A Modern Approach to Grid Planning

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Grid modernization is essential for electric utilities to power our future reliably and efficiently. As electric utilities progress along the path of modernizing platforms and infrastructure, there are numerous objectives they must address, including meeting net-zero emissions targets, maintaining affordability for their customer base, increasing hardening and resiliency, and more generally, adapting to the changing landscape of our energy industry. And as an organization works towards these lofty goals, it must both modernize its technology and reskill people.

The rise of fresh players in the energy industry, coupled with advancing technologies, creates increasing complexities for utilities as they plan for the future. Grid modernization initiatives require grid planners to not only look at hardening, resiliency, and affordability, but to have the foresight to consider the industry transformations on the horizon. Complexity for grid planners will only continue to increase with the expansion of distributed energy resources (DERs), increasing customer expectations, extreme weather, and regulatory considerations. The evolution of a bi-directional power grid and additional players in the marketplace will require grid planners to consider many potential solutions for investing billions of dollars each decade.

Grid planners need planning processes and tools that are faster, more flexible, and more robust to address growing complexities. By developing these, an electric utility can better prepare for their grid investments as technology advances and the industry transforms.

GRID PLANNING CHALLENGES

Based on our experience, many utilities execute grid planning throughout the year, but have limited coverage of all circuits. Grid analysis is traditionally a manual, time-consuming process due to a lack of modernized tools and processes. As a result, only a portion of the circuits on the grid are evaluated in each planning cycle for many utilities, and some circuits may go years without review and investment.

Consistently producing optimal solutions – Solutions need to be justifiable to regulatory commissions and customer bases to not only be approved, but also ensure the electric utility can achieve its own intended outcomes and results. Inconsistencies in current state stem from differences in solutioning techniques among planners, variable tool sets, and the inability of antiquated tools to produce optimal solutions. Additionally, the added complexity of grid planning may require additional headcount if old processes and tools are maintained.

Lack of efficient processing – Grid planning programs often require many manual steps and time-consuming analysis efforts. The variables and inputs for forecasting and solutioning are also increasing, resulting in a high volume of required calculations. The outcome is a reduced frequency in solution delivery to only a portion of the grid each cycle.

Disparate data systems – Data inputs for forecasting and distribution planning tend to be in several systems. By consolidating in a central repository, a utility can more effectively leverage the latest technology for modeling grid solutions, including the many benefits of the cloud such as computational power, speed, reliability, and up-time.

Data quality – Grid data is complex to manage, and many utilities struggle with data quality across their assets. Data inaccuracies can result in poor solutioning as teams run power flow simulations for new construction projects. The outcomes may result in poor decisioning and ultimately misses on the expected return from the planned investments.

SOLUTIONING AND BENEFITS

With the limitations facing grid planning organizations, as well as aggressive emissions targets through 2050, utilities will benefit from assessing their capabilities and modernizing their tools and processes, driving value for grid planners and the broader customer base.

By making investments in people and technology, electric utilities will be able to proactively prepare for the future. This includes generating optimized solutions based on current strategies and jurisdictional considerations. Investments need to begin upstream with forecasting capabilities and continue downstream with the solutions that are identified for final grid investment decisions. Making these investments today will position utilities to successfully navigate the evolving landscape.

UTILIZE TECHNOLOGY AND PROCESSES TO MANAGE KEY ASSUMPTIONS AND INPUTS

- Grid Planners have numerous inputs and variables to consider in support of their business stakeholders. This includes upstream processes such as forecasting, as well as adjustments that need to be made for different solution strategies. For example, photovoltaic systems, wind generation, broader renewables, and DERs are critical to prioritize based on assumptions of future growth. A flexible, nimble, data-driven solution will allow for changing forecasts and assumptions around new technologies and new customer programs, to name just a few. Having technology in place is critical to ensure solutions are optimized to meet strategic goals in parallel with the evolution of the industry.

AUTOMATED ANALYSIS AND SOLUTIONING TO PROVIDE CONSISTENCY DESPITE INCREASING COMPLEXITY

- Many grid planning organizations require large headcounts to solution small portions of the grid each cycle. By automating processes associated with forecasting, solutioning, and validation, electric utilities can eliminate manual tasks and drive consistency in the output. Solutions can be produced across the entire grid and prioritized according to short and long-term strategic roadmaps. Grid planners will also have increased capacity to focus on higher-value activities like validating the solutions, which provides justification for stakeholders.

LEVERAGE THE CLOUD TO INCREASE SPEED, FREQUENCY, AND BREADTH OF SOLUTIONS

- Migrating grid planning functions to the cloud will allow for faster processing and more frequent solutioning based upon continuous improvements from artificial intelligence (AI) and changing inputs. Utilizing the cloud ensures scalability, speed, and flexibility while also offering cost efficiencies. The speed, frequency, and breadth of solutions will position electric utilities to manage changing assumptions on a shorter timeline. Additionally, cloud computing power can allow for full grid solutioning on a regular, ongoing basis as these capabilities mature.

PLAN FOR THE NEAR TERM WITH A VISION FOR THE FUTURE

- Consideration for an electric utility's immediate goals and longer-term strategies is critical to future success. This can also include localized strategies, jurisdictional considerations, and operations such as bi-directional power flow. Many grid improvement projects require long lead times for planning, engineering, and construction,

so optimizing solutions and investment decisions across different time horizons is critical. Consistently looking at short term needs and longer-term roadmaps allow utilities to meet evolving customer expectations, maintain affordability, and increase resiliency and reliability, while also allowing for cost avoidance opportunities.

BUILDING A ROADMAP CAN DRIVE SIGNIFICANT VALUE FOR YOUR ORGANIZATION AND YOUR CUSTOMERS

- It can modernize grid planning processes and tools to optimize grid investments as part of the clean energy transition, while also helping meet customer expectations
- It can automate grid planning capabilities allowing for repeatability, as well as cost savings and risk mitigation
- It can leverage cloud computing power, speed, and scalability to handle the large volume of variables and calculations needed for forecasting and optimizing grid solutions

MODERNIZING THE GRID AT A FORTUNE 500 UTILITY

CapTech recently collaborated with a Fortune 500 electric utility in the development of tools and associated business process changes to automate grid analysis and solution generation. This program involved generating a long-term, hourly forecast of kilowatt usage by both circuit and meter, programmatically identifying violations on those circuits through automated powerflow simulations, and using data science to find optimal solutions to solve those violations using a variety of different solutioning methods.

We are transitioning these tools into the cloud, which will result in efficiency improvements and enhancements that lead to more flexibility, security, and cost-savings. Ultimately, the new processes will allow for greater coverage of more impactful circuit reviews during each cycle.

John Mayberry
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John leads CapTech's Energy and Utilities practice, driving innovation and sharing best practices across our client partners. Additionally, he serves as an account executive for one of our largest utilities clients, working to ensure successful delivery. He has more than 14 years of consulting experience with more than a decade supporting utilities clients.

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