Predict the future with Vibration Diagnostics
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Predict future component failures and reduce O&M costs

Ensuring the health of main components through predictive maintenance of your wind turbines is a key factor in achieving an optimal energy production and reduced operational expenditures. A reliable condition monitoring solution combined with a Vibration Diagnostics service from Siemens Gamesa is your best way of achieving early detection on developing component failures within the wind turbine’s drivetrain to secure a reliable energy production.

Unplanned correctives remain the largest portion of an operator’s O&M budget

**AMER, EMEA and APAC unplanned repair market forecasts**

<table>
<thead>
<tr>
<th>Year</th>
<th>AMER</th>
<th>EMEA</th>
<th>APAC</th>
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<tbody>
<tr>
<td>2018</td>
<td>$700 million</td>
<td>$949 million</td>
<td>$1,241 million</td>
</tr>
<tr>
<td>2019</td>
<td>$700 million</td>
<td>$949 million</td>
<td>$1,241 million</td>
</tr>
<tr>
<td>2020</td>
<td>$700 million</td>
<td>$949 million</td>
<td>$1,241 million</td>
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<tr>
<td>2021</td>
<td>$700 million</td>
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<td>2022</td>
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<tr>
<td>2027</td>
<td>$700 million</td>
<td>$949 million</td>
<td>$1,241 million</td>
</tr>
<tr>
<td>2028</td>
<td>$700 million</td>
<td>$949 million</td>
<td>$1,241 million</td>
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**Breakdown of major repairs by component type**

- **AMER**
  - 2018: Drivetrain 34%, Generator 34%, Rotors 32%
  - 2028: Drivetrain 45%, Generator 35%, Rotors 20%

- **EMEA**
  - 2018: Drivetrain 25%, Generator 54%, Rotors 21%
  - 2028: Drivetrain 35%, Generator 53%, Rotors 12%

- **APAC**
  - 2018: Drivetrain 26%, Generator 26%, Rotors 48%
  - 2028: Drivetrain 39%, Generator 39%, Rotors 22%

Major repair spends related to drivetrain components combined with an increase of unplanned correctives will become increasingly challenging for wind turbine owners in the coming years.

A Vibration Diagnostics service from Siemens Gamesa enables you to turn unplanned- into planned maintenance activates. Keeping your O&M budget under control and securing a profitable business throughout the lifespan of your assets.
Experience the benefits of Vibration Diagnostics

**Monitoring Capabilities**
Provides an increased monitoring on a range of additional components compared to alternative solutions, giving you a more comprehensive picture of your turbines’ general performance and health.

**Hit rates on detected failures**
99% detection hit rate on detected failures within the drive train to significantly lower the risk of consequential damages leading to unplanned downtime of the turbine.

**Longer lead times on detected failures**
With the capability of predicting component failures up to three years in advance enables optimized forecast on resources requirements throughout the entire supply chain resulting in a better planning of service and maintenance activities.

**Increased revenue**
The condition monitoring solution behind Vibration Diagnostics provides an average availability of 99.7% and Siemens Gamesa provides remote fix rates in 70% of all cases. With less downtime and smarter maintenance, your turbine will perform more efficiently and generate more revenue.

**Better use of data**
Act smarter - Benefit from Siemens Gamesa 20 years of expertise in condition monitoring. Our advanced artificial intelligence (AI) has over 600 TB of data stored for training of proprietary machine learning algorithms, enabling you to get maximum output from your turbine data.

**Less OPEX**
It is often cheaper to refurbish than to replace. With more extensive monitoring, better hit rates and longer lead times, you can plan better and reduce service costs.
Detection hit rates

The image shows the hit rate capabilities gained by Vibration Diagnostics across a range of critical drivetrain components. By having a Vibration Diagnostics service by Siemens Gamesa the wind turbine owner will be able to obtain an average detection hit rate on drivetrain components of 99%, allowing optimal conditions for securing the wind turbines are up and running resulting in a profitable annual energy production.
Case story:
Early detection on a high-speed pinion saving 300,000 EUR.

The graph shows how a Vibration Diagnostics service from Siemens Gamesa provided a wind turbine owner with a 27-day lead time on a developing component failure of a high-speed pinion within the gearbox. Cracks on high-speed pinions are fast developing and difficult for the human eye to detect during visual inspections. However, due to the advanced detection capabilities of Vibration Diagnostics, it was possible to advise the wind turbine owner with an early warning. The early warning provided enough time to order the necessary spare parts and conduct the repair prior to the damage evolving into a complete failure of the gearbox. A combination of these activities ultimately generated a saving of 300,000 EUR.

Condition monitoring setup and data supply

To complete the Vibration Diagnostics service, a market leading turbine condition monitoring system called TCM is placed in the nacelle of all the wind turbines within the windfarm. The system picks up vibration data via a series of sensors placed on the wind turbines drivetrain. The data is available and accessible on a site server installed on the substation.

The system software allows users to remotely connect via a web interface which can be accessed on a site level for further analysis. For windfarm owners with a global setup of several windfarms all data can be collected via an enterprise server which is setup within the fleet network. This allows various synergies by knowledge sharing and comparing data across windfarms enabling a centralized overview of multiple sites.
Pythia™ - turning big data into actionable insights

Predicting the future sounds like science fiction, but with a large historical database, correct methodology and advanced mathematical models it is possible.

The vibration data is embedded into Siemens Gamesa AI technology and machine learning capabilities called Pythia™. It enables us to analyse the vibration data and comparing it to our vast knowledge base of more than 600 TB of captured data throughout 20 years of remote monitoring services. The results of the analysis are shared on Siemens Gamesa customer portal site providing alarms, notifications and reports on component trends and health.

Our service and expertise support wind turbine owners with accurate and actionable insights providing the necessary knowledge to perform a predictive, streamlined and effective maintenance of the wind turbines.

Pythia™ is our key to provide our customers with market leading predictive maintenance capabilities.
CMS Analysis: Provides you with a complete turbine condition monitoring system and reporting to keep you updated on the trends and health of the drivetrain components.

CMS Maintenance: Provides you with system notification reports and secures your condition monitoring system is updated with the newest software releases. Should you experience any issues with your condition monitoring system our team will be able to remotely remedy the issue in 70% of all cases.
To enable our Vibration Diagnostics service, Siemens Gamesa offers tailor-made retrofit packages with turbine specific hardware including onsite installation carried out by qualified Siemens Gamesa technicians. Our retrofit packages can be installed on a wide range of Gamesa platforms and turbine models. Please contact us today for more information on the retrofit package needed to upgrade your turbine and apply a state of the art turbine condition monitoring system combined with a high performance Vibration Diagnostics service from Siemens Gamesa.

Road to Vibration Diagnostics

Upgrading your wind turbines to unlock the possibilities of Vibration Diagnostics
Your benefits of partnering with Siemens Gamesa

Siemens Gamesa is a leading supplier of wind power solutions to customers all over the globe. A key player and innovative pioneer in the renewable energy sector, we have installed over 105 GW in 75 countries.

Your reliable energy partner:
Siemens Gamesa has a global reach and helps improve your profitability by optimizing O&M expenditures offering a modular and comprehensive portfolio to suit your requirements.

Engineering expertise:
Our service engineers have a proven track record in providing industry leading turbine developments to improve the serviceability of your assets.

Fleetwide expertise:
Servicing and upgrading turbines throughout the entire design life regardless of technology.

Operational excellence:
Covering advanced wind and energy forecasting models and securing an average fleet-wide availability of more than 98% we are your partner of choice.