



WHITE PAPER

Sustainable power grids: How the digital transformation of work drives decarbonization, agility and profitability in power transmission and distribution

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Executive summary:

Stricter environmental and safety regulations, pressure to shift to green energy sources, and a retiring workforce all present significant challenges for today's power grid operators. Transmission and distribution companies must create a more resilient, dynamic grid, capable of handling increased load and the complexity that distributed energy resources (DERs) will add. New digital tools that enable operators to collect and organize data can help transmission and distribution companies face these challenges by addressing three major imperatives.

1. Improve their own agility and resilience, helping to improve grid reliability
2. Empower workers with better situational awareness
3. Incentivize decarbonization while improving customer satisfaction

Power transmission and distribution companies must become more agile and resilient. According to McKinsey & Co., “to meet demand, the world’s transmission and distribution lines will need to increase by more than a third to an estimated 94 million kilometers by 2035.” McKinsey estimates the cost of this expansion will be around \$310B annually.¹ Originally designed for a one-way flow of electricity, the power grids in developed nations are becoming increasingly complex. As the demand for renewable energy has increased, so too has the number of distributed energy resources (DERs) tied into the grid. This complexity presents a unique challenge to utilities, as they work to balance power supply and demand amid fluctuating environmental conditions. Moreover, given the retiring workforce, there may be a shortage of skilled labor, which will force companies to find new ways to transfer institutional knowledge and empower and train new workers. In short, the power transmission and distribution industry will need to surmount many hurdles in the coming decades – and the stakes have never been higher.

To overcome these challenges, improve profitability and decarbonize along the way, grid operators will need digital tools that improve situational awareness, help teams collaborate better, and increase operational efficiency. Because digital work allows workers to complete tasks from different sites or remote locations, organizations can accomplish more with fewer operators. Remote work improves overall efficiency and helps utilities build agility and resilience against future workforce and market disruptions.

These new ways of working, based on common data platforms and global visibility, help companies become more profitable and advance their long-term decarbonization strategies. **To succeed in the future of the industry, utilities must:**

Increase the
agility and
resilience
of their
operations

Empower
workers

Accelerate the
carbonization
of the grid

¹Transmission & Distribution, McKinsey & Co.

With real-time data operations solutions, you can break down silos and share information. By sharing data via a centralized visualization, operators can collaborate on the same information at the same time to identify asset malfunctions, reduce unplanned downtime, and improve situational awareness and profitability. Software applications optimize operations, streamline environmental reporting and automatically record relevant data in a safe, secure and non-editable format.

Digital tools that let workers share data also help transfer institutional knowledge and prevent workforce burnout. Workers can share the information and data they generate in a central digital repository, rather than in individual silos or on paper. So, even when those workers retire, new generations of workers can access the repository and use the information. Operators can apply analytics to digital data, which allows newer employees to find all the relevant information about an asset they need. Analytics can also alert them about abnormal conditions that, before, they might have needed to rely on more experienced workers to recognize.

Digital data augments human insight in new ways. Artificial intelligence (AI) and machine learning (ML) can help operators analyze vast amounts of data to make informed decisions. AI-powered algorithms also enable higher levels of data analytics, like predictive and prescriptive maintenance capabilities.

Increasing operational resilience and agility

With the right digital tools, grid operators can decrease unplanned outages, gain real-time visibility into grid capacity and improve customer satisfaction. With more accurate operational data and a model-driven execution process, transmission and distribution companies can improve efficiency and reliability, and be better positioned to participate fully in the energy transition.

Governmental regulation and public opinion are both compelling utilities to be more transparent about how they operate and what their power sources are. Utilities must also meet environmental, social, and governance (ESG) targets and reduce their contaminant emissions. To achieve these goals, utilities will need to update old processes and upgrade assets. By understanding the capabilities of the grid, operators can optimize it, make it more agile and improve its efficiency.

