Results of Competition: Bilateral UK and US Offshore Wind R&D: Phase 3: Full Stage

Competition Code: 2009_UKUSBILATERAL

Total available funding is £5,000,000

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
RINA CONSULTING LTD	Floating wind innovative assembly: design and cost estimate for US coasts	£283,408	£141,704
OCEAN FLOW ENERGY LTD		£202,512	£141,758

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
A strong cooperation between **two UK-based partners and three US-based partners** built this **UK-US project for offshore wind at deep-water locations off the east and west coast of the United States**. The feasibility study aims of validating an innovative construction and deployment solution, using the **Starfloat floating wind foundation from Oceanflow and mooring/anchoring solution from RINA, Triton and UMass**, that can enable construction at many coastal industrial sites and achieve deployment **without the need to involve costly and non-Jones Act offshore construction vessels**. Starfloat is constructed using an Assembly and Deployment Barge (ADB), which has great potential to address the above requirements. Floating platforms can only be deployed if a technically viable and economically attractive anchoring solution is available, the investigation of which is also a key element of the feasibility study. Starfloat platform's design allows a **procurement strategy that competitively interacts with numerous fabricators and it is capable of being deployed by commercial harbours in the USA and UK. This reduces CAPEX and avoids the need for specialist construction vessels, with positive impact on LCOE**. There's a direct impact on the local manufacturing industry, as platforms can be constructed and assembled in the US and UK. This strategy can bolster the energy economy by exploiting knowledge of the offshore O&G industry and stimulate its transfer and job creation.

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition’s results

Results of Competition: Bilateral UK and US Offshore Wind R&D: Phase 3: Full Stage

Competition Code: 2009_UKUSBILATERAL

Total available funding is £5,000,000

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
GARRAD HASSAN & PARTNERS LIMITED	Use of Wind Farm Control on floating platforms for the U.S. offshore wind market.	£105,151	£52,576
Durham University		£121,110	£121,110
OCEAN FLOW ENERGY LTD		£187,518	£131,263

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition’s results

Project description - provided by applicants
Wind energy is expected to be a major contributor to the global energy supply in the coming decades, and in many areas it is already the cheapest form of electricity generation available. Offshore wind energy is now playing a significant and rapidly increasing role in areas with suitable shallow seas. A further step to floating offshore wind turbines, which are just beginning to be installed commercially, could massively increase the potential offshore wind resource by allowing deeper sea areas to be used. Research over many years has led to the very large, efficient and cost-effective wind turbine designs seen in today's wind farms. Much recent research has focussed on more efficient and cost-effective installation and operation of wind farms. There is serious interest in novel wind farm control strategies which can improve the operation of the wind farm as a whole, rather than just controlling each wind turbine as if it was operating in isolation from its neighbours. One strategy for example, known as 'wake steering', attempts to deflect each turbine's wake away from downstream turbines, allowing increased overall power production, and longer lifetime through reduced fatigue damage. This study will focus on the use of wake steering in a floating offshore wind farm context. More research is required to get a deeper understanding of the wake effects, particularly in wind conditions typical of offshore environments, so that the most effective control strategies can be devised. _DNV GL, Durham University_ and _Ocean Flow Energy_ have partnered to apply to this R&D programme in order to investigate the feasibility of this innovative control technology on floating-offshore wind farms. The main objectives of this research proposal include: * increasing confidence in the use of wake steering, * identifying technical challenges and advantages of using wake steering on floating offshore wind farms, * analysing the effects of the use of wake steering using the Starfloat floating platform design as a benchmark, * analysing the effects of the application of wake steering on the economic performance of a floating offshore wind farm. This research will be carried out in cooperation with a US consortium, led by NREL, which has been formed to investigate similar control strategies for fixed offshore wind farms. Sharing of expertise and wind farm data will lead to improved wake modelling techniques which will help bring the technical and economic benefits of wake steering to the growing US and UK offshore wind farm markets.

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition’s results

Results of Competition: Bilateral UK and US Offshore Wind R&D: Phase 3: Full Stage

Competition Code: 2009_UKUSBILATERAL

Total available funding is £5,000,000

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
INTELLIGENT MOORINGS LIMITED	Quarter Scale Testing of the Intelligent Mooring System for Floating Offshore Wind Platforms	£366,827	£256,779
University of Exeter		£153,156	£153,156

