THE IMPERATIVE OF INTEGRATED PLANNING: BREAKING SILOS AND BUILDING THE GRID OF THE FUTURE

GE VERNOVA | UTILITY DIVE

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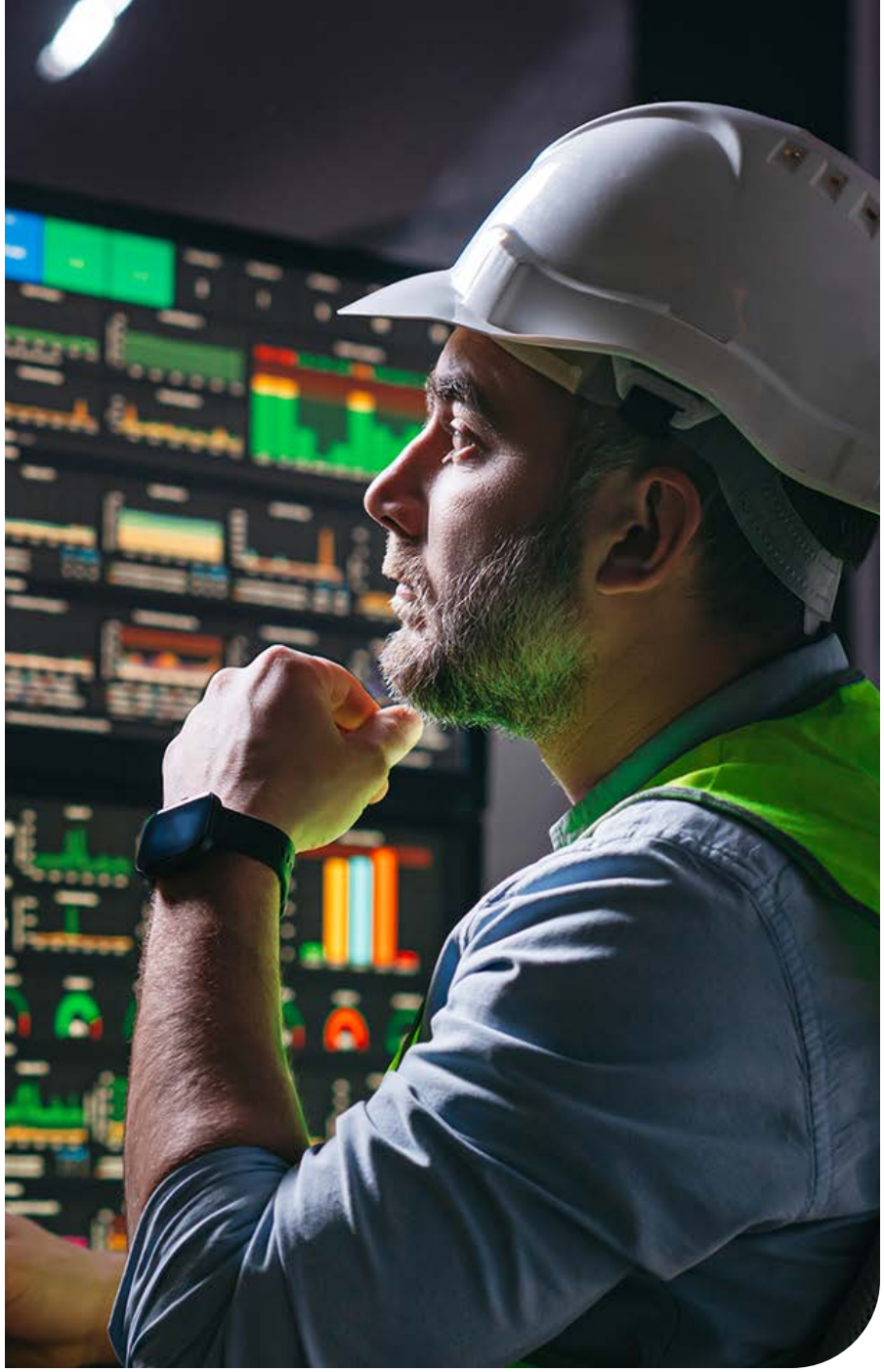
ELECTRIC UTILITY PLANNERS FACE CHALLENGES TODAY THAT WERE UNTHINKABLE JUST A FEW YEARS AGO.

