



# Nuevas Tecnologías para incrementar la rentabilidad y confiabilidad de los activos

Noviembre 26, 2020

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**SIEMENS Gamesa**  
RENEWABLE ENERGY

# Company profile



## Who are we?

**Siemens Gamesa is a global leading provider of wind power products & service solutions**

- #1 in Offshore
- Leading position in Onshore & Service

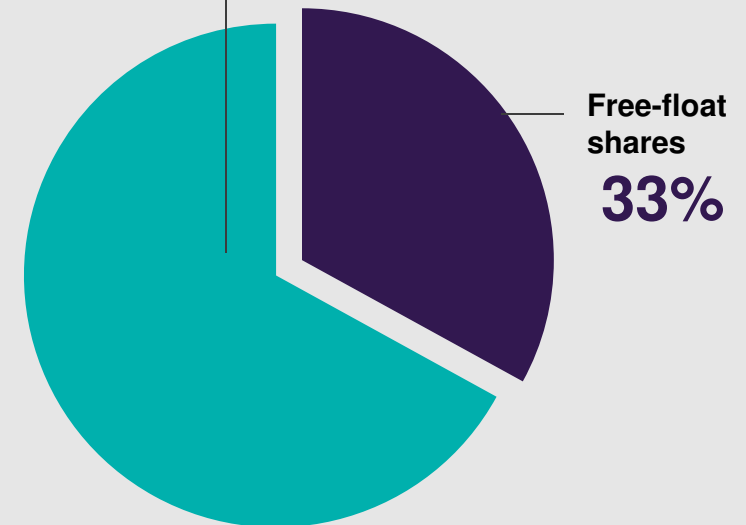
Founded in April 2017 as a **merger of Siemens Wind Power and Gamesa**

**A global company**, based in Zamudio (Vizcaya, Spain), listed on the **Spanish Stock Exchange**

**Member of IBEX 35**, is traded on Madrid, Barcelona, Valencia and Bilbao

### Ownership structure

Siemens AG  
**67%**



## Key facts



**>107 GW**  
Globally installed\*



**26,000**  
Employees



**€10.2 B**  
Annual revenue\*\*



**€10.7 B**  
Market capitalization



**€31.5 B**  
Order book



True global, modern  
and scalable footprint



Advanced  
digital capabilities



Portfolio  
covering all requirements

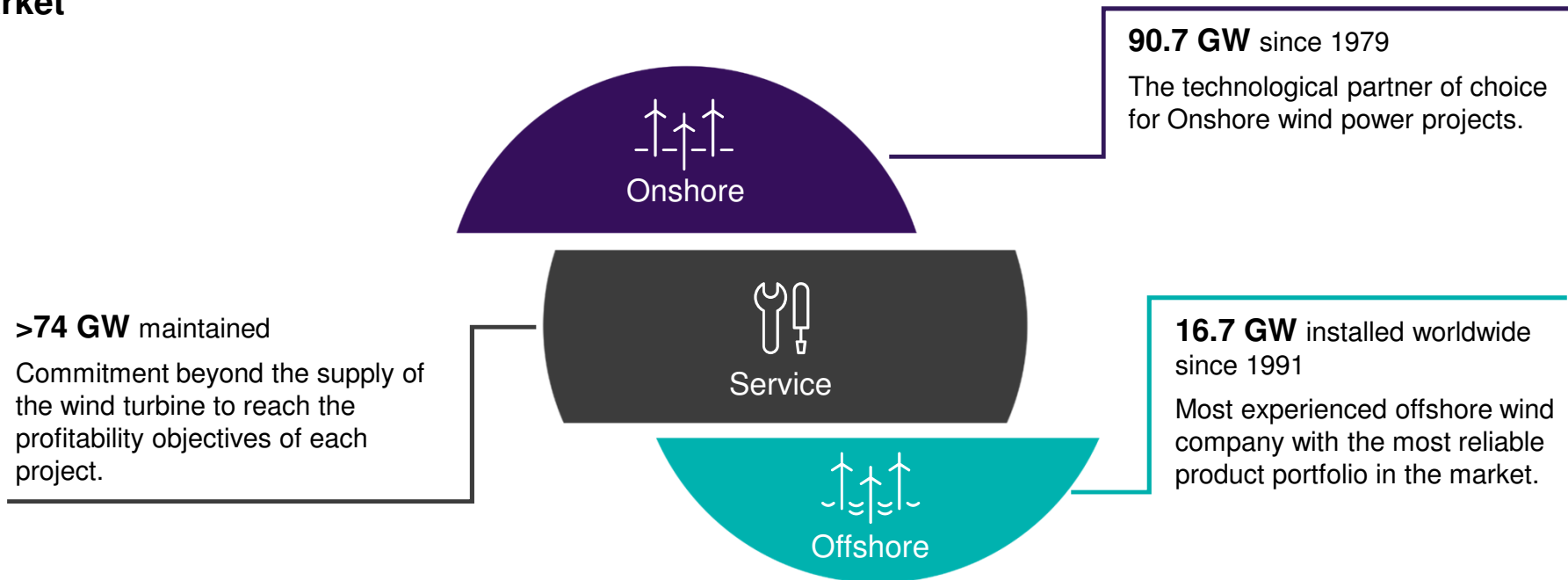
End of June 2020

\* End of September 2020

\*\* End of September 2019

## Activity

### Three business units strongly positioned in the market



Figures as end of Q3/FY20

# Service

## We never compromise safety

### Transparent reporting to drive down our Total Recordable Injury and Lost Time Injury Rates

- Analysis of trends and areas for improvement
- Incident investigations to prevent reoccurrence
- Contractors included in all aspects of our safety performance

