Project Acronym: WATEREYE
Project Title: O&M TOOLS INTEGRATING ACCURATE STRUCTURAL HEALTH IN OFFSHORE ENERGY
Funding: EU-H2020-LC-SC3-RES-14-2019, GRANT AGREEMENT 851207
EU Financial Contribution: 4,7 MILLION EUROS
Start date: NOVEMBER 1, 2019
Duration: 36 MONTHS
Partners: 9 PARTNERS FROM 5 COUNTRIES
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objective

WATEREYE integral solution will allow Wind Farm (WF) Operators to accurately predict the need for future operations & maintenance to reduce O&M costs, which can represent up to 30% of the LCOE* (an estimated LCOE of 70 €/MWh in 2030), and to increase the offshore wind annual energy production thanks to an accurate structural health monitoring and control of the Offshore Wind Farms.

* levelised cost of energy

innovations

1

High-accuracy, fast-response & non-invasive ultrasound smart sensor will be developed to detect and estimate corrosion levels by analysing wall thickness evolution, which will be integrated in a high-precision indoor "drone-based mobile platform" inspection system capable of monitoring the entire critical area. WATEREYE will design a robust wireless communication system and a custom protocol that will prevent data losses or corruption even in harsh environments.

2

WATEREYE will collect, store, and provide efficient access layers for the wind turbines data in order to ensure optimal understanding of structural health. WATEREYE will develop accurate mathematical corrosion models for offshore wind turbines structures to characterise the corrosion phenomena in the wind turbine tower. Condition-based maintenance tools will be developed for fault diagnosis; corrosion prognosis algorithms; decision support to define predictive O&M; and fault tolerant control of offshore wind structures.

3

WATEREYE will develop control algorithms for adaptive O&M strategies of individual wind turbine and the overall plant. The WATEREYE monitoring system will determine the condition of the structures. This information, together with O&M schedules and forecasted weather conditions, will be used to adapt the power production. WATEREYE will ensure an optimal execution of the wind farm operation & maintenance tasks, by minimising human inspection, vessel transfers and optimising onshore logistics.

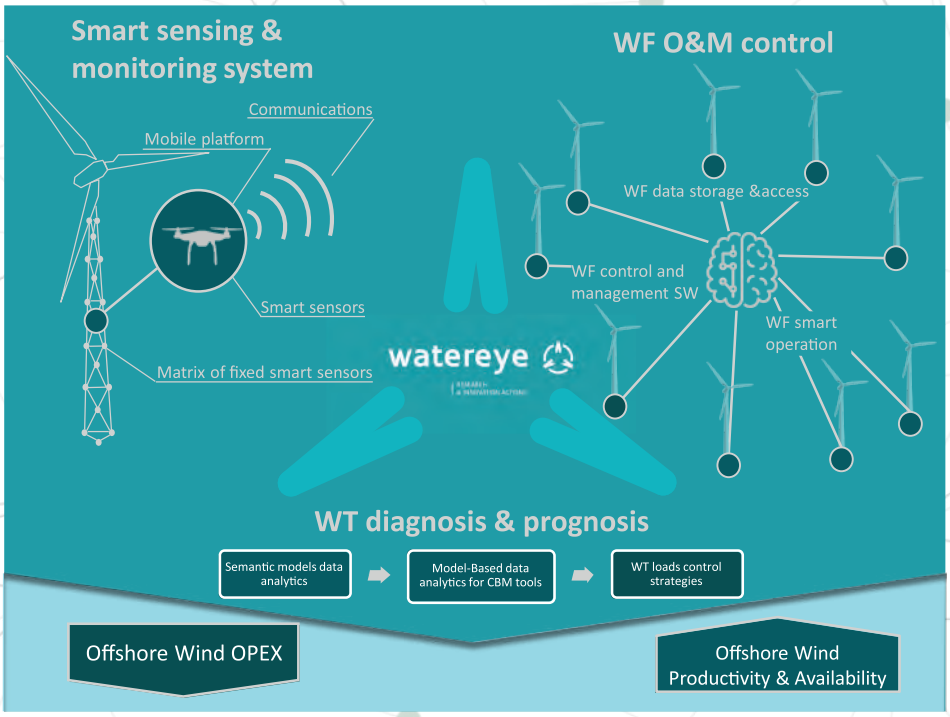
watereye

RESEARCH
& INNOVATION ACTIONS

WATEREYE has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 851207

concept & methodology

WATEREYE will develop low-cost smart sensors based on ultrasound technology to measure the structural components wall thickness and to predict other structural defects like corrosion cracks. The monitoring concept combines two ultrasound solutions (a mobile sensor node and a matrix of fixed sensors) to cover the atmospheric and splash zones of the tower. A drone with an embedded ultrasound sensor will be the mobile solution to monitor the most critical points of the atmospheric zone whereas the splash zone will be monitored by the matrix of sensors. Although the ultrasound solutions work inside, the system detects the loss of material and thus, is capable of monitoring the corrosion produced outside. This monitoring system will function 24/7 automatically in an unattended manner. In the case of the matrix of sensors located in the splash zone, housing with a high level of protection will be used to avoid electronics damage.



WATEREYE will develop a wireless radio communication system to send corrosion data from the matrix of fixed smart sensor nodes as well as from the drone to the base station.

Based on the collected data, WATEREYE will develop accurate corrosion diagnosis and prognosis tools for offshore wind turbine structures. That involves three conceptual steps of transmission of the information: (1) Semantic Web Company will analyse the requirements for an efficient data management and develop a tool including data acquisition, storing and access; (2) WATEREYE will develop diagnosis and prognosis tools for predictive maintenance of the wind turbine structural health; and (3) wind turbine control will be feed with its loads calculations and new control strategies considering the accurate structural health condition and the estimated RUL (Remaining Useful Life-Time), leading the information and its interpretation with models to decision commands for optimal wind turbine control.

A wind farm controller will be developed and it will be in charge of receiving short-term data from the individual wind turbine controllers, and perform a global optimization of the wind farm operation, querying the longer-term maintenance scheduling that will be also developed, as part of the cost evaluation.

The WATEREYE control strategy and hierarchy will be conceived to be used for conventional wind farms, as well as virtual power plants with distributed energy sources. Therefore, WATEREYE will contribute to the development of a virtual power plant. The control algorithms will require the WATEREYE smart sensors, plus typical operation measurements of rotor speed, blade pitch, electric power, yaw angle, and an accelerometer in the nacelle – and will meet grid code requirements for wind power plants. The control algorithms will be flexible, in terms of the trade-offs between foundation load reduction, energy production, and blade pitch actuation, so that they can be adapted to various operation & maintenance strategies.

The project will mature technologies from a range of Technology Readiness Level (TRL) of 3-4 to TRL 5, most of them will be demonstrated in a relevant environment, indeed, the offshore platform of PLOCAN will provide a real sea conditions test.

the consortium

ceit · cobra · Delft Dynamics · Flanders Make · Semantic Web Company

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