Between 2005 and 2020, for example, the U.S. Energy Information Administration (EIA) reports that load growth averaged about 0.1%. The EIA's Annual Energy Outlook report in 2015 forecast annual electricity demand growth of under 1% through 2040.

The universe in which planners needed to guide investments to accommodate modest upticks in demand is now a distant memory. According to the consulting firm ICF, electricity demand in the United States could surge 25% by 2030. Much of that rapid spike in demand comes from data centers needed to power cloud computing and artificial intelligence (AI) applications.

For example, the Electric Power Research Institute (EPRI) recently released a report concluding that training a single large-scale AI model could require over 4 gigawatts of power by 2030.



THE STORY IS SIMILAR GLOBALLY.

According to a recent report from the International Energy Agency (IEA), electricity demand around the world is expected to increase 3.3% in 2025 and 3.7% in 2026. Between 2015 and 2023, worldwide electricity demand grew by an average of 2.6%. According to the IEA, demand growth is especially high in China and India; China's demand is forecast to grow 5.7% in 2026 while India's is expected to increase by 6.6%.

There are plenty of other drivers of demand, including the electrification of transportation, the proliferation of heat pumps and increased domestic manufacturing. Another complicating factor: the timeline to meet this growing demand is much faster than traditional utility planning cycles. Indeed, hyperscalers seeking abundant and reliable energy to power data centers cannot wait multiple years for a utility to accommodate their electricity demand. Protracted delays could cost utilities large new customers. A recent survey found that 84% of data center developers ranked access to power as their top priority in making siting decisions and that 27% of facilities may be powered by on-site resources by 2030.

“The conventional energy system of the past versus the energy system of today and where it is heading are two different worlds, almost creating an alternative definition of how the dictionary describes past and future. It’s all for good reasons. The energy mix is changing to include more renewables. The speed with which new energy resources need to be integrated is increasing. And the demand for energy is increasing in a manner that’s anything but predictable.”

GAGAN PORWAL
CHIEF OPERATING OFFICER AND HEAD OF SOFTWARE

LOAD GROWTH IS ONLY PART OF THE CHALLENGE

Meeting rapid and meteoric load growth is an enormous planning challenge on its own. But it’s also far from the only factor complicating planners’ jobs. The electric power system itself is also transforming at breakneck speed.

What does that mean for planners tasked with ensuring the power system can reliably deliver increasing amounts of electricity without causing rates to skyrocket and risking deploying stranded assets? It means being able to both keep pace with rapid change and confidently manage complexity. Planners around the globe are wrestling with how to integrate and operate large amounts of weather-dependent renewable generation without sacrificing system reliability. For example, the IEA recently forecast that the combined output of wind and solar is expected to surpass 5,000 terawatt-hours (TWh) in 2025, up from about 4,000 TWh in 2024.

> We're not saying the sky is falling. What we're trying to say is, it's fundamentally different. And we need to be aware of those risks so that we can plan ahead for them."
>
> **DR. SHEILA MANZ**
> TECHNICAL DIRECTOR GE VERNOVA'S CONSULTING SERVICES

WEATHER-DEPENDENT AND INVERTER-BASED RESOURCES (IBRs) CHALLENGE PLANNERS AND GRID OPERATORS.

"A generator isn't a generator anymore," said Dr. Sheila Manz, technical director of GE Vernova's Consulting Services. IBRs, for example, are not like traditional synchronous generators that provide inertia, fault current and frequency support that stabilize the grid during disturbances. "We're seeing a lot more risk associated with generators tripping offline due to instabilities in voltage and frequency generated by IBRs.

Adding to the planning complexity posed by the influx of renewables and rapid load growth are the increasing frequency and severity of extreme weather events, the proliferation of distributed energy resources (DERs), and an aging grid.