### Proactive control measures and education to deliver improved EHS performance

- Robust risk assessments to ensure safe operations
- EHS programs based upon high risk activities and operational control
- Real world effective safety training



*“Safety is our number one priority. Each and every one of us has to ensure a safe work environment and stop work if there is a concern. A mindset that all accidents are preventable is crucial to drive our business to zero injuries and ensure we all go back home safe to our families.”*

**Juan Gutierrez**

Service CEO, Siemens Gamesa Renewable Energy

## +40 years of service experience in numbers



**€15.1bn**  
Backlog<sup>1</sup>



**€4.1bn**  
Order entry<sup>2</sup>



**€1.6bn**  
Revenue<sup>2</sup>



**~8 k**  
Employees<sup>1</sup>



**>74 GW**  
under service<sup>1</sup>



Average **contract**  
**length ~9** years<sup>3</sup>



Active in  
**>60 countries<sup>1</sup>**



Advanced **digital**  
**capabilities**

1) End of Q3/FY20

2) Last Twelve Months Q3/FY20

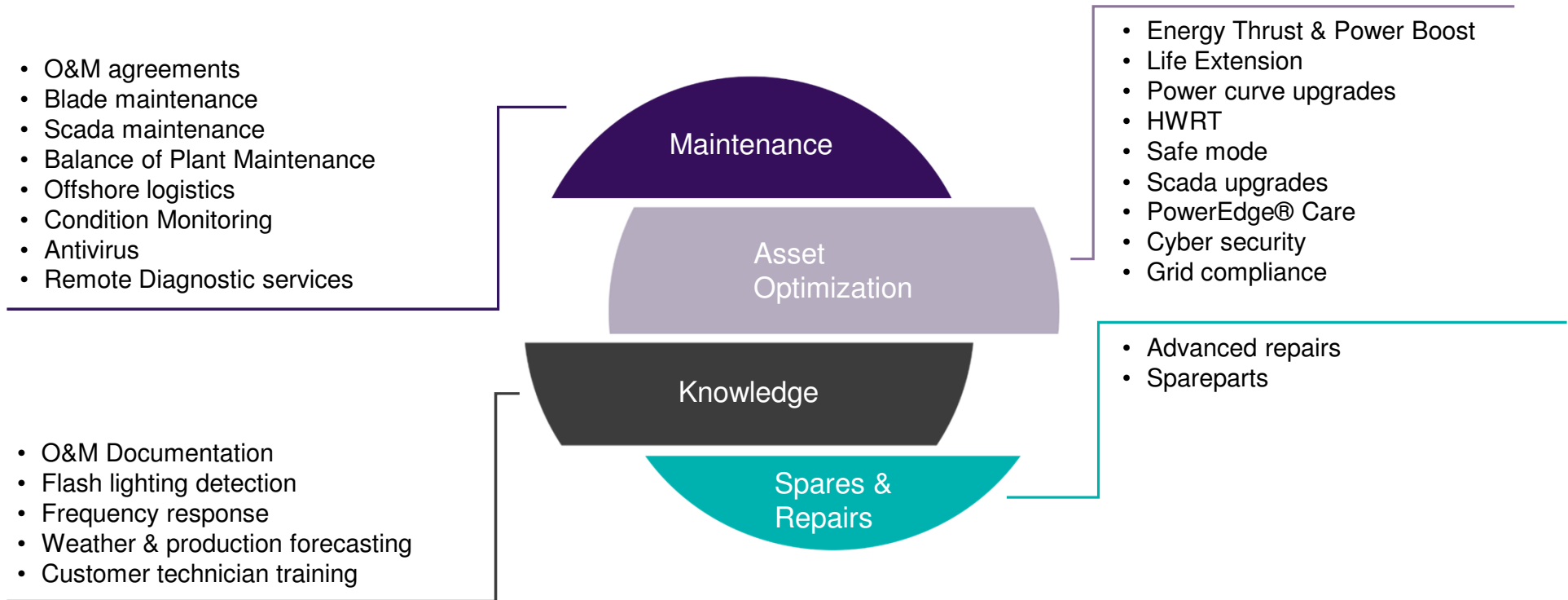
3) Weighted average duration of all O&M contracts in backlog



