LEANWIND Project - Publishable Summary

Summary description of project context and objectives

LEANWIND was awarded to a consortium of 31 partners (52% from industry) from 11 countries and is led by University College Cork, Ireland. The diverse team brings together experts from multiple sectors including oil and gas, maritime, shipping and offshore wind industries with representatives across the supply chain including developers, utilities, turbine suppliers, vessel owners, shipbuilding, classification societies, academics, and other industry representatives. The project received funding of almost €10million from the European Commission and has a total value of €14.9million. LEANWIND commenced in December 2013 and runs for 4 years.

Project context:

In 2009, the European Wind Initiative (EWI) set an objective to make wind a competitive source of electricity (offshore wind by 2030), achieving a 20% reduction of wind energy electricity production costs, and increase jobs in the wind energy sector.[1][2] Tapping into the vast potential of offshore wind, it is estimated that installed capacity will increase from 8GW in 2014[3] to 23.5GW by 2020.[4] As well as an anticipated increase in the size of turbines beyond 10MW, wind farms will move further offshore into deeper waters with more extreme conditions but better wind resources. For such wind farms to be viable, significant cost reductions need to be achieved. Therefore, the industry must determine where improved efficiency and cost savings can be found across the wind farm supply chain and life-cycle in the short to long term.

In the development of offshore wind farms there are many technical obstacles to overcome, a number of which relate to the transport of components or personnel for installation and maintenance operations. Since downtime and delays due to poor planning, inefficient operations or vessels not fit for purpose are extremely costly, it is critical that the logistical processes are streamlined and technology improvements are made to optimise both installation and Operations and Maintenance (O&M). This not only relates to vessels, but also making substructures and other components easier to transport, install and maintain. Since the offshore wind industry is still relatively young there is still significant scope for cost savings in these areas.

Main objectives:

LEANWIND bridges two themes addressing key targets of both the European Wind and Transport Technology Platforms, with a focus on reducing the cost of offshore wind. The project aims to contribute by seeking efficiencies across the wind farm life-cycle. Innovative logistics including transport and erection techniques are key research objectives identified by the EWI to achieve wind energy targets.[5] Therefore, the project will particularly address industry transport, logistics and equipment needs in the short and medium term.

Core technical work examines practical ways of improving and developing technologies and strategies to optimise the deployment, maintenance and decommissioning of large-scale wind

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[1] European Commission, "Investing in the Development of Low Carbon Technologies (SET-Plan)," Brussels, 7 October 2009, COM(2009) 519 final, p. 5.
[2]TPWind Secretariat , "Wind European Industrial Initiative Team 2010-2012 Implementation Plan", May 2010, p. 3 and "Wind European Industrial Initiative Team 2013-2015 Implementation Plan", February 2013, v. 3, p. 5.
[3] EWEA, "Wind in Power – 2014 European Statistics," February 2015, p. 3.
[4] EWEA, "Wind Energy Scenarios for 2020," July 2014, p. 4.
[5]TPWindSecretariat , "Wind European Industrial Initiative Team 2010-2012 Implementation Plan", May 2010, p. 6 and "Wind European Industrial Initiative Team 2013-2015 Implementation Plan", February 2013, v. 3.

turbines. LEANWIND will specifically consider large scale wind turbines (5 and 8MW) using both fixed and floating substructures to include long term wind farm prospects. The transport, logistical and maintenance challenges associated with these structures will be addressed by developing novel approaches to vessel design, vessel management, sub-structure alterations and O&M strategies and streamlining logistics across each project stage in order to reduce both capital (CAPEX) and operational (OPEX) costs. Project innovations will be rigorously tested and validated where possible using real life projects and case studies from industrial and research partners. Details of the integrated and validated innovations will populate and inform full life cycle logistics and economics models. These are then combined to evaluate the viability and cost benefits of project results and applicability to industry to facilitate market uptake of innovations and thereby increase the competitiveness of the sector.

Description of the work performed and main results

LEANWIND has completed 36 of the 48 month programme. The main results achieved so far are:

Keystone reports defining the main challenges for the offshore wind industry.

Construction, Deployment and Decommissioning

- Generic 8MW turbine design developed to facilitate vessel and substructure design.
- Novel adaptations for fixed and floating substructures to improve installation efficiency and reduce costs.
- Novel deployment and assembly strategies.
- Tank testing of the floating substructure concept.

