DIMPACT

Design of floating wind turbines taking into account the impact of wave steepness and breaking

DURATION: 40 months (2020-2023) | **Total budget:** €2,600K

CONTEXT

Floating offshore wind turbines will generally be deployed in areas with strong winds and powerful waves. This needs to be taken into account at the design stage because of the damage that can be caused to systems. To date, little account has been taken of the loads caused by the extreme waves that apply to floating wind turbines. **We therefore need to go further in defining specific engineering methods to take into account the effect of breaking waves on floating wind turbines.**

OBJECTIVE

To develop new tools to improve the design of floating offshore wind turbines by better integrating loads due to wave breaking

MAIN ACHIVEMENTS

- Study of the geometric and kinematic properties of breaking waves using numerical simulations and tank experiments
- Wave channel tests using an instrumented cylinder representative of a spar turbine to reproduce the movements and inclinations typical of a floating wind turbine
- Establishment of a relationship between the properties of breaking waves and the loads exerted on the cylinder in order to assess the loads induced by breaking waves in any sea state
- Development and validation of an engineering formula specific to floating wind turbines, taking into account the movement and inclination of the turbine subjected to loads induced by extreme waves
- Development of a solution for estimating the loads induced by equivalent non-linear waves, based on the properties of linear waves
- Development of an engineering method to take account of the slamming force on the floating wind turbine, then integration into the codes of the DIEGO and OpenFAST tools

CONCLUSION

DIMPACT has led to the development of a method for defining the design sea state specific to floating offshore wind turbines. An engineering solution has also been developed for estimating the loads caused by non-linear waves in coupled numerical models such as OpenFAST. This is mentioned in the recommendation documents published in 2024 by the DNV certification body.

TECHNOLOGIES

STAGES OF THE VALUE CHAIN

Design

Operations Maintenance

MAIN OUTPUTS

- **New method** for defining the design sea state in coupled aerohydrodynamic models of floating wind turbines
- **New engineering solution** for estimating non-linear wave-induced loads in coupled numerical models, mentioned in version 2024 of the guidance documents published by the DNV certification body

PARTENERS

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