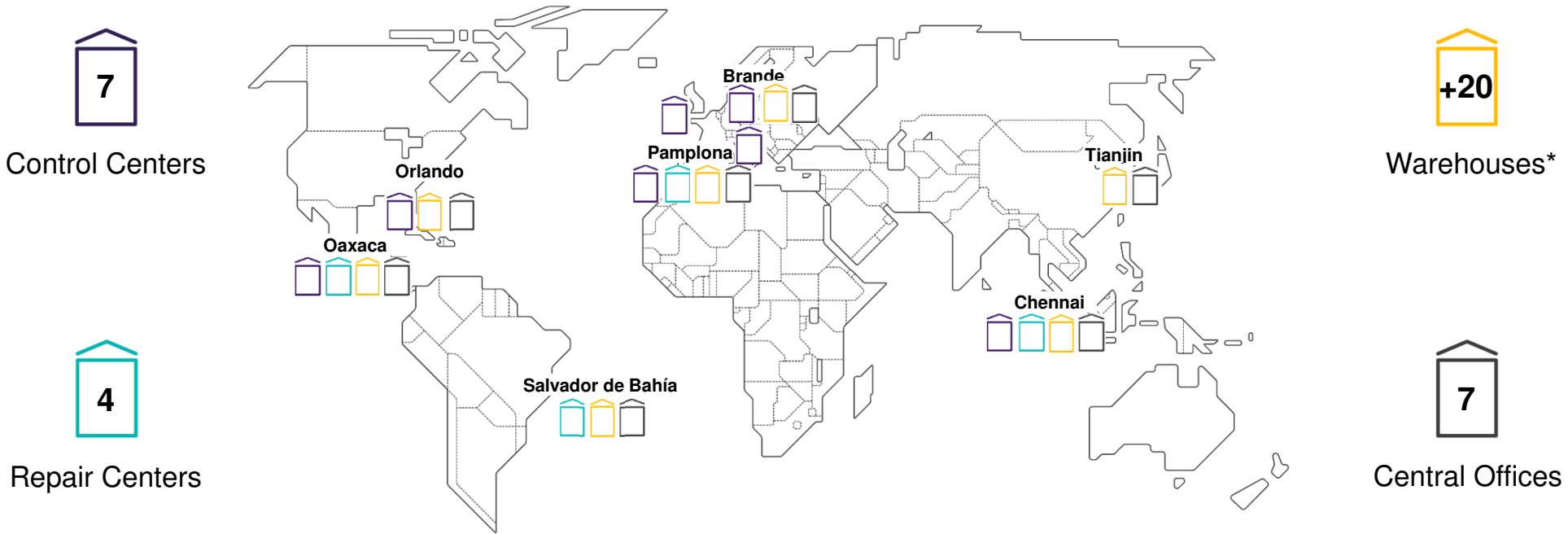
## Service is in our DNA



## Contract what you need: Modular approach to pick & choose the optimal option for each wind farm

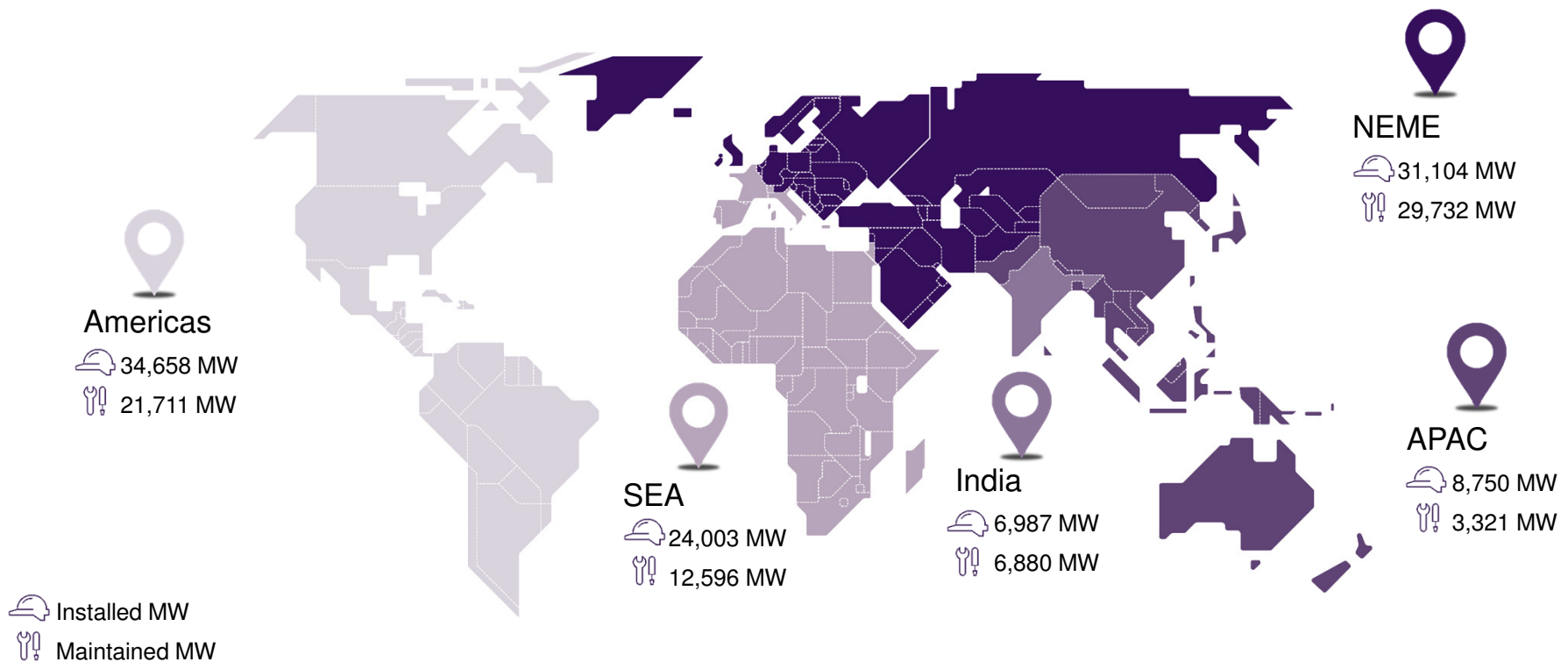


# Service facility footprint



\*2 Central and +20 regional warehouses

**Service Organization:** >107 GW of capacity installed worldwide & >74 GW in O&M at September 2020



## Our value brought to your assets

### Your reliable energy partner

- Improving profitability through maximizing income and optimizing O&M expenditures
- Comprehensive modular portfolio
- Global reach with local focus

