AVEVA

WHITE PAPER

Powering the future:
Five ways to spark growth using data and AI

This guide highlights five key challenges many power operations face and offers practical steps to spark growth using data and AI.

Executive summary:

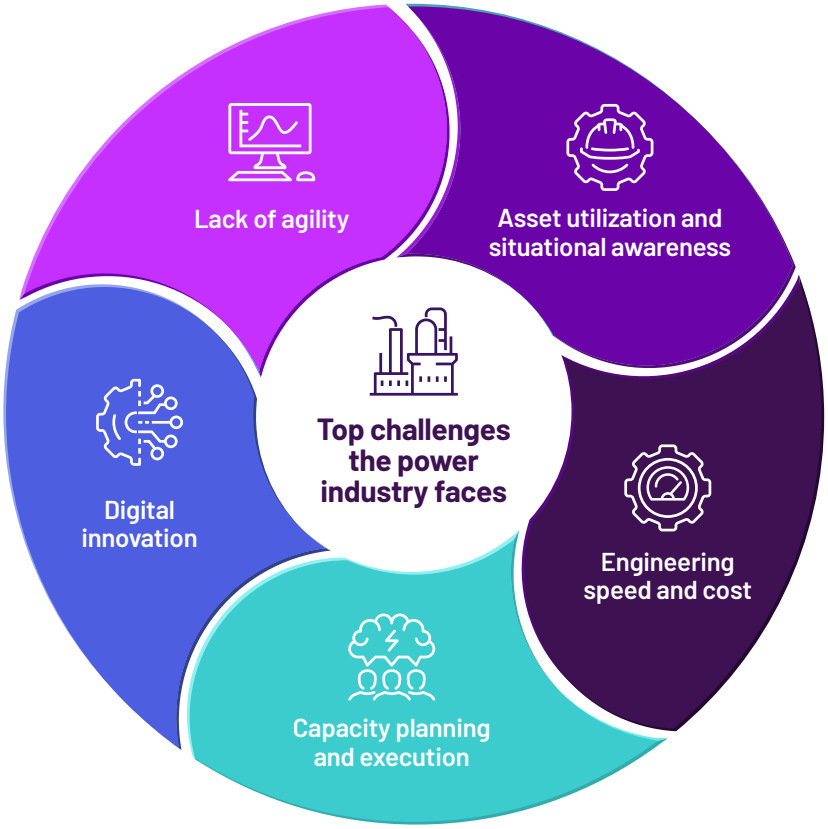
It's no secret that the power industry faces challenges at every turn: The race to reach net-zero goals requires power companies to incorporate more renewable resources, complicating operations. The rise of prosumers is forcing utilities to modernize the grid. AI and data centers demand more power every second of every day, pushing global consumption up by an estimated 4% annually through 2027.[1] Assets and teams are aging, requiring massive infrastructure upgrades and companies to bridge the gap between systems and people to capture knowledge for the next generation.

These challenges are everyday realities for power companies. While it's important to understand this landscape, the real question is: What can they do about it?

Here's how to take action to future-proof your power operation and ensure reliable, resilient, and renewable power.

Overcoming key challenges starts by transforming old mindsets

When the first power plant was built in 1887, the world was far simpler.[2] The term "climate change" wasn't yet coined, regulations were scant, and technology was basic by comparison. The power industry has changed dramatically since then, and today, power operations are subject to economic, social, and regulatory pressures, forcing them to adapt rapidly.



While the power industry faces numerous obstacles, the largest hurdle is, by far, continuing to do things the same way they always have. Current methods may be well-known, but they are not compatible with the world today.

The current reality of the power landscape

Accenture[3] projects that the cost to transition the power system to net zero will be $115 trillion by 2050—all while many consumers struggle to pay their bills. Given the costs and changes required, it's no wonder that 87%[4] of utilities are on a trajectory to miss their net-zero goals, despite the power industry accounting for 40% of the world's CO_2 emissions.