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
The Intelligent Moorings project **"**Quarter Scale Testing of the Intelligent Mooring System for Floating Offshore Wind Platforms" is a joint UK and US collaborative project comprising Intelligent Moorings, the University of Exeter, PCCI, Inc, and Ocergy Inc together with a range of further support from the ORE Catapult, the US Navy and NREL. Intelligent Moorings is developing the IMS load reduction mooring systems based on pressurised rope technology, the University of Exeter provide modelling and the Dynamic Marine Component Test Facility (DMaC), PCCI are bespoke moorings specialists managing the sea trial deployment, Ocergy will provide platform interface support and end user feedback, the US Navy provide the WETS test facility, the ORE Catapult LCOE studies, NREL data acquisition and ABS Product Design Assessment and Certification support. The project undertakes coupled modelling, interfaces with platform design requirements and scales up an existing IMS design to meet quarter scale loads for the NREL 15MW reference turbine. It designs and builds an IMS system for deployment and test at the US Navy WETS test site to prove the operational performance of the IMS system can deliver significant LCOE reductions. Mooring systems are critical sub-systems for floating installations, warranting safe station keeping and hydrodynamic stability. The moorings must withstand ultimate load conditions, as well as cyclic fatigue loading. Floating installations in water depths exceeding 50m will be required to access much of the global offshore wind resource. Conventional mooring designs rely on adaptations from the oil and gas sector that can meet the required integrity and safety margins but lead to CAPEX intensive designs. The capital cost of moorings is driven by extreme (peak load) conditions, whilst revenue is generated under normal operating conditions. If peak loads can be mitigated, the cost of mooring systems and associated structural elements, as well as deployment and installation costs, can be significantly reduced. The IMS provides innovative non-linear responses based on hydraulic load damping mechanisms. It includes a water-filled bladder housed in a braided rope and connected to an accumulator, functioning like a shock absorber. Increased mooring loads result in the pressurised rope extending and reducing the volume of the internal bladder. Active control of the pressure provides intelligent stiffness variations that can be tuned to reduce peak loads and control platform dynamics.

Innovate UK

Results of Competition: Bilateral UK and US Offshore Wind R&D: Phase 3: Full Stage

Competition Code: 2009_UKUSBILATERAL

Total available funding is £5,000,000

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
JR DYNAMICS LIMITED	Wind turbine sensor placement optimisation for digital twin development (OSP)	£300,567	£210,397
OFFSHORE RENEWABLE ENERGY CATAPULT		£166,524	£166,524
UNASYS LIMITED		£91,600	£64,120

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition's results

Project description - provided by applicants
This project will focus on developing a state-of-the-art, holistic monitoring system that can collect, analyse, and interpret all component level data acquired from an offshore wind farm and make Operations & Maintenance (O&M) decisions remotely. Advanced machine learning algorithms will be developed to improve the information that can be acquired using SCADA data. This will inform where SCADA can be used in place of more expensive instrumentation, and where it is critical to deploy sensors in order to develop a more informative predictive condition monitoring system. A digital twin combining physics based model analysis and post-processing of acquired data will be developed. This will facilitate better O&M planning leading to more efficient maintenance processes, reduced O&M costs and a reduced need for technicians going offshore, thus maximising the availability of OWTs and ultimately reducing the levelized cost of energy. The project brings together JR Dynamics Ltd (trading as Transmission Dynamics - TD), an award-winning engineering company with over 20 years' experience of designing and manufacturing bespoke monitoring systems to measure critical parameters in challenging environments, with Unasys Limited (UNASYS), experts at developing digital models, and the Offshore Renewable Energy Catapult (OREC), the UK's flagship innovation and research centre for offshore renewables. The consortium features key elements of the supply chain required to deliver the project, as well as the capacity to exploit in adjacent sectors. The consortium will work in collaboration with a team in the U.S., led by Tufts University, who have an approved project titled "Optimal Sensor Placement for Physics-Based Digital Twins" commencing in January 2021\. Their focus will be to develop a new SPDT Bayesian Assimilation Framework (BAF) for load inference (LI), model uncertainty (MU), foundation nonlinearities (FN), and optimal sensor placement (OSP) for structural fatigue monitoring. The two consortia will exchange SCADA data for model validation and will work together to develop a roadmap for integrating and commercialising their technologies to develop a world leading solution for global exploitation. This project is the first of it's kind bilateral collaboration between the two countries, striving to pave the way for stronger future collaboration.