### Engineering expertise

- Service engineering R&D to improve wind asset serviceability
- Proven industry leading turbine enhancements
- Technology as a service



### Fleetwide expertise

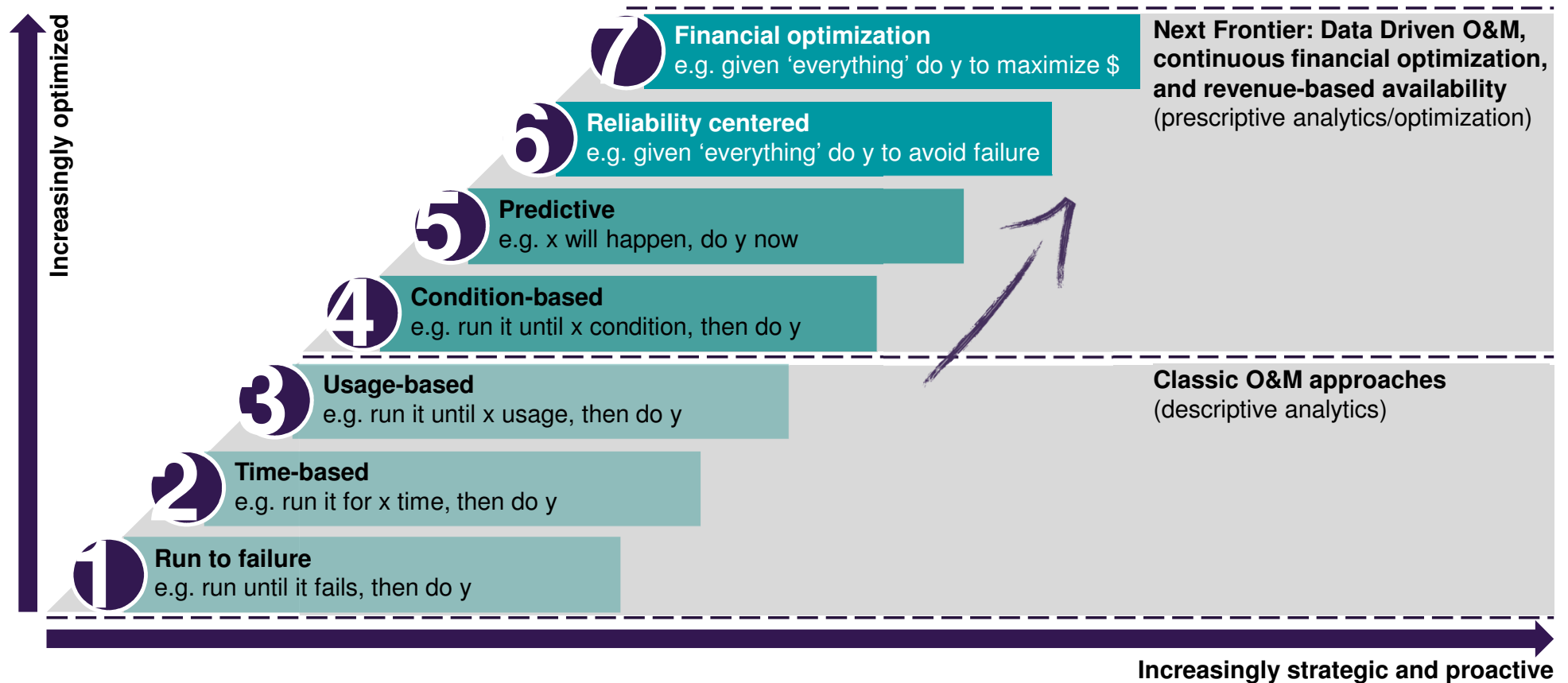
- Servicing and upgrading turbines regardless of technology throughout the entire useful lifetime

