



# Driving Cross-Sector Innovation in Offshore Wind

## Strategies, synergies and barriers

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**CATAPULT**  
Offshore Renewable Energy

### Summary

Critical to the success of the moon landings and instrumental in the creation of the internet, cross-sector innovation is also one of the key drivers of the offshore wind industry.

This Analysis and Insight paper will explore two innovation strategies, and how cross-sector innovation feeds into them. Two examples of sectors that have synergies with offshore wind will be highlighted as well as a case study of a company from another industry that has successfully innovated in offshore wind. Some high-level barriers to cross-sector innovation will be emphasised, along with some of the work that ORE Catapult is doing to break them down.

### Headlines

- Understanding innovation and its drivers can help companies navigate the funding and innovation support landscape, complete applications, and increase the chance of success.
- Open innovation and mission-led innovation are two contemporary approaches to delivering new solutions that have strong groundings in cross-sectoral pollination of ideas.
- The UK is rich in existing expertise in other sectors that could be adopted by offshore wind, including oil and gas and aerospace.
- Barriers to cross-sector innovation do exist – however with the right market understanding, they are not insurmountable and should not act as a disincentive.
- By embracing cross-sector opportunities, companies can increase the number of markets they operate in, increasing their overall resilience.

## Introduction



*Ørsted's Burbo Bank Extension. Image: Ørsted*

Cross-sector innovation is crucial to the success of the UK Government's new Industrial Strategy, which focuses on mission-led innovation. The Industrial Strategy Challenge Fund (ISCF) is a source of public grant funding to support and enact this industrial strategy. This increases the importance of understanding and embracing cross-sector innovation.

Offshore wind stands to benefit from cross-sector innovation and technology transfer. As a maturing industry striving to achieve cost reduction, adopting technology already proven in another sector has clear benefits. It is often more efficient than developing technology from the ground-up: there is, of course, no reason to re-invent the wheel. Additionally, bringing together multiple sectors will often result in new thinking and more innovative concepts.

## Understanding Innovation Strategy and Policy Drivers Helps to Capitalise on Opportunities

Understanding innovation is essential. By appreciating the drivers behind innovation, and by appreciating innovation policy, companies are better placed to commercialise their own innovations and successfully navigate potentially complex funding landscapes. Grant funding is essential to smaller companies – with their smaller cash reserves and investable revenues – to develop new technologies, services and processes. Leveraging knowledge of the drivers behind a grant funding scheme (or other innovation support mechanism) can assist in completing the necessary application forms and increase the chances of a successful proposal.

### *Mission-Led Innovation is at the Heart of Current Government Policy*

Traditional industrial policies have focused on individual sectors. These sectors tend to be ones that require support, such as the United Kingdom’s waning heavy/manufacturing industries in the 1970’s. Critics accuse these sectoral policies of “picking winners”<sup>[1]</sup>.

In 2017, the UK Government unveiled its new Industrial Strategy <sup>[2]</sup>. It takes a dramatically different form to its predecessors. Mission-led innovation is front and centre, championed by Prof. Mariana Mazzucato. It is a way of creating linkage between industrial strategy and innovation policy. The European Commission too is following suit <sup>[3]</sup>. It commissioned a report by Prof. Mazzucato examining what a mission-oriented future could look like for European research and innovation.

This approach has a strong track record: it was mission-led innovation that resulted in the successful Apollo moon landings and the creation of the internet. It focusses on large-scale societal challenges or problems, which will invariably require input from a range of sectors and actors. Innovation is geared towards solving these ambitious challenges, and those willing to take risks and large steps forward are often rewarded. Through focussing on problems rather than on sectors, more solutions with wider-reaching impacts can be found. Measurable targets should be incorporated into the problem statements to provide milestones for success.

The Industrial Strategy Challenge Fund (ISCF) is the UK’s implementation of this type of policy and is a way of providing grant funding for R&D activities across the technology readiness levels (TRLs). The ISCF is rolling out challenges that feed in to solving four Grand Challenges identified in the Industrial Strategy White Paper <sup>[2]</sup>: artificial intelligence and data, ageing society, clean growth, and future of mobility.

