



SEIZING THE OPPORTUNITY
A REVIEW OF HOW
THE MIDLANDS CAN
ENTER THE OFFSHORE
WIND SUPPLY CHAIN





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PREFACE

In 1913 Henry Ford installed the first moving assembly line, allowing high volume production at a massively reduced cost. This revolutionary advance in the manufacturing process enabled access to products and technology to a much larger proportion of the population, products that had previously only been accessible to a wealthy few. Just over a century later, a mere blink of the eye in the grand scheme of things, the industrial and technological landscape has changed beyond recognition.

Industry is undergoing its fourth revolution, built around digital engineering, the Internet of Things, automation and the seamless integration of these technologies. The standard of living, education, healthcare, and housing have all risen in the last 108 years thanks to the widespread access to technology that industry has made possible. However, within the last 40 years, scientists have become increasingly aware of the potentially devastating impact of industrialisation: global warming and the resulting climate crises.

This paper marries two passions of mine, engineering and net zero. As an individual, when I look at the worst-case predictions of global warming I am extremely concerned. Even some of the best-case scenarios are cause for alarm, and predict widescale damage to the natural world. As an engineer I see a duty to respond.

Reaching net zero will challenge industry and it will challenge society. However, it will also provide us with incredible new technologies, new sectors, and new skills. It is the reason behind this paper - as carbon targets are set by governments across the globe a shift is happening to the way in which we utilise our natural resources. Industry in the UK needs to capitalise on this shift. Those who don't risk being left behind, and those who do stand to benefit from substantial growth, all the while providing solutions to an ever growing global crisis.

Kieran Ciniiewicz
Industrial Policy Research Centre
Loughborough University, May 21

EXECUTIVE SUMMARY

Climate change is an ever present issue, weighing on the certainty of the future, with the impact of global warming on our environment becoming ever clearer as the years go by.

There is a growing demand from consumers, government and industry for the development and implementation of sustainable practices and technology in all areas of the economy.

Over the coming years there will be a significant change in the way we utilise our planet's natural resources. This will create new challenges across all of industry, resulting in the decline of some sectors, growth in others and even the creation of some new ones.

The UK is a densely populated island with shallow waters and strong winds. Geographically, it is ideally placed for generating electricity through offshore wind. Over the last 10 years the UK has steadily grown its offshore wind capability and currently leads the world, with UK offshore wind farms having a total electrical generating capacity of 10GW¹, greater any other country.

Despite these achievements, there is still work to be done. Offshore wind will play a key role in the decarbonisation of the country's energy sector, with ambitious targets being set by the UK government, detailed in the 'Ten Point Plan for a Green Industrial Revolution'. The government is aiming to increase the UK's offshore wind

capacity to quadruple its current level over the next 10 years. There is significant opportunity for industry within this commitment.

There are many areas of technology, science and engineering that I cannot say with great certainty what direction they will go in the coming years. However, when it comes to electricity generation, based upon the need, the recognition and the benefits, I can confidently say that the offshore wind sector will play a major role in the decarbonisation of the UK's energy sector and indeed the global energy sector.

Clean energy is the foundation that all sustainable technologies need to be built upon. Without clean energy no technological solution to climate change can be truly 'green', whether this be newer and untested industries such as the use of hydrogen as a source of power, or more familiar and well established solutions such as electrification. Overcoming our dependency on fossil fuels for the production of electrical energy will be an arduous task, and there is not a 'one size fits all' solution. However, the case for offshore wind is compelling, the incredible advances in offshore wind technology over the last ten years has resulted in massive reductions in costs of the manufacture, construction, and operation of offshore wind farms. Through these advances, offshore wind has become the lowest cost route to large scale renewable energy.

There has been significant contribution to the establishment and development of the UK's offshore wind capabilities from foreign companies deploying their technology in UK waters. This work has greatly benefited the UK's citizens and economy, providing thousands of long term skilled jobs, the utilisation of UK based SME's and the supply of renewable energy across the country. However, it is important that the UK offshore wind industry is well positioned to capture the vast export opportunity that will come from the technology that has been developed around its shores. In order to do this, there needs to be a long term drive to increase the amount of intellectual property, knowledge and associated skills developed within the UK to increase the export potential.