To say that power companies must rapidly evolve is an understatement. But there's good news: The technology needed to meet growing electricity demand and slash[5] global emissions by 2030 already exists, and the policies that can drive their deployment are already proven. It's called industrial intelligence.

With industrial intelligence, power and utilities companies can use data and artificial intelligence (AI) to overcome key challenges.

Challenge:
Lack of aglity

Solution:
Gain global operational visibility and data-driven insights

Digital twins, advanced AI-powered analytics, and remote monitoring all help optimize operations. When teams have access to critical data and insights, they can monitor assets remotely, quickly respond to ever-changing conditions, and optimize and integrate intermittent energy sources to improve operational performance and meet demand capacity. By linking real-time monitoring, AI-powered advanced analytics, and predictive maintenance, companies improve forecasting, information management, and asset performance.

A mere **23%**[6] of executives report that their workforce, on average, has self-service access to real-time data and key insights.

While wind is an excellent source of renewable energy, it's also unpredictable. When winds die down, **Xcel Energy's**[7] operators rapidly ramp up coal and gas plant generation to compensate. However, the constant ramp-up was costly, putting stress on assets and increasing maintenance costs and labor. Rather than rely solely on company meteorologists for forecasting, Xcel Energy opted to enable wind forecasting using AVEVA™ PI System™.

With this standardized data infrastructure, Xcel Energy uses a data model that provides 15-minute forecasts for the next three hours, allowing operators to identify available and potential power.

With insights available in real time, operators can see when the wind is projected to falter and slowly ramp up coal and gas plants over hours instead of minutes, saving wear and tear on assets and maintenance. These insights led to greater efficiencies and reduced curtailment payments, saving the company more than $7 million annually.

Qatar Power[8]

Facing increased fuel and seawater costs and decreasing plant efficiency, Qatar Power deployed AVEVA PI System to improve plant efficiency, optimize operations and maintenance, reduce resource consumption, and improve worker safety. With real-time insights into gas turbine cycle efficiency, operator efficiency, inlet and outlet conditions, and environmental monitoring, Qatar Power saved $1.3 million in seawater margins, improved fuel efficiency by 10% or $1.4 million per year, and improved worker safety.

Take action:

Identify and deliver the top real-time insight your teams need to improve operational performance.

Challenge:
Asset utilization and situational awareness

Solution:
Drive reliability through improved asset performance

With a modern data infrastructure and advanced analytics tools, teams can gain visibility into asset performance or even predict asset behavior to identify potential problems sooner, often before they occur. Users can then make strategic, scheduled repairs to reduce unplanned downtime and increase asset performance. By improving overall asset health and efficiency, operators can optimize capacity planning and dispatching, achieve safety excellence, and create asset health indexing and monitoring plans to determine how to optimize capital expenses and investment strategies.

55%[9] of leaders lack access to reliable, real-time data and insights most or all the time when making key business decisions.

At **Drax**,[10] teams weeded through raw, unprocessed data, attempting to extract insights from Excel spreadsheets. Meanwhile, data scientists lacked critical tools to work with live data. As the UK's largest provider of renewable electricity and a global bioenergy supplier, these manual processes weren't efficient, and teams lacked critical visibility into operations. To maximize the insights users could extract from data, such as blockages in pellet pipes, and minimize extraction time, Drax implemented an operational data infrastructure, predictive analytics, and a connected data-sharing ecosystem.

With the combination of these tools, Drax removed the errors in its raw data while making ten times the amount of data more accessible to its users.

Engineers now have access to near real-time data to prevent blockages, and users have created data models to enable predictive maintenance. Teams anticipate and schedule repairs, leading to fewer expected outages and unlocking massive potential savings for each day of prevented generator downtime. Drax has also de-risked a significant number of assets using analytics-driven alarms.

Ontario Power Generation[11]

Ontario Power needed to optimize operations and enable proactive maintenance in its critical and high-risk nuclear and renewable facilities. The company deployed AVEVA PI System and AVEVA™ Predictive Analytics to connect the monitoring and diagnostic team with the on-site operations team, facilitating live collaboration in the cloud and enabling AI-infused condition-based maintenance. Teams established over 1,200 predictive and prescriptive maintenance operating models, reducing risk, cutting 3,000 annual maintenance hours, and saving up to $4 million in efficiency in the first 24 months.