Each of the challenges that is rolled out has a programme of funding, from academic level research hubs to higher-TRL innovation grant funding. The decision-making process for deciding upon which challenges are to be rolled out is administered through a competitive request for expressions of interest (EOIs). Successful EOIs must be founded in an industrial need and ideally fall across multiple sectors.

This is where cross-sector innovation becomes critical. Collaboration between different sectors brings together a wider range of expertise and increases the likelihood of solving these challenges.

## ***Cross-Sector Innovation and Technology Transfer is Crucial to Making Mission-Led Innovation Work***

Having seen the importance of collaborating between sectors, especially in relation to the UK's national innovation funding policy, the distinction must be made between technology transfer and cross-sector innovation.

Technology transfer increases efficiency: it helps to avoid industries reinventing the wheel when they could have directly lifted technologies from another sector. A prime example of this is utilising the oil and gas industry's existing heavy-lift vessels for installing offshore wind turbines. Often, a demonstration and validation of the technology in an offshore wind setting is all that is required to commercialise these technologies into the industry.

Cross-sector innovation requires more adaptation of a technology to make it applicable. There are several examples of this having been successfully done in offshore wind – however, more research and development activity is required before they can be successfully tested, demonstrated and commercialised into the sector.

Jacketed structures, for example, have been used extensively in the oil and gas sector. However, that industry has certain requirements of jacket structures that are not present in offshore wind – for instance, risers, pumps and umbilicals are incorporated to allow for extraction of hydrocarbons. Since these are not required in offshore wind, and turbines are lighter than a typical oil and gas topside, a direct transfer of a jacket foundation would result in a substructure that is highly overengineered for use in offshore wind.

Cross-sector innovation and its importance to mission-led innovation is paramount to succeeding in today's funding landscape, but companies embracing cross-sector technology is not necessarily something new: the success of companies embracing an open innovation strategy has highlighted this over the years.

## ***Open Innovation is an Important Mindset for Companies to Follow***

Open innovation is a mindset for smaller companies to embrace that can help them take advantage of opportunities, and a way of solving challenges for larger companies.

Large companies – especially those providing technology and services – have in the past invested large portions of turnover into research and development programmes. This strategy is critical to innovating and delivering sustainable growth for the company<sup>[4]</sup>. A policy of Open Innovation assumes that the best ideas and innovation may not arise through internal research and development spend. To be successful, it must also acknowledge the importance of external innovation, and that external businesses may be better placed to exploit and commercialise the innovation<sup>[4]</sup>.

In the offshore wind (and wider low-carbon energy) sector, EDP (Energias de Portugal) a now-multinational energy company, has adopted open innovation wholesale. Two EDP initiatives are industry-leading.

**EDP Starter** <sup>[5]</sup> is a competitive scheme run in Portugal, Brazil and Spain allowing start-ups and ventures access to in-kind EDP support, mentoring, and potentially a fast-tracked procurement process for providing products or services to EDP. It is one of EDP's principle strategies for bringing innovation into the organisation and is focused on five of EDP's core business strands.

**EDP Open Data** is a platform for allowing access to operational data for innovators. It is formed around challenges, to be solved using the data. EDP's participation as a challenge-setter and data provider at the 2018 Hack the Wind hackathon event in Hamburg was based upon the launch of the open data platform. Its goal is to give innovators the necessary tools to solve operational challenges that will, in turn, deliver improvements for EDP.

By its nature, open innovation encourages and fosters bringing ideas and technologies from other sectors to solve challenges. It does require a degree of openness and transparency (for example, organisations must be willing to disseminate their challenges to be successful).

Smaller companies are more likely to act as the innovators and solution providers in the case of open innovation. Having the correct mentality can open many more opportunities. Pulling across sectors is important to open innovation, and therefore smaller companies must also be willing to cross perceived sectoral boundaries. Seizing these opportunities can help to diversify a company's offerings, opening new markets and increasing resilience.

