![GE Vernova logo] GE VERNOVA

REVOLUTIONIZING RENEWABLE ENERGY MANAGEMENT WITH GridOS® ORCHESTRATION SOFTWARE

THE RISE OF RENEWABLES

The number of renewables and distributed energy resources (DERs) connecting to the grid has risen rapidly over the past decade, and will only continue to increase. By 2026, **global renewable electricity capacity is forecasted to rise more than 60%** from 2020 levels. BloombergNEF estimates there will be **730 million passenger electric vehicles** (EVs) on the road by 2040. And shipping conglomerate DHL has pledged to **electrify 60% of its fleet** by 2030.

The influx of renewables onto the grid adds complexity, making management of the grid an immense challenge. The solution is in grid orchestration, like that available via GridOS by GE Vernova – the first software portfolio designed specifically for grid orchestration.

Take a look at what you can accomplish by leveraging GridOS to orchestrate the large scale renewables and DERs connecting to your grid.

~25%

of the world's electricity generated with the help of GE Vernova's technology base

Revolutionizing renewable energy management with GridOS® Orchestration Software

Source:
2023 Sustainability Report

MANAGE LARGE-SCALE RENEWABLES

Renewables are tricky to manage on their own and even more so at scale. GridOS Orchestration Software cuts through complexity, making it easier to both manage the uncertainty of renewable-sourced power and improve resiliency against disruptive events.

Here is how GridOS helps manage large-scale renewables:

1

Regulate wind power

Wind power is intermittent, making predicting and controlling it a major challenge. The GridOS-compatible Advanced Energy Management System (AEMS) automatically monitors and dictates the amount of wind energy that should be sent to the grid at any given time. To do this, it takes into account such factors as the availability of wind resources, the demand for electricity, and the state of the power grid, among others.

2

Create grid restoration plans

When disruption events (such as storms, heat waves, or floods) strike and knock out power, fast restoration times are of the essence. But restoring power is not a one-size-fits-all approach, meaning precious time is often wasted trying to leverage predetermined restoration plans that may not be appropriate in each situation. AEMS can calculate and automate the best restoration process using real-time information, significantly lowering downtime for customers.

3

Digitally estimate and increase line ratings

The traditional hardware-based approach to estimating and increasing line ratings is far from an exact science – and hardly economical. A great alternative can be found in AEMS' Digital Dynamic Line Rating (DDLR) solution. With DDLR, real-time temperature and wind speed data from weather data providers are fed into algorithms that can dynamically adjust the line rating based on actual line conditions at any given time. DDLR technology can help increase transmission line capacity, reducing the need for new infrastructure and improving grid efficiency. It can also help reduce the risk of power outages by allowing transmission lines to safely operate at higher capacities.

Renewables are expected to account for **over 90% of global electricity expansion.**

Source: **IEA**

02
INTEGRATE AND MANAGE DERs

DERs are an essential component of any sustainable energy grid, but pose a number of challenges, from capacity concerns to complex electrical patterns. Grid orchestration technology enables efficient and cost-effective DER management by optimizing available energy sources and minimizing waste.

90%

of the world's power transmission utilities have been equipped with GE Vernova technology

Revolutionizing renewable energy management with GridOS® Orchestration Software

Source:
2023 Sustainability Report

Here is how GridOS Distributed Energy Resources Management System (DERMS) helps utilities integrate and manage DERs:

1

View and monitor all connected DERs

DERs are expected to increase by the tens of millions through 2030. Every utility needs to be able to view and monitor all DERs connected to their grid at any given moment for maximum situational awareness. With GridOS DERMS, you can access an aggregated or disaggregated view of connected DERs through a single, easy-to-use interface. GridOS DERMS ensures you have targeted control of your DERs at a wide and granular level. DER monitoring and forecasting technology can be used to anticipate and avoid violations.

2

Simulate EV grid impact

The rapid growth of EVs has raised major concerns about grid reliability, in the event that EV charging overwhelms capacity. You can minimize any potential issues by leveraging GridOS DERMS' simulation capabilities. Its advanced scenario analysis can simulate your grid's hosting capacity for EVs, giving you a better sense of EV impact now and in the future. This insight can help you take the right measures to increase grid reliability despite the influx of EVs.

3

Scale as needed

Many DERMS solutions are static and do not scale easily. GridOS DERMS, on the other hand, is designed to grow along with the size of your operation – an essential feature as millions of DERs get added to the grid every year. Our solution has the capability to scale up use case by use case, feeder by feeder, and substation by substation.

03
OPTIMIZE COSTS AND CAPITAL EXPENDITURES

The increasing infusion of renewables onto the grid is mirrored by the amount of additional costs utilities must manage.