For example, the Australia-based utility, Energy Queensland, faced new challenges when new, large solar farms and other renewable energy sources started feeding into its grid. The influx of new energy sources forced Energy Queensland to find new ways to manage the capacity of its grid, which was originally designed with a one-way flow of electricity in mind. To complicate its task further, drastic fluctuations in weather conditions in Energy Queensland's territory also alter the capacity of the grid, as power lines expand and contract according to both the electrical current they carry and environmental factors.

To keep power lines from overheating, Energy Queensland uses ratings for different sections of the grid as an upper limit on how much power each section can carry. That approach works, but in an ever-changing environment, a static rating means that there is unused potential capacity for power flow. As the network is taxed more heavily by two-way power flow, it becomes more critical to tap into that unused capacity.

Energy Queensland gains real-time visibility into grid capacity.

Energy Queensland used AVEVA™ PI System™ to build a virtual model of its assets in the field. Engineers combined technical information on individual assets with real-time environmental data collected in the field to create a dynamic rating for each piece of its network, allowing it to take full advantage of any unused capacity and incorporate as many DERs as possible into the grid.

Empowering workers

Empowering its workforce is one of the best ways for the power utility sector to decarbonize and make its operations more sustainable. Power grids often span large territories and include many remote locations.

By digitally connecting workers across these long distances with one another and with the data they need, utilities can incentivize innovation, lower the cost of curiosity and take full advantage of the workforces they already have in place, while saving on transportation costs. An empowered, energized workforce can make impressive efficiency gains while keeping operations safe.

DTE Energy is the 12th-largest utility in the United States, serving over 2.2 million customers in the state of Michigan. It faced challenges in promptly identifying and triaging issues with its grid. But now it uses AVEVA PI System to visualize sensor data in real time. When sensors show that something is wrong, DTE sends alert notifications to its operators, crew and consumers. This system allows DTE workers to respond quickly and efficiently to common issues like trees falling on power lines or routine equipment failures. As a result, the utility has shortened outage times by approximately 500,000 minutes per year and increased customer satisfaction, all while reducing the time it spends on proactive patrols.

DTE Energy's teams reduce outages with improved situational awareness.

Decarbonizing the grid

In order to overhaul operations so they are more sustainable and use more renewable energy sources, grid operators often need to make costly upgrades to their infrastructure and capacity. To justify these added expenditures, decision-makers must have a way to share utilities' demonstrable progress with customers, regulators and stakeholders alike. They, in turn, can take full advantage of the incentives and credits associated with consuming renewably sourced power. When utilities can track and securely share energy-sourcing data, their customers can benefit from the information, which drives new revenue.

Dominion Energy (Dominion) has used digital tools to do just that. Using cloud-based data management solutions, the team at Dominion gathers and shares energy source and performance data with customers from across its network. By sharing its data, Dominion proves it's using energy from low-carbon sources and allows its customers to track Dominion's sustainability commitments.

As a result, Dominion's customers can provide evidence of their own net-zero commitments to investors, environmental, social, and governance (ESG) auditors, and other stakeholders. Dominion's embrace of cloud-based digital solutions has forged a profitable new business model for the company, which other grid operators will likely replicate in the future as more transmission and distribution companies seek to decarbonize.

Dominion Energy shares green energy information via the cloud.

Four digital initiatives that will transform the way your teams work

According to LNS Research's recent "Industrial transformation in 2021: Getting real" research spotlight, half of industrial enterprises report they have embarked on a digital transformation journey, and these programs are yielding very real benefits. LNS found that leaders in digital transformation are 72% more likely to have increased revenues by more than 10%.

Many power utilities wonder where to start their own digital transformation journey and which steps can be quickly taken to catch up with competitors that were early adopters of digital technologies.

Four digital initiatives will help transmission and distribution companies address the business imperatives set out above:

1. Build your industrial information infrastructure:

Establish a solid foundation for all your digital transformation initiatives by integrating and contextualizing all sources of operations data to centralize information and foster a data-driven decision culture.

2. Create full visibility and awareness:

Go beyond situational awareness by creating a multi-experience dashboard and mobile-enabled visualization system. These tools can break down functional work silos and help you make informed decisions more quickly by letting every user visualize information in a way that's tailored to their specific role.

