

Collaborating for Growth – Playbook

Strategies for expanding the
UK offshore wind supply chain

October 2020



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Foreword



The UK can be proud of its world-leading offshore wind industry. Through continued collaboration between Government, industry and academia, innovation in technology combined with targeted policies and frameworks have not only enabled the industry's rapid growth, but also unlocked the steep cost declines which the sector has delivered, surpassing even our own expectations.

As our industry has grown organically, so too has the domestic supply chain, with the UK now home to large component facilities such as blade manufacturing, as well as cable factories, smaller components providers and services such as surveys and offshore logistics.

But despite the UK's status as the world leader in Offshore Wind, there is more that we can do to build on our successes, creating world-beating supply chains that will compete and win in the growing global market for this vital technology.

For some companies, this could mean entering an entirely new market, or for existing supply chain companies, it could mean investment in expanded operations.

Either way, in order to win, companies will require knowledge and understanding of how contracts are awarded, detailed understanding of how products are used, foresight of future technology trends and a visibility of future projects.

This document sets out tangible examples of how developers, supply chain companies and industry bodies have successfully collaborated resulting in new products, new entrants to market, new investment in UK facilities and UK companies winning export contracts for projects overseas.

With our ambitious Sector Deal targets, the estimated UK market value in 2030 is in excess of £40 billion, with the value of export products and services in the industry expected to increase five-fold in the same period.

We want to continue to expand this collaboration, and encourage suppliers whether existing or new, to engage with the opportunities this industry presents, bringing more UK suppliers into the market, whilst keeping costs down to benefit UK consumers and drive an affordable energy transition for the country.

Benj Sykes
OWIC Co-Chair

Collaborating for Growth – Playbook

This document forms a Playbook to support offshore wind developers in their activities drawing on best practice to support the growth of the UK supply chain and giving visibility to the supply chain of the types of interactions developers can engage in.

The Playbook draws out successful examples from a wide range of companies to demonstrate the types of initiatives which can be utilised by developers in supporting such growth. These activities will inevitably vary between projects and it is envisaged that more examples of different approaches will come to light as the sector continues to grow. This document is not intended to be exhaustive and will be updated over the life of the Sector Deal to include new initiatives and examples of best practice in industry.

Offshore Wind Sector Deal

In March 2019, the UK Government and the Offshore Wind Industry Council signed a world-leading Sector Deal. It is an ambitious, long-term strategy, in which offshore wind will become the backbone of the UK's power system.

The Sector Deal will ensure that the UK can significantly increase its share of affordable renewable generation while cutting carbon emissions, targeting at least 30GW of operational offshore wind by 2030. A new Government has raised the ambition even further, aiming to deliver 40GW by 2030, reflecting the growing significance of the offshore wind industry. This revised ambition demonstrates the importance of the Sector Deal and the need to accelerate many of the actions identified.

Amongst other commitments, the Sector Deal seeks to secure further investment from UK and international offshore wind farm contracts in our fast-growing supply chain, which already extends to every part of the country. UK companies lead the world in key services such as designing, building and operating offshore wind

farms. In addition UK companies also manufacture blades, cables and on/offshore substations. One of the intentions of the Sector Deal is to further develop these areas to enable the UK to deliver the technology and components to support the growing global demand for next generation offshore wind turbines in support of ambitions of increased UK content within the offshore wind supply chain. The sector has set an ambition of achieving total lifetime UK content of 60 per cent for projects commissioning from 2030 onwards including increasing levels of UK content in the capital expenditure phase.

The UK's global lead in offshore wind means we are uniquely placed to sell our innovative products and services not only to domestic projects here but also overseas. The Sector Deal also targets a five-fold growth in exports to £2.6bn a year by 2030.

Offshore Wind Growth Partnership

The Offshore Wind Growth Partnership (OWGP) is one of nine workstreams established to deliver the Offshore Wind Sector Deal, with the other workstreams dealing with Aviation and Radar, Pathways to Growth, Clusters, Innovation, People and Skills, OFTO and Future Transmission Model, Solving the Integration Challenge and Supply Chain.

The principle of the Partnership is based on similar successful initiatives from other sector deals such as those for the aerospace and automotive industries.

The focus of the OWGP is to support the growth of the UK supply chain. It will achieve this by promoting closer collaboration across the supply chain,

implementing structured productivity improvement programmes and facilitating shared growth opportunities between developers and the supply chain. This will allow companies to play a greater role in the UK's global leadership in offshore wind generation while enhancing their competitiveness internationally. By aiming to support an increase in the productivity and competitiveness of the UK supply chain, the OWGP is contributing towards the Sector Deal targets of increasing UK local content and increasing export value.

If the supply chain can prove itself to be competitive in the UK, it increases the likelihood of firms being globally competitive, allowing the UK to export the skills, services and expertise established in the domestic market to other growing offshore wind markets around the world.

The OWGP will promote initiatives to strengthen and expand the supply chain by supporting existing companies and encouraging new entrants to the offshore wind market. It will also drive innovation and the development of new technologies whilst supporting the UK's ability to capitalise on opportunities for Intellectual Property. These elements will help the UK supply chain to continue to grow.

In order to achieve the aims of the OWGP, activity was split into four main elements, three of which (business competitiveness, building new capacity and supply chain futures) will be delivered by the OWGP Special Purpose Vehicle (SPV), managed by an independent Board and a Delivery Team staffed from the Offshore Renewable Energy Catapult (OREC). The fourth element (collaborating for growth) is intending to capture the

activities that go on directly between developers and the supply chain and which have historically supported the growth in the UK supply chain.

Collaborating for Growth

Collaborating for Growth intends to capture the early engagement activities by individual developers with their existing and potential supply chain, and to promote and enhance these where possible.

These activities are intended to provide greater near-term visibility of the market and to support companies in making investment cases for enhanced supply chain capability that may be needed to help deliver UK contracts for UK projects. The activities that developers undertake in support of this workstream will be complementary to commitments made within Supply Chain Plans and many developers undertake such activities as part of normal project development.

Typical UK Project Supply Chain Plan Engagement Constraints

The Contract for Difference (CfD) mechanism which most UK offshore wind farms currently select to secure the price of the electricity they produce, influences the way in which offshore wind developers typically engage with the supply chain in the procurement process. In this process, offshore wind farm projects compete with each other (and other energy generation technologies) in a sealed bid auction process to secure a contract. This process has been very successful in supporting the significant cost reduction seen in offshore wind over the past decade by driving competition and ensuring developers build and operate projects as cheaply as they are able to, thereby delivering the best value to electricity bill payers. Certain elements of this process are time constrained and influence the way in

which developers engage with the supply chain. One particular example is around the time from contract award to what is referred to in the CfD as 'Milestone Delivery Date' (MDD), which is currently set at 12-months. At MDD, the project is required to have demonstrated its commitment to delivering the project through one of two possible actions;

- The 10% spend route – achieved through providing evidence of spending 10% or more of a project's pre-commissioning costs; or,
- The project commitments route – evidence of project commitments such as a board resolution or supply contracts

For offshore wind farms, the second route noted above would typically be met by a project passing a Financial Investment Decision (FID). Given the significant scale of investment in a typical offshore wind farm, both MDD routes will typically require a relatively high level of certainty on anticipated total costs. This in turn requires the procurement process for most major contracts to have been completed to such an extent to give this confidence. Given the complexity of these large-scale procurement processes, it is therefore common for these to have been initiated some time before the CfD auction itself. At this stage, discussions are particularly confidential given the competitive nature of the auction process. As a result, whilst all procurement processes are confidential, the external communication a project may be able to share in this period (pre-competitive auction) may be further limited and this can in turn influence the type of supply chain engagement conducted in this time. The examples provided throughout this document should therefore be considered in this context - not all types of activities will always be suitable or possible. Whilst engagement might be recommended between Tier 1 contractors and sub-suppliers, the developer is not always in a position to identify these Tier 1

suppliers at the point in time where it would be most beneficial for sub-suppliers to be engaging in this way. To this end, whilst this document is intended to provide a useful set of examples of the types of activities that occur between developers and the supply chain, Tier 2 and 3 suppliers are also encouraged to proactively engage with the Tier 1 supply chain regardless of known project contracts as it may not always be possible to widely advertise opportunities for sub contracts ahead of contracting. However, wider development of and support for the supply chain will also be available through the industry-wide initiatives delivered by the OWGP.