Avoid up to

40%

in inertia management costs for large grids with high renewables penetration

DISCLAIMER: Data based on a single demonstration project – NG ESO in UK. Results may vary based on utility's generation mix.

Here is how GridOS helps utilities optimize costs and capital expenditures:

1 Identify grid inertia needs

Renewable generators are poor sources of inertia. Because of this, grids with high renewables penetration often experience challenges with low inertia when running the grid. The costs of restoring inertia to a safe level can add up fast. AEMS constantly monitors inertia in real time, offering a crystal-clear picture of what's available now and in the near future. Whenever inertia appears to be in danger of running low, AEMS kicks in. It informs operators of the total amount of inertia needed to bring the grid back to a secure point. This precise calculation helps utilities avoid the significant costs of excess inertia.

2 Avoid grid violations

The intermittency and complexity of DERs, unfortunately, can lead to violations. Examples of violations include voltage quality, balancing issues, back-feeds, and more, which can negatively affect the customer experience and KPIs such as SAIFI and SAIDI. Also concerning is the potential for financial penalties, which can result if the violations breach regulatory standards or guidelines.

GridOS DERMS is designed to proactively anticipate violations with DER monitoring and AI-based forecasting. This proactive approach enables utilities to take preventative measures and minimize the impact of violations before they occur. It also provides effective management of violations by enabling control of DER assets through standardized communication protocols, such as IEEE 2030.5 and OpenADR.

3 Enable Non-Wire Alternatives (NWAs)

Upgrading wires and other infrastructure to accommodate periods of peak demand is not in every utility's budget. NWAs are gaining traction as a solution – but not every utility has the technology to enable DER flexibility and NWAs on its grid. GridOS DERMS unlocks this flexibility. Through an intuitive interface, you can quickly and easily dispatch DERs whenever needed to curtail or offset electricity use as appropriate. As an added bonus, it can help you achieve techno-economic optimization by simulating the cost of DER flexibility on your own grid. From there you can benchmark this figure with the cost of physical grid upgrades for the same purpose and determine the most economical option your utility.

GridOS® ORCHESTRATION SOFTWARE AT PLAY

GridOS provides the modern software tools to orchestrate the complexity of a modern, sustainable energy grid.

130+

years of grid innovation behind GE Vernova

Revolutionizing renewable energy management with GridOS® Orchestration Software

Source:
2023 Sustainability Report

Here are the GridOS applications that help utilities meet the demands created by increasing grid complexity and achieve reliable, sustainable and affordable energy globally:

1

Advanced Energy Management System (AEMS)

AEMS provides transmission and system operators with a powerful solution to proactively manage the uncertainty of renewable resources and quickly react to extreme weather events. AEMS brings advanced generation and transmission applications such as renewables modeling and forecasting, battery dispatch, grid restoration, and a full wide area monitoring system (WAMS) portfolio of applications – all modelled and managed by a single source of truth.

2

Distributed Energy Resource Management System (DERMS)

Integrated, modular, standards-based, and scalable, DERMS offers grid operators a suite of tools to connect, visualize, control, and optimize DERs from both a technical and economic standpoint. End-to-end tools help improve grid reliability and resiliency, ensure regulatory compliance, and unlock energy affordability and customer participation in grid modernization. The result is a suite of interoperable software in one comprehensive solution that enables utilities to integrate DERs safely and securely onto the grid, while also supporting the energy transition towards a more sustainable future.

3

Advanced Distribution Management System (ADMS)

DER-enabled ADMS enhances grid reliability by leveraging new energy sources and controllable loads to balance the grid, while boosting grid resiliency to prepare for and recover from storms. ADMS delivers reliability, productivity, and efficiency through a modern modular architecture, including containerized micro-service apps, with adaptive algorithms, predictive analytics, and a brilliant user experience. ADMS' robust software supports utilities' journeys towards predictive and autonomous operations, and an optimized distribution grid that accelerates the energy transition. It can also be paired with DERMS for a full-scale, all-encompassing distribution management solution. DERMS augments ADMS with its many modules, including a look-ahead DER optimization engine that can determine the impact of DERs on the grid and achieve techno-economic optimization.

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For more information about **orchestrating renewables and DERs with grid orchestration software**, contact the GE Vernova Grid Software team:

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ELECTRIFICATION SOFTWARE

GE Vernova's Electrification Software is focused on providing a suite of software products and services to customers aiming to accelerate a new era of energy by electrifying and decarbonizing the energy ecosystem through intelligent and efficient data analytics, monitoring, and management.