We must continue to accelerate the incredible growth and development of the offshore wind sector. However, to achieve growth that will provide the most social and economic benefit, more UK businesses need to commit to the sector, building a stronger supply base that will support the industry through the huge growth that it will need to undergo to reach its desired capacity in the next ten years. There is real opportunity for UK businesses to expand into the rapidly growing offshore wind sector, and now is the time to do so, while the country and indeed the whole world is in need of what offshore wind can provide: a low cost, effective, scalable source of renewable energy.

There is significant opportunity for UK businesses to enter, or expand into the offshore wind sector, including those operating in what might be seen as very contrasting sectors. As a nation the UK has a long history of innovation and responding effectively to new challenges. The offshore wind sector has the potential to benefit hugely from knowledge and learning that is readily available in other, more mature, sectors. These opportunities don't just exist for those working in more 'traditional' parts of the offshore wind supply chain such as the development and manufacture of components like turbines, cables, boats and foundations, but also those working in areas such as advanced manufacturing, robotics, sensors, drones, data management and AI.

This paper is an exploration of how the Midlands region can seize the opportunity that offshore wind is offering, by building on the UK's world-leading deployment of offshore wind energy, through the development of clusters, R&D and skills, effectively entering the offshore wind supply chain, creating long lasting economic benefits.

¹ www.renewableuk.com/page/UKWindHome/Wind-Energy-Statistics.htm

INTRODUCTION

The UK has committed to achieving Net Zero carbon emissions by 2050, enshrining it in law in 2008². It is an ambitious, yet necessary, target for dealing with the climate crisis.

The first step in reducing global carbon emissions requires the transition from fossil fuels to low carbon, renewable electricity generation. This requirement will only be enhanced as electrification increases across all sectors such as transport, heating, and manufacturing, raising the already high demand for low carbon electricity.

When it comes to energy policy, there are three main challenges: security of supply, cost, and environmental impact. With current technology, and the UK's geographical positioning and resources, offshore wind is the most effective way to address these challenges, by providing regionally independent, low cost, low carbon energy production. Offshore wind is also a booming market; estimates indicate that by 2040 global investment in wind energy provision (onshore and offshore) will reach £2.3 trillion³.

The UK's offshore wind sector is a story of success. In the past decade, UK offshore wind power capacity has grown from 1GW to 10GW, giving the UK the largest offshore wind generation capacity in the world. Additionally, the construction and installation costs associated with offshore wind have shrunk at incredible rate, by almost two-thirds in the last 10 years⁴, making it one of the lowest cost options for new energy production, even cheaper than new nuclear and gas power⁵.

As detailed in the 'Ten Point Plan for a Green Industrial Revolution'⁶, which can be found in the appendix, the UK government has pledged to expand the its already extensive offshore wind sector at an even greater rate than previously planned, setting a target of growing capacity to 40GW from the current capacity of 10GW by 2030. It is an increase from the previous target of 30GW capacity by 2030.

Alongside this goal is the aspiration that within the same timeframe, 60% of the content in offshore wind projects will be delivered by UK developers, and furthermore, the industry will support up to 60,000 jobs and attract approximately £20 billion of private investment⁷. This will not be a simple task. However, through the development of local supply chains, R&D and public investment, it will be within reach.

¹ commonslibrary.parliament.uk/research-briefings/cbp-9390/

² citymavx.com/www.renewableuk.com/resource/renew/publications/capacit_prospectus_final.pdf

³ www.theguardian.com/environment/2022/oct/06/powering-all-uk-homes-via-offshore-wind-by-2030-would-cost-50bn

⁴ www.renewableuk.com/page/WindEnergy

⁵ www.gov.uk/government/publications/the-ten-point-plan-for-a-green-industrial-revolution

⁶ assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/95557/10_POINT_PLAN_BOOKLET.pdf

MARKET REVIEW

UK offshore wind projects are almost entirely owned and operated by multinational organisations, very few offshore wind developers are headquartered in the UK. Ørsted owns the most substantial proportion of the UK's offshore capacity, approximately 24% of the total capacity. The next leading companies are Vattenfall (13%), SSE (12%), Iberdrola (11%) and Innogy (8%). Out of these organisations only SSE is headquartered in the UK⁶. Early offshore wind farms were much smaller, and as a result, it was possible for them to be taken forward by independent developers, and these developers could then sell on consented projects to larger companies. Due to the increase in the size of individual projects this approach is no longer feasible. As a result, entering the market of project development and ownership for offshore wind is incredibly difficult, as it requires a large amount of start-up capital, long-term investment, and large amounts of experience.

