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WEBINAR BRIEF

# Clearing the Air:

## How to overcome the uncertainty mixed-generation fleets bring to utility planning and operations

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## OVERVIEW

Legacy tools that utilities have traditionally relied on for generation planning are no longer sufficient to handle the uncertainty and complexity that renewables have introduced into the market. As a result, generators are burning more fuel on spinning reserve than what is truly required, causing utilities to overspend on replacement power. To address these issues, vertically integrated utilities with mixed generation fleets need digital solutions that replace static curves and automate workflows for improved risk management.

GE Digital's new solution, Fleet Orchestration, empowers utilities to seamlessly move from day-ahead planning to real-time operation. In a landscape of ever-increasing uncertainty, next-generation models able to account for uncertainties in demand, weather, and generation capacity of individual assets are necessary to determine which units should be running. Models using AI and machine learning result in greater accuracy in predictions and improve productivity across the workflow. Fleet Orchestration uses intelligence, analytics, and seamless communication to provide real-time visibility to generation and capacity predictions and unit commitment optimization.

## CONTEXT

Daniel Hynum discussed operational challenges that utilities face as the power grid shifts to renewables, and how GE Fleet Orchestration can help address those challenges.

## KEY TAKEAWAYS

### Market shifts create challenges for vertical integration of utilities' operations.

There is a major energy transition taking place in power grids around the world. As the market moves toward renewables, traditional fossil-based plants are retiring at a rate such that many will be eliminated by 2050 or sooner. However, vertically integrated utilities are facing organizational shifts driven by three factors stemming from this transition:

1. **Uncertainty.** Renewable energy sources are being added to grids daily, creating variability in both power generation and demand. Coupled with weather volatility, utilities are facing ever-increasing uncertainty in operations.
2. **Transmission constraints.** As renewable projects are built out, the increased generation requires a corresponding transmission buildout.
3. **New market mechanisms.** As utilities are going through planning processes, new market mechanisms, such as the Western Energy Imbalance Market (WEIM) and the Southeast Energy Exchange Market (SEEM), must be taken into account when making operational decisions.

In a conservative operation position, utilities want to ensure there is spinning reserve to cover some percentage of the renewables being delivered into the system. The exact percentage has usually been a heuristic, rather than a true probability computed from system statistics and predictive analysis.

Historically, a utility would use a nearly 100% thermal fleet, highly predictable with minimal variation, as its baseline. Although there was some variation based on demand and temperature, planning based on fully thermal fleets previously did not need to account for significant volatility.

However, renewables produce power at levels that are much more dependent on weather patterns and sunlight, introducing greater variability into the planning process. As more renewables come online, utilities are having to adjust operational processes to use increasingly stochastic, rather than probabilistic, data sets.

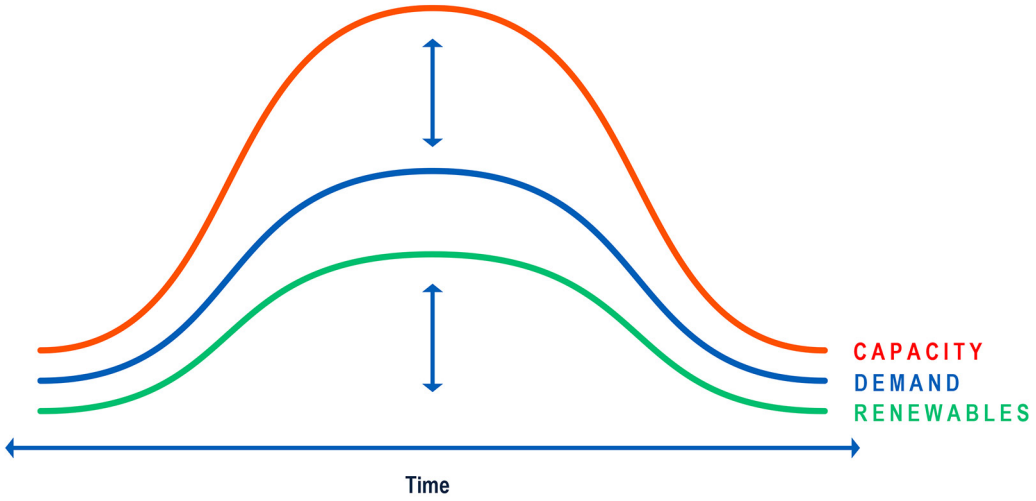


Figure 1: Conservative Operation Position

To help address the challenges of the Energy Transition, which requires balancing reliable power with high proportions of variable green energy utilities are turning to digital technology. AI- and ML-driven solutions running on high-powered compute provide faster and more accurate predictions, and streamlined workflows make communications easier and straightforward.