East Anglia ONE Supply Chain Event

In 2017 ScottishPower Renewables hosted Day 2 of the Southern North Sea Conference in Norwich as an East Anglia ONE Supply Chain Event. The day consisted of 15 presentations from Tier 1 supply chain companies from the project.

The event was widely publicised with the aim of providing UK supply chain companies with direct contact to the Tier 1 companies and their sub-contracting opportunities. The event was followed up with publication of the Tier 1 sub-contracting opportunities and contact details. Key to success of the event was holding this at a time when Tier 1 supply chain is known and can be introduced to local supply chain whilst tender opportunities are available.

The event formed day 2 of the East of England Energy Group's Southern North Sea (SNS) conference. ScottishPower Renewables was in the process of finalising its major contracts for the construction and supply of components for the £2.5bn

East Anglia ONE wind farm and together with its contractors outlined future opportunities on the project.

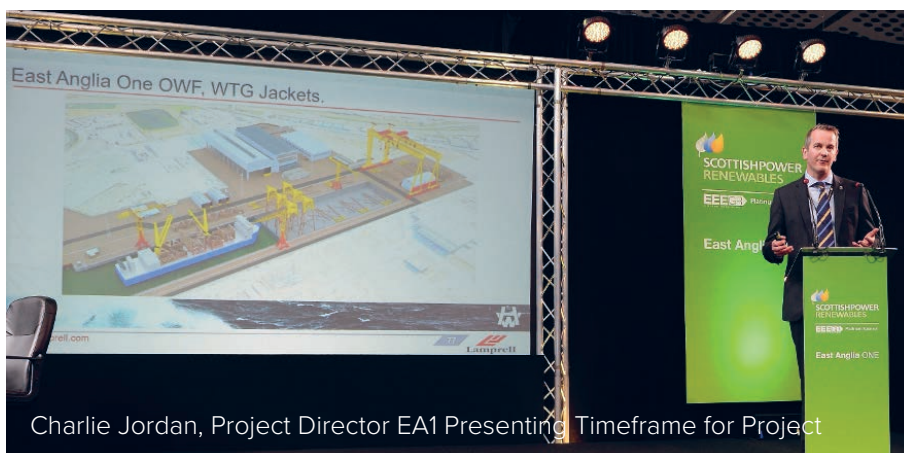
Opportunities on the construction of East Anglia ONE ranged from civil and electrical works, vessel and ports support, to technicians, logistics and more. For SMEs keen to be involved in the project, and the offshore wind industry in general, the event presented a brilliant opportunity to gain a real insight into what is required to build a project such as East Anglia ONE.

Lombard Shipping won a contract to provide storage and transport solutions for East Anglia ONE as a result of attending the Supply

Chain event. At the event Lombard Shipping met Prysmian Group who supplied the onshore cables for the project. Establishing this relationship led to Lombard Shipping having the opportunity to tender for the work.

Operations Director of Lombard Shipping, Peter Fraser said:

"The event was useful to understand the scope of the work and speak to the tier 1 suppliers about the opportunities available for local businesses. It was great to provide our services for such an important local project."



Open4Business (O4B)

The Open4Business (O4B) portal was originally set up in 2012 by SSE to link supply chain firms with large SSE construction projects. In just over five years it led to c£174 million in contracts to local businesses, contributing directly to the economic well-being and sustainable development of many communities across the region.

In addition to the obvious success of c£174 million being awarded via the platform, the Open4Business portal had over 1500 active suppliers registered with 750 opportunities being advertised by SSE and its Tier 1 contractors, who also bought into the initiative.

When the platform was first introduced in 2012, it was the first private sector portal in the utilities industry that was free to use and offered SME organisations the opportunity to engage with large national organisations that were placing contract opportunities. For SSE, this platform became critical to its large capital project delivery in the North of Scotland and would be the centre piece to any meet the buyer events that were held in advance of construction beginning on site.

As a portal, it was extremely user-friendly and simple to use; it allowed buyers to create and post their opportunity, suppliers to respond as appropriate, and then the buyer would receive a shortlist of responses that they could then extract and take into their procurement process. As a developer, SSE included a flowdown clause within all Tier 1 contracts that were placed, stating that where possible the platform would be used to advertise all appropriate sub-contracting opportunities. It was recognised that not all contracts would be advertised on the site due to the nature of some of the activities involved.



www.o4b-highlandsandislands.com

Examples of awarded opportunities via the portal;

Description of work	Successful supplier
Cattle grid Installation, Strathy Village	MM Miller
Blacksmith Services	Caledonian Sheet Metal
33kV Cable Laying - Dundee	Inverness Paving
Achany Windfarm civil works (site drainage and repairs)	Waverley Engineering

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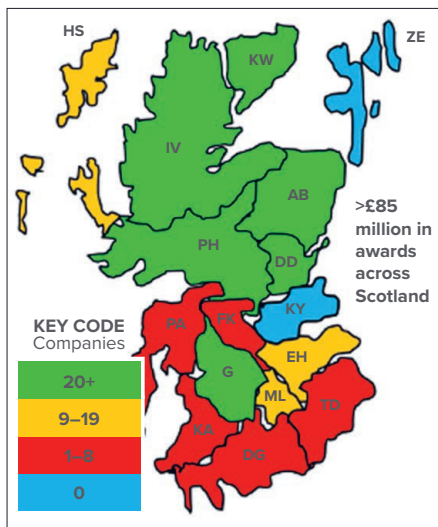
The Open4Business portal has been fantastic in bringing opportunities direct to local businesses and enabling top tier companies to find out what is available locally. Working with the Inverness Chamber of Commerce to continue to build on what was developed by SSE has really helped to continue to broaden awareness of the asset and how it can benefit local business. We look forward to the coming year and seeing how the portal can expand its reach in a way that will benefit even more local firms across the region and beyond the energy sector.

Elain Macrae

Head of Energy Strategy, HIE

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Awarded contracts from 2016/17



In order to ensure the platform delivered success, an active Steering Group was formed that was chaired by SSE and included Tier 1 contractors working for SSE and local support bodies as outlined below: In 2018 SSE passed O4B to Highlands and Islands Enterprise (HIE) so it could be extended to include new industries and developers and encourage them to advertise their requirements on the portal. HIE have

now appointed Inverness Chamber of Commerce to promote and manage the portal for the next two years. The two organisations will work together to further develop the platform and include opportunities in other key sectors. There will be an emphasis on recruiting new contractors to push their upcoming works through the service; opening up more opportunities for Highlands and Islands businesses.

Tier 1 Contractors	Local Support
RJ McLeod	Highland & Islands Enterprise
BAM Nuttall	Highland Council
Balfour Beatty	Inverness Chamber of Commerce
Siemens	SCDI
ABB	Energy North (no longer active)

GE Meet the buyer

In March 2018, GE Offshore Wind Energy announced its Haliade-X turbine, the world's first 12MW offshore wind turbine. When launched, the turbine was offered for projects that would ship from 2021 making it a viable option for projects competing in the UK CfD Auction Round 3.