Over the past decade, investors in offshore wind have mainly been interested in operational assets. However, due to the offshore wind sector maturing along with the ever-increasing scale of projects, the risks associated with investing in the manufacturing and infrastructure of

offshore wind is decreasing, creating a potential shift in investor focus towards the construction and development phases for offshore wind projects. This shift in investor focus is another reason why the over the next decade UK industry should be focusing on expanding its reach into the offshore wind sector. As it stands, the majority of the manufacturing related to offshore wind turbines is based outside the UK, with Germany and Denmark being the largest suppliers.

These figures paint a picture that the majority of UK offshore wind investment is going overseas. This is not entirely accurate, supply chain analysis shows that 43% of the lifetime cost of a UK wind farm is spent in the UK⁷.

Figures also show that approximately 60-70% of the workforce related to the deployment of recent offshore wind farms is UK based, with the industry directly employing 10,000 people in 2017⁸. The majority of the jobs produced throughout the lifecycle of offshore wind farms are based in the O&M (Operations & Maintenance) and construction of wind farms, by their nature these jobs are predominantly UK based.

⁶ cdn.gmawcs.com/www.renewableuk.com/resource/reemg/publications/supply_chain_review_31_01_20.pdf
⁷ <http://www.windenergynetwork.co.uk/wp-content/uploads/2014/12/Chim-Review-Supply-Chain.pdf>
⁸ renewablenow.com/news/study-eeer-260-growth-in-uk-offshore-wind-jobs-by-2022-severe-competition-for-talent-632330/



BARRIERS TO ENTRY

RISK PROFILE

The acceptable levels of risk between a large operator and an SME can be significantly different. Perceived increases of risk can act as a deterrent when a wind farm operator or a Tier 1 supplier is looking for suppliers. Development of credibility based on a solid track record forms a massive part of the decision making process for developers when choosing potential suppliers. This creates what Chinn¹¹ describes as a "Catch 22" scenario for new entrants to the market. "How do you win an order requiring a track record if you are new to a sector, and without an order how do you attract the necessary investment to develop the required facilities?"

RISK ALLOCATION

Risk in the sector needs to be better allocated. This is especially important for SME's and for new entrants to the supply chain. Currently, risk is often 'pushed down' the supply chain. In order to better support SME's and encourage new entrants to the offshore wind supply chain there needs to be greater consideration made to how risk is allocated within the industry.

INNOVATION FATIGUE AND SELECTION

Often only a small workforce is present for the day-to-day operation of an offshore wind farm. Operation is complex and activities can often have knock-on costs and time implications for other parts of the system.

As such, it may be challenging to convince the teams who would use them, of the value of investing time and effort in accommodating unproven services or solutions which may jeopardise their performance or add risk.

SUPPORT LANDSCAPE

The support landscape can be difficult to navigate and complex, especially for SME's and new entrants to the market. These companies at times have limited resources due to the small amounts staff and cash, further complicating the situation. Additionally, at times funding bodies require a certain percentage of match funding. The lack of dedicated funding attached to the offshore wind sector threatens to hinder technology innovation.

CREATING A CLUSTER IN THE MIDLANDS

The benefits of clustering is proving to be more and more self-evident. It leads to increased productivity, innovation and the formation of new business. Across the UK there are 7 established or planned offshore wind clusters: North Scotland, Forth & Tay, North East, Humber, East Anglia, Solent and North West/North Wales¹². In fact, in the UK, the Midlands is one of the only regions that currently has no offshore wind cluster, planned or otherwise. This is not to say that offshore wind is not present in the Midlands. There are 38 manufacturers, headquarters, and offices that are involved in offshore wind in the West Midlands and 27 in the East Midlands¹³. There is a missed opportunity here.