Take action:

Determine the most critical or high-value asset and use underlying performance data to feed a predictive model.

Challenge:
Engineering speed and cost

Solution:
Accelerate engineering cycles to decrease project timelines

With any upgrade project, collaboration and visibility are key to reducing overall project costs and ensuring compliance without compromising safety and reliability. Using a system-of-systems approach, power companies can guarantee that the digital toolkit always keeps pace with growth and lowers the burden of adoption, whether in a single plant or across a global fleet. This approach de-risks CapEx by streamlining engineering cycles, minimizing rework, and enabling collaboration and scalability so teams can complete capital projects on time and on budget and seamlessly hand them over to operations and maintenance.

51%[12] lack visibility into real-time, reliable information, 48% lack visibility across the entire product or process lifecycle, 49% say data or data silos prevent collaboration or inhibit insight, and 49% cite difficulties sharing data with trusted suppliers, customers, and partners.

The **Shanghai Laogang Waste Incineration Power Plant**[13] is a waste-to-energy power generation project split into two phases: waste handling and treatment capacity. Shanghai Environmental Group owns and operates the plant, and China Wuzhou Engineering Corporation is the engineering, procurement, and construction (EPC) partner. During Phase I, numerous companies contributed 2D methodology designs, resulting in inaccurate and out-of-date information, inability to share effectively, and design interference and collision. In addition, there was no way to transfer information between the EPC and operator, limiting plant efficiency and inhibiting an effective startup, and data queries delayed operations and maintenance.

During the Laogang Phase II project, the partners adopted a digital integration and delivery platform that allowed all users to work from one single source of truth. This platform is used for formal engineering design and to optimize the design and build process. Now used for formal engineering design and to optimize the design and build process while enabling continuous handover. Both partners now have access to ongoing 3D simulations of the various construction phases, keeping the project on track and reducing errors.

Commonwealth Fusion Systems[14]

Commonwealth Fusion Systems is constructing a fusion net energy device called SPARC to commercialize fusion energy. All engineers work remotely, so the company deployed CONNECT, a cloud-based industrial intelligence platform, so teams could collaborate from and publish to the same single version of data in real time. Together, these tools improved accuracy, eliminating the need for rework, reduced project time schedules, eliminated IT overhead by using a cloud-based solution, and delivered commercial advantages for a fluctuating number of users.

Take action:

Determine the top risks associated with modernization projects and leverage unified engineering technologies to mitigate those risks.

Challenge:
Capacity planning and execution

Solution:
Bridge CapEx and OpEx to enhance planning and execution

Digital twins, simulation tools, and design optimization shorten project timelines, protect against cost overruns, and improve project outcomes—and form the foundation for optimal operations upon commissioning. By eliminating data silos, companies can bridge CapEx and OpEx to optimize scenario planning and improve engineering efficiency. With a single set of tools across the organization, teams can seamlessly collaborate and use digital twins and simulation tools to evaluate multiple scenarios and optimize design, sustainability, and profitability.

9 of 10[15] construction projects have cost overruns — regularly up to 50%, 11% of every dollar on a large-scale project is wasted due to poor project performance, and 47% of infrastructure and capital project performance data is still collected in paper forms or spreadsheets

Qair[16] is an independent renewable energy company that spans all stages of green hydrogen, marine renewables, and onshore renewables and energy management—from development to operation. The company uses a variety of routes to get electricity to market, including auto-consumption, grid, battery, and hydrogen and derivatives. Given the company's focus on renewables, intermittency is expected, which meant Qair needed flexible tools and technology to optimize asset sizing and cost efficiency.

Using a centralized data infrastructure and process simulation tools, Qair simulated equipment sizing iterations and industrial yields, gathered live production data, and analyzed large amounts of real-time data. Together, these solutions form a data platform that allows Qair to pilot, monitor, and optimize real-time energy production and delivery from design inception to operations.

