Grid Solutions

SERVICES FOR FLEXIBLE AC TRANSMISSION SYSTEMS (FACTS)

Ensuring Lifetime Power System Reliability

GE VERNOVA

Keeping The Power Flow Stability

The grid is evolving and becoming more complex to manage with the impact of growing electricity consumption, the integration of renewable generation, and the aging of the transmission infrastructure. Those new conditions can cause voltage on the grid to fluctuate, which can impact power quality and power transfer capability. Grid operators are looking for solutions ensuring the required level of Flexible AC Transmission Systems' performance all along the stations' lifecycle to provide reactive power support, enhance controllability, and improve stability without interruption.

- O&M **costs during the lifecycle** of the station can represent up to **50%** of the initial project cost
- **60%** of **unplanned outages** in FACTS systems are **due to normal wear** of critical components
- **1%** of annual unavailability could cost up to **1.5M$**

Sources : IEEE & GE Vernova database

GE Vernova's Solution - **Ensuring Lifetime Power System Reliability**

GE Vernova provides a comprehensive suite of services for FACTS solutions globally, depending on your needs, enabling Flexible AC Transmission Systems (FACTS) to operate at the required level of performance and optimized cost during their lifetime. The services delivered help Industrials and Utilities to provide power quality and power transfer capability management without interruption.

The services portfolio includes:

- Operations and Maintenance (O&M)
- Asset Lifecycle Management (ALM)
- Modernization and Upgrade Services

The GE Vernova services portfolio provides customers with the following outcomes:

- Limitation of outage frequency and duration
- Reduction of risk of failure in an evolving environment
- Customization of the operation and maintenance strategy

GE Vernova supports and troubleshoots FACTS across the world through transactional and multi-year contracts, optimizing the cost of ownership.

INCREASED AVAILIBILITY

Reduced failure rate up to 50%

IMPROVED RELIABILITY

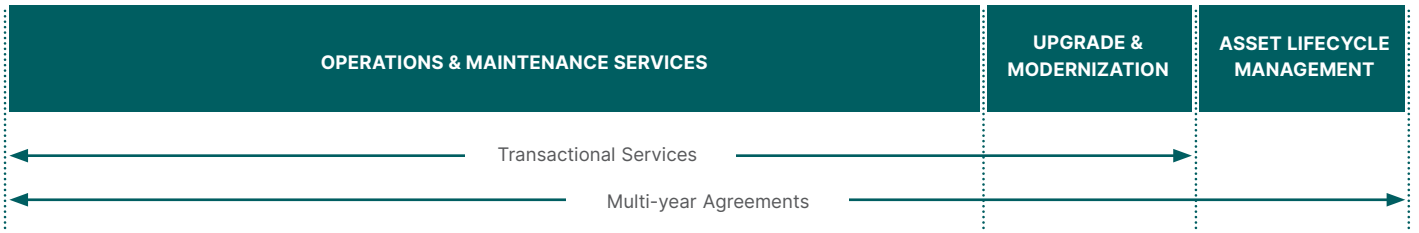
Improved annual reliability up to 5% over the lifecycle of the station

OPTIMIZED COST OF OWNERSHIP

Reduced maintenance cost up to 25%

EXTENSIVE EXPERIENCE

Extended warranty up to 30 years



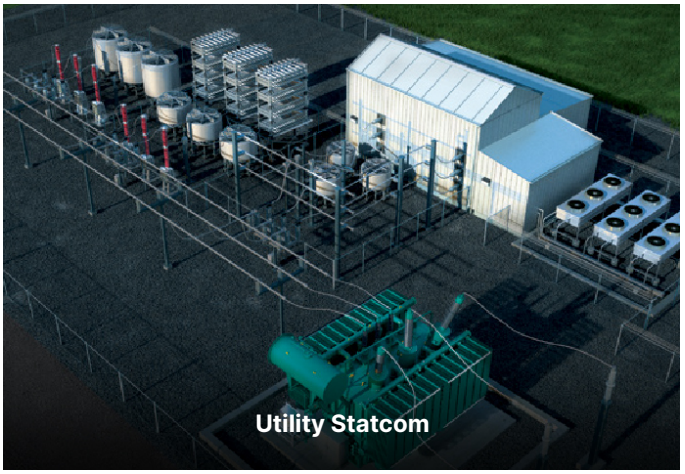
Leveraging A Global Facts Field Experience

GE Vernova has a unique FACTS knowledge base gained through the design, manufacture, installation, maintenance, repair, and modernization of FACTS projects since the 1950's. The extensive expertise captured over the decades has enabled GE Vernova's service engineers to better understand aging processes and failure modes, thus allowing them to make recommendations on the best maintenance strategy to fit customer outcomes.

