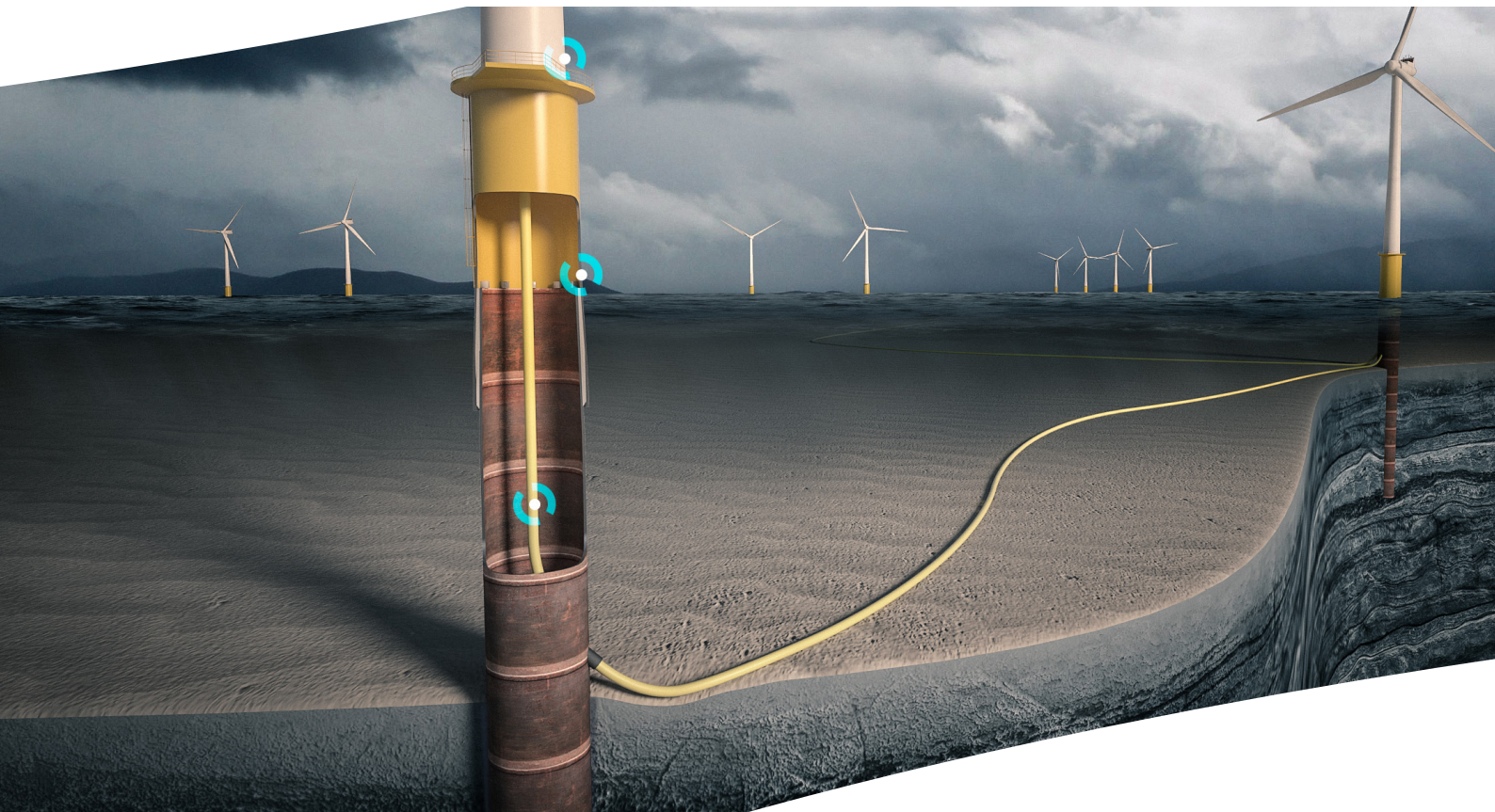


Wind Farm Monitoring

Reduced Levelized Cost of Energy (LCOE) with SMS Guard™



SMS Guard™ is a retrofittable instrumentation solution for monitoring of offshore wind turbine substructures. The magnetic sensors, combined with advanced machine learning algorithms and 4Subsea domain expertise, help operators realise the significant potential of reduced LCOE (Levelized Cost of Energy) using digital tools.

