

# SOLCYP +

## Cyclic loadings of offshore wind turbine monopiles

**DURATION: 46 months (2017-2020) | BUDGET: €998K**

### CONTEXT

Fixed wind turbines are currently the most mature technology in the offshore renewable energy system. The foundation of a fixed wind turbine represents 15% to 20% of its total investment and there are no regulations governing its design. **The strong constraints of energy profitability imply a constant increase in the power of the turbine and has a direct impact on the design of the foundations which take up the installation and operating forces (high frequencies of the rotor and cyclic forces of the swell).**

### OBJECTIVES

- To propose recommendations for predicting the effects of lateral cyclic loading on soil-structure interaction in the case of a rigid pile
- To characterise the behaviour of the cement-concrete interface

### MAIN ACHIEVEMENTS

- Creation of an experimental reference database including the results of centrifuge tests and analysis of the behaviour of the monopile under cyclic transverse loading in dense sand
- Experimental and rheological characterisation of the mechanics of chalk and the cement-chalk interface
- Comparison between the obtained stresses and the normative application recommendations, definition of a new methodology for a scale 1 pile
- Consideration of the change in ground conditions due to the installation, calculation of displacements and forces on flexible and rigid piles according to the loading cycles

### CONCLUSION

The tools developed make it possible to better take into account the restructuring of the soil following the effect of pile driving in sandy soils, as well as the evolution of the parameters influencing the soil-structure interaction. The project also made it possible to develop a design procedure for rigid monopiles under transverse cyclic loading. A behaviour law for carbonate soil and its interaction with cement extends the scope of application.



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### TECHNOLOGIES



### STAGES OF THE VALUE CHAIN



Design



O&M

### OUTPUTS

- **State of the art** on the behaviour of carbonate materials and methods for the mechanical characterisation of chalk
- **Database** from 3D shear box tests on the cement-concrete interface
- **Database** of uniaxial and triaxial compression tests of raw and crushed chalk
- **Database** from about 100 centrifuge tests of rigid and flexible piles under transverse cyclic loading after driving
- **Fibre optic instrumentation** for continuous monitoring of the physical phenomena involved in the tests
- **Transverse cyclic loading model** for a rigid pile
- **Behavioural model** of the cement-chalk interface

### PARTNERS



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