Oskarshamn Nuclear Power Plant[17]

The Oskarshamn Nuclear Power Plant needed to modernize the electric cabling system in its three reactors. During the process, the company also needed to minimize downtime and unplanned outages—a day-long reactor outage costs around 1 million euros—while ensuring a safe modernization project. To reach those goals, the company used AVEVA™ E3D Design to model the components in 3D and integrate them with laser data from the reactor containments. Not only did this process ensure accuracy, the company used just 25 laptops to complete the design, compared to 20,000 documents. Reactor outage time was reduced to below 80 days, down from the original 150-day projection.

Take action:

Compare one design with actual capacity to determine differences and identify best practices for future projects.

Challenge:
Digital innovation

Solution:
Build agility and resilience with industrial intelligence for power

Using hybrid data management to connect on-premise systems and data from edge to cloud means companies can drive IT and OT convergence and enterprise governance practices while forming the foundation for a data-sharing ecosystem. Secure data-sharing enables seamless collaboration inside and outside the organization, unlocking new value streams and streamlining carbon accounting and compliance practices. Opening up a flow of trusted data-sharing alongside AI and ML tools can facilitate collaboration—inside and outside the organization—for better capacity planning and forecasting while attracting a new generation of workers.

77%[18] of companies have yet to adopt industrial AI organization-wide.

In a grid the size of **Dominion Energy's**,[19] assets are coming online and being retired weekly. However, as the network of assets grew, so did the size and complexity of the company's SCADA system. Dominion was collecting more data, but the company was having difficulty maintaining longstanding operation models. Using AVEVA PI System, Dominion standardized its data models using an asset framework, creating a unified asset environment that linked systems across business functions and made data insights available for sharing in the cloud with CONNECT.

Now, Dominion Energy team members use CONNECT to safely and securely share data with trusted partners.

By enabling real-time data sharing in the cloud, Dominion has increased speed-to-market for vital environmental data by 50%, identified and prevented 42 potential equipment failures in just one year, and improved overall plant reliability and efficiency.

AGL Energy[20]

AGL's capacity was growing rapidly, making it imperative to centralize data management to manage aging infrastructure and optimize operations. To gain visibility into operations and securely share wind and solar generation data with trusted partners, AGL deployed AVEVA PI System and CONNECT. Using advanced pattern recognition diagnostics, the company has saved $6-10 million AUD annually in avoided failures, optimized performance improvements to justify site-wide turbine upgrades, and demonstrated ROI payback for upgrades in just four months. With CONNECT, AGL securely shares real-time wind power generation data from turbines with university partners to uncover academic insights.

Take action:

Choose one specific use case where sharing data with key stakeholders can save money or increase revenue and enable a real-time data-sharing ecosystem.

Conclusion

While power companies face numerous challenges, they are not insurmountable. In today's unpredictable world, the predictability of any power operation is only as good as its industrial intelligence. Using data and advanced tools, such as AI and ML, power operations can evolve past the status quo to drive meaningful long-term change—and ultimately increase reliability and resiliency and put the company on the path to reaching net zero.

Take action to start your industrial intelligence journey today.

Challenge	Solution	Take action
Lack of agility	Gain global operational visibility and data-driven insights	Identify and deliver the top real-time insight that your teams need to improve operational performance.
Asset utilization and situational awareness	Drive reliability through improved asset performance	Determine the most critical or high-value asset and use underlying performance data to feed a predictive model.
Engineering speed and cost	Accelerate engineering cycles to decrease project timelines	Determine the top risks associated with modernization projects and leverage unified engineering technologies to mitigate those risks.
Capacity planning and execution	Bridge CapEx and OpEx to enhance planning and execution	Compare one design with actual capacity to determine differences and identify best practices for future projects.
Digital adoption	Compare one design with actual capacity to determine differences and identify best practices for future projects.	Choose one specific use case where sharing data with key stakeholders can save money or increase revenue and enable a real-time data-sharing ecosystem.

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