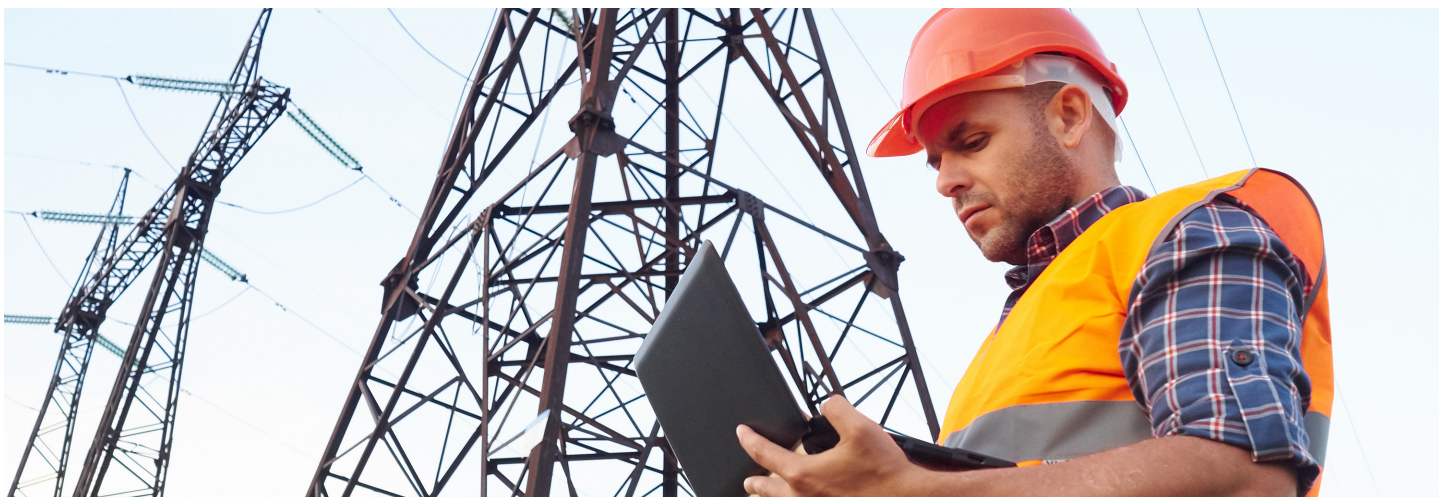
3. Increase asset health and performance:

Improve reliability and identify areas for proactive maintenance. Use AI to improve your asset strategy with risk-based guidance, asset analytics and maintenance execution.

4. Increase revenue by sharing sustainability information:

Gather and share energy-sourcing data with cloud-enabled tools to incentivize investment in green energy and create new revenue sources.

These initiatives use the latest advances in cloud, artificial intelligence (AI), big data and IIoT/edge technologies, along with open and agnostic industrial software design principles. Grid operators can use one or more of them to decarbonize their businesses and increase their profitability.



Conclusion

According to McKinsey & Company's Global Energy Perspective 2022 report, investments in energy supply and production are expected to double by 2035, and nearly all growth is expected to come from new decarbonization technologies. As power producers and utilities incorporate these renewable technologies into existing electrical grids, transmission and distribution companies will need to use more complex processes to monitor and fully utilize grid capacity. To handle the bi-directional flow of electricity and fully use all available capacity, grid operators must invest in digital technologies.

Utilities must build their industrial information infrastructure, upgrade their operations applications, and securely share and display information to foster collaboration both within their teams and with their partners. By undertaking these initiatives, utilities can achieve greater measures of operational agility and resilience, empower their workforce to ensure profitable and sustainable operations, and accelerate the transition to green energy.

About the author



Douglas Nunez is the Power Industry Global Marketing Manager at AVEVA. With over 20 years in the Power and Utility area, Douglas has a deep understanding of power market dynamics, including key issues, policies, and trends affecting renewable energy development.

Learn how transmission and distribution companies worldwide are putting new digital solutions to work in their operations at [aveva.com/en/industries/power-utilities/transmission-distribution](https://www.aveva.com/en/industries/power-utilities/transmission-distribution)