A NECESSARY EVOLUTION IN PLANNING

> **The fundamental question for utility planners and system operators is whether the tools and processes that have worked so well in the past are suited for today's dynamic and complex power system?**

The short answer is no. It's worthwhile to acknowledge upfront that the tools and processes planners and operators have relied on for decades have been remarkably effective in delivering safe and reliable electricity. In fact, the National Academy of Engineering (NAE) declared electrification to be the greatest engineering achievement of the 20th century, beating out automobiles, airplanes, spacecraft, and the Internet.

But those tools and processes were built for a rapidly disappearing power system in which electricity flowed in one direction from large power plants to industrial, commercial, and residential customers. It was a system where transmission, distribution, and generation planners and operators could work largely in isolation from one another, using their own data. The complex and increasingly interrelated and interdependent power system of today, however, demands evolved and modern tools that allow for seamless and fast integrated planning based on a common and highly reliable set of data.

"In the past, transmission, distribution, and generation planners used their own desktop tools some of which were even custom-built for specific use cases and separate data sets to do their work. Sharing data and findings was the last step of the conventional process slowing down decision making and increasing complexity to deliver long-term system plan", Porwal said. "But this approach no longer provides the speed needed, nor the continuum of transparency and common set of facts necessary for today's more interdependent power system."

THE RISK OF INACTION AND THE PROMISE OF INTEGRATED PLANNING

The risks of not evolving planning tools and approaches to become more integrated and reliant on shared and accurate data are significant — both for electricity customers and for planners and operators. For instance, investment decisions based on inaccurate or incomplete data can result in inefficient resource allocation that financially burdens ratepayers at a time when customers and regulators are keenly aware of higher bills. In fact, the EIA reports that average residential electricity rates increased by over 9% between January and May of 2025.

“Utilities are looking for no-regrets investments,” Manz said. “Historically, you could get away with using one of the planning silos to do your due diligence. You can’t do that now, but instead need to do your due diligence and see the value of your investments from a holistic perspective.”

The call for more integrated planning isn’t just a matter of preference; it’s a necessity. But recognizing the need for integration is only the first step. The harder part is putting it into practice. While important, integrated planning is not just about occasionally convening staffers from different departments. Instead, it’s about building an ecosystem of shared, reliable data that allows everyone to work from the same reality.

For example, Federal Energy Regulatory Commission (FERC) Order 2222 enables aggregated DER participation in wholesale energy markets. DERs are connected at the distribution level but can provide services that impact the bulk system. As a result, transmission planners must account for how DERs can influence reliability and wholesale market operations. For their part, distribution planners must ensure safe, local integration of DERs while generation planners must consider DERs as both partners and rivals in providing capacity, energy, and ancillary services. Simply put, close coordination across these three traditionally siloed domains is necessary to capture the full value of DERs, maintain grid reliability, and avoid duplicative investments.

THE CENTRAL ROLE OF DATA IN INTEGRATED PLANNING

Data is the connective tissue of integrated planning. In traditionally siloed planning, it's common for different departments to maintain their own spreadsheets, models, and assumptions. A transmission planner, for example, might utilize one set of demand forecasts, while a generation planner works from another, and a distribution planner from yet another.

This was manageable in an earlier era, when forecasts changed slowly and operational realities didn't shift much from year to year. Data must now be shared, unified, and constantly refreshed to reflect the constantly changing realities of today's system. Without the right tools, even planners motivated to work across silos and share data will find they spend the bulk of their time reformatting spreadsheets or reconciling discrepancies between models rather than analyzing and planning.

This needs to change. "Your power system planners need to be focused on power system planning, not monkeying data between three different tools," said Wesley Hall, director of product management for GE Vernova's Consulting Services.

THE OBVIOUS QUESTION IS, HOW?

How can planners effectively approach integrated planning without spending their time wrestling with data? It starts by defining the necessary data characteristics to empower integrated planning.