The Midlands, once dubbed the 'workshop of the world', is a region famed for its manufacturing and innovation, they traits are part of the Midlands identity. The Midlands is also home to many world-renowned universities and to three national Catapult Centres, with the High Value Manufacturing Catapult headquartered in the region.

SSER (Scottish and Sothern Energy Renewables) has recognised the importance of increasing the geographical diversity of offshore wind. In their roadmap for aiding the UK delivering 40GW capacity of offshore wind by 2040, they recognise that deployment has mainly been concentrated off the east coast of England. They outlined that ensuring geographical

diversity of the UK's offshore wind fleet will result in: improved security of supply; help mitigate price cannibalisation; and see industrial, commercial and employment benefits spread more widely. SSER believes that reviewing the 'place' element of transmission charging will enable levelling up between the South East of England and the rest of the UK¹⁴.

When we think about the Midlands expanding its reach into the offshore wind sector, we need to consider its geography. It is an excellent location for the supply of parts due to its central location in Great Britain. The Midlands is a neighbour to London and the South East; Wales and the North West; Yorkshire and Humber and the South West. That being said, the Midlands are not ideal entrants to all parts of the offshore wind supply chain and its limitations must be considered. The Midlands, more specifically the West Midlands, is not suited to the manufacture of certain parts due to a lack of ports. The manufacturing of offshore wind turbines' larger structures, such as turbine blades, tower and foundations, need to take place close to ports as it is difficult and expensive to transport these components large distances by land. These parts tend to be what comes to mind when we think about offshore wind turbines. However, there are still plenty of areas where the Midlands' manufacturing sector can achieve high levels of supply chain penetration.

¹² ewgip.org.uk/clusters/
¹³ maps.esri.com/maps/jap?geoMapId=411388&TENANT_ID=115744
¹⁴ www.sser.com/media/d0p5qub/delivering-40gw-of-offshore-wind-by-2040.pdf

¹¹ <http://www.windenergy.network.co.uk/wp-content/uploads/2014/12/Chimn-Review-Supply-Chain.pdf>

CROSS-SECTORAL OPPORTUNITIES

As the demand for offshore wind grows, so does the demand for innovation. The technology that is utilised for the design, manufacture, operation, deployment and management of offshore wind farms can be traced back to multiple engineering sectors. There has been significant input from the Oil and Gas sector, with the development in capability for the installation of offshore wind farms. Power Systems Engineering has been key in the development of electrical generation, transmission and distribution, from offshore wind turbines. The aerospace industry has been instrumental with their deep understanding and experience of materials and manufacturing techniques. There are many more synergies with other, well-established UK industries. There is great opportunity for knowledge and skill exchange between the offshore wind sector and said industries. Advances in materials, AI, data management and processing, power electronics, energy supply, robotics, and manufacturing, are all areas with potential applications to offshore wind. Companies that are active in these adjacent sectors, with solutions and advances in technologies such as the ones listed above, have the potential to be new entrants to the supply chain for offshore wind turbines.

The transfer of technology between sectors is a well-established practice and an effective way of increasing efficiency. Technology transfer across sectors can be straightforward when a technology in one sector is directly applicable to another, with demonstration and validation of technology being effectively utilised within the new sector being all that is required. However, there is often a requirement for technology to be modified in order for it to be suitable for the transfer between sectors, as it is

not always directly applicable. This requires innovation across sectors. For this type of innovation to be successful, businesses must realise the importance of external innovation. When businesses cross the supposed sector boundaries it can provide substantial benefits, increasing innovation due to the cross-pollination of technology and skills and resilience through the diversification of services.

During the pandemic, Midlands' manufacturing has shown itself capable of pivoting into new sectors. Businesses rose to the challenge, producing ventilators, face shields and other essential equipment at an unprecedented rate. Although this was the result of a global shock like no other, it demonstrated the capability of established organisations to pivot into new sectors.

With the global economy experiencing one of the most severe interventions, many sectors have been impacted; the aerospace sector has declined at an unprecedented rate; the automotive sector is experiencing significant disruption, with supply chain issues and decreased demand. There has been a clear demonstration that adaptability and flexibility are vital to the future of business. By being creative with available assets, be that repurposing equipment or people, businesses can start to respond by addressing emerging requirements in other market sectors, such as offshore wind, mitigating any further decline in their current sector.