The services portfolio supports all FACTS applications that are operated by Industries and Utilities:


Series Compensation System


Synchronous Condensers


Utility Statcom


Static Var Compensator (SVC)

Facts Operations and Maintenance Services

GE Vernova provides a full portfolio of operations and maintenance services solving a broad range of customer challenges. Depending on the station operator situation and its expected benefit, we can recommend the adequate services.

Condition Assessment & Studies

Understanding unexpected events

- **Visual inspection** using analyzers and recorders to determine root cause are applied to any power electronic systems and conventional equipment.
- **Measurement campaigns** are performed as per the international standards and customer requirements, through the installation of portable power meters. A diagnosis based on data analysis is provided with the appropriate corrective recommendations.
- **Network studies** cover the investigation on repeated failures, as well as power quality study to adapt system performance to the required level, including sizing, design, and adaptation using real-time simulation tools.

24/7 Support

Providing a fast response time

- **24/7 Support** includes access to the required technical expertise from level 1 to 3 in power electronics, control, automation, and High Voltage equipment, as well as a monthly reporting of site interventions, unplanned maintenance activities, and open issues.
- **24/7 Remote support** is a single point of contact for 24/7 phone-based technical support with a maintenance specialist to assess and recommend remedial actions
- **24/7 First responder** is an on-site field engineer allocated on planning availability or following the response time guaranteed through a customized agreement.

Corrective Maintenance

Fixing unexpected failures

- **The investigation and repair** on the electronic parts used in control, protection, relays or other types of equipment are performed in our **workshops and laboratories** for diagnostic, mock-up and power testing after repair.
- **On-site repair** can be performed using high-precision testing equipment to solve complex issues, including troubleshooting, measurement campaigns, and critical parts replacements.

Facts Operations and Maintenance Services

Preventive Maintenance

Reducing unscheduled downtime

- **24/7 Support** includes an access to the required technical expertise from level 1 to 3 in power electronics, control and automation and high voltage equipment, and a monthly reporting of site interventions, unplanned maintenance activities and open issues.
- **24/7 Remote support** is a single point-of-contact for 24/7 phone-based technical support with a maintenance specialist to assess issues and recommend remedial actions for GE Vernova equipment.
- **24/7 First responder** is an on-site support providing a field engineer based on planning availability or following the response time guaranteed through a customized agreement.

Spare Parts Program

Securing maintenance of legacy reliable technology

Focused on technology components, the program copes with urgent corrective maintenance and supports the control of replacement lead-time and cost. To ensure availability of all parts and to manage obsolescence, the program can include:

- **Last-time buy:** provides the option of bulk purchase prior to a part being discontinued, allowing customers to cover future consumption until the station's end-of-life.
- **Back-engineering services** ensure the availability of any part of the power electronic system, including :
  - Supply equivalent components
  - Remanufacturing
  - New design adaptations to legacy systems