Consistency

Generation, transmission, and distribution planners all need to work from the same fundamental dataset. Flawed decisions are inevitable if, say, a solar project is modeled as 200 megawatts in one group's planning tool but 180 megawatts in another's. Tools don't have to mirror one another exactly. But fundamental assumptions around things like asset capacity, location, and performance should be aligned.

Automation

Data can't live in departmental silos or proprietary formats. It must be stored and managed in ways that multiple teams can access, use, and build on. "A data platform approach where there's one unified set of truth that a whole bunch of people can contribute to and use brings these silos together and allows people to work together easily," Hall said.

Accuracy and granularity

Integrated planning requires finely tuned data that represents the complexity and interdependencies of the power system. For instance, weather patterns, circuit-level constraints, and DER performance characteristics all must be represented in detail for planners to manage growth, reliability, affordability, resilience, and flexibility.

Scenario flexibility

The foundational challenge facing any planner today is uncertainty. Certainty about the future is never attainable. But by testing myriad future scenarios — including differing fuel prices, load growth, policy, and weather — planners can make better decisions.

Accessibility

Manual data transfers are not just an inefficient time suck; they also invite errors and omissions. Data needs to move automatically between everything from resource adequacy models, production cost models, power flow analyses, stability studies, and the other tools planners and operators need.

HOW GE VERNOVA'S PlanOS ENABLES INTEGRATED PLANNING

GE Vernova's PlanOS software platform was developed based on decades of expertise in energy, consulting, and software. At its core, PlanOS seeks to make integrated planning accessible and practical. It was also an outgrowth of self-reflection.

"We sat down and looked at the breadth of capability GE Vernova had — production cost modeling, resource adequacy, power flow. There's no one else who brings all of those together," Hall said. "But we were still operating in the same way as everyone else, with three separate tools and three separate data sets. The idea of PlanOS started with, how do we bring these together?"

Unified data platform

PlanOS creates a single source of truth. Everyone works from the same data, with updates distributed automatically across the platform.

Integrated modules

Capacity expansion, resource adequacy, production cost, and power flow aren't run in isolation. They inform one another in real time, producing faster and more reliable results.

Collaboration features

Teams can work in their own domains but also have the opportunity to contribute to a shared plan. Version control and distributed collaboration mean updates flow smoothly without manual patching.

Scenario analysis

Scenario analysis: PlanOS can solve across multiple futures, helping utilities make confident investments even when the future is uncertain — which is always.

> “The fabric of integrated planning is a unified data backbone, one which brings in the ability to work from one source of truth, collaborate effectively and execute multi-step analysis in one go across different planning steps. That’s what makes it possible for transmission and generation planners to work together effectively.”

