CL-Windcon

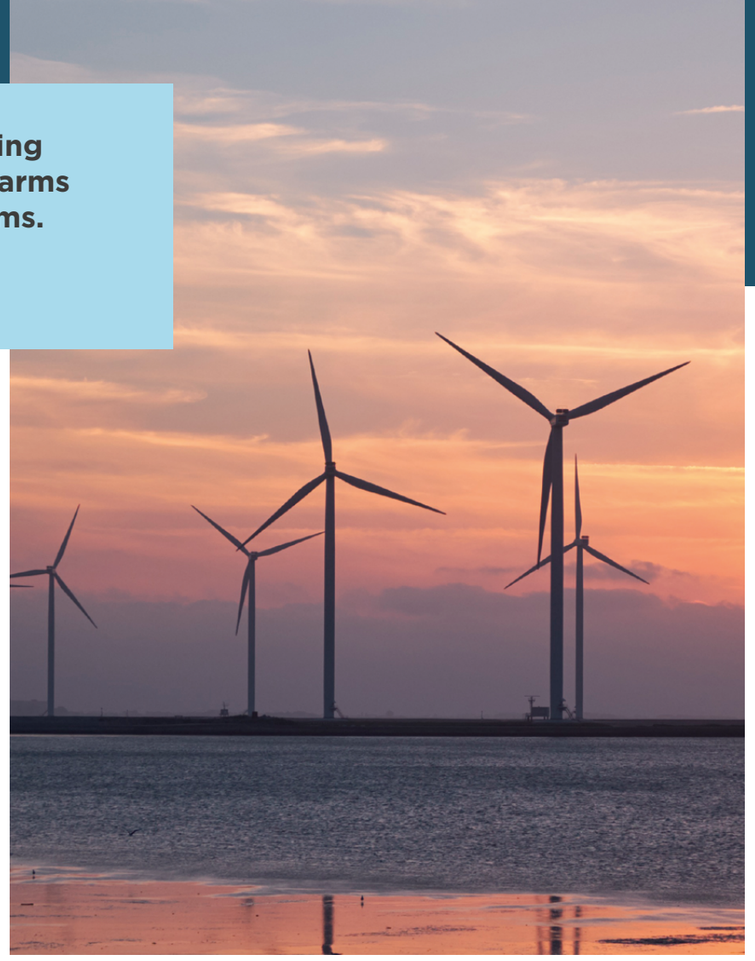
Closed Loop Wind Farm Control

www.clwindcon.eu

Multi-fidelity dynamic modelling and advanced control algorithms at a farm level by treating the entire wind farm as a comprehensive real-time optimisation problem

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727477.

A new way of designing and operating wind farms with control algorithms.



CL-Windcon project focuses on wind farm control. Current practice in wind farm operation is that every turbine has its own controller optimizing its performance in terms of energy capture and loading, based only on the available information of its own measurements.

CL-Windcon will put forward new innovative solutions based on wind farm multi-fidelity dynamic modelling, and open- and closed-loop advanced control algorithms, which will enable the entire wind farm to be treated as a single integrated real-time optimisation problem.

15	€ 4.9M	36
PARTNERS	TOTAL COST	MONTHS

MAIN OBJECTIVES

TECHNICAL & TECHNOLOGICAL

1. Development of new control algorithms that treat the entire wind plant as a holistic control optimization problem.
2. To optimize energy capture for individual assets with the wind turbine-centric controls.
3. To develop a better understanding of the wind flow resource, and its dynamics among wind turbines.

ECONOMIC

1. To evaluate how the novel control algorithms impact the reliability of the wind farm optimizing the operation and maintenance costs, hence easing the deployment of renewable wind energy within the energy mix and accelerating its roll-out.
2. To evaluate the total economic worth of the new wind farm control algorithms maximizing the potential payoffs coming from the new technology and contributing to the European Security of Supply.

ENVIRONMENTAL

To evaluate the overall value chain of the new control strategy through a Life Cycle Assessment, including supplies, production, distribution, use and disposal as well as all intervening transportation steps necessary or caused by the equipment use. This is especially relevant in case of modifications of existing wind farms.

SOCIAL

1. Creation of green business opportunities and jobs, fostering the European competitiveness and increasing the public acceptance of wind energy.
2. To improve design norms affecting the loads and power performance of individual wind turbines by integrating new designs of the wind farm and the individual wind turbines.

A WORK PLAN TO REACH THE GOAL

To implement CL-Windcon project, a work plan has been designed, consisting of 7 different Work Packages:

1. Wind farm control-oriented model development.

The overall objective of WP 1 is to close the gap between current state-of-the-art modeling of wind farms and the models needed for the applications in WP 2 and WP 3. The definition of publicly available reference wind farms, the specification of a common framework for simulations, and the development of the multi-fidelity and the reference model will support this goal.

2. Wind farm flow control technologies and algorithms.

The main goal is developing control technologies to optimize the performance of wind farms in real-time by creating advanced control algorithms to make this feasible.

3. Demonstration and validation.

The project will validate the developed modelling tools and wind turbine and farm control methods through:

A. High-fidelity CFD simulations conducted with the software SOWFA.
B. Testing at POLIMI's boundary layer wind tunnel.
C. Field tests, using a cluster of 1.5MW wind turbines with moderate terrain complexity in Sedini wind farm (Sardinia, Italy).

4. Feasibility.

CL-Windcon will also include **a comprehensive analysis of economic and environmental impact** of the technical improvements resulting from the project, as well as **standards review** for future wind turbine and farms design.