There are many well established sectors in the Midlands including the automotive and aerospace. Their strong presence in the region coupled with the clear synergies they have with the offshore wind sector means that they are ideal entrants to the offshore wind supply chain.



AEROSPACE

There are strong synergies between aerospace and offshore wind. Areas of possible cross-sector innovation and technology exchange range from materials to aerodynamics.

Wind turbine blades are very similar in design to an aeroplane wing, both are aerofoils, require protection against corrosion and have a long operational lifetime. There is a great deal of expertise and resource in the aerospace sector, with proper support and collaboration the sector could be instrumental in overcoming technological barriers.

CASE STUDY

The market for advanced technological solutions to edge protection is estimated to be £120m annually over the next 10 years for UK businesses. Advances in protection against leading edge erosion of wind turbine blades is a vital part of these technologies. Wind farms are designed and built to achieve a 25-year operational lifespan. This time is spent in potentially unforgiving environmental conditions, damage caused by erosion can result in the parts requiring repair and even replacement.

Doncaster's Bramah, is an aerospace company investigating the viability of repurposing a metal alloy used for protecting helicopter rotors for use on wind turbine blades. The alloy, originally intended for aerospace applications, is initially more expensive than the standard paint-based leading edge protection. However, it has the potential to provide lifetime blade protection as well as enabling increased blade tip speeds.

Higher tip speeds allow lighter turbine nacelles and lower forces on the drive train. This has a knock-on effect of a 6% reduction in the capital cost of the turbine, 3.5% reduction in operating cost and a 3.2% reduction in Levelised Cost of Energy (LCOE). LCOE is a measure that enables the comparison of different methods of electricity generation. It can be calculated as the net value of all costs over the lifetime of an asset divided by the energy output from the asset over that lifetime¹⁵.

After accelerating the metal alloy in a test rig at a tip speed of 173m/s for 85 hours there was no degradation of the material. The next stage of this investigation is to test this metal alloy on the 7MW Levenmouth Demonstration Turbine in order to further determine its viability in real-world applications. The result of this study resulted in £200k funding from Innovate UK to develop more metallic protection solutions.¹⁶

¹⁵ www.eia.gov/outlooks/aeo/pdf/electricity_generation.pdf
¹⁶ ore.acaipull.org.uk/wp-content/uploads/2018/05/Protecting-against-leading-edge-erosion_v2-1.pdf

AUTOMOTIVE

The automotive sector has been hit particularly hard by the COVID-19 crisis. Building resilience and adaptability into the industry is key to protecting it against future shocks. There is a great deal that the offshore wind sector could gain from the established, more mature, automotive industry. Innovation and technology exchange between the two sectors are numerous, from robotics to manufacturing processes.

For years the automotive industry has optimised manufacturing by introducing standardisation and modular design, allowing the industry to construct different vehicles using the same platform with small variations in design. Introducing the same kind of techniques into the offshore wind sector will decrease manufacturing costs, thus reducing the risk and costs associated with the sector.

CASE STUDY

Formula one is at the cutting edge of the automotive industry, indeed all industries. Every improvement and innovation, no matter how small it is, is absolutely critical, increasing performance by any means.

More money is spent on R&D for aerodynamics in Formula One than in the aerospace and offshore wind sectors combined, with very little technology transfer present between the industries¹⁷.

The CEO of Anakata Wind Power, an SME based in Oxford, has taken his experience and expertise from his previous post as Chief Aerodynamicist at Mercedes Grand Prix, in order to find innovative solutions for wind power.

The company has succeeded in developing and installing enhancements that can be retrofitted to wind turbine blades in order to increase performance and energy output by up to 10%. Due to the fact that this technology can be incorporated onto existing wind turbines it enables the enhancement of existing structures, preventing the need to build entirely new structures in order to increase the efficiency and output of wind farms. So far, the components have been installed on turbines throughout the UK, Europe and the US.

The company has now entered the Chinese market, presenting a massive opportunity, with the potential to retrofit up to 20,000¹⁸ turbines, making a vast improvement to China's offshore and onshore wind sector; increasing efficiency and aiding the nation in achieving its carbon reduction target.