As members of the Offshore Wind Industry Council (OWIC), GE Renewable Energy supports the Offshore Wind Sector Deal and the ambitions of this deal to increase the capacity of the UK supply chain for domestic and overseas offshore wind projects. With this ambition in mind, alongside the intention to supply the Haliade-X to UK offshore wind farms, GE looked at identifying UK small and medium-sized enterprises to qualify them as potential suppliers for the Haliade-X.

In 2019 this process commenced in earnest with GE Offshore Wind Energy sponsoring, hosting and running a series of both regional and national events. These events provided an opportunity to introduce the Haliade-X to UK industry, and to explain the potential supply opportunities it offered. A number of regional events were held around the UK including at locations in Edinburgh, Blyth and Inverness. Regional organisations were also engaged in this process with an aim of leveraging their networks to spread the information widely amongst the local supply chain. For example, NOF supported the Blyth event whilst Highlands and Islands Enterprise and Scottish Enterprise together supported the events in Edinburgh and Inverness. The Inverness event was attended by 20 organisations with presentations provided by GE, EDPR (as a potential GE customer), Highlands and Islands Enterprise and ORE Catapult. The event also included an informal networking element, providing the opportunity for some one-to-one engagement between suppliers and GE representatives as well as broader networking between companies.

This supplier engagement process culminated with a national event that was run as a side-event at RenewableUK's Global Offshore Wind (GOW) conference, recognising the opportunity to draw on the large audience that this annual event attracts. The event was structured to include ten presentations from multiple GE functions, Vattenfall (as a potential GE customer), UK Government and ORE Catapult. This final event was a great success, with more than 150 attendees all having the opportunity for early engagement with GE as the buyer. The associated networking (supported by the alignment with the wider GOW event) with other UK supply chain companies and potential GE buyers was noted as being particularly useful. During the Event at GOW GE shared a detailed overview of its Supplier Development Programme designed to explain and assist UK suppliers to orient how they may be able to position for future engagement and supply contracts. Interested suppliers can also find much of this information on the GE website which has been set up to provide potential offshore wind suppliers with tools and services to improve their knowledge of the buying process and help to sustain a close, productive relationship with GE Renewable Energy.

The combined programme of supplier events was very successful in helping GE understand the potential capacity and capability of both the existing UK offshore wind supply chain as well as those companies seeking to enter the industry. Potential suppliers were also given the opportunity to really understand the needs of GE in supporting delivery of the Haliade-X both through formal presentations

and more informal networking. As a result, GE has gone on to engage with more than 300 UK-based suppliers in detailed procurement activity. The type and scale of products from these suppliers ranges from electrical cabinets to large scale castings. Final qualification and assessment of a number of UK-based companies is ongoing with contracts to follow in due course, cementing the UK supply chain as a valuable part of the delivery of the Haliade-X.



Images from GE's Meet the Buyer event

Prysmian

Growth of Ørsted's portfolio of projects, an increase in the scale of projects as well as a growing overall offshore wind market, led Ørsted to consider options for additional array cable supply capacity having previously worked with UK-based JDR Cables.

Ørsted discussed with Prysmian the cable manufacturer's plans for expanding their array cable offer, including investing in repurposing their land-cable production facility in Wrexham for offshore wind. After the initial approach and discussions, Ørsted and Prysmian teams reached agreement in respect of the commercial parameters for any prospective collaboration. A series of face-to-face workshops and factory visits then took place in order to reach agreement in respect of the technical solution and delivery timeframe that would work for Prysmian and support a

successful business case for the Wrexham factory. Following key milestones being met an order was placed for 300km of array cables conditional upon investment in the Wrexham factory to repurpose it for the production of submarine array cable cores. As a result, Ørsted was able to ensure that the large volume of array cables for Hornsea 2 could be delivered by two UK-based manufacturing facilities. Prysmian's newly established Wrexham-based submarine production facility is now well placed to deliver cost competitive increased UK content across the industry.

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With over 100 years of experience, Prysmian is the largest cable manufacturer in the UK. Operating since 1968, the 53,000m² factory located in Wrexham has seen various investments in its equipment and technological capabilities, enabling it to serve the growing offshore wind market. Prysmian is pleased to be supporting Ørsted's offshore wind development in the UK.

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Gary Graham
Prysmian UK
Sales Manager



Image: Prysmian

Siemens Gamesa Renewable Energy

Visibility of the Future Project pipeline and customer partnerships are key to creating capacity in new markets. As a leading player in the emerging offshore wind sector Siemens wind division had researched 55 European ports looking for a new portside facility in 2009.

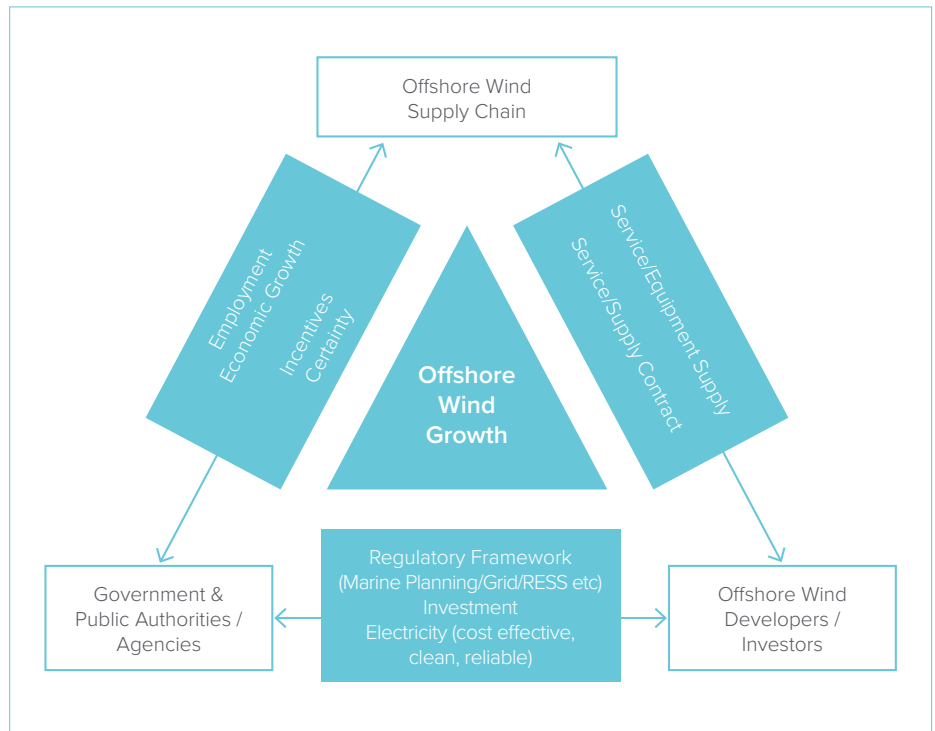
As the offshore wind sector began to take off, the increasing scale of both components and projects created the need for Siemens to consider additional manufacturing and execution facilities to meet the rising demand.

The UK had clearly become the leading market prospect for offshore development – the UK having signalled huge ambition with the Crown Estate's Round three zone allocation of over 30GW of potential projects.

In order to secure supply chain investment however, a 'virtuous triangle' of activity was needed. Government could offer the attractive CfD contracts to developers, who needed this support to invest in their projects. In turn, the developers could then offer supply contracts to the turbine supplier, who needed such contract visibility to make their investment, completing the triangle by creating the jobs and economic growth required by the Government.