### Operational Excellence

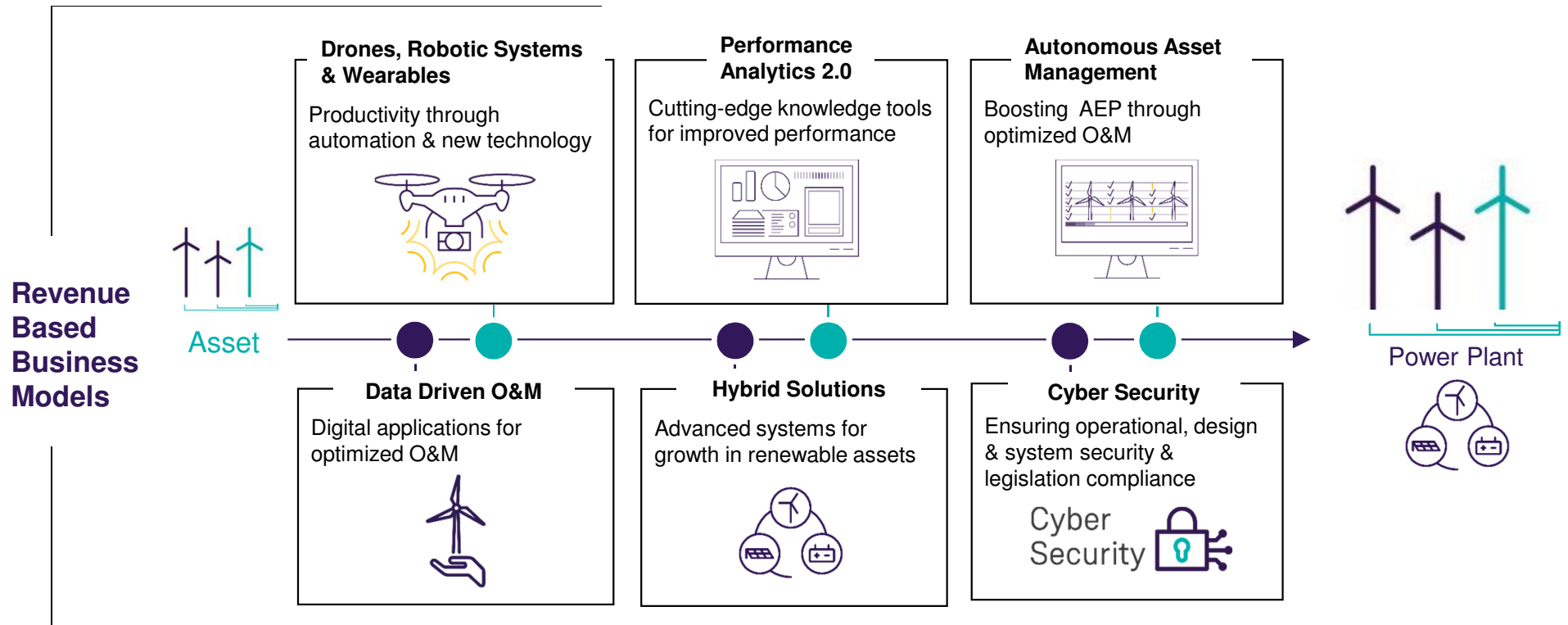
- **>98%** average fleet-wide availability
- Diagnostics with **>99%\*** failure prediction accuracy
- Wind and Energy forecasting models for advanced planning

\* Depending on the stage of failure

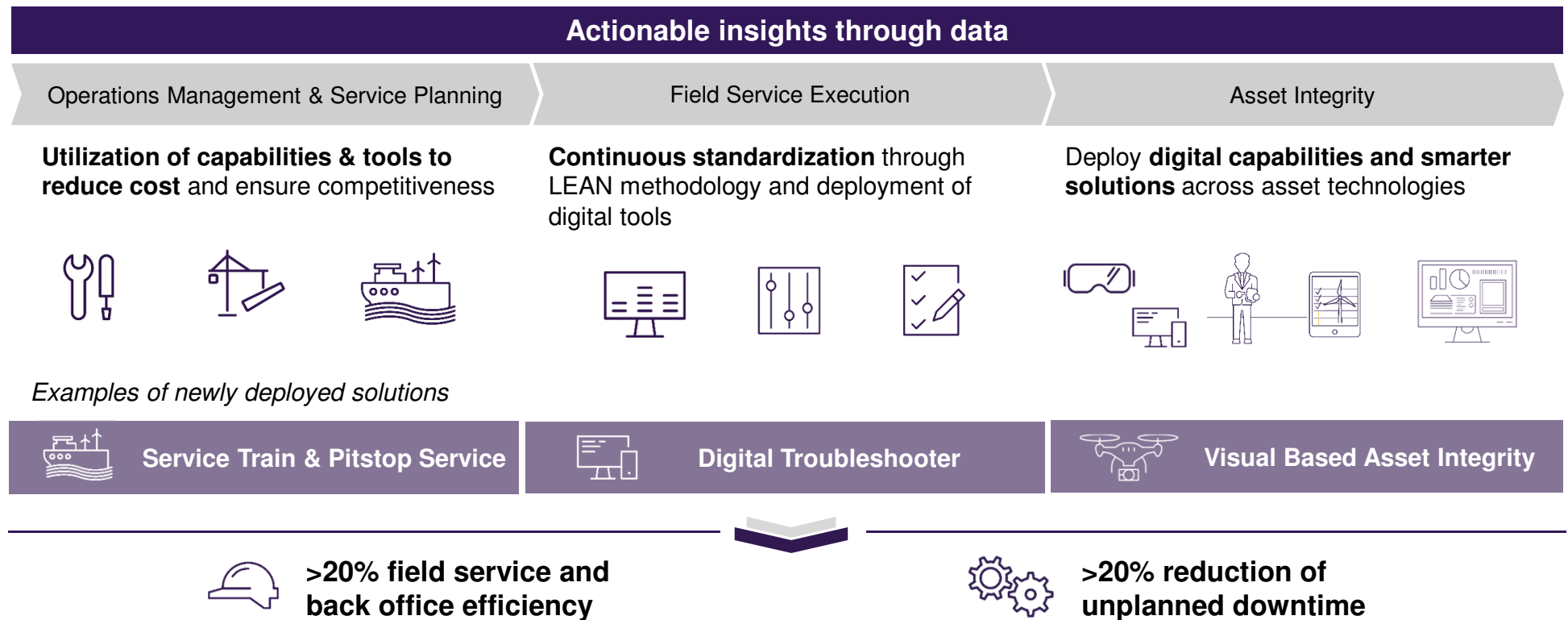
## Wind O&M is evolving from “reactive and descriptive” to “proactive and predictive” with data-driven analytics insights paving the way