¹⁷ www.anakatawindpower.com/
¹⁸ ore.casapull.org.uk/stories/anakata-wind-power/

CROSS-SECTOR INNOVATION BARRIERS

There are numerous challenges involved in successful cross-sector innovation. These range from the different regulations and standards between sectors, to the difficulties that come from understanding and navigating unfamiliar supply chains. For businesses looking to pivot into the offshore wind sector, the regulations and standards can be difficult to overcome, but are vitally important.

Health and safety standards are an important consideration, with the installation, operation and maintenance of offshore wind turbines being of significant importance due to the hazardous environments that these perform in. At times these regulations can be less stringent, for example, when compared to those associated with sectors such as oil and gas, which has to take considerations surrounding dangerous and highly flammable chemicals and other hazardous substances.

There is support for businesses who want to take advantage of cross-sector innovation for the offshore wind sector. The UK's catapult network is a reliable resource for this, with the Offshore Renewable Energy (ORE) Catapult being perhaps the most relevant. The catapult, in partnership with the Knowledge Transfer Network¹⁹, has helped setup the Offshore Wind Innovation Hub (OWIH) which provides industry roadmaps that are a useful resource for those looking to enter the offshore wind supply chain, and can help companies identify possible similarities between their current sector and the offshore wind sector.

The Offshore Wind innovation eXchange (OWiX)²⁰ is an innovation platform that runs competitions to connect solution providers in different sectors directly with offshore wind project developers providing incentive and opportunity for SMEs and innovators in all sectors to develop solutions relevant to the offshore wind sector. The platform is funded by the Department for Business, Energy and Industrial Strategy, and delivered jointly by OWIH and the Knowledge Transfer Network (KTN).

The KTN was established by Innovate UK, the network connects people and companies enabling them to reach their full potential in regards to their innovative capabilities by connecting them with each other. Its members consist of large and small companies, government agencies and public funding bodies, universities and research organisations, technology hubs and start-ups²¹.

Additionally, the High Value Manufacturing Catapult (HVMC) can help provide manufacturing expertise, facilities and networks to improve business performance by transforming products, the way they're manufactured and the skills of the workforce, providing support for moving beyond an existing industry market. With a strong business focus, the industry can drive growth by working with companies to de-risk, enable and support innovation.

Innovate UK is also a valuable resource for all those looking to pivot into the offshore wind sector, connecting businesses with partners, customers and investors, helping transform ideas into commercially successful products, services and business growth. They fund business and research collaborations to accelerate innovation and convert business investment into research and development, with support available to businesses across all economic sectors, value chains and UK regions.

Ben Wood, CEO of Anakata Wind Power Resource (UK) Ltd, whose expansion into the offshore wind sector, who's case study is discussed above, has highlighted the value of some of the institutions discussed in the previous paragraph, stating: "Anakata is now successfully accessing the Chinese wind energy rotor blade retrofitting market for its innovative aerodynamic add-ons as a direct result of all the hard work of ORE Catapult, Innovate UK and the TUS-ORE Catapult Research Centre. Without their help, support and bridge-building with the ideal Chinese partner companies, this would have been a near impossibility."

We are delighted to be able to bring such innovative technology to China and support the growth of the Chinese wind market. We've established a long-term strategic partnership with TORC and will co-locate our Chinese HQ with the Centre. We'll continue to promote our technology and products through the Centre for the mutual benefit of both China and the UK.²²

Cross-sector innovation and the exchange of solutions, ideas and management between sectors is hugely advantageous to all involved. The offshore wind sector is particularly poised to capitalise on this transfer and exchange, from more mature sectors such as aerospace, automotive, and oil and gas. An understanding of the offshore wind sector, the innovation landscape, and the regulations and standards of the industry is key when considering pivoting into the wind sector. The barriers that are present for business that want to take this path can be difficult to navigate. However, they are not insurmountable, and with the correct understanding of the sector and the guidance and support of institutions such as the UK's catapult network, the Offshore Wind Growth Partnership (OWGP) and Innovate UK, they can be overcome.