Around this time the UK was going through the Electricity Market Reform (EMR) process and the Renewables Obligations Certificate (ROC) scheme was coming to an end. This created uncertainty in the market and presented difficulties for the supply chain to invest against an uncertain project timeline. In partnership with the developer community and the UK Government it was recognised that a hiatus in the market would be damaging and hence an interim scheme to ensure pipeline continuity was agreed.

The Final Investment Decision Enabling for Renewables (FIDer) programme gave developers the certainty of project pipeline that the industry needed ahead of the



Siemens Gamesa facility in Hull UK

introduction of competitive auctions. These early FIDer contracts were awarded to five offshore wind projects with a combined capacity of around 3GW.

Siemens successfully secured turbine supply agreements on four of these projects and this created the conditions which underpinned Siemens' investment decision into its UK facility during 2014.

The Siemens Gamesa facility in Hull combines three critical business functions in one location;

- A blade manufacturing facility,
- A dedicated Project execution port and
- An extensive service base with warehousing and marine access

The project was a joint investment between SGRE and its partner and statutory port authority, Associated British Ports (ABP) and had a combined capital cost of £310m.

Completed in 2017 the facility has created around 1,000 jobs. Recruitment of the new team was a major success story. Siemens Gamesa received over 26,000 applications for the available posts, and 96% of the new recruits were recruited from the Hull/Humber area. Independent analysis conducted by University of Hull has indicated the wider economic benefits to the region, with the direct jobs more than doubled in the wider economy .

A number of projects have been successfully executed from the port facility, including the world's largest offshore wind farm, Hornsea 1, which was delivered in record time from the facility during 2019. The benefits of having a purpose-built facility on the East coast have been fully demonstrated and are a key factor in the significantly reduced costs which offshore projects are delivering.



Image: Siemens Gamesa Renewable Energy

ORE Catapult & Green Angel Syndicate – Innovation Competition

In 2018 ScottishPower Renewables, ORE Catapult and Green Angel Syndicate came together to launch an Innovation Competition, providing three main elements to support successful innovation – an end-user, private investment and an independent partner to test and validate any new solution.

The competition sought technological solutions to specific industry innovation challenges, with successful companies able to access ORE Catapult's world-leading market knowledge and test and validation facilities to de-risk their technology, as well as pitch their ideas to investors and wind farm developers. The competition set four innovation challenges and provided an event with a panel of engineers to ask questions about the innovation challenges. The four key areas were:

- **Wind measurement** – Effective wind measurement is required to accurately perform power curve analysis. Existing technology struggles to accurately measure the wind for the swept areas that offshore wind turbine generators have. This challenge was to find technologies which can measure the wind across the swept area accurately.
- **Subsea Survey** – This challenge was aimed at finding a fast, autonomous, low-cost method for surveying and monitoring foundations and cables underwater on an offshore windfarm.
- **Cable Fault Detection** – This challenge was aimed at finding a technology which could identify faults in cables and locate the specific location of the fault as well as the type of fault that has occurred.
- **Jacket Connections** – This challenge was aimed at finding an alternative way of connecting the jacket topside structure to the piled foundation without the use of grouting. Grouting is used to secure the jacket in place but is expensive and is not always effective.

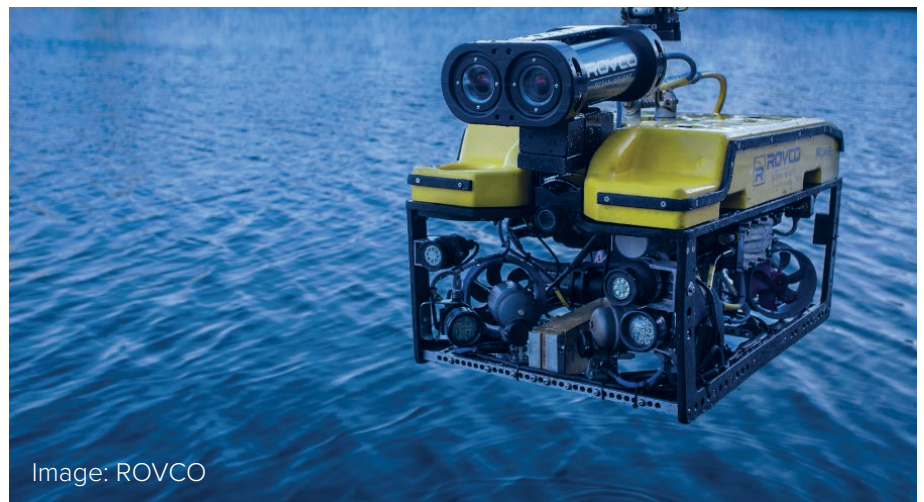


Image: ROVCO

There were 19 applications in total with 11 taken forward for interview. Following the interviews eight collaborative R&D projects were established with three technology demonstrations planned at ScottishPower Renewables offshore wind farms.

Applicant – Competition Area and Project Title	Status and result of the competition entry
Rovco (Subsea Services Provider) Project Title: Advancing Underwater Vision for 3D Phase 2 (AUV3D-P2)	Rovco and the ORE Catapult were awarded a total of £1m from Innovate UK for their phase 2 demonstrator project. Rovco has also recently completed a £5m equity raise on the back of the success in the competition. Rovco aims to create 70 new high-skilled jobs and estimates its export revenue at £20mil per year before 2025
Consub (pin-pile connection) Project Title: Jacket Pile Gripper Connection	Cedeco have been awarded funding for a £132k feasibility project from Innovate UK
Kraken Robotics (subsea survey) – ScottishPower Renewables introducing company to supply chain for potential collaboration	Kraken Robotics were also invited to test their prototype at Vineyard/Kittyhawk

Pict Offshore - Get Up Safe (GUS) System

In 2017, Ørsted Operations Technology team were looking for alternative offshore access systems. One of the team found Scotland-based PICT (then known as Limpet) during some initial research and approached the company for a meeting.

The system was at that time an early ladder-based working prototype with some, albeit limited, testing behind it. PICT carried out development work and trials after an initial agreement with Ørsted to work together to demonstrate the ladder-based prototype. This successful study led Ørsted to partner with Pict Offshore and jointly develop the innovative ladder-free motion compensated hoist which improves safety and reduces cost by removing the need for turbine boat landings and external ladders altogether. The PICT team were able to benefit from knowledge shared by Ørsted experts who construct, operate and maintain the largest global fleet of offshore wind turbines. Insights included product design and engineering criteria, certification requirements, as well as practical operational input. Ørsted and PICT are now working towards first commercial deployment of the ladder-free GUS access systems which has enabled PICT to expand its business and develop a new assembly facility attracting funding from Scottish Enterprise.