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition’s results

Results of Competition: Bilateral UK and US Offshore Wind R&D: Phase 3: Full Stage

Competition Code: 2009_UKUSBILATERAL

Total available funding is £5,000,000

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
CPDSYS LIMITED	Stinger Keel Floating Wind Foundation Structure Development	£103,143	£72,200
EXCEEDENCE UK LIMITED		£67,662	£47,363
GMC LIMITED		£58,599	£41,019
HR WALLINGFORD LIMITED		£104,846	£62,908
SCDX LIMITED		£30,422	£21,295
TADEK LIMITED		£53,385	£37,370
TUGDOCK LIMITED		£36,266	£25,386
University of Strathclyde		£109,793	£109,793

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition’s results

Project description - provided by applicants
In 2009, wind turbines supplied 2% of the UK's electrical demand \[2\]. By 2019, this has risen to 20% \[1\]. A 10-fold increase in ten years. Impressive. More impressively, the UK government plan to quadruple offshore wind capacity over the next ten years. A total of 40GW offshore wind generating capacity by 2030 of which 1 GW is targeted to be floating offshore wind. That is, wind turbines mounted on a floating foundations, not fixed to the seabed as currently deployed. Floating wind is the next frontier of offshore wind power generation. By 2040, FESL expect floating wind to be a central technology for global energy generation. Fixed seabed wind turbines are feasible up to 60m water depth which has been the main technical driver for the explosion of developments around England's coast, But beyond England's shallow continental shelf lie much larger acreages of sea with more powerful and sustained wind flows than near the coast. Be it Scotland, Norway, the US Pacific Coast, Japan or any country with limited continental shelf but an energy hungry population, the deployment of floating windfarms would allow these regions to share in the clean power revolution that is offshore wind. This presents great opportunities for the UK economy and workforce: with a unique combination of experience in developing North Sea deep water oil and gas reserves and more recently windfarms closer to shore, the UK has the potential to be a leading developer and exporter of floating wind technology to the world. Floating Energy Systems Ltd shares in this skills combination and is working in the UK to be part of this global market. FESL have studied the evolution of floating foundation concepts and patented a unique hybrid design, the Stinger Keel. This combines the convenience of construction and the stability in deep water operations of established concepts. With InnovateUK funding support, FESL propose a thorough dynamic motion assessment of the Stinger Keel concept with its UK marine engineering partners through computer and wave tank simulations. The objective is to deliver fully detailed construction plans from which UK and overseas fabricators can start to plan and cost delivery of multiple floating wind platforms for the UK's and the world's floating windfarm market. All made possible with UK IP, engineering prowess and financial support. \[1\] BEIS Digest of UK Energy Statistics 2020\. \[2\] DECC Historical Electricity data (2013). \[3\] Queen's Speech December 2019\.

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition’s results

Results of Competition: Bilateral UK and US Offshore Wind R&D: Phase 3: Full Stage

Competition Code: 2009_UKUSBILATERAL

Total available funding is £5,000,000

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
FLICQ UK LTD	Offshore Component Condition Monitoring via Machine Learning Enabled Smart Sensors and Low-bandwidth Data Transmission	£128,286	£89,800
OFFSHORE RENEWABLE ENERGY CATAPULT		£54,007	£54,007

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition’s results

Project description - provided by applicants
Operations and Maintenance in Offshore Wind is based currently on old models generated in the maritime sector, where routine, scheduled maintenance is carried out periodically. Industry insight has indicated a strong desire to transition to a predictive maintenance framework, based on accurate condition monitoring of individual components within an offshore wind asset. A key reason for this need is the prohibitive cost that offshore maintenance commands. Currently 20-30% of the overall expenditure for an offshore wind farm is based on Operations and Maintenance, and as the number of offshore wind farms increases and becomes even more remote, the resources (human expertise, CTV's and SOV's) will become more limited, and costs could therefore increase further. The current state of the art in the field offer sensors for monitoring aspects of mechanical systems such as vibration and acoustic emissions. A key challenge in this area is the communication required for transfer of data back to the control centre. FLICQ have developed Smart Sensor technology based on Industrial Internet of Things technology that not only collects data from the assets, but can also process and analyse sensor data to extract the meaningful information and minimise the amount of data required to be transferred back onshore to the cloud or to legacy systems. To carry out this data analysis, the FLICQ technology uses machine learning algorithms to pre-process this data for transmission. By accurately modelling how asset condition is changing, predictive models can be used to plan the best intervention time based on risk, anticipated downtime, and projected revenue loss. This project aims to demonstrate the potential of FLICQ smart systems to support the development of predictive maintenance strategies in the offshore wind sector through a practical application and product development at Levenmouth offshore demonstration turbine, owned by ORE Catapult. While FLICQ sensor technologies have been employed in a range of other sectors, the technology is yet to be implemented in the challenging offshore wind environment. The innovative technology proposed by FLICQ uses intuitive machine learning algorithms where the data is collected. This means that the data connection required for transmission to onshore control centres is low-bandwidth and low data usage. This allows the sensor to remain low-powered and have a long life in position on any component. The success FLICQ have experienced in other markets represents an opportunity to disrupt maintenance strategies in offshore wind using disruptive, Smart Sensors, powered by enabling technology.

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
Use the Competition Code given above to search for this competition’s results