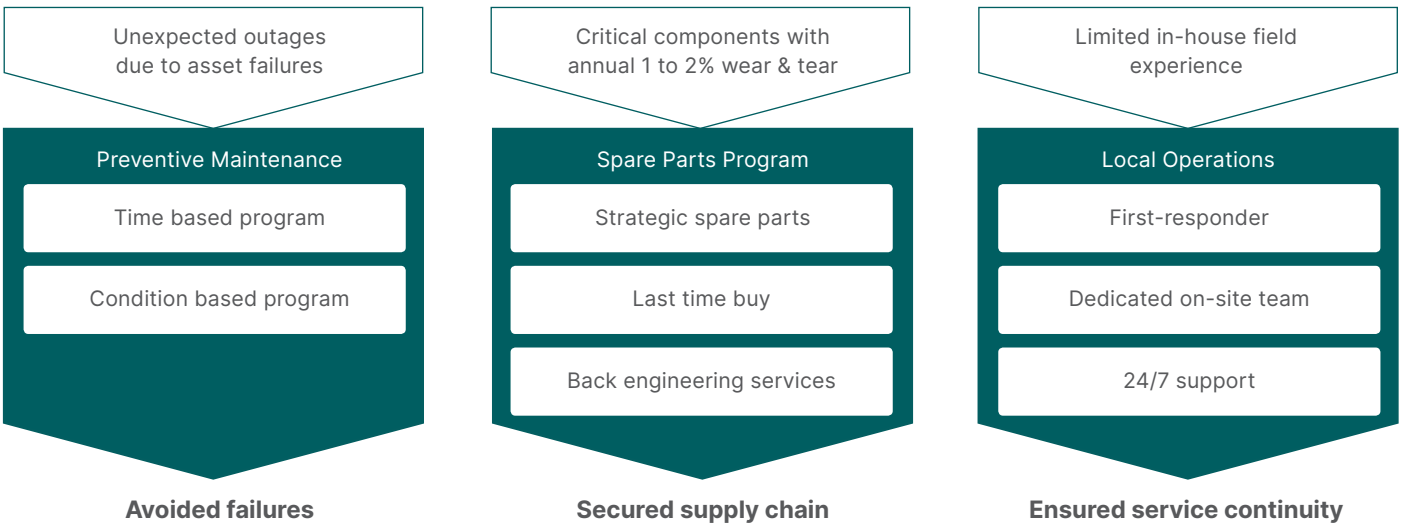
Local Operations

Ensuring service continuity

GE Vernova Local operations services can cover de-energization, re-energization, and the resetting of all periphery and yard equipment around the power FACTS system, including protection relays.

The service is provided through a multi-year agreement and includes:

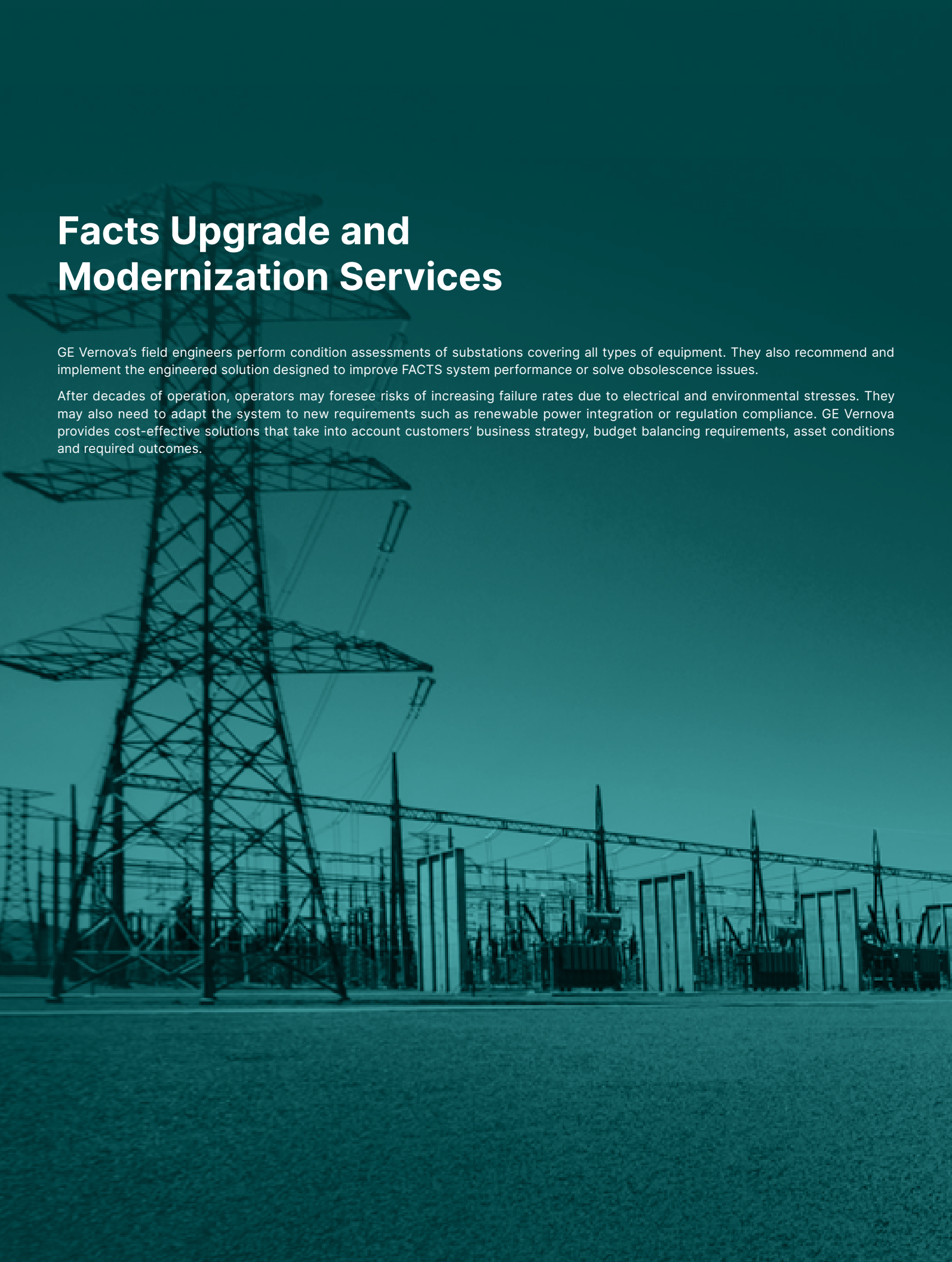
- **A dedicated on-site** field-service team
- **First responder** support
- **Communication of all issues** to GE Vernova Field specialists within 30 minutes;
- **All switching operations** as per dispatching center's instructions;
- **Clearance procedures** during maintenance and repair activities



