FORCE Technology

Wind Power Services

http://www.forcetechnology.com
• 70 years of experience with innovation and application of knowledge and technology

• Turnover app 164 million Euro (2014)

• 60% of the turnover is generated on the international market

• Serves customers in more than 60 countries

• More than 1600 employees

• Spend more than 25 million Euro yearly on R&D activities
FORCE Technology: Wind Power Services
Our services to the wind industry covers:

- Development and implementation of inspection/maintenance strategies and programs (RBI/RCM)
- Structural design and dynamic analysis (structural integrity, structural assessment)
- Condition monitoring
- Monitoring of concrete foundations (online load measurements)
- Non-destructive-testing (NDT of the wind turbines – steel, concrete and composite materials)
- Corrosion protection and materials & surface technology
- Corrosion management
- Inspection services

Our facilities and equipment to the wind industry:

- Wind tunnel tests
- Hydrodynamic tests (towing tank)
- Automatic scanning of wind turbine blades
- Automatic scanning of welds on wind turbine towers
- Thermography (identify defects and excessive loads in different components of the turbine)
- Software tools for Maintenance planning and inspection planning (RCM/RBI)
On-site inspections (onshore & offshore)

- Blade inspection
- Tower - Weld inspection
- Subsea inspection
- UAV - Drone
- Automated UT Scanning - Tower
- Automated UT Scanning - Subsurface
- Blade Scanning and inspection
Services

Blade inspections

- UT inspection for hidden wrinkles between fibre layers, no adhesion, dry areas and porosities in laminates, laminate thickness and lack of bonding between the shell and beam.
Coating and corrosion protection inspections and consulting

- Assessing the need for corrosion protection and condition monitoring of steel structures, counselling and selection of coating types and systems.

- Work Planning and implementation for customer-specific system for checking before, during and after surface treatment.
Internal and external Cathodic Protection services

• CP design and computer modelling of all types of design monopile, jacket, floater, concrete, etc.

• CP inspection with drop cell, stab probe or FiGS (field gradient sensor)
Services

Monitoring on the offshore support structures

- Monitoring system in order to assess initial design assumptions and anticipate operation and maintenance issues by use of strain gauges, gas, temperature and water level sensors as well as corrosion probes, accelerometers, inclination sensors and scour sensors.
Strain Gauge Monitoring

- Monitoring of deformation, stresses and strains in a structure, such as gear boxes, concrete structures, steel towers and platforms, and composite materials such as blades and nacelles.
Services

Steel and welding inspections

• Design and examination of proposals from suppliers, quality control, plans for reception control, control of materials, evaluation of welding procedure tests (WPAR) and methods, review of procedures, welders’ certificates, NDE and inspection of NDE procedures and certificates, audit and final documentation.
3rd party inspection

- Audits and selection support of suppliers, evaluation and control of subcontractors, review of procedures, specifications for manufacture and inspection of documentation from subcontractors. FORCE Technology as building consultant for foundations manufacturing.
Services

On-site inspection

• Operating turbines, offshore as onshore and above and below the waterline and from the foundation to the blade tip.

• Assessment and calculations of remaining service life based on the results collected during the inspection.
Concrete inspections

- Periodic inspections of structures, visually combined with NDT. Condition Assessment Scheme and damage analyses using both the NDT and laboratory tests, corrosion measurement and monitoring, and protection against corrosion.
Subsea inspections

- Detailed visual, UT, or eddy current inspections and documentation. With FORCE Technology-developed underwater NDE inspection equipment that can be configured for operation by diver or ROV.
Services

Failure analyses

- Accident, damage and RCA analyses of components and structures on-site and in the laboratory.
Services

Lift/elevator inspections

- As accredited inspection and testing institution, FORCE Technology performs professional and independent inspection and testing of all types of lifts and elevators.
Services

Pressure tanks

- Periodic surveys and conformity assessment of Pressure Assemblies in turbines.
Wind Tunnels

Our largest tunnel has a length of 21 metres. Used especially for testing of ships, offshore installations, bridges and building structures.
Services

Vortex vibrator

• Vortex vibration study of maritime structures, including SPAR platforms and subsea structures.
Wind Farms Integrity Management – FORCE Technology Package

- Inspections services
  - Specialized personnel and tools

- Inspection products and technologies
  - Visual inspection (UAV helicopter)
  - Scanners (ATS-2, MWS-6)

- Corrosion management
  - Materials technology
  - Coating and corrosion
  - Cathodic protection
  - Corrosion monitoring services

- Structural integrity
  - Structural reliability assessment of turbine components (loads/resistance analysis)

- Inspection and maintenance planning
  - Software tool: MANIFER

- Monitoring
  - Load/response sensors (strain, accelerations, inclination, etc.)

- Monitoring data
  - External data (complementary information)
    - Monitoring data about the condition of other turbine components (e.g. rotor, electrical systems)
    - Production forecasts
Wind Power RCM analysis - Software

A software tool that facilitates maintenance analysis according to the RCM methodology

Main features

- Detailed assessment of the turbine components
  - Equipments
  - Failure Modes
  - Maintenance Tasks

- Cost-effective maintenance planning based on the component criticality
Wind Power References

SIEMENS
Siemens Wind Power

aibel

DONG
energy

Statoil

Vestas

ABB

VATTENFALL

Statkraft

HOCHTIEF

Sheringham Shoal
Scira Offshore Energy

Tennet
Taking power further
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<tr>
<th>Project</th>
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<tr>
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FORCE Technology Norway

FROM KNOWLEDGE TO VALUE

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