Novel Vessels and Equipment

- Installation and service vessel design requirements to optimise operational capabilities and performance.
- Preliminary design specifications of three installation vessels and one O&M vessel (including lifting equipment) near completion. One installation and O&M vessel selected to be taken to next design level and validation.
- Development of simulator based tools supporting concept design feasibility studies; the development of operational procedures and training of crews and operators.

Operation and Maintenance Strategies

- A remote presence prototype to monitor turbine condition to reduce the need for offshore maintenance work and improve O&M strategy and planning.
- A planning tool to optimise O&M strategies for near and far-shore offshore wind farms. A dynamic scheduling tool is currently under development to consider the benefits on O&M operations.
- Identification of wind turbine critical components based on RAMS methodologies. Failure/degradation models under development for a selection of components to be considered in the O&M strategy model.
- Development of an online system for condition monitoring and diagnosis/prognosis of faults in offshore wind turbines.

Integrated Logistics

- Reports describing the important characteristics of the offshore wind transportation and logistics system, defining a basis for the development of logistics decision support tools.

- A Geographic Information System (GIS) providing a comprehensive database of manufacturing facilities, transportation links and port locations across Europe.
- Nine inter-connected optimisation models for all life cycle phases and supply chain legs resulting in a holistic set of decision support tools applicable to port logistics, offshore and on-land transportation for the offshore wind industry.

System Integration

- Two successful integration workshops held to faciliate interactions between project partners and the integration of results, an essential aspect of this project.
- Initial and intermediate assessment conducted of expected project innovations and their integration requirements as well as recommendations for how they can be integrated.
- Assessment of H&S risks and required personnel skills for offshore activities almost complete.

Testing and validation of tools and technologies

- Case-study scenarios established to validate the cost-benefit and optimal integration of project innovations.
- Testing of the remote presence prototype.
- Installation of sensors on the structure of a Gravity Base Foundation (GBF) to measure the loading and wave profile used to inform the design process and installation methodology.
- Planned validation activities for highwind blade installation system based on real testing and simulation. Scheduled for 2017.

Economic and Market Assessment

- Analysis of current offshore wind supply chain management strategies and the methods in which risk is shared. Recommendations for innovative business models to cope with increasing complexity of current and future projects.
- Holistic financial model considering business models and risk; CAPEX and installation; OPEX; decommissioning; and life-cycle assessment. Currently being validated and will be used in combination with the logistics optimisation models to evaluate project innovations within a selection of case-studies and provide recommendations to define a roadmap for offshore wind industry.

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Expected final results and potential impact and use

In general terms, it is expected that LEANWIND will:

Support offshore wind take-off in the medium term. LEANWIND is committed to developing innovative techniques and technologies tailored to match the supply chain and practical constraint issues that are, and will be, industry reality in the near future.

Support the development of new niche markets for EU shipping and shipbuilding industries thereby contributing to the competitiveness of the sector and to the creation of new jobs. LEANWIND will support sustained growth of the offshore wind sector in the immediate future by accelerating the route to market of new innovative tools and technologies that address industry challenges. The project will also contribute to EU competitiveness in the niche market of specialised offshore wind installation and servicing vessels, delivering technological developments to meet industry needs.

Specific expected results and their impact include:

- Novel adaptations for fixed and floating substructures and a substructure selection tool to minimise costs and installation time.
- Streamlining the deployment and installation of large-scale turbines and both fixed and floating substructures with improved installation processes e.g. optimising vessel deck usage and developing efficient processes for turbine erection and technology that facilitates quicker and/or safer loading, transport or ballasting operations for substructures.
- A GIS transport model and a decision-making model for port layout/configuration to improve planning of on-land logistics.
- A full supply chain logistics model to increase efficiency and reduce bottlenecks with individual modules applicable to port logistics, transport, vessel chartering etc.
- Holistic financial model considering CAPEX and installation, business models and risk, OPEX, decommissioning and life-cycle assessment.
- Recommendations for optimised O&M strategies for representative existing and planned farms to help reduce costs and improve efficiency.
- A remote presence device and condition monitoring software to reduce the need for human intervention and maintenance costs.
- Helping meet the increased demand for purpose-built installation and servicing vessels with design innovations.
- Tank and field testing activities to validate and assess the benefits of selected project innovations and procedures e.g. remote presence device, gravity based substructure, floating substructure and offshore operations.
- Vessel simulation technologies to assess novel design concepts and replicate deployment and O&M activities, mitigating the risks associated with new strategies.
- Identifying industry specific safety and training procedures for installation and O&M.
- Assessing business models at European level for large offshore systems to encourage existing and new sources of investment.
- Evaluating the benefits of optimised procedures and technical solutions with a combined financial and logistics offshore wind farm model, resulting in recommendations for wind farm development.
- Assessing the positive and adverse impacts that the project innovations could bring to local environment and communities from an environmental, societal and economic perspectives.