Facts Upgrade and Modernization Services

GE Vernova's field engineers perform condition assessments of substations covering all types of equipment. They also recommend and implement the engineered solution designed to improve FACTS system performance or solve obsolescence issues.

After decades of operation, operators may foresee risks of increasing failure rates due to electrical and environmental stresses. They may also need to adapt the system to new requirements such as renewable power integration or regulation compliance. GE Vernova provides cost-effective solutions that take into account customers' business strategy, budget balancing requirements, asset conditions and required outcomes.



Overhauling & Renovation

Extending the life of aging equipment

Through renovation services, the life of reliable aging equipment can be extended, using the same technology. The custom service includes:

- Assessment of actual conditions and development of a replacement strategy for failed or aged components.
- Replacement of worn parts including control, protection, equipment, valves, platform components, and spark gaps using the same equipment technology.
- Minor component upgrades with current technologies can be used to solve obsolescence issues.

Modernization

Adapted to technical and application evolution

The life of the system can be extended by using new technology. Modernization services are applicable to :

- Valve systems
- Control systems
- Cooling systems

The turnkey solution includes:

- A feasibility study
- Adaptation of new designs and technology to equipment in current operation
- Installation of condition monitoring systems

Upgrade For Industrial Customers

Improving system performance

To improve the Equivalent Availability Factor (EAF) which requires more Var or to adapt the system to new network power quality standards, the system performance can be upgraded using new technology and/or by adding new components to solve customer challenges through:

- Increased nominal current
- Increased nominal power
- Improved flickering
- Reduced network disturbances