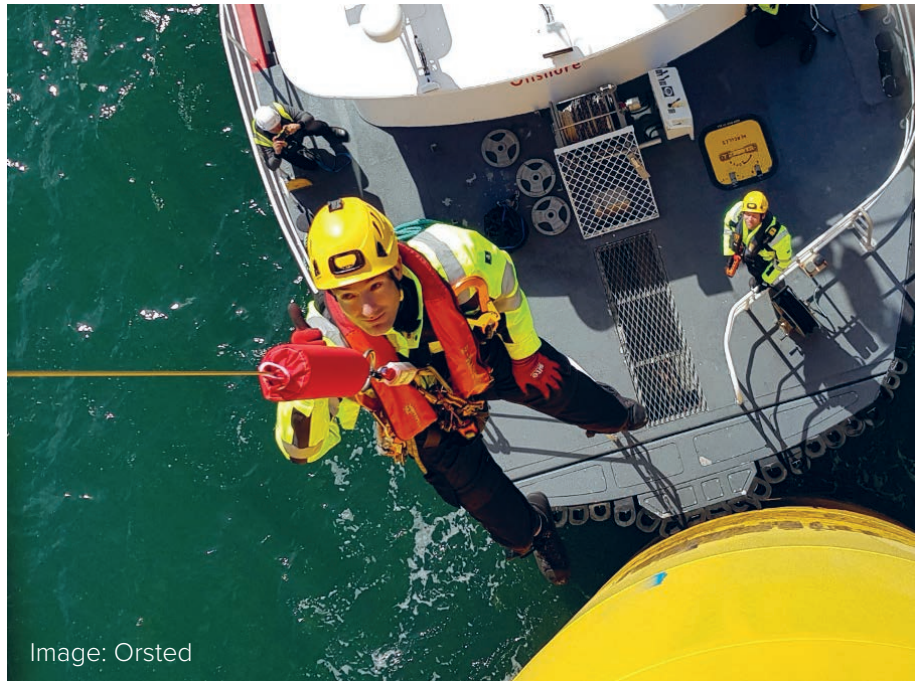


Image: Orsted

Triton Knoll electrical system

Triton Knoll Offshore Wind Farm, which is being constructed by RWE, took some notable measures to increase suppliers' understanding of the project's electrical systems delivery needs and foster collaboration between businesses.



The onshore export cable installation works for the Triton Knoll project is particularly complex – involving 57km of cable that needs to be undergrounded across the county of Lincolnshire. The route runs from the landfall location at Anderby Creek, through to Bicker Fen where the power generated by the offshore wind farm is connect into the National Grid network.

Companies interested in tendering for the works were invited over a two week period to attend workshops and extensive 1-2-1 interviews with the development team at a local hotel, and were also taken by minibus for route walk downs to enable them to secure a detailed understanding of the site. Ground, archaeological, ecological and landowner risks were thereby thoroughly understood by tenderers thus ensuring their final offers were realistic, appropriately-costed and deliverable. The workshops also provided a forum for establishing appropriate partnering agreements between cable suppliers and installers. The final outcome was the appointment of UK-based J. Murphy & Sons Ltd, to deliver the onshore cable works.

To ensure that local Lincolnshire businesses could find out about what opportunities this major infrastructure project could bring to them directly, Triton Knoll worked with Lincolnshire Growth Hub who organised an onshore electrical systems focused 'Meet the Buyer Event' for the project. This event was hosted at Boston College. Julian Garnsey, project director for Triton Knoll and RWE, said:

"This was an excellent first event which clearly demonstrates the willingness of both Triton Knoll and our key suppliers to put local suppliers at the forefront of opportunities with the project. It was a very well organised event by the Lincolnshire Growth Hub, and we were really encouraged by the level of interest from the local supply chain and the level of enthusiasm and interest from them to engage with the project."

Procurement leads from Triton Knoll and its primary contractors J Murphy & Sons Ltd, responsible for the onshore cable and Siemens Transmission and Distribution Limited (STDL), responsible for the onshore substation, conducted 1-2-1 interviews with the regional suppliers regarding potential opportunities.

J. Murphy & Sons Ltd's senior subcontract buyer Lukasz Olszewski said: "It was a very encouraging event and we are now exploring a number of leads with local companies to support the onshore works at Triton Knoll. We are looking forward to engaging more with local suppliers in the future."

STDL's Jane Duckworth, Senior Project Procurement Manager, said: "We've been contacted by lots of suppliers since the event at the college, all with positive feedback and showing a real interest in the project. It was a really worthwhile venture and I was impressed with the engagement from everyone involved on the day."

The installation of the underground cable and the substation construction have presented one of the most significant opportunities for local companies to get involved with the project.

GE Offshore Wind Energy

GE has engaged extensively with offshore wind developers in the UK in recent years in an effort to understand their project requirements and, where feasible, to develop its UK supply chain to support these projects.

This engagement has highlighted the incredible opportunity for UK based suppliers to deliver the world's next generation offshore wind farm technology. Various aspects of GE's business have the potential to support the industry including through the technology offered by GE Grid Solutions for connection of offshore wind farms to the UK National Grid.

GE's Grid Solutions has now been invited to participate in a number of competitive FEED studies for UK offshore wind projects. These studies are invaluable in helping GE to understand project specific requirements and propose the most appropriate technical solutions, as the company develops potential offerings to different developers. In particular, the typical detail provided on the wind farm parameters and requirements to ensure Grid Code Compliance for the Transmission System Operator (TSO) connection help immensely in defining the actual technical solution to be proposed for the electrical infrastructure that will eventually be handed over to the Offshore Transmission Operator (OFTO).

Adoption of a FEED process for this scope is beneficial for both the developer and potential supplier. The process, which is typically more iterative and collaborative than a standard procurement process, enables accurate and economic sizing of the OFTO assets proposed for the project. This in turn allows for much more accurate pricing which gives confidence and security to both the developer and potential contractor. Typically, developers will use such FEED processes to establish two or more competitive designs. These can be based on different design and technological principles, each with



Image: Haliade 150-6MW offshore wind turbine at the Merkur offshore wind farm, Germany. GE Renewable Energy.

their own merit, allowing developers to really understand the optimal solution for the project. Typically, these proposals will then be considered in the context of the wider wind farm both in terms of most appropriate overall design approach and best commercial model for investors.

A FEED approach was adopted on innogy's Galloper and Triton Knoll offshore wind farms with GE securing a contract on the former. In both cases the studies were conducted as paid studies. This approach is particularly beneficial for the potential suppliers because it helps to offset the risk of the bidder's engineering resource being tied up when a contract may not eventually be won.

GE's Grid Solutions are committed to developing higher HVDC capabilities and greener solutions utilising SF6 free technology such as the g3 (Green Gas for Grid) family of switchgear products being rolled out. What is also apparent is the focus on not only

economic solutions, but technological advances in electrical grid infrastructure solutions, for example to enable offshore wind farms to expand further offshore and into deeper water. These learnings from FEED studies combined with other feasibility studies and tender events with various developers have positioned GE's Grid Solutions in the UK in the best way possible. This ensures it can provide the optimum solution for the future UK and global offshore wind market including those projects expected to be awarded through the upcoming Crown Estates Round 4 and Scotwind Leasing programmes.

Teesside's Able Seaton Port

New multi-million pound infrastructure will enable turbine handling for the first time at Teesside's Able Seaton Port, expanding services offered and enhancing competitiveness

Encouraging the growth and competitiveness of UK companies while investing in coastal communities is an important priority for the RWE-managed Triton Knoll Offshore Wind Farm.

As the 857MW project developed its supply chain network throughout 2015/16 ahead of onshore construction start in 2018, collaboration with its seven Tier One contractors was key to ensuring UK firms could compete on a level playing field for key contracts.

In 2018, Triton Knoll placed orders with world-leading turbine manufacturer MHI Vestas to provide the offshore project with 90 of its V164-9.5 MW machines, at the time considered to be the most powerful on the market.

MHI Vestas's default choice for turbine assembly had been Vlissingen Port which was already set up in terms of production. Triton Knoll Offshore Wind Farm conducted a review of East Coast Ports and provided detailed information to help inform MHI Vestas of UK Port options. MHI Vestas then included these ports in their own review and selected Able Seaton Port as a brand new facility from which to assemble turbines.