### ***Academia are set to reap the reward of mission-led and cross-sector innovation***

In 2014, the Research Excellence Framework (REF) was introduced in the UK, aiming to deliver greater impact for academic level research. The driving force behind this is the need for further justification of investment in research projects within the higher education system, greater accountability for the public investment and to deliver benchmarking between institutes and a more informed process for allocating funding.

This drive has led to a much greater emphasis on real-world impact for university-based activities. Mission-led approaches provide innovation challenges and use-cases that can be used to drive the direction of these academic projects and allows academics to showcase the potential impacts of their research. There is a recognisable critical mass of research strength across several sectors, including offshore renewable energy, in the UK. Mission-led innovation can frame this strength and, ultimately, provide an outlet for commercialising this research through mechanisms such as the Industrial Strategy Challenge Fund. A key example of this is the establishment of networks of research hubs across the UK's Industrial Strategy Grand Challenges, that had a requirement of being industry-led, both in the direction of the research carried out and through the attraction of match funding from industrial partners.

ORE Catapult too is driving this vision forward through a programme of Academic Research Hubs. With two hubs already kicked off focused on Wind Turbine Blades, and Electrical Infrastructure, and a third, Powertrains, hub in the pipeline they are providing a clear industrial focus for university-based research. Their core research programmes are complemented by industry-led projects aligned with the focus of the hub. This results in a "hub and spokes" research model to drive the greatest impact for the investment and ensure alignment with innovation challenges.

The Stern Review <sup>[7]</sup> further highlights that these Grand Challenges, due to their complex, and wide-reaching nature, will require multi-faceted approaches to solve them. This is perfectly aligned with the theory of mission-led innovation. For the academic world, this means that the next REF, due in 2021, will have a focus on ensuring cross-sector, interdisciplinary research is at the fore.

The next section will explore some of the sectors that both the offshore wind industry and academia can leverage to draw in new innovation, ideas and expertise from in order to solve the sector's own set of challenges.

## There are Sectors with Synergies to be Exploited

Cross-sector innovation and cross-pollination of solutions has a role to play in successfully taking advantage of opportunities through the Industrial Strategy Challenge Fund and other mission-led innovation funding programmes.

The UK has existing strengths in several sectors that have synergies with offshore renewable energy – offshore oil and gas and aerospace being just two examples.

### Offshore Oil and Gas

It is difficult to discuss cross-sector innovation and technology transfer in offshore wind without mentioning oil and gas. There are clear synergies between oil and gas and offshore wind: first and foremost, because of the offshore nature of these industries.

The sector has significant expertise in subsea technology and asset management: two key areas that are becoming increasingly important in the offshore wind space.

Throughout a typical offshore wind project's lifecycle, there are a multitude of opportunities for oil and gas companies to lend expertise, from site development, construction and installation to decommissioning.

Scottish Enterprise has produced several reports examining the synergies and diversification opportunities for oil and gas companies in the offshore wind sector <sup>[7]</sup>.

Since the downturn in oil and gas prices beginning in the mid-2010s, there have been many supply chain companies seeking diversification opportunities.

Many of these companies work in areas such as subsea operations, installation and fabrication of substructures. Skills in floating structures in oil and gas are also highly transferrable to the emerging floating wind market.

## Case Study: Tekmar



Tekmar's TekLink system in testing at the Catapult's National Renewable Energy Centre in Blyth, Northumberland.

Founded in 1985, Tekmar designs and manufactures seals and protection systems for subsea applications in the oil and gas sector.

In 2008, Tekmar responded to increasing demand in the offshore renewables industry with the first-generation TekLink cable protection system – an innovation that was successfully tested and validated at the Catapult's National Renewable Energy Centre.

This diversification has seen them become the market leader in cable protection systems for the sector, and their products now encompass many protection systems for static and dynamic cables and seals.

