MOORING SYSTEM INTEGRITY MANAGEMENT THROUGH MONITORING, DIGITAL TWIN AND CONTROL TECHNOLOGIES FOR COST REDUCTION AND INCREASED EFFICIENCY

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INTRODUCTION

The MooringSense project aims at reducing operational costs and increasing efficiency through the development of an efficient risk-based integrity management strategy for mooring systems based on affordable and reliable on-line monitoring technologies.

The proposed solution will be enabled by the development of a low-cost smart sensor for floating offshore wind turbine motion monitoring, a mooring system digital twin model, structural health monitoring techniques, as well as control strategies at turbine and farm levels.

MooringSense monitoring technology will replace the existing unreliable and expensive monitoring systems based on load cells in the mooring lines by a combination of a robust motion sensor and numerical models. In addition, measurements will enable the development of condition-based operation and maintenance strategies, including optimized control.

OBJECTIVES

MooringSense aims at reducing floating offshore wind operational costs by 10-15% and increasing operational efficiency by means of a 2-3% annual energy production increase.

Annual Energy Production

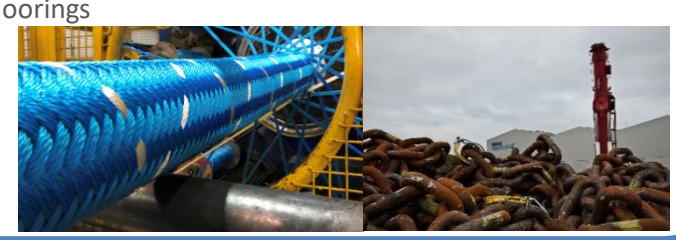
- Reduce weather downtime
- Reduce downtime due to damages and failures

CAPEX

- Optimized mooring system design enabled by the improvement of modelling tools and the mitigation of dynamic loads

OPEX

- Transform corrective unscheduled maintenance into less costly scheduled predictive maintenance.
- Reduce the need for inspection through the design and implementation of a risk-based condition-based integrity management strategies
- Reduce failure rates by mitigating dynamic loads in the moorings



TECHNOLOGY

MooringSense implies remarkable progress in several technologies:

A **digital replica** of the mooring system will be developed to provide updated condition information of this critical component by processing real sensor measurements. The digital twin will be used to obtain virtual measurements and remaining useful life predictions.

A low-cost and robust **smart motion sensor** will be designed and developed. This sensor will provide accurate attitude, position, velocity and time information, as well as, statistics of motion measurements. The sensor will be based on GNSS multi-constellation and multi-frequency technology.

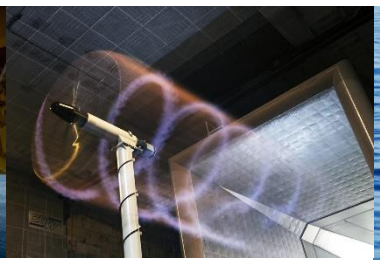
Structural Health Monitoring algorithms will be developed. These algorithms will be able to exploit GNSS motion measurements and condition parameters predicted by the digital twin to detect and classify damages in the mooring systems.

Control algorithms will be developed to take advantage of floating platform pose and mooring system condition information to optimize operation. Strategies such as blade pitch control, dynamic loading control and distribution of turbine operating thrust setpoints at farm level will be studied.

A more efficient **mooring system integrity management** strategy will be designed to leverage the MooringSense developments, reduce operational costs and increase efficiency, while keeping risks in acceptable levels.

CONSORTIUM

The consortium comprises 9 partners from Europe's OW industry and academia, including market leaders in mooring chains, wires and fiber ropes, a FOWT developer, a provider of smart sensors for marine applications and a project developer with a vast track record in the O&G and OW sectors.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