see how much water is in the Rio Grande in early June.

PUF: If I'm wanting to know, is the Western Conference the one I need to go to? What's the elevator pitch that says, you'd better get there?

Commissioner Pat O'Connell: Again, we're getting back to our roots. If you want to remember why you're doing the job you're doing, come join us at the Western Conference. PUF

Points of Connection

(Cont. from p. 31)

living system where you have to manage power outages and stability with extreme precision. When you plan and build through a unified team you reduce the risk of delays that can stall future work. This creates a predictable path that keeps things affordable while still meeting the urgent needs of our customers.

PUF: Looking ahead, what needs to change over the next few years and why are you hopeful that we can successfully meet these challenges?

Bill Brackmann: We have to shift toward proactive planning and get our partners involved much earlier in the process. We cannot just react to requests anymore. We must secure our teams and our materials before the market gets even tighter. Workforce development has to stay at the top of the list because we need a solid base of talent to keep the lights on for the long term.

Even with all these challenges, I am very confident. We have the talent and the technology to get this done. If we commit to working together and untangling these issues, we can build exactly what the country needs. The path forward is all about alignment and I know we have the capability to meet this moment. PUF