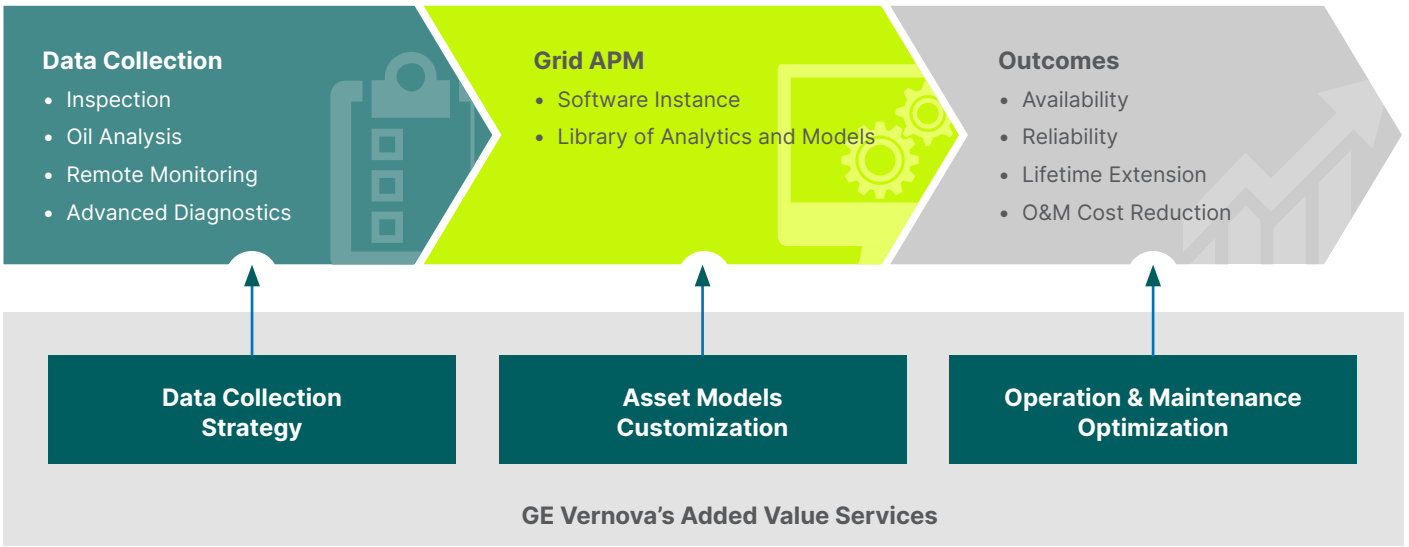
Asset Lifecycle Management

Optimizing Maintenance Strategy

GE Vernova's Asset Lifecycle Management (ALM) Services encompass a set of flexible solutions to optimize electrical substations' maintenance and replacement strategy.

ALM Services combine GE Vernova's expertise in grid asset maintenance and reliability management with an innovative end-to-end set of digital applications and tools, suitable for all types of independently of the original equipment manufacturer.

The ALM Services include a comprehensive portfolio of methods to collect data, a set of proven analytics and consulting services designed to build and maintain a tailored solution for operators to fulfill their asset lifecycle management goals, including asset availability, risk management, and total cost-of-ownership.



A large index portfolio focusing on system health supports the selection of the maintenance strategy for a critical equipment or a fleet of assets. This includes :

- **Asset health index:** representing the overall aging and residual life of the asset
- **Maintenance index:** indicating the nature and urgency of issues requiring system intervention
- **Estimated residual life**
- **Criticality index:** the impact in case of failure
- **Probability of failure**
- **Risk index:** representing system exposure to failure risks

Asset Lifecycle Management

Ensuring Performance and Outcomes for Long-Term Value

GE Vernova service agreements focus on system performance and outcome-based solution in order to enhance guaranteed outputs and give greater flexibility for customers' specific long-term goals. Agreements can be tailored for anything from parts replacement to full operations & maintenance for GE Vernova and non-GE Vernova assets.

Close Partnership

To help achieve business goals, GE Vernova's expertise on asset behavior and operation excellence is available as part of the customer service.

Fixed-Costs & Planned Outages

Costs are contractually guaranteed with the option for jobs to be planned out months in advance during outages scheduled with the customer.

Customized Services

Agreements can include 24/7 support, obsolescence and parts management, maintenance and operations, asset lifecycle management.

Outcome-Based

Through outcome-based contracts, GE Vernova can guarantee the performance and availability of the system in order to ensure long-term value.

By offering substantial guarantees and increased risk sharing flexibility, GE Vernova customizes each agreement to operators' substation needs and desired business outcomes. **Guaranteed outcomes may include:**

Consumables Availability & Cost
Material required to perform preventive maintenance

Spare Parts Availability & Cost
Components required to repair failed parts

Labor Availability, Level & Cost
Resources required to perform repair works

In/Out Transportation
Logistic costs to repair failed equipment outside customer facilities

System Performance
Additional services to guarantee the system reliability and availability

Obsolescence Management
Technology watch to maintain the supply chain to procure parts

Customer Case Studies

Multi-Year Maintenance Agreement **Statcom**

Transmission Utility - USA

Customer Challenge

The 150 Mvar STATCOM system was installed in 2004 in the utility's transmission network. Over time, the system experienced a decline in reliability due to limited maintenance, shortage of spare parts, and the obsolescence of electronic boards. The customer decided to invest in a plan to restore the availability of the system.

GE Vernova's Solution

GE Vernova deployed a multi-year program to increase the availability of the system. The agreement scope included:

- A 24/7 technical support with a 5h on-site intervention guarantee
- A single point of contact for failure analysis
- The refurbishment of obsolete boards and replacement of obsolete parts
- A spare part management through the maintenance of obsolete spare parts and on-demand delivery

Customer Benefits

+10 YEARS
life extension

+10 POINTS
availability achieving **99.2%**

5 HOURS GUARANTEED
for on-site intervention

Customer Case Studies

Upgrade
Static Var Compensator

Steel Manufacturer - USA

Customer Challenge

Due to upgrades on the electric furnace, the 30/+200 Mvar SVC harmonic capacitors became highly-utilized, causing an increase in the number of failures. As a result, 34 capacitors had a failure rate of 20% and became incapable of ensuring enough power supply. Loss-of-production due to capacitors' failure and replacement outages became very costly to this steel manufacturer.