## Innovation on asset and plant level as a key focus for SGRE to drive performance and improve customer returns



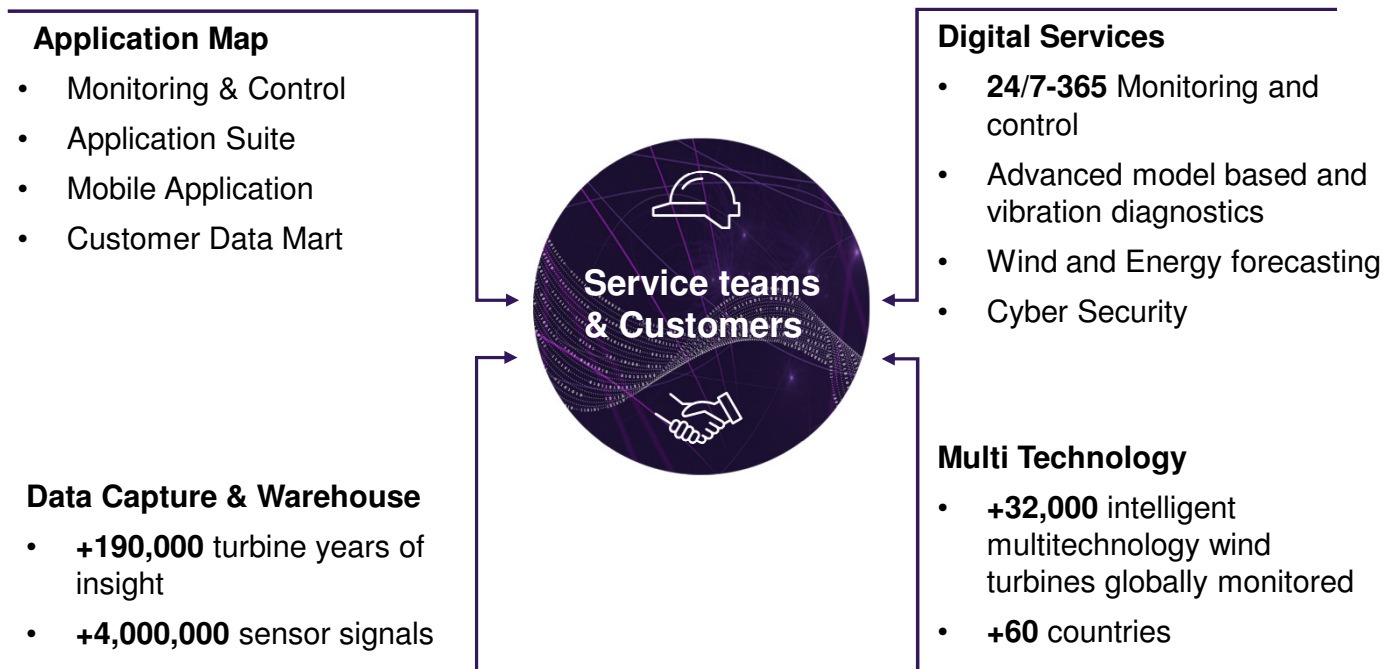
## Data driven O&M to harvest benefits of scale and reach operational excellence





# Digitalizing wind service

## Digitalizing wind service



## Our core for converting Big Data into value to customers



- Reduced downtime and optimized production by fast remote response
- Improved onsite first-time fix rates by analytics and advices to site
- Optimized maintenance strategy, reduced risk and operational expenditure by predictive methods



>32,000

globally monitored wind turbines



>85%

of issues can be resolved remotely



24/7

center manned all day – every day



>200 GB/day

received data from numerous sensors



>99%

of serious component failures detected in advance

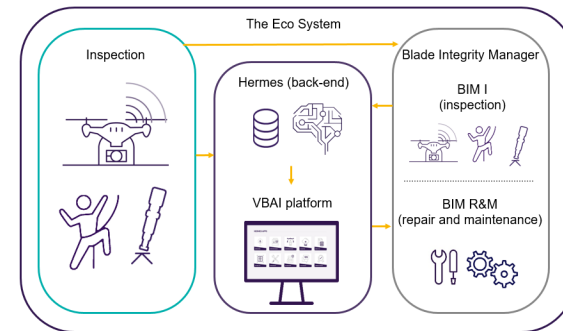
## Leveraging SGRE developed digital technologies to significantly higher field execution efficiency and better asset performance

### Digital troubleshooter

- **Interactive tool** to support turbine fault identification and remediation
- **Leveraging collective SGRE intelligence** through self-learning and best practices
- **Reduces turbine downtime** and **spare parts replacement**
- **Successfully implemented and deployed** on SGRE OF platforms since summer 2019



### Visual Based Asset Integrity (VBAI) platform



- **>25,000 turbine blades** inspected
- **Impressive results to date**
  - ✓ **Cloud artificial intelligence** enables image stitching in **34 seconds** compared to 4-6 hours for manual stitching
  - ✓ **400 images** of each rotor in **20 minutes** using automated drones
- **Technology** with the potential **to be applied beyond blades**

# Advanced Vibration Diagnostics using Pythia AI drives the shift towards AI-based future for main component failure detection

## Analytics evolution

### Standard vibration diagnostics, TCM

- Human experts
- Manual evaluations based on outliers
- Hundreds of evaluations daily

### SGRE Pythia today



- Mix of human experts and virtual experts
- Semi-automated based on machine learning
- ~120,000 components evaluated daily

### Next generation analytics

- Virtual experts; Data evaluation and pattern recognition powered by AI
- Millions of evaluations daily
- Robust outlier detection/evaluation near real time
- Prognostics and reliability centered maintenance