5. Dissemination and technology transfer activities.

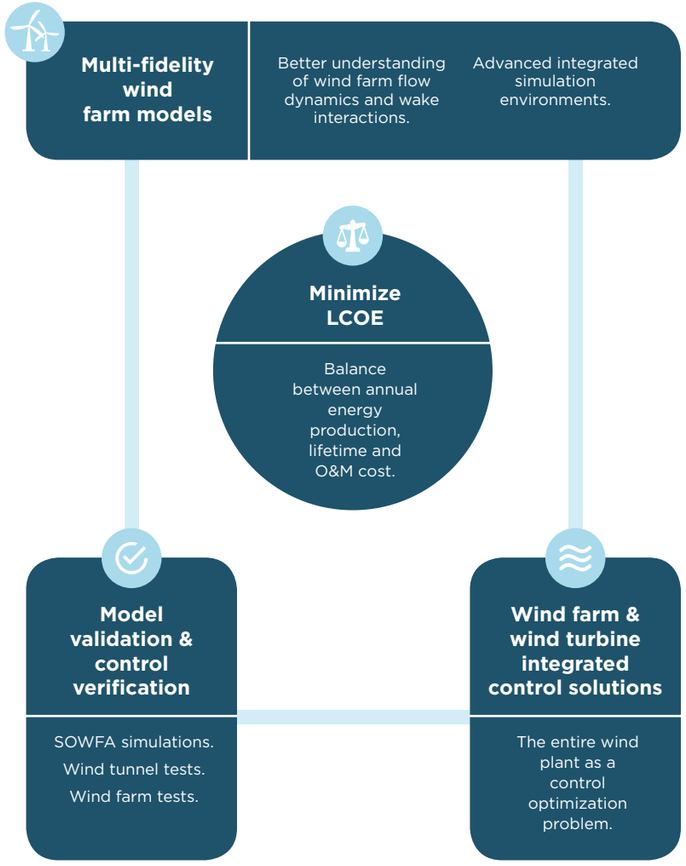
To ensure the full exploitation of the innovations and scientific results will be carried out with the active involvement of the engineering partners and the industrial companies.

6. Management.

7. Ethics requirements.

To comply with applicable ethics requirements.

SYSTEMS ENGINEERING RATIONALE



EXPECTED IMPACTS

ENVIRONMENTAL

The new business opportunity will encourage both offshore and onshore installations setting them in a more competitive position with respect to other energy generation sources, greening even more the European energy mix. This will contribute to solving the global climate and energy challenges by saving CO2 emissions.

SOCIAL

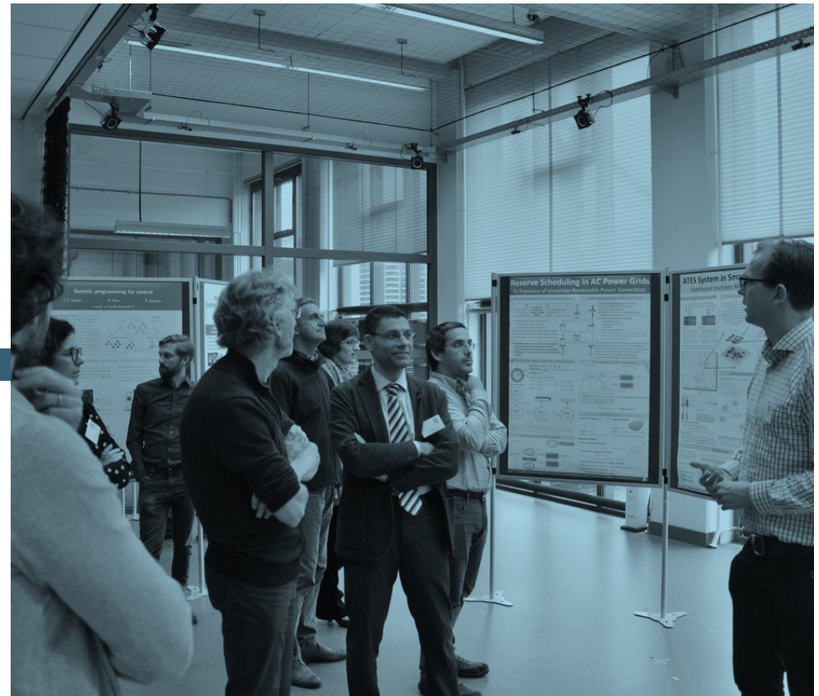
The development and industrial application of the new technology will strengthen the European industrial technology base and will promote new investment and business activities. This will mainly impact in the opportunities for skilled European workers by increasing the demand of high-quality jobs.

TECHNICAL & TECHNOLOGICAL

The novel control methodologies applied to existing or new wind farms will derive in reducing the technological risks and increasing significantly technology performance by load mitigation, fault tolerance improvement and energy capture. This will contribute to the development and strengthening of the European wind technology base and the industrial capacity of wind farm operators.

ECONOMIC

CL-Windcon results will increase the reliability and lifetime while decreasing operation maintenance cost and life-cycle environmental impact with material cost savings and O&M reduction. This will represent a real opportunity to boost wind technology markets, providing additional energy capture for new and existing wind power plants and reducing the total LCoE.



PARTNERS

A well-balanced consortium made up by **15 partners from 6 countries** (Germany, Italy, Denmark, the Netherlands, UK and Spain) participate in **CL-Windcon**. Academia, research centres and industrial partners work together in this project **covering all the stakeholders in the wind energy field** (from academia to end users).

COORDINATOR

CENER (National Renewable Energy Centre of Spain)

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SOCIAL MEDIA

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