Challenge 1.2

Serial production

Validation of design tools	Short-term	High priority

Description and scope

A system is only as robust as its weakest link. For floating wind turbines the design process must account for various elements including the atmospheric flow, wind turbine aero elastic behaviour, hydrodynamics of the floating platform, anchors and mooring lines, electrical components and cables, and control systems.

The methods and tools used for design dictate what the architecture and dimensions of all the system's components will be, and how reliable these components are in operation. *Probability* and *experimentation* are central to the development of good design tools and ultimately reliable components.

Component reliability is achieved by characterising the probability of material or component failure limits as a function of the load regime and a probabilistic analysis of the operating load due to environmental conditions, control/operator commands, or faults.

Design methods are validated with a building-block approach, starting with small coupons of individual materials, and progressing upwards to sub-components, components, prototypes, and fleet experience. In commercial deployment of floating wind plants, there is currently a gap between small-scale experiments in ocean basin laboratories and full-scale deployment. This hinders the development of novel design methods and technologies.

Recommended research actions

- Identify best practices for holistic design and optimisation of floating wind energy systems, how to co-optimise the turbines, platform, moorings, and control systems.
- Develop probabilistic design methods, especially joint probabilities of operating states (wind/wakes/waves, plant control/operator power commands, faults) and system limits (considering the interactions between components as they operate as a system).
- Identify plant-scale effects on loads and control.
- Validation of model tools against full scale measurements and model tests (need for high quality measurement data for validation, with low uncertainty. This applies both to model test and full scale measurements) to reduced uncertainty of simulation tools.
- Facilitate gaining access to full-scale prototype and fleet data, in order to validate system models.
- Development and deployment of experimental facilities that can be used to test and demonstrate designs.
- Facilitate open access to test results from experimental tests of complicated physical phenomena.
- Validation of new innovative concepts.

Milestones

- Define format for data sharing.
- Share data from floating offshore wind structures within 2019.
- Model testing methods need to be validated.
- Design tools validated to quantified accuracy.