## Value to customer vs. standard vibration diagnostics

### HS pinions, planet wheels, IMS bearings, HS bearings, planet bearings, and main bearings:

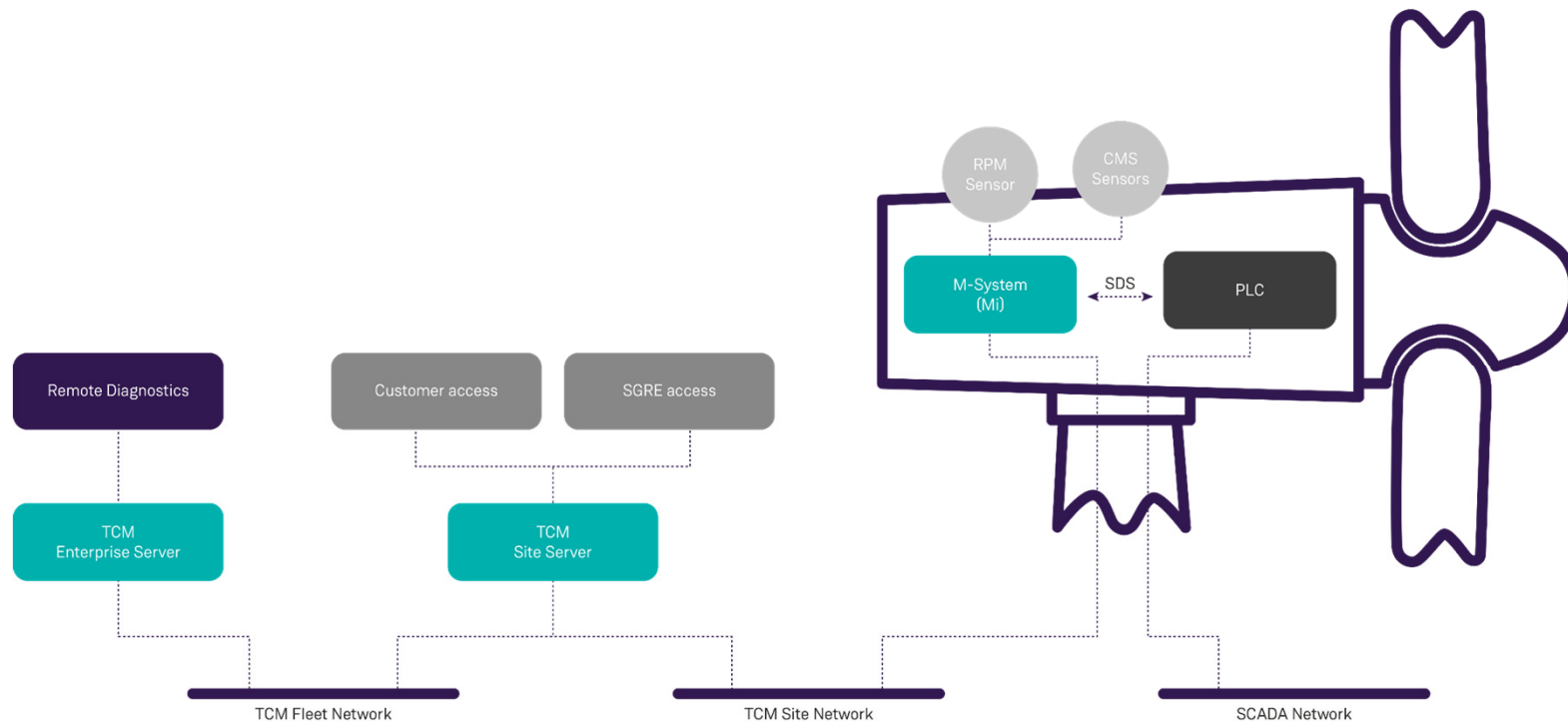
- **Earlier warning detection (days to months, months to years) = more efficient planning of resources, spare parts + bundle work with next turbine visit + crane not required (except main bearing) = reduced turbine downtime**
- E.g. from knowing **6-8 hours** in advance for planet wheels with standard TCM to **up to 6 weeks** in advance with Pythia; or from 1 year to >5 years for HS bearings.



