Technology Strategy Board
Driving Innovation

Results of competition:
Infrastructure for offshore renewables - Collaborative R&D

Total available funding for this competition was £7.5m from the Engineering and Physical Sciences Research Council and the Technology Strategy Board.

Note: These proposals have succeeded in the assessment stage of this competition. All are subject to grant offer and conditions being met.

Participant organisation names	Project title	Proposed project costs	Proposed project grant
AWS Ocean Energy Limited (lead) Teqniqa Systems Ltd University of Exeter	Development and Demonstration of an intelligent active mooring load-management system (IAMS)	£692,828	£450,916
Project description - provided by applicants			
This project will develop and test a mooring component for floating wind, wave and tidal energy installations - the intelligent active mooring system (IAMS). The system will reduce the cost of anchors, mooring components and the moored structure to reduce the overall cost of energy produced from marine renewables, whilst also reducing mooring footprints and providing some element of energy recovery from structure motions. The key project objectives include fatigue testing of the active mooring component, development of the intelligent control system and prototype testing. The final deliverable will be an investor-ready technology development proposition supported by a detailed technology report, prototype basis of design a costed development plan and a commercial business case analysis.			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Babcock Marine (Rosyth) Limited (lead) Iberdrola Engineering and Construction UK Limited Ore Catapult Glasgow Limited Scottish Power Renewables (UK) Limited University of Strathclyde	Reducing the Cost of HVDC Offshore Platforms	£1,553,916	£712,396

Project description - provided by applicants

This project seeks to identify and validate concepts that deliver significant savings against the structural, ancillary and installation components of offshore HVDC platforms.

The project will engage with upstream and downstream stakeholders to establish and prioritise potential areas of improvement for cost reduction and develop innovative strategies to deliver savings. The methodology will seek to identify several concepts and develop the best ones to validate the potential savings and demonstrate technical feasibility. The final concept(s) will be hydro-dynamically tested to ensure that the proposed solution has suitable hydrodynamic performance.

The project will build on knowledge of existing HVDC platform projects in non-UK waters. The concept will be based on the generic requirements imposed by the electrical plant associated with HVDC rather than be fixed to a single supplier.

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Iberdrola Engineering and Construction UK Limited (lead) Ore Catapult Glasgow Limited University of Strathclyde	TLPWIND UK: "Driving the cost down of offshore wind in UK Waters"	£894,658	£580,787
Project description - provided by applicants			
The UK is currently leading the offshore wind (OW) market worldwide. There is a clear need for developing new technologies that will help cut our electricity bills whilst building a UK manufacturing industry. Iberdrola has been developing an innovative floating foundation concept, TLPWIND, during the last four years to help reduce the costs of electricity from OW. The floating foundation will be moored to the seabed using a tensioned cable system that will restrict its motion almost entirely. Its main dimensions and steel weight have been carefully optimised and its fabrication costs minimised. The TLPWIND concept enables more efficient and reduced cost transportation and installation ("T&I") with the wind turbine being assembled onshore, in a controlled environment. This heavily reduces offshore operations and the use of expensive heavy installation vessels, and thus T&I costs. This approach is intended to de-risk offshore wind projects, particularly in the view of Insurers and Financiers, and consequently increase investor confidence and commitment to OW projects. This project aims to adapt this semi-mature concept to UK site conditions (50-60m plus) and help reduce overall LCOE.			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Plant Integrity Limited (lead) Greater Gabbard Offshore Wind Limited PDL Solutions (Europe) Limited Sonomatic Limited	Development of a new integrated approach for Structural health monitoring and lifecycle management of offshore wind turbine foundations and transition pieces. (Acronym: Pile-Monitor)	£1,450,548	£786,933

Project description - provided by applicants

The aim of this project is to develop, and to demonstrate, a novel real-time monitoring system to detect in-service degradation in offshore wind turbine support structures using ultrasonic guided waves.

This system uses active sonic/ultrasonic waves to cover the whole volume of concern to detect fatigue cracking at welds, and possibly at other locations, in the pile and transition piece. Fatigue performance of current structures is estimated by extrapolation from potentially unrepresentative data, so the possibility exists of cracking before the end of the design life. There may be over 1km of weld in the entire structure and potential sites of cracking may not be easily predicted, so that any monitoring system must be capable of crack detection over a large volume of material.

The method will allow cracks to be detected across a large volume of material and is expected to save considerable costs of local examination of welds, especially when these are underwater and/or around the mud line. The project will develop designs of sensors, monitoring procedures and electronics and will be demonstrated on a structure offshore.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Scottish Power Renewables (UK) Limited (lead) Geotechnical Consulting Group Limited Imperial College London	Rationalising offshore wind-turbine pile design and assurance in difficult ground	£1,226,415	£487,965

Project description - provided by applicants

Nearly all offshore wind turbine foundations, whether monopile, tripod, jacket or floating wind turbines rely on strong piled foundations. However, difficult ground conditions are often encountered at North Sea and Baltic sites that make it hard to design foundations that are both effective and economic. Foundations can consume 25 to 30% of project costs and uncertainty over piled foundations can restrict or block the development of offshore renewable energy.