4Subsea offers a wide range of engineering support and digital monitoring services related to floating and bottom-fixed offshore wind systems. We cover all life cycle phases, starting with technology development and conceptual design through FEED and detailed design, procurement, construction, installation, operation, and decommissioning.

KEY BENEFITS

- Lifetime extension of substructures
- Continuous monitoring of substructure - seabed interaction
- Live integrity monitoring of bottom-fixed and floating wind turbines
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- Load and fatigue monitoring of the tower and substructure
- Data made available through open APIs enabling data analytics and collaboration
- Potential for reduced steel weight and reduced installation cost
- Production uptime optimisation
- Automatic detection of turbine anomalies
- Digital monitoring on [4insight®](#)



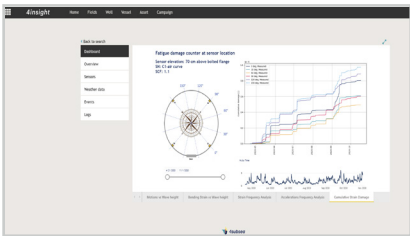
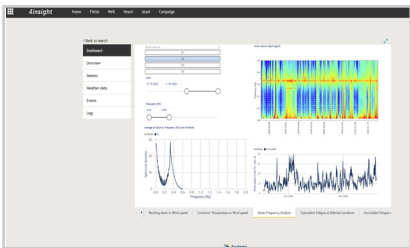
Key Functionality

SMS Guard™ is an easy to install retrofittable instrumentation package that enables continuous integrity monitoring of offshore wind turbines. SMS Guard™ gives operators full control of the loads acting on- and the motions of the tower and substructure.

A digital twin model of the turbines combined with machine learning algorithms are used to predict correlation between wind and loads. The trained digital twin model is then used to back-calculate historical loads and to predict future loads in order to give a continuous update on remaining operational life of each turbine. Defining operational life based on actual recorded loads removes unnecessary conservatism and typically enables 10%-30% lifetime extension, thereby significantly reducing levelised cost of energy (LCOE)

The sensor data is also used for continuous integrity monitoring and early detection of anomalies both in the turbine itself, in the tower and substructure and the seabed support of the substructure.

SMS Guard™ is a true IoT solution where all data is made available through an open API, enabling cloud computing and collaborative data analytics.



Installation

The system is typically installed immediately above the cable hang-off deck, however, the exact elevation of the system is not critical for its functionality. The installation entails a small cabinet containing a 6-axis inertial motion unit and 4 strain sensors that are placed at 90 degree intervals around a cross-section of the tower structure.

The system only requires a single power supply and either WiFi or LAN connection and will then automatically start streaming of measurement data. Once connected the operator will get immediate access to a set of standard integrity monitoring dashboards showing;

- Bending moment at the cross-section where the system is installed
- Horizontal accelerations at the sensor elevation
- Rotational rates at the sensor elevation

All the above parameters will be plotted and correlated with wave height and wind speed based on satellite monitoring of the region. More advanced monitoring such as monitoring of seabed stiffness and damping, response frequency monitoring and structural fatigue can be added upon request.



4Subsea is a leading provider of technology and services that help operators optimise energy production from subsea oil & gas fields and offshore wind farms. We combine domain expertise with data analytics and digital services to maximise lifetime of assets, reduce operational cost and optimise future projects through data-driven design.

The company was established in 2007 and clients include the major energy operators as well as the large suppliers of subsea equipment. 4Subsea is headquartered in Asker, Norway with additional offices in Bergen, Kristiansand, Stavanger, Rio de Janeiro, and Aberdeen. 4Subsea is a company in the Subsea 7 Group. More info at www.4subsea.com.

4Subsea - Share ideas, move forward

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