The ensuing investment provides a fantastic opportunity for the port to establish a full skill-set for the first time, capable of supporting and handling all stages of wind farm construction, from foundations and large vessels, to turbine assembly and installation. In turn, the port says the investment will help it become a competitive force within the offshore sector and provide considerable opportunities for the local supply chain.



Image: MHI Vestas

Julian Garnsey, project director for Triton Knoll and RWE, reinforced the project's commitment to investing in the region's businesses: "It has always been our aim as a project to use our investment to help regional and UK businesses increase their competitiveness in the global market. We're therefore delighted to have been the catalyst along with MHI Vestas for Able's progression into turbine handling.

"Looking ahead, the growth of offshore wind and the likely construction of so much new capacity off the East Coast presents the region with a great opportunity to compete and bring new investment, growth and jobs into Teesside."

Under the contract, MHI Vestas will establish a full-scale turbine pre-assembly operation at Able UK's Seaton Port in Teesside, from enabling works to loadout. It is anticipated that, in total the port activity involving all partners could create up to 100 new and predominately local jobs, and

unlock over £16m investment in new infrastructure and equipment.

MHI Vestas Vice President and UK Country Manager, Julian Brown, said:

"Establishing Able Seaton in the River Tees as a construction base for offshore wind turbines has been a long time in development and we are delighted to be working with Triton Knoll project team and Able UK to bring this about. We believe Teesside will continue to grow its contribution to offshore wind construction and the supply chain, and MHI Vestas is pleased to play a lead role in that development."

Able UK will develop an additional 140 metres of new heavy-duty quayside at the port, and invest in equipment and facilities to support delivery of Triton Knoll. Works to support the transformation ranges from establishing new drainage and upgrading internal electricity supplies, to establishing new infrastructure including access roads, office buildings and accommodation for a project team of around 50 people.

New turbine handling equipment will be capable of handling the 89-metre-high turbine towers, 80-metre-long turbine blades and the 375-tonne nacelles will be prepared ready for transport to the offshore site and for installation.

Able UK's Executive Chairman Peter Stephenson, added:

"It's a massive vote of confidence in the UK, ourselves and the Teesside supply chain. Our sustained investment means we can provide a bespoke and tailor-made solution for Triton Knoll.

"This contract effectively completes Able's offshore wind CV and is very much the start of something that will continue to grow. Government policy is successfully enabling growth across the offshore wind sector, with much of that potential on our very doorstep, we certainly aim to build on this fantastic opportunity."

The significance of the investment, and particularly the new capabilities and enhanced competitiveness it unlocks, has not been lost on the Tees Valley region's elected Mayor Ben Houchen.

With future opportunities firmly in his sights, he said: *"This is an incredibly important and strategic announcement for our area, and underlines both the reality and the ongoing potential that we have to offer in respect of offshore wind. Able is already experienced in supporting foundations installation and will now be able to showcase Able Seaton Port facility (ASP) and the wider area as a world class location for the installation of wind turbines.*

"We look forward to this positive trend continuing and anticipate we will be well placed to provide similar support to the massive wind farms making up the Dogger Bank zone, as well as looking to further opportunities beyond that to the end of the next decade."



Image: Able Seaton Port turbine pre-assembly area

With the Port's new ability to offer turbine handling, in September 2020 Able Seaton won a contract with GE Renewable Energy to serve as the base for the turbine service, equipment, installation and commissioning activities for the 190 turbines for Dogger Bank A and B, creating 120 skilled jobs at the Port during construction.

Hutchinson Engineering Ltd

Established in 1979 servicing the local petro-chemical industry, Hutchinson Engineering Ltd has expanded into the offshore wind sector, recently opening new facilities next to their existing site and at a new site at the Port of Garston.

Ørsted's Supply Chain Development Manager worked with Hutchinson Engineering Ltd to support their development in advance of procurement activity. The Supply Chain Development Manager was able to share market outlook information including potential future opportunities, provide indicative requirements, as well as visiting Hutchinson sites to view facilities, processes & capabilities. Tier 1 contractors were then informed by Ørsted's Supply Chain Development Manager of several potential UK sub-suppliers (including Hutchinson). Following a competitive tendering exercise, in November 2019, Hutchinson was awarded a contract from offshore wind specialists, EEW Group, for the fabrication and on-site assembly of 30 Suspended Internal Platforms (SIPs) for Ørsted's Hornsea 2 offshore wind farm. Through continued investment in their people, plant and machinery, Hutchinson has been able to implement a production line style process throughout their business, allowing them to compete in the rapidly growing market.

Steve Adams, Chief Operations Officer; *"Working on the project with EEW and Ørsted has provided Hutchinson with opportunities to further develop key skills and efficiencies. Incorporating the production of engineering design drawings and the final assembly of the SIPs at EEW-OSB has demonstrated that extending Hutchinson Engineering's scope of services provides a bonus to project costs, timescales and risk-mitigation"*.



Image: Hutchinson Engineering

Introduction of alternative suppliers for refurbishment of components

In 2014, condition monitoring at Equinor's Sheringham Shoal offshore wind farm identified the need for two gearbox replacements in its 3.6MW turbines. At this point, the project was no longer under the Original Equipment Manufacturer (OEM) warranty.

Sheringham Shoal was looking to expand the supply chain for these gearboxes, and following similar successful refurbishment of smaller turbine components, considered this an opportunity to also test the approach for gearbox replacement. The project team set about seeking an alternative supplier to the original manufacturer in what was a change to standard industry practice at that time. Through a collaborative process with potential suppliers, a Finnish company, Moventas, was identified with the skills required to understand the problem and develop technology to fix the issue. Moventas already had interest in developing a deeper in-house understanding of the 3.6MW drive train and gearbox based on feedback from various customers who had flagged that some gearbox interventions had been necessary on these machines earlier than otherwise planned. Moventas' 35+ years' experience as a wind turbine gearbox OEM meant they were well placed to look at potential causes and possible resolutions. The opportunity for engagement with Sheringham Shoal to further investigate this issue provided a win-win scenario where the project provided a collaborative forum for open learning, training and sharing of gearbox expertise which supported Moventas' business case and associated later UK specific investments. Following a due diligence on the company's competence and quality assurance, Moventas refurbished two damaged gearboxes (removed from other projects using the same turbine) ready for use in Sheringham Shoal's turbines. These gearboxes were installed in the turbines in 2015 with the pilot demonstrating a cost saving



Image: 3.6MW Load Test Bench, Moventas

of approximately 15% compared to purchasing a refurbished gearbox from a supplier.

The decision to take this approach to gearbox replacement was driven by the project's aim to introduce competition to the market. As a result, Equinor saw the importance of collaboration with the selected supplier as an important part of the process to ensure both success for the project and longer-term engagement of Moventas in the UK market. The success of the work on Sheringham Shoal was one of the key elements that allowed Moventas to make an investment decision in October 2015 to build a Full Load Test Bench & Final Assembly workshop in Huddersfield, UK – a critical testing component to demonstrate the gearbox is fit for deployment offshore. This £5m facility was part of a Regional Growth Initiative, with the example from Sheringham Shoal, alongside the future market potential

– given the significant number of 3.6MW turbines deployed in the UK and Europe, supporting the business case for the facility. The Huddersfield team has seen continuous growth since that initial investment, supported by the business generated by being able to provide competitive and unique propositions to the UK market. This has been driven by the local and hence lower cost logistics of offering these services close to the market. In addition, the location has also allowed the customer teams to visit the local facility either during the gearbox refurbishment process or during the testing phase to gain more detailed information, which is considered to be an additional benefit. The test bed is able to production test 8 different models of turbine gearboxes with examples of each having been tested since the setup of the facility. In 2019, the team increased again with recruitment of a number of new positions including apprentices and university interns.