GAGAN PORWAL
CHIEF OPERATING OFFICER AND HEAD OF SOFTWARE

THE CHALLENGES FACING UTILITY PLANNERS TODAY ARE IMMENSE

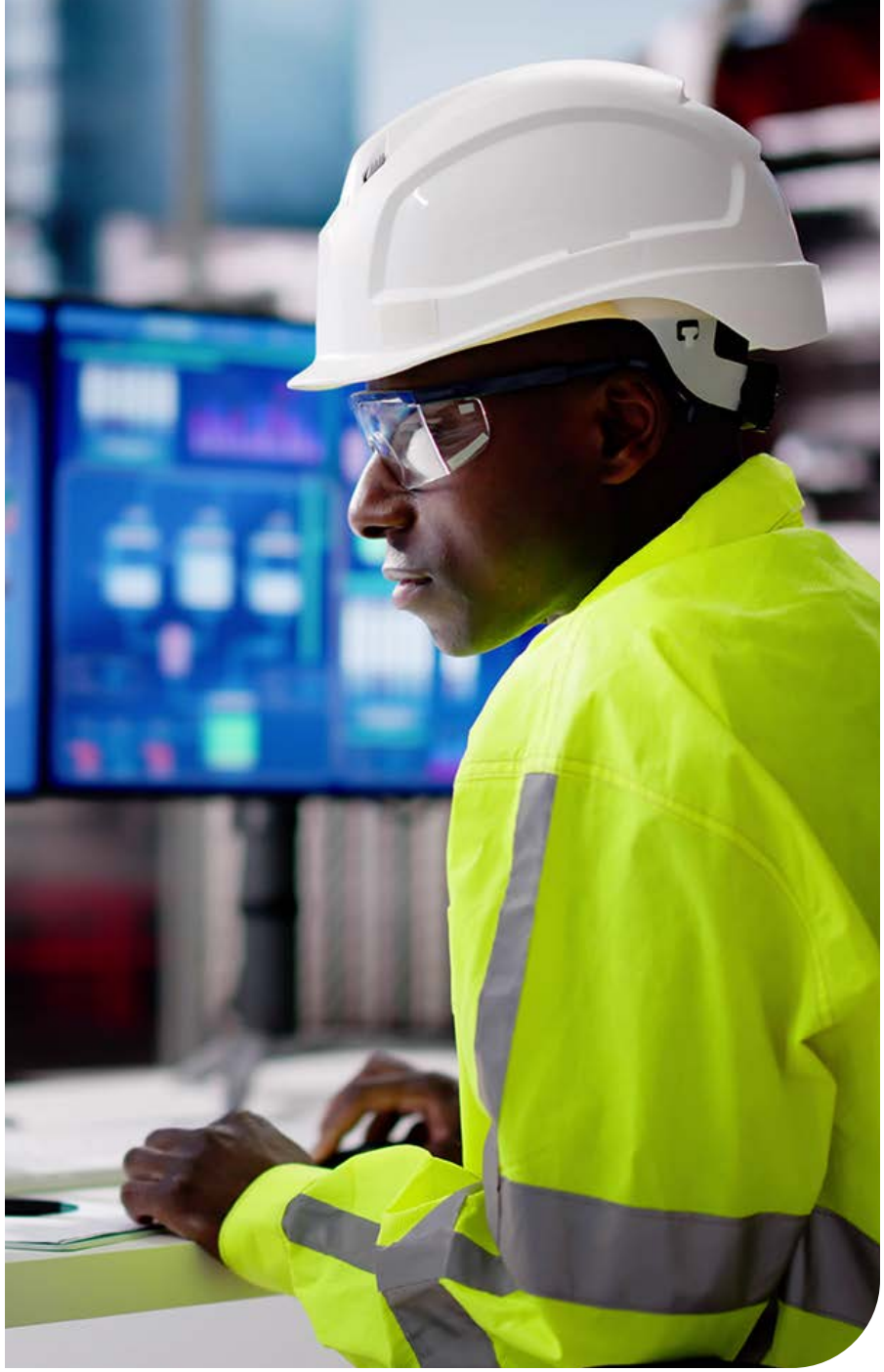
Soaring demand, a transforming generation mix, intensifying climate impacts, and stressed infrastructure. Meeting those challenges requires a fundamental shift from siloed processes to integrated planning grounded in shared, reliable data.

ABOUT GE VERNOVA

GE Vernova Inc. (NYSE: GEV) is a purpose-built global energy company that includes Power, Wind, and Electrification segments and is supported by its accelerator businesses. Building on over 130 years of experience tackling the world's challenges, GE Vernova is uniquely positioned to help lead the energy transition by continuing to electrify the world while simultaneously working to decarbonize it. GE Vernova helps customers power economies and deliver electricity that is vital to health, safety, security, and improved quality of life. GE Vernova is headquartered in Cambridge, Massachusetts, U.S., with approximately 75,000 employees across approximately 100 countries around the world. Supported by the Company's purpose, The Energy to Change the World, GE Vernova technology helps deliver a more affordable, reliable, sustainable, and secure energy future.

GE Vernova's Consulting Services helps energy leaders mitigate risk in high-stakes power system investments and operational decisions. Backed by more than a century of innovation, the team combines deep technical expertise with advanced power system planning and integration studies that analyze the economics, physics, and market forces at work from the grid level down to individual assets.

Contact GE Vernova



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