Project public website address: www.leanwind.eu

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LEANWIND Project Consortium

Coordinator

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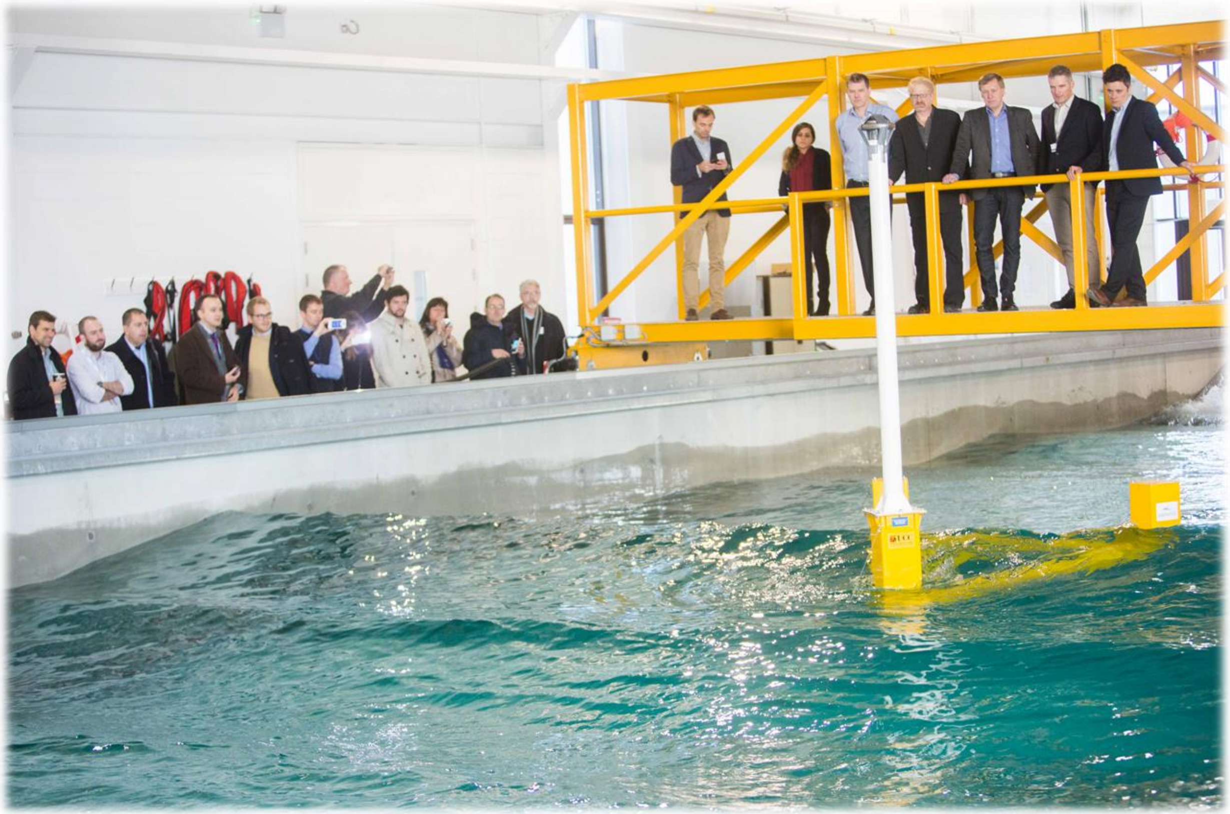
Contact: leanwind@ucc.ie or visit our website www.leanwind.eu for more information on the project and partners, to see public deliverables, for more and upcoming events, and to sign up for our electronic newsletter.

Stakeholders Showcase event, 8 September 2016, Ostende

Credits: REBO

Dedicated Project event, 28 September 2016, WindEurope Summit 2016, Hamburg

Credits: WindEurope



Floating wind energy platform being tested at LIR national ocean test facility [Watch the video!]

Credits: UCC

LEANWIND Annual General Assembly, 29-30 November 2016, MaREI centre and NMCI, Cork, Ireland

Credits: UCC

ACCIONA / PLOCAN Gravity Based Structure
Credit: PLOCAN

Remote presence solution developed by NA.AS
Credit: NA.AS