A Consortium representing a major developer, Scottish Power Renewables, a leading University, Imperial College London, and a small firm of specialist geotechnical engineers (GCG, London) is working to drive costs down across the Industry, especially in Chalk-dominated, but otherwise promising, development areas.

The key steps being taken are:

(i) developing novel offshore test procedures that can be applied in all uncertain ground conditions,
(ii) conducting a unique set of field tests in Chalk, drawing on recent advances made by the research and development team and
(iii) synthesis with all available data to develop new more reliable design procedures. The work will cut the costs and risks faced by many major future projects.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
SgurrEnergy Limited (lead) Fraunhofer UK Research Limited Thales UK Limited Wind Farm Analytics	Steered LIDAR Resource Performance and Condition Monitoring For Optimising Offshore Wind Infrastructure	£1,926,546	£1,277,898
Project description - provided by applicants			
This project seeks to take a new LIDAR system from construction of field demonstrator through to installation on wind farm and environmental test for marine ruggedisation. The programmable scanning LIDAR under development will bring a step change in LIDAR measurement capability and enable wind farm operators to really know the wind profile that is hitting their turbine, rather than being kept ignorant by unrepresentative hub height measurements. A number of innovative steps will be employed in order to improve accuracy and capability. This will enable the total farm output to be forecast from seconds to minutes ahead, thus enabling truly flexible grid resource planning. The system will also offer savings by reducing infrastructure failure rates. This will be achieved by augmenting condition monitoring systems with detailed mapping of the incident wind vector field. As an added bonus the system will highlight yaw misalignment. The system will assist wind turbine parameter tuning so that wind turbine may be set up like a race car for the relevant operating conditions.			

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Sustainable Marine Energy Limited (lead) PE Composites Ltd	PLAT-0 2 - Proving a Low Cost, Composite, Buoyant, Mid-Stream Tidal Turbine Platform at Full-Scale	£1,971,962	£1,183,177
Project description - provided by applicants			
Successfully development and proving of the composite PLAT-O buoyant tidal turbine platform in this project will lead the way towards a 50% reduction in capex for deployment costs in tidal stream projects and bring levelised cost of energy down towards a commercial £169/MWh – a fourfold reduction on current figures within 3 years. Typically sea floor mounted with expensive piled or gravity bases tidal turbines are hard to maintain and use expensive vessels with small operational windows for maintenance. PLAT-O is an innovative mid-water, not surface floating, platform for tidal turbines has low cost anchoring technology deployed by small vessels. On-board winches pull the device to the required depth and turbines placed in the most effective part of the tidal stream. Project proves a 100kW scale steel PLAT-O structure with on-board power conditioning electronics and novel rock anchor technology before developing a composite PLAT-O #2 structure for a 200kW demonstration. Proves the use of composite structures to reduce loadings and improve life and the complex mooring system and tethering loads. Partners: Sustainable Marine Energy Ltd and P E Composites Ltd.			

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Tata Steel UK Limited (lead) JR Dynamics Limited National Renewable Energy Centre Limited OGN North Sea Limited	Offshore Foundation Condition Monitoring Systems (OFCMS)	£1,209,780	£808,717
Project description - provided by applicants			
The project aims to reduce the cost of offshore foundation structures in terms of both the initial capital cost of design and also by developing methods for ongoing improved preventative maintenance. The work will be carried out by a consortium of 4 partners, Tata Steel UK Ltd, Offshore Group Newcastle (OGN), JR Dynamics and The National Renewable Energy Centre (Narec). The initial capital cost aspect will be addressed through the development and validation of a structural model which will define structural loadings, fatigue aspects, defect tolerance and hence materials requirements based on a simulation of the true dynamic forces on that structure associated with real operating conditions. Condition monitoring will be used to gather information in order to validate this model and this aspect will drive the development and demonstration of a novel condition monitoring system with future application to this sector that has in its own right the potential to significantly improve the maintenance programmes and reduce OPEX costs associated with this type of infrastructure.			

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Zagres Limited (lead) University of Cambridge	Design, build and testing of a 50 kVA SiC BJT inverter as a building block for high-power HVDC inverters	£786,241	£345,320
Project description - provided by applicants			
This project is a collaboration between Zagres Limited and Cambridge University Engineering Department (CUED) and aims to study, prove and quantify the performance and economics of a newly developed Silicon Carbide Bipolar Junction Transistor (SiC BJT) technology through building and testing a prototype 50 kVA SiC BJT inverter as a building block for High Voltage Direct Current (HVDC) transmission applications. The SiC BJT power module technology has voltage, frequency and thermal ratings substantially greater than existing Si-based modules, which can significantly reduce size and enhance reliability and efficiency of power electronics inverters. These benefits will contribute to reducing the cost of energy for offshore renewables.			