In the years since entering the offshore renewable energy market, Tekmar has seen more than a threefold increase in turnover <sup>[8]</sup> and the launch of a new company, AgileTek, in 2018 <sup>[9]</sup>.

## Aerospace and Defence

Another sector that has strong synergies with offshore wind is aerospace: from materials and aerodynamics to reliability, there are several challenges shared.

Many of the synergies have already been exploited, however the expertise present in the sector holds potential to solve future challenges <sup>[10]</sup>.

A wind turbine blade has many similarities with an aeroplane wing – from aerofoil design through to the importance of leading-edge protection.

The Catapult's 2017 O&M Case Study, Spare Parts Management in Offshore Wind <sup>[11]</sup>, highlighted the lessons to be learned in offshore wind from the much more mature aerospace industry.

Based upon work carried out by Accenture for an aerospace client, this case study highlights that exploitable synergies do not necessarily have to be technology-focused but can also be practice-focused.

## Case Study: Doncasters Bramah



A sample of Doncasters Bramah's metal alloy undergoes testing at the Catapult's Rain Erosion Test Rig in Blyth.

Leading edge erosion of wind turbine blades can cause severe damage to the structure, resulting in requirements for repair or replacement, as well as reducing the aerodynamic performance of the blades. Doncasters Bramah, an aerospace engineering company, has taken helicopter rotor-inspired technology and is applying it to protecting wind turbine blades.

Its solution of applying an alloy protection to turbine blades has yielded extremely promising results so far.

An initial test on the rain erosion test rig at the Catapult's facility in Blyth was stopped after 85 hours with no visible degradation of the material – these tests are normally run to failure and end much sooner than 85 hours.



## **Barriers to Cross-Sector Innovation Do Exist, but are not Insurmountable**

Differences between sectors can create challenges to the successful commercialisation of a product into a new sector. These challenges can come in many different forms, from differing regulation and standards and technological differences to a requirement for new business models and navigating an unfamiliar supply chain.

The sheer scale of the offshore wind industry, with its number of installed turbines, can be challenging – particularly for manufacturers. The upside, of course, is the opportunity for high-volume orders. Jacket foundation designs – a mature technology originating in the oil and gas sector – are difficult to manufacture serially for yards used to dealing with a few large, bespoke items.

The number of installed turbines can also prove challenging for those undertaking asset management. Inspecting and maintaining many dispersed assets requires new approaches compared to other sectors. For instance, it may not be possible to carry out a full inspection on every asset during every campaign. This necessitates moving towards a risk-based approach. Conventional utilities and oil and gas have long made use of asset management tools. Successfully implementing these for offshore wind farms with tens or hundreds of (almost) identical assets can be difficult.

A key consideration when developing technology for a new sector is the regulatory landscape and relevant standards. In offshore wind, for instance, key components are subject to DNV GL standards. This includes blades, electrical infrastructure, cables, and substations amongst others. Understanding which standards are applicable is an important step.

In addition to new standards that may not be applicable in other industries, transferring into offshore wind may allow for changes in technology that can reduce costs. The offshore oil and gas sector have stringent design codes owing to the chemicals and flammable substances that are present, but these are not as applicable in offshore wind. Differences in Health and Safety Executive requirements also need to be considered.

## **ORE Catapult is Working to Break Down These Barriers**

To best take advantage of the opportunities that cross-sector innovation and technology transfer offer, it is essential that the right support is available. This might be as simple as helping companies to understand a new market. Alongside our SME portal – an online resource with reports and insight for companies looking to break into the industry – ORE Catapult has several initiatives that can help draw technologies developed within other sectors into offshore renewable energy.

### ***The Offshore Wind Innovation Hub (OWIH)***

Delivered in partnership between ORE Catapult and the Knowledge Transfer Network, OWIH looks to highlight and marshal innovation priorities across the offshore wind industry. It presents a series of industry roadmaps, each exploring a technological area, its current state within the industry, its potential impact, and some key associated challenges. These roadmaps are a key resource for companies exploring the opportunity to develop and commercialise technology for offshore wind. The information presented can inform those companies on the synergies between their current sector of operations and offshore wind.

