FLOATECH

THE FUTURE OF FLOATING WIND TURBINES

Optimization of Floating Offshore Wind Turbines using innovative control techniques and fully-coupled open source engineering tools

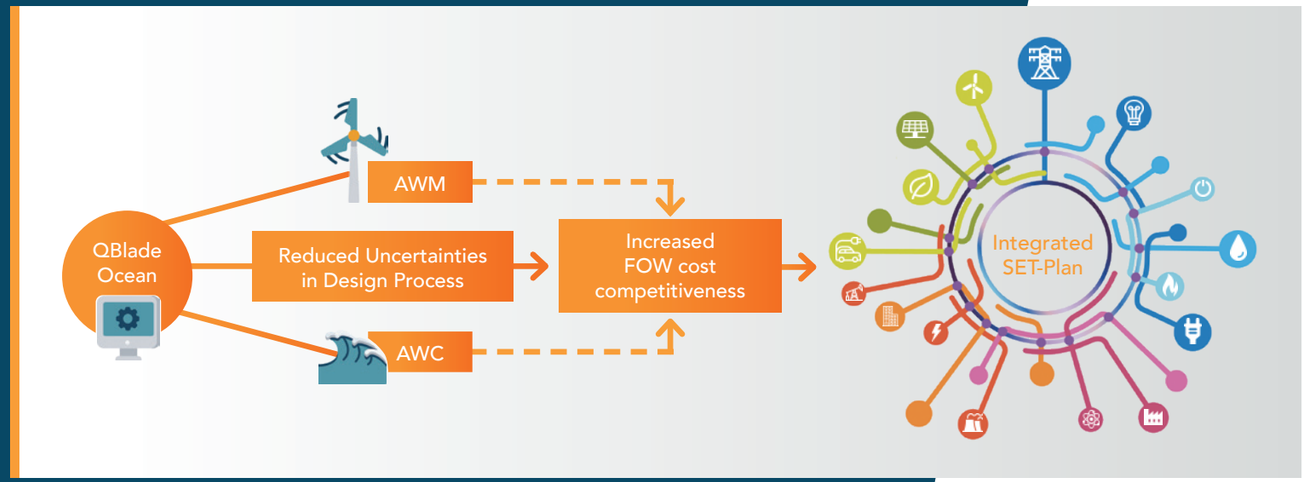
The FLOATECH project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101007142.

FLOATECH in a nutshell

FLOATECH has been conceptualized to ensure efficient development, validation and application in order to achieve the primary goal of a reduction in Levelized Cost of Energy (LCOE) of Floating Offshore Wind (FOW).

This is achieved following an integrated approach combining two mutually beneficial actions:

- The development of a practical and efficient simulation tool named QBlade which allows for the calculation of important higher order physical effects relevant to Floating Offshore Wind Turbines (FOWTs).
- Using this tool to develop, validate and test two pioneering FOWTs control strategies which aim directly at reducing operational costs and improving the energy yield of FOWTs: Active Wave-based feed-forward Control (AWC) addressing the impact of the waves on the platform stability and the Active Wake Mixing (AWM) method aimed at enhancing the mixing of the wakes and thus reduce wake effects downstream.



A collaborative EU-funded project

The FLOATECH consortium brings together expertise from leading institutions on each of the key aspects that Floating Offshore Wind Turbines combine - aerodynamics, hydrodynamics and control.

COORDINATOR
TU Berlin (Technische Universität Berlin)