### GE uses powerful AI and machine learning capabilities to improve operations.

GE's Fleet Orchestration is one such technology, developed to help regulated electric utilities maximize the use of their renewables without sacrificing reliability. GE starts with the fundamentals—providing fleet-level predictions of generation capacity and demand. Rather than use a single high level prediction, Fleet Orchestration first builds neural net digital twin models of every individual plant under a utility's management, then aggregates those up to the fleet level. This makes predictions more accurate, as the digital twins continuously process and learn from operational data to incorporate the latest facility information when making predictions.

GE Fleet Orchestration uses machine learning to provide utilities insight into relevant energy market pricing. This is used to provide guidance on which periods are advantageous to purchase from or sell to the market when balancing their overall generation plan.

GE also leverages a highly flexible constraint engine  to power its new Unit Commitment Optimizer that can be configured to match the specific needs of different utilities, including:

- Planning for energy market conditions
- Meeting bilateral contract terms
- Establishing efficient reserve requirements
- Conducting power flow analysis based on transmission limits and system architecture
- Operation and maintenance cost of power generation equipment

Model speed is an essential capability in order to be effective. Fleet Orchestration is optimized to run quickly. Although runtime depends on size, in six- to twenty-gigawatt fleets, runtime is significantly below five minutes.

GE Fleet Orchestration also provides integration capabilities to grid software. GE's Advanced Distribution Management System (ADMS) gathers additional information about distributed energy resources and behind-the-meter assets to assist in increased demand prediction accuracy.  GE Fleet Orchestration can also provide basepoint inputs to the GE Energy Management System (EMS) to alleviate manual transcribing of tables across platforms.

Trusting a new model takes time. GE deploys its unit commitment technology in parallel to a utility's current best practice, building trust in the GE solution by establishing a method of side-by-side comparison and easing the integration process before completing the full transition to Fleet Orchestration.