In 2020, Moventas remains the only gearbox OEM in the UK to have such a facility.

The two faulty gearboxes that were removed from the turbines at Sheringham Shoal were also refurbished by Moventas, including load testing at the Huddersfield facility and are now stored under a care and maintenance agreement, ready for efficient delivery to the wind farm. The refurbishment of these gearboxes also allowed Moventas to conduct a Root Cause Analysis study which both parties considered beneficial to better understand the original cause of failure and options for improving reliability.

Equinor's relationship with Moventas has continued in recent years through contracts on both Sheringham Shoal and Dudgeon offshore wind farms, with strong collaboration being an important part of the ongoing relationship. Both Equinor and Moventas acknowledged improved in-house competence following the initial project and this collaborative approach has continued in building knowledge and experience regarding turbine condition monitoring for Equinor's projects. In this respect, the specific knowledge of the 3.6MW turbine held by both parties has been of particular benefit.



Image: Moventas

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Sheringham Shoal and Dudgeon Offshore Wind Farm contracts provide excellent examples of the real benefits of a collaborative approach that have allowed project and product optimisation to realise win-win partnerships. This, in turn, has allowed Moventas to develop our capabilities so that we can offer the best possible product to the wider market. We value these long-term relationships with developers and truly believe in the benefits for both sides.

Craig Jones

Moventas Sales Director UK&I

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ScottishPower Renewables Offshore Wind Tender Participation Workshop

In 2018 ScottishPower Renewables and Scottish Enterprise presented a tender workshop to supply chain companies in Dundee.

The supplier engagement event was unique in that it focussed on the experience of participating in a tender and was aimed at new entrants to the market. The presentation covered key topics such as the contracting strategies of offshore wind, the structure of the tender process and the contracting approach. The format of the event was agreed with Scottish Enterprise with the intention of taking into account key questions on behalf of supply chain about the tender and contract process in offshore wind. The primary aim of supply chain was to improve tender scoring and gain insight to the procurement criteria. 24 companies attended the event with a range of services for the offshore industry and two of these have gone on to win multi-million pound contracts with the East Anglia ONE Offshore Windfarm. Turner ICENI were awarded a £4 million crew transfer vessel contract for construction and commissioning of the project and CWind have been awarded an £8.2 million contract to provide subsea maintenance. ScottishPower Renewables and Scottish Enterprise concluded that future events could build on the success of this event by encouraging supply chain to attend with the personnel managing their bid submissions, encouraging break out group discussions during the workshop and where possible sharing success examples.

To provide this insight ScottishPower Renewables presented the following information:

Presentation Topic	Description
Overview of Contract for Difference and Final Investment Decision Timeline	Highlight the wider project context that influences cost, design and programme assumptions during the tender. Supports new supply chain understanding of offshore wind project development.
Structure of Tender and Factors of Change	Explains the basic tender structure and the outside influences that can lead to changes in the scope and requirements. Knowledge sharing to help supply chain prepare business to respond to changes in tender requirements.
Prequalification Requirements	Overview of typical requirements of prequalification and how to ensure readiness. Support supply chain to respond to prequalification efficiently.
Example Invitation to tender and draft contract conditions	Overview of standard tender and contract contents and ScottishPower Renewables expectation of commercial schedules. Knowledge sharing to prepare supply chain to respond to tender.
Tender Evaluation Process	Explanation of evaluation phases and the personnel responsible for completing this. Knowledge sharing to give supply chain insight to evaluation process.
ScottishPower Renewables Tips	Tips for tendering with recommendations based on experience of ScottishPower Renewables that lead to success. Support supply chain success in future.



Image: Head of Contracts for East Anglia ONE Presenting

Dynamic Cables

In 2015, JDR – a UK-based subsea cable supplier – was invited to tender for the dynamic cables package for Equinor’s Hywind Scotland, the first floating offshore wind farm in the world.

Following the outcome of the tender process in 2015, where the company was unsuccessful, Equinor ran a detailed feedback session with JDR in 2016 to discuss potential areas for improvement. There were three key areas of development for JDR identified during the feedback session. The first was related to a lack of completed qualification testing at the point of tender for Hywind Scotland. In order to manage the risk associated with this, Equinor and JDR discussed how a technology road map for the new innovative solution proposed could be helpful to reduce risk on future floating wind projects. Over the years following the Hywind Scotland tender, JDR continued the development of its product, building the company’s confidence in the technology maturity. As a result, they were later able to offer a more robust contingency plan which demonstrated better control of the technology and programme risks.

The second main area for development was identified as the complex solution presented by JDR at that time. This solution would have resulted in more offshore work during the wind farm construction when compared with other solutions. JDR received similar feedback from other developers in subsequent offers which motivated the company to explore a simplified solution to serve the needs of complex floating offshore wind projects. That solution was later implemented in JDR offshore wind floating projects and was subsequently offered to Equinor for their next floating project, Hywind Tampen.

The final area of improvement was related to sub-supplier management and the need for a comprehensive supply risk management plan. Equinor had identified that JDR was heavily dependent on its supply chain for the delivery of the project due to, at the time, a limited list of sub-suppliers per component. JDR took the feedback

onboard and kicked off a qualification process with additional suppliers to mitigate the risk of single-sourcing of components. As a result of the above change in supply chain approach and the acquisition of JDR by TFKable, JDR has now qualified multiple suppliers for every component in their offer, strengthening their supply chain, providing options for local content and having the ability to offer solutions to their customers based on their individual requirements. Additionally, Equinor advised that there was a need for better client visibility on sub-supplier management and compliance with key project requirements (e.g. Corporate Social Responsibility). JDR has since made this a more predominant aspect of their supply chain plan by amending their requirements from their sub-suppliers. Consequently the company now has a more solid plan to demonstrate how they control their supply chain, putting JDR in the forefront of the industry in this respect.

Subsequently, three years later, JDR was invited to tender for Equinor’s Norwegian Hywind Tampen floating offshore wind farm. The project will consist of 11 wind turbines each of 8 MW, and will be capable of meeting 35 percent of the annual power demand of the five Snorre A and B, Gullfaks A, B and C oil and gas platforms. The floating wind project is in water depths of 300 metres, will be the largest floating offshore wind farm in the world, and the first ever to power oil and gas platforms.

JDR was invited to perform an inter-array and export cable study for the Hywind Tampen project with the aim to mature the weak link and connector design in order to improve the floating wind concept. This provided them an opportunity to get familiar with the project and as a result, they were successful in this tender process and will provide 56 km of 66 kV cabling, 28 km of which are Dynamic Power Cables and 28km are static export

cables with dynamic ends to Snorre A and Gullfaks A. As a result of the additional development work done by JDR between the Hywind Scotland and Hywind Tampen offers, JDR was able to demonstrate that product qualifications and increased technology readiness levels were partly already in place, reducing the technology risk on the project. At the same time, a more robust technology risk management plan could be presented demonstrating how the specific product configurations and innovative technologies required by Equinor for Hywind Tampen would be tested and how performance would be verified during the project. Additionally, JDR presented further experience and track record in floating applications and deployment of cables in deeper waters from Oil & Gas and other Floating Wind demonstration projects, which included projects executed after the first Hywind Scotland offer. Finally, following the changes in sub-supply chain management, JDR presented an improved supply-chain integration plan detailing how project requirements would be cascaded down to their sub-suppliers, including critical ethics and compliance practices and the company is in continuous collaboration with Equinor as part of Hywind Tampen project on such compliance issues.