CONSORTIUM
9 partners
4 countries

FLOATECH Timeline

Highlight of the most important outcomes of the project

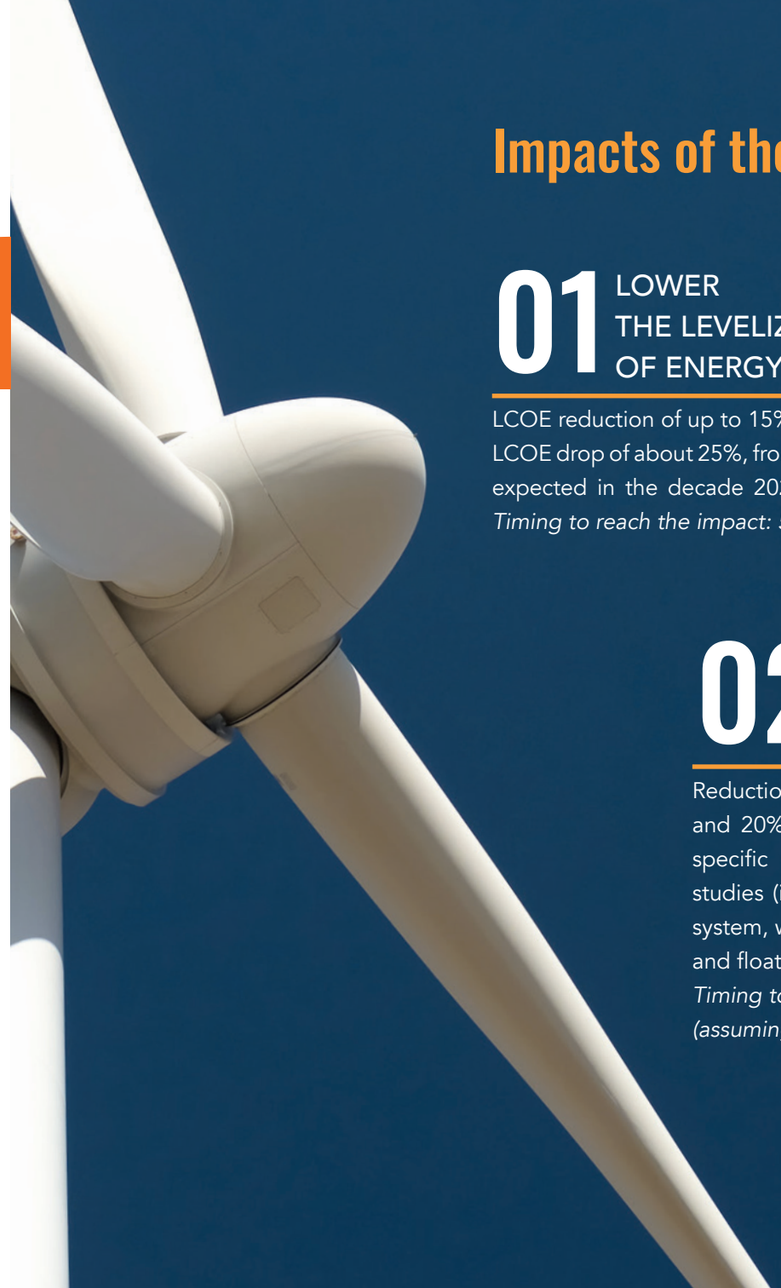
DURATION
48 months

OVERALL BUDGET
€ 4 294 688,75

JAN. 2021

- **JUNE 2021** — Coupling of QBlade and NEMOH
- **DEC. 2021** — Development of hydrodynamic solver
- **MARCH 2022** — Aero-hydro-elastic model database
- **JULY 2022** — Public release of QBlade-Ocean in open-source
- **NOV. 2022** — Development of Feed-forward wave control
- **DEC. 2022** — Uncertainty quantification through QBlade-Ocean
  - NEMOHv3.0.0 is released in GitLab
  - FOWT design for AWM
- **MAY 2023** — Feed-forward Controller validation
- **OCT. 2023** — Wave tank validation AWC
- **NOV. 2023** — Potential for LCOE improvement
- **DEC. 2023** — FLOATECH Final Info Day

DEC. 2023



Impacts of the project

01 LOWER THE LEVELIZED COST OF ENERGY (LCOE)

LCOE reduction of up to 15% (contributing in a relevant way to the LCOE drop of about 25%, from the initial value of about 130 €/MWh, expected in the decade 2020-2030, based on expert estimates).
Timing to reach the impact: 5 years

02 INCREASE THE MARKET VALUE OF WIND POWER

Reduction of market value drop between 10% and 20% at a 30% wind energy share, under specific conditions, according to literature studies (impact is dependent on actual power system, wind energy share in electricity market, and floating wind share).
Timing to reach the impact:10 years
(assuming 10 years to reach 30% of wind share)

Main achievements and results

SOFTWARE

QBlade-Ocean: openly available wind turbine simulation suite developed at TUB for the design and simulation of floating turbines. Its aerodynamic, structural and hydrodynamic fidelity allow for greater understanding of underlying physical processes and interactions which occur on FOWTs single platforms and multiple turbine arrays. This has a range of far-reaching applications not only to complete turbine design, but also to turbine element and module technology for other projects with limited access to higher-order methods.

NEMOH: open-source hydrodynamic potential flow solver developed at ECN. NEMOH is a Boundary Element Method (BEM) code dedicated to the computation of first order wave loads on offshore structures. Under FLOATECH, it has been improved to include second order hydrodynamic effects in the form of a quadratic transfer function (QTF).

HOS-Ocean: the coupling of an open-source spectral high-order nonlinear wave field generation tool, developed at ECN, with QBlade-Ocean to allow an import functionality of high-fidelity wave fields.

FOWT CONTROL STRATEGIES

Active wave-based control (AWC) system: a new control technique for Floating Offshore Wind Turbines combining an open-source feed forward control algorithm and a wave sensing system to achieve wave-based control in floating wind turbines - designed and developed by TU Delft - validated in wave tank at ECN.

Validation of the wave prediction system on a full-scale FOWT in real environment: the wave-based radar system has been mounted on the FOWT «ID1-Floatgen» aimed to predict motions of the platform, with real time remote wave measurement for validation of the technology by ECN.

Active Wake Mixing (AWM) system to enhance wake mixing control in floating wind farms and thus significantly increase wind speed downstream - designed and developed by TU Delft.

OTHER RESULTS

LCOE evaluation tool evaluating the economic impact of the novel control technologies developed within FLOATECH.

Creation of scientific data:

- Experimental measurements of the response to realistic met-ocean conditions of a scaled floating wind turbine within a Software-in-the-Loop setup at ECN.
- Full scale experimental measurements and prediction of wave fields at the SemRev test site.

Novel methodology to derive met-ocean conditions for use in FOWT simulation.

www.floatech-project.com

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FLOATECH H2020 Offshore Wind Project

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SEAPOWER scrl
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