## ***Articulating Innovation Challenges is Essential to Help Companies Understand the Opportunity***

A key reason why a company may not seek to commercialise technology into offshore wind is simply not knowing what the opportunities for new technology are. These opportunities may be key pinch-points for the offshore wind sector where there is a significant potential for cost reductions, or they may be areas where there are gaps in technology usage. Innovation challenges are the Catapult's method of disseminating some of these opportunities out to the innovator community.

## ***Innovation Competitions Can Be Used to Attract Companies from Different Backgrounds***

Innovation competitions are a way of pushing innovation challenges out to SMEs and other innovators, along with a concrete opportunity such as pitching to an end-user/customer or potential investors.

The Offshore Wind Innovation Exchange (OWiX), run alongside the Knowledge Transfer Network (KTN) consists of utilising the KTN's extensive network, which spans multiple sectors, to market end-user backed challenges. OWiX competitions take forward the responses with the most promise and invite the companies behind them to pitch to the end-users, who put forward the challenge in the first place. These competitions have been successful in attracting cross sector expertise. For example, Wood – an oil and gas-focused multinational – responded to an OWiX challenge targeting improved connectivity with offshore technicians and monitoring of health and wellbeing. With its eWorking Suite already deployed in the oil and gas sector, OWiX enabled Wood to develop the internal business case for further development of the suite for offshore wind, and as a direct result of the competition had three offshore wind operators interested in adopting the technology.

Perhaps most successfully, in 2018 ORE Catapult piloted the Offshore Wind Innovation Competition. This saw Scottish Power Renewables (SPR) push four innovation challenges out through ORE Catapult in relation to their under-construction East Anglia One wind farm. Successful applicants were given the opportunity to pitch directly to SPR, along with Green Angel Syndicate (an angel investment network).

This combination provides a string incentive to innovators: a potential customer in SPR; the opportunity for investment to fund R&D activities in Green Angel Syndicate; and support for developing, testing and demonstrating their technology in ORE Catapult. Eleven companies pitched their solutions to SPR, with two securing new research projects worth £1.66million and three securing priceless demonstration opportunities at SPR offshore wind farms.

## Conclusion

The success of the UK Government's new Industrial Strategy depends on cross-sector innovation: the cross-pollination of ideas and solutions between industrial sectors. Offshore wind, in particular, stands to benefit massively from technology transfer from more mature industries like oil and gas and aerospace.

For companies to transfer their ideas to offshore wind, it is essential to understand the innovation landscape. The key strategies, open and mission-led innovation, require different approaches and create varying demands for organisations. However, the opportunities for those who get it right are significant.

The UK has strengths in several industries that have synergies with offshore wind: oil and gas and aerospace and defence among them. Regulations and standards are among the barriers to effective cross-sector innovation, but the big barriers are not insurmountable.

Helping companies diversify and cross-pollinate into the offshore renewable energy sector is at the heart of the Catapult's mission, and several programmes are available for developers to transfer their technology into the sector, including the Offshore Wind Innovation Hub, Offshore Wind Innovation Exchange, and the Offshore Wind Innovation Competition.

## Appendices

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## Author Profile



Alex Loudon joined ORE Catapult in September 2017 having completed his MSc in Renewable Energy and Environmental Modelling.

Alex's role as Innovation Manager sees him building relationships with a number of stakeholder types such as SMEs and academic partners. Through attending events, conferences, and developing strategies for engaging with stakeholders, he is involved in building collaborative projects to contribute to de-risking technology and reducing costs.

## Disclaimer

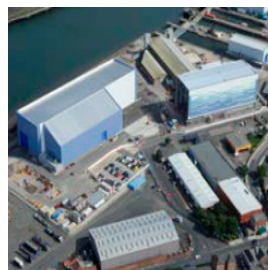
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