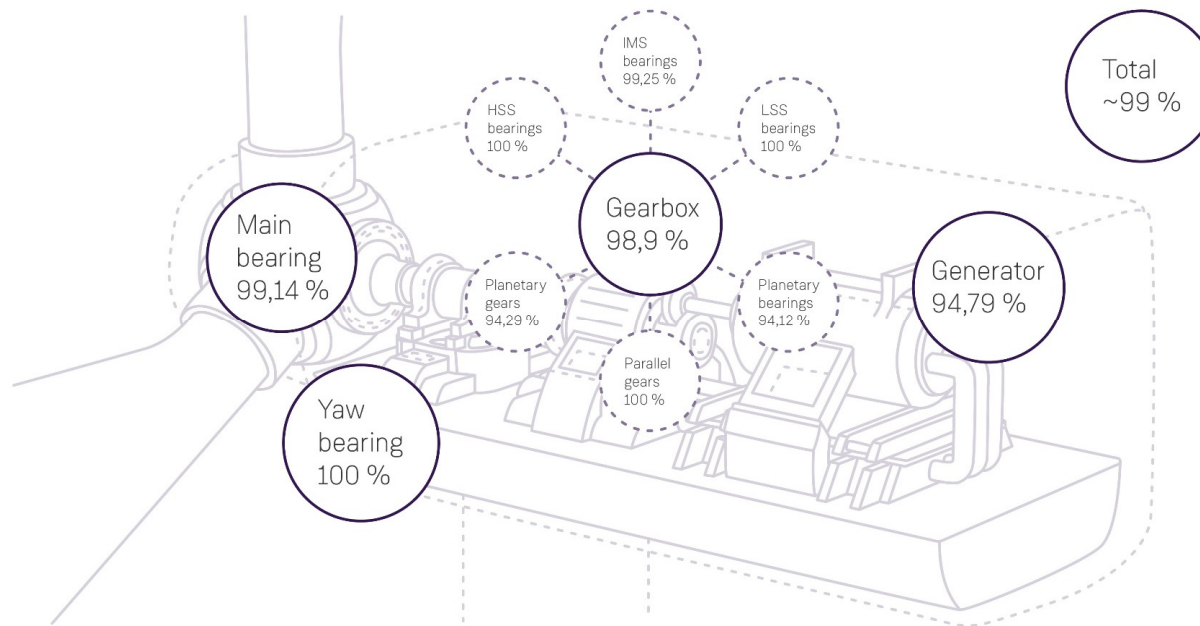
- **Improved scalability** through machine learning
- Pythia AI applied to full fleet incl. OEM
- **Smarter, faster, more maintenance-focused**
- More accurate models

Actionable insights from diagnostics remain key to manage costs & risks for customers

## Product configuration – TCM server setup



## Summary of detection capabilities



## Benefits of TCM & vibration diagnostics



### Additional monitoring

TCM & vibration diagnostics allow for increased monitoring on additional components, giving you a more comprehensive picture of your turbines' general performance and health.



### Better hit rates

TCM drastically improves component reading hit rates, compared to SMP systems. This gives more reliable data readings and less margin for interpretation mistakes.



### Longer lead times

Increased lead times allows for more timely interception of potential component problems. This improves efficiency of planned turbine maintenance.



### Increased revenue

Our availability is on average 99,7% and SGRE provide 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 SGRE's 20 years of expertise in condition monitoring. Our advanced AI has over 600 TB of data stored for training of AI enabling you get maximum output from your turbine data.



### Less CAPEX and 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.

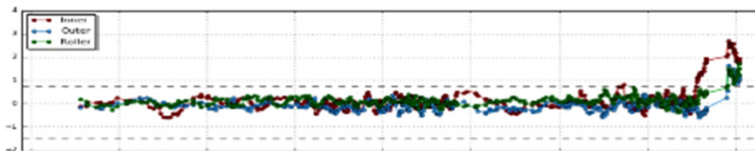


## Vibration and Model Based Diagnostics

Vibration Diagnostics has a **99% hit rate** on drivetrain damages.

Daily, we use advanced algorithms to look for changes in the vibrational behaviour of **120,000 components** according to certain patterns.

By applying machine learning, we can significantly increase the time between initial warning to failure.



	Basic analysis	Advanced analysis
HS Pinion	2 – 3 days	Up to 27 days
Planet Wheels	6 – 8 hours	Up to 6 weeks

Bubble size = Portfolio Size (# of Patent Families)



By September 2020, MBD had shared **50,000 opportunities** with sites to prevent faults from becoming failures.

A SGRE turbine can have up to 1,000 sensors providing data to Digital and non-vibration data such as lubrication, cooling and hydraulics are handled by Model Based Diagnostics.

By comparing the data to our knowledge of a turbine's normal operation, our **400+ digital models** can detect patterns that may indicate a fault in the turbine.

This insight allows us to give sites an opportunity to act preventively by providing them with time to plan the repair, suggestions on how to handle the issue, which spare parts and tools to bring etc.

## Remote Diagnostics Services: Leverage Data Intelligence

Wind turbines are often located in remote areas that are challenging to reach. With remote diagnostics, we can limit service visits to a minimum – and even fix issues remotely – without ever compromising reliability, detecting potential errors before they become serious.

### Your benefits

- Reduces downtime and optimizes production by fast remote response.
- Improves onsite first time fix rates by analytics and advices to site
- Optimizes maintenance strategy, reduce risk and operational expenditure by predictive methods

**Proactivity is the smartest response** to prevent developing damage and assure an optimal performance.

### Turning data into valuable knowledge

Pythia® diagnostics, an agile platform that allows for digital twins, health checks, optimized spare part forecasts and the early prediction of potential damage up to 3 years in advanced.

### Products included

- 24/7 Alarm Notification
- 24/7 Alarm Management
- Software Version Update
- Diagnostics Support
- Turbine Setup Control
- Vibration Diagnostics
- Advanced Vibration Diagnostics
- Antivirus
- Oil Particle Counter
- Main Bearing Surveillance

## Mitigate your risk



### Protection

Full peace of mind with warranty options, cybersecurity and grid compliance tools



### Contract what you need

Wide range of options within our modular or packages offering to match any service needs

## Grid code compliance and cyber security

As the wind energy increases, wind asset owners are required to participate to national grid stability, being compliant with more and more demanding grid codes and managing wind assets integration.

### **SGRE provides the necessary upgrades for your wind farms to ensure its grid code compliance**

High/low voltage ride through, Reactive power at no wind, Inertial response.

### **Grid management services**

Production forecasting, Active power control, Multi-grid release mode, Frequency response, dispatching center.

### **Cyber Security**

Endpoint protection, Patch & Service pack management.



# Gracias

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