GE Vernova's Solution

GE Vernova provided a turnkey SVC harmonic filter upgrade solution. The scope included:

- Site measurements performed with a high speed recorder
- A network study identifying failure root causes
- An engineering calculation to design proper H-filter and capacitor sizing
- A turnkey project for a harmonic filter replacement with a new capacitor design

Customer Benefits

2.8%
Capacitor Failure Rate

98%
System availability restored

0 DAYS
of outage for Capacitor Replacement

Customer Case Studies

Preventive and Corrective Maintenance **Synchronous Condenser**

Wind Farm - USA

Customer Challenge

A synchronous condenser is a critical asset for network integrity, providing short-circuit power in case of line fault on weak grids. Due to ISO New England regulations, wind power production is limited if the synchronous condenser does not synchronize with the grid. This wind farm's operator required a program that ensured high availability of the 30/+200 Mvar synchronous condenser and increased wind power production.

GE Vernova's Solution

GE Vernova deployed a multi-year program to manage the risks and minimize the overall OPEX and CAPEX. The project scope included:

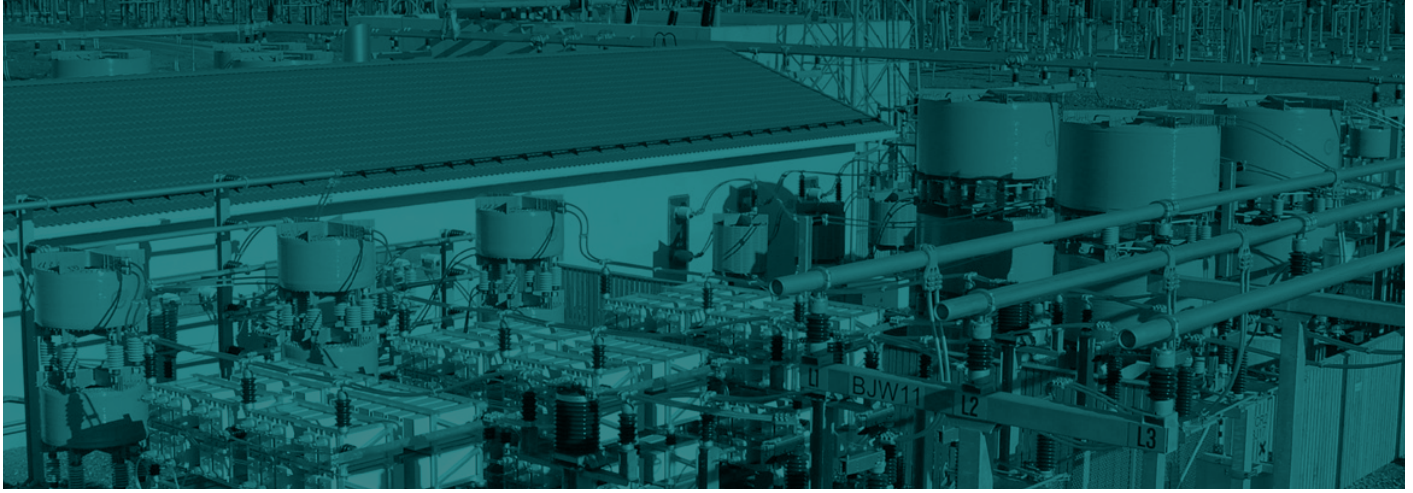
- 24/7 technical support with field specialist on site in less than 24 hours, when required
- A remote connection capability for data analysis, trending assessments and troubleshooting
- A preventive maintenance, including 3 days of scheduled outage per year during low-wind season
- A planned corrective maintenance on low wind days, minimizing impact on power production

Customer Benefits

98%
System availability

24 HOURS
Guaranteed on-site intervention

3 DAYS
Scheduled outage per year



Customer Case Studies

Control and Valve Upgrade **Static Var Compensator**

Steel Manufacturer - USA

Customer Challenge

The 0/+200 Mvar SVC thyristor valve and controls installed were obsolete, causing a decline in reliability and spare parts' shortages. This compromised the life expectancy of the SVC system and increased the number and duration of unexpected outages.

GE Vernova's Solution

GE Vernova implemented an upgrade solution, extending the lifetime and availability of the system. The project scope included:

- A system assessment
- The replacement of controls and valves
- A remote access and monitoring through a VPN link
- A spare parts and test equipment supply program

Customer Benefits

99%
System availability

20 Years
Life extension

4 DAYS
Outage for upgrade

For more information, visit
gevernova.com/grid-solutions

GEA-33140-(E)
English
251119

GE VERNOVA