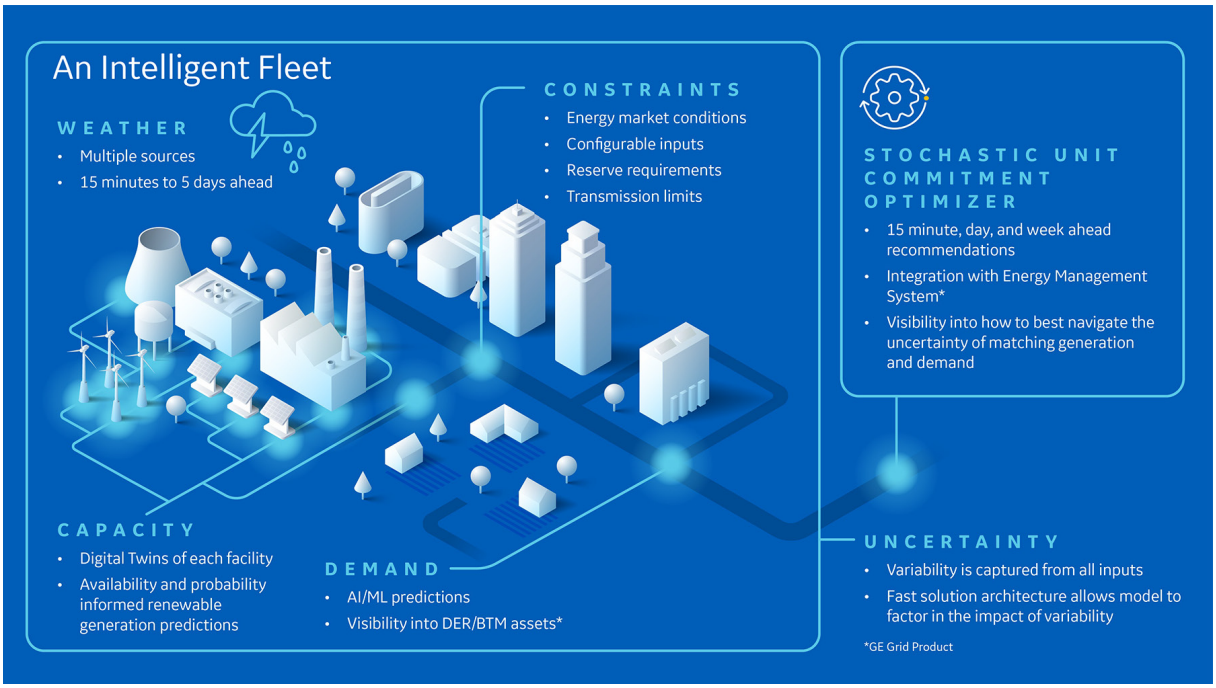


Figure 2: GE Fleet Orchestration Helps Utilities Meet the Challenges of Today and Tomorrow

**Fleet Orchestration empowers utilities to seamlessly flow from day-ahead planning to real-time operation.**

GE technology also helps streamline workflows and communication across organizations. Typically, the planning team within a utility conducts the unit commitment process before sharing analysis with the marketing team for the purpose of purchasing and selling power. The marketing team shares the plan with grid operators to execute on the operating day. However, the sharing process today is primarily manual, leading to inefficiencies in communication and frustration that the plan does not match what is currently happening on the grid. GE's Fleet Orchestration provides a single source of truth for all three departments to reference and interact with, allowing changes to be reflected and communicated in real time.

> When you have a single source of truth that multiple folks from different parts of the organization can reference, it's a game changer.
>
> Daniel Hynum, GE Digital Power Generation, Oil & Gas

In GE's fully integrated solution , not only is information shared out, but it also takes into account availability and ramp-up time to help grid operators make the right call at the right time. The software alerts when upcoming conditions deviate from the plan along with recommendations for addressing via changes to unit operation from start/up shutdown to simply a basepoint shift. This ensures demand is met without overcommitting spinning reserve. In fact, using these technology solutions, vertically integrated utilities can reduce their spinning reserve—and therefore their carbon footprint.

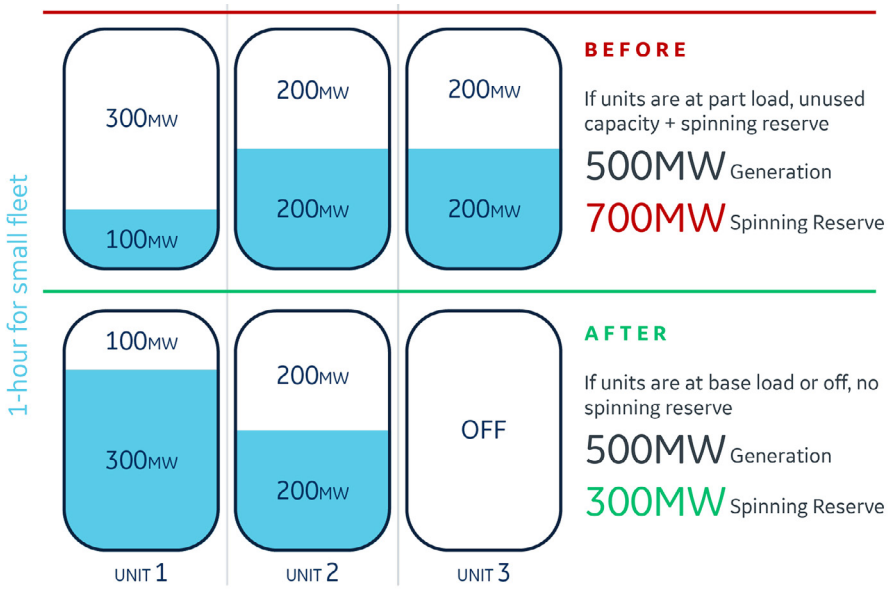


Figure 3: Spinning Reserve Before and After Implementing Recommendations

Utilities around the world have made carbon commitments for as early as 2030. Evaluating their systems, reviewing their generation mix, and gathering unit commitment level feedback helps move utilities closer to reaching their carbon goals as optimizing spinning reserves drives down fuel cost and carbon emissions. With GE Fleet Orchestration, utilities can achieve approximately 3% annual carbon reduction and its corresponding fuel savings (based off a six-gigawatt fleet analysis). *results vary depending on generation mix and operating profile

## ADDITIONAL INFORMATION

To learn more about GE Fleet Orchestration, visit
Seamless Renewables Integration with Fleet Orchestration | GE Digital