This case demonstrates the effectiveness and importance of a tender feedback processes to supply-chain development. In this example, the process has allowed JDR to fully understand the developer’s requirements, adopt lessons learnt, and refine product offerings with additional technical qualification, track record and improved planning, supply chain integration and risk management in the project. Overall JDR has been able to improve their competitiveness, achieve greater alignment with the developer’s requirements and provide them with products meeting their expectations for their project. Through the process JDR has benefitted by increasing the export of their dynamic cable system products to other markets outside the UK.

Windfarm Autonomous Ship Project (WASP)

The Windfarm Autonomous Ship Project (WASP) was funded by Innovate UK and led by L3Harris in partnership with ORE Catapult, SeaRoc Group, Houlder and the University of Portsmouth, and Ørsted as an industry advisor.

WASP was a feasibility study which explored the potential applications for unmanned surface vessels (USVs) in offshore wind, with a focus on light cargo delivery. Ørsted's contribution was to provide representative data on vessel logistics and to meet with the team at key milestones to review progress and provide feedback to help ensure the relevance of the project to industry. Key outcomes from the WASP project included:

- From L3Harris: an autonomous navigation and control system for their USV.
- From Houlder: A vessel concept design that allows cargo to be collected from port and delivered directly to turbines without the need for crew.
- From SeaRoc Group: Extended capabilities of the SeaPlanner software for integrating the monitoring and operation of USVs.
- From the University of Portsmouth: A bespoke USV health monitoring system and logistics optimisation analysis and algorithm.
- From ORE Catapult: Industry use cases; a Levelised Cost of Energy Model; a Cost Benefit Analysis comparing manned and unmanned operations and a technology road map.



Image: Houlder

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To enable SMEs and academia to fully understand the challenges facing Developers, collaborative projects like WASP provide that vital face to face discussion that stimulates the pull through of the best technology solutions.

Audrey Bowie

ORE Catapult project manager for WASP

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Offshore Wind Accelerator

The Offshore Wind Accelerator (OWA) is Carbon Trust's collaborative R&D programme set up in 2008 between Carbon Trust and nine offshore wind developers, partly funded by the Scottish Government and partly by the industry.

One of OWA's aims is the reduction of costs in offshore wind through innovation in technology and since 2008, the OWA has supported the development of floating LIDAR technologies, 66 kV cables, lightweight monopiles and suction-bucket foundations for projects in the UK and Europe. To date, there has been a number of innovation competitions (e.g. foundation design, cable design, etc) launched which have resulted in the winning designs being developed and becoming commercially available. An example of the recent successful programmes is the 66 kV cable competition:

In 2013 the OWA kicked-off an international competition for the development of competitive 66 kV array cable technologies in time for CfD Allocation Round 3 and to help cut the cost of offshore wind energy by 1.5% by moving to higher array cable voltage. The cable qualification competition allowed the OWA to provide support for the testing and qualification of four different designs by three suppliers, JDR, Nexans and Prysmian.

The additional support funding awarded to JDR (a UK-based subsea cables supplier) allowed them to advance their technology investment in the new 66 kV cable system products. The involvement of OWA partners in the competition gave JDR management greater insight into the longer term trends in the industry and more certainty there would be a demand for their innovative new cable types. The opportunity given via OWA for JDR to receive a coordinated input from major offshore wind developers was beneficial for a number of reasons. When compared to the approach that JDR would normally take to seek individual inputs from developers, the OWA project



led to greater alignment in a shorter timeframe as well as insights into the future requirements of the industry. JDR were then able to complete the type test qualification of their 66 kV lead-free wet-design cable system solutions, much sooner than would have been achieved without support from the OWA.

66 kV cable technology has already had a direct impact on reducing the costs of offshore wind by enabling the use of larger turbines. For example, JDR's 66 kV technology has now been deployed on a number of commercial projects by major developers of offshore wind, with some of the cables now in operation for a few years. The 66 kV technologies supported by the OWA competition funding will be deployed on further projects due for installation during 2020 and 2021. Furthermore, at the time of the competition there were no recognised standards for design and testing of 66 kV array cables. An additional benefit of the OWA competition was that by supporting quicker development of the technology, it has enabled the development of design and testing standards which have been subsequently introduced within the industry and compliment the work done by the OWA as part of this competition.

The OWA objective of ensuring 66 kV array cables were type tested and ready for commercial projects (such as those eligible to compete in the 2019 CfD UK Allocation Round 3) was achieved with all three of the 66 kV competition winning cable manufacturers bringing their type-tested cable systems to the market between 2015 and 2016. This example clearly demonstrates the benefit of sponsored industry competitions and how they can encourage supply-chain companies to push forward their innovative technologies.

GE OREC Innovation Challenge case study

In March 2018, GE Offshore Wind Energy announced its Haliade-X turbine, the world's first 12MW offshore wind turbine. At that time, this was the largest turbine offered to the offshore wind market.

The transition to ultra-large turbines poses a set of new challenges to the offshore wind industry which exist across the value chain of technology, supply chain and operations. There is a clear drive to take the industry on a journey to develop the ecosystem for reliable and cost-effective large-scale use of ultra-large offshore wind turbines. This is only achievable by partnering with credible and respected domain experts.

GE's plan, called "StayAshore" focuses on developing novel technology to minimise the time people spend offshore for both safety and cost considerations. GE is focussed on validation of the turbine technology to drive system reliability and the development of digital technology to maximise remote operations and development of new robotics applications. These activities are now taking place with local UK partners / companies also leading to the potential to yield spin-offs in adjacent industries.

In 2018 GE Renewable Energy and the UK's Offshore Renewable Energy (ORE) Catapult formed a £9 million four-year research partnership aimed at minimising the time people have to spend offshore. This is expected to enhance both safety and operating costs for offshore wind farms and will directly support the roll out of the Haliade-X turbine. One of the focus areas of this research and development agreement was specifically intended to support collaboration with the UK supply chain to enable growth and support innovative SMEs.

As part of the partnership, in 2019 GE and ORE Catapult launched a robotics challenge for two areas; blade inspection/maintenance and bolt

torqueing. Use of robotics for planned maintenance events, specifically repetitive tasks, inspection activities as well as activities in areas that are difficult to access offer great potential benefits.

John Lavelle, president & CEO of GE's Offshore Wind business, said: *"By eliminating unplanned offshore human intervention through increasing productivity with digital and robotic tools, in addition to our Haliade-X 12 MW performance and design features, we will contribute significantly to reducing the cost of offshore wind energy."*

Once technologies of interest are identified and contracts are signed GE will work with the relevant SMEs to validate these concepts and accelerate commercialization into the market over 1-2 years. The blade inspection/maintenance challenge is ongoing, but the bolt torqueing challenge has already identified a technology from a UK based company for further development.

The technology concept, EchoBolt, is the brainchild of Peter Andrews, founder of the Stratford-based microbusiness Energy Integrity Services. Once fully developed, it will drastically reduce the cost of inspecting and retorquing wind turbine bolts – one of the biggest maintenance tasks that face wind farm operators. The cost saving for the European wind industry (offshore and onshore) will be an estimated £250 million per year.

Partnering with ORE Catapult following the innovation challenge has offered EchoBolt huge and exciting opportunities for developing its inspection technology. The project, which is funded by Innovate UK,

will develop the existing EchoBolt prototype for deployment and testing at ORE Catapult's Levenmouth Demonstration Turbine and then on one of GE's operational wind turbines. In the next two years alone, Peter expects to grow his company by an additional 10-20 employees in readiness for commercial roll-out, demonstrating the direct growth potential that competitions like this offer the UK supply chain.

