Challenge 2.3

Floating wind farms

Control methods	Short-term	High priority

Description and scope

Most types of floating wind turbine are subject to a control-driven instability involving platform pitch and control of the rotor speed. Auxiliary damping is often needed to stabilise the platform. The platform resonant modes, which may have frequencies below 0.05 Hz, pose a special challenge to the stable control of floating wind turbines: either the controller must have a very slow action, or else it must compensate actively for the platform resonance. Auxiliary damping is purely reactive, in response to platform motion.

There are unrealised opportunities to anticipate and actively reject or balance loads on the turbine and platform structures, beyond the damping of pitch resonance either through control methods or a reduced mooring system to reduce floater motion and fatigue damage.

Advanced model-based control algorithms can be used to find the ideal trade-off between conflicting control objectives, such as power production and load reduction.

Recommended research actions

- Improve the use of model-based control, in combination with advanced sensors like Lidar and wave cameras, to anticipate load fluctuations and accommodate them in an optimal way.
- Analyse side-to-side damping in cases of misaligned wind and waves, and in general counteracting the accumulated cycles and extremes of environmental loading, without sacrificing production.
- Test and use fleet operational data to provide the foundation for adaptive, machine-learning algorithms that can supplement or perhaps transcend model-based approaches.
- Explore the possibilities and limitations of machine-learning-based control algorithms, especially regarding the relationship between the data available for training and the reliability of the control response under various normal and abnormal operating conditions.
- Parametrisation of the methodologies to auto-tune controllers.

Milestones

- Protocol for motion controller interaction with turbine manufacturers.
- Develop and test new controllers for floating offshore wind to demonstrate reduced floating motion and fatigue damage.
- Integrated analysis tools be able to include controller functionalities.