TWINVEST

Digital Twin for Forecasting of Power Production to Wind Energy Demand

Funded by the European Union

Brussels, December 2024

NEW EU-FUNDED PROJECT PAVES THE WAY FOR A UNIVERSAL, OPEN-SOURCE, AND CYBERSECURE DIGITAL TWIN FOR ONSHORE WIND

A new Horizon Europe (HEU) project has been launched to develop a universal, open-source, and cybersecure Digital Twin to provide investors in onshore wind farms with valuable insights into both current performance and future investment potential. The project, titled TWINVEST, has received funding from the European Climate, Infrastructure, and Environment Executive Agency (CINEA).

The TWINVEST project – short for *Universal, open-source, and cybersecure Digital **T**win to provide **invest**ors in onshore wind farms valuable insights about current operations and future investments* – was officially launched on 4 September 2024 at AVESTA facilities located in Ninove (Belgium). The project has been granted €5.3 million from the European Union's Horizon Europe research and innovation programme to contribute to Europe's leadership in the wind energy sector and enhance energy independence.

Power generation has historically relied on fossil fuel plants that can adjust output to meet demand. In contrast, renewable energy sources, such as wind power, are weather-dependent and can fluctuate significantly. To manage these fluctuations, operators must implement effective grid management strategies to prevent underloading or overloading the grid according to the transmission system operator's requirements. Ancillary services and energy storage systems play a crucial role in stabilising the grid in response to the variability of wind power generation to provide a consistent and predictable energy supply. They also enable wind farms to optimise operations by storing excess energy during periods of oversupply. To enhance the profitability and reliability of renewable energy projects, investors should focus on funding technologies and infrastructure, such as storage, advanced forecasting tools, and grid-friendly systems, that support operators and enhance the integration of renewable energy.

TWINVEST will address all these challenges in developing the foundations for a universal open-source and cybersecure Digital Twin that will represent the main trustable and collaborative environment for different stakeholders in the onshore wind energy sector, including wind farm owners, operators, investors, technology developers, and policymakers. This innovative tool will provide users with insights that help optimize operations, reduce risks, and make informed decisions about wind farm design, investment opportunities, operational efficiency, and long-term sustainability in the onshore wind energy sector.

The project aims to establish a new digital tool that operates as a cloud service, utilizing a web-based interface to deliver all services and functionality. Thus, TWINVEST will also design and implement protocols for cyber security to safeguard critical systems and data from malicious attacks, protect

Funded by the European Union

Funded by the European Union under Grant Agreement No 101146936. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them.

privacy, and maintain the integrity and reliability of digital infrastructure and operations. In this context, the project is primarily focused on the following objectives:

1. Develop an Investment Framework Platform to model and forecast conditions across different European regions, helping guide decisions on future onshore wind farm investments in key markets.
2. Develop a Component for the Farm Platform to model wind farm energy production and provide an upfront investment costs forecast from design to operation.
3. Develop an Environment and Earth Platform to leverage hybrid AI algorithms to precisely forecast wind farm energy production by integrating weather and spatial modelling, optimising site selection and farm sizing across Europe.
4. Develop a Maintenance and Risk platform by utilising AI-driven diagnostics to analyse large datasets from the monitoring and control system, optimising energy production, guiding predictive maintenance, and minimising downtime and operational costs, reducing the Levelised Cost of Energy (LCOE).
5. Validation and optimisation of the digital twin's output on physical and virtual use cases to effectively assess the capability of the digital twin to provide useful information and ease the investment decision.
6. Digital twin exploitation roadmap beyond the lifetime of the project.
7. and effective communicating and disseminating toward industrial and scientific communities.

Founded on an interdisciplinary approach, the TWINVEST consortium included research organisations and universities, industrial partners, and consultancy companies. The project will run for the next four years, under the coordination of Reliability and Safety Technical Center (RSTER).

Coordination team: RSTER

Foad Gandoman: foad.gandoman@rster-link.com

Vijay Nagulapati: vijay.nagulapati@rster-link.com

Follow the project on social media

Funded by the European Union

Funded by the European Union under Grant Agreement No 101146936. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them.