¹⁹ ktn-uk.org/

²⁰ offshorewindinnovationhub.com/what-we-do/owix/

²¹ www.gov.uk/government/news/connecting-innovators-the-knowledge-transfer-network

²² ore.catapult.org.uk/stories/anakata-wind-power/

OPERATIONS AND MAINTENANCE

A large proportion of the lifetime costs associated with the development of offshore wind farms is a result of O&M (Operations and Maintenance), with this phase of offshore wind projects representing approximately 25% of the total project value²³. It is a phase of the project that represents the largest opportunity for local contribution, offering high-value employment, and a low barrier to the market for newcomers allowing significant UK supply chain penetration. There are ways to develop O&M practices by adopting more proactive data-driven predictive maintenance. Improvements in health and safety procedures provide mid-term achievable results, with the development of technology allowing workers to decrease their exposure or number of visits to potentially dangerous environments. This ties into the continuous drive towards increased reliability in order to improve efficiency and profitability of offshore wind farms.

Typically, from initial service, there is a warranty phase of five years where OEMs maintain the turbines, and the developers, either in house or through a contractor, maintain the balance of the plant. After this warranty expires there are several different strategies for the continuing operation and maintenance of offshore wind farms. These include long term service agreements (LTSAs) with OEMs or potential independent service providers, multi-contract or a combination of all of these methods.

Due to the increasing capacity the UK's offshore wind, and developers having multiple projects operating in parallel, there is an industrialisation of operations and maintenance.

By bundling services such as technicians, facilities, equipment, vessels, helicopters and developers, costs are decreased and there is an increase in value through better utilisation of resources. This provides the opportunity for existing and potential supply chain companies to develop globally competitive operations and maintenance knowledge, skills, experience and technology for the UK market and provides export potential.

There is also a large market in the UK for the supply of large offshore installation vessels. This is a difficult market to enter as it entails a large upfront cost. Additionally, offshore wind is a rapidly evolving sector with ever changing technologies with different installation requirements. This means the main barrier to entry for UK companies is early upfront costs and the requirement for experience to construct. There is an opportunity for oil and gas vessel owners to pivot into the market, especially with the current decrease in demand as a result of the global pandemic. The demand for oil and gas will pick back up in due course as the restrictions put in place to contain the virus begin to be relaxed. However, as the drive towards clean energy intensifies this demand will again dip. By investing in the offshore wind sector now Oil and Gas companies fortify their business by increasing their portfolio and resilience.

UK companies have a solid base for experienced personnel and technicians for the deployment to maintain and manage windfarms. Small companies are able to provide expertise to the industry along with rapid deployment of personnel. There are few barriers for entry into this market, however as is often the case in the offshore wind industry, a proven track record is a requirement from developers.



²³ s3-eu-west-1.amazonaws.com/vmedia-renewablecalipul/app/uploads/2018/03/23/15/1357/Breaking-into-the-Offshore-Wind-Sector-AP-0015-Owen-Murphy.pdf

RESEARCH AND DEVELOPMENT

Innovation is key for creating thriving societies, and without it the offshore wind sector, indeed any sector, risks stagnating. The UK government has stated its ambition to make the UK 'the world's most innovative economy', in the Industrial Strategy White Paper²⁴. This includes increasing public research and development spending by £7 billion by 2022, a further increase to 2.4% of GDP by 2027 and 3% in the long term. These are welcome figures; however, it is imperative that this funding is utilised in the best possible way.

The Midlands as a region has of late, not been receiving the same levels of public sector R&D investment as other parts of the country. These lower levels of public funding ultimately leads to lower levels of private funding, due to companies being more likely to invest in regions which have greater access to public funding, as it reduces their risk and maximises returns. Figure 1 illustrates this point, with the ratio of private to public being approximately 4:1 for the West Midlands and 3:1 for the East Midlands, far from the target 2:1 ratio. The picture is even more concerning when compared to London, Wales, Scotland, Yorkshire & Humber and the North East, each with ratios closer to 1:1. The rebalancing of the ratio is of vital importance to the Midlands region.



²⁴ assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/666693/industrial-strategy-white-paper-web-ready-version.pdf

The UK's offshore wind sector has benefited substantially from foreign technology, investment and capability, especially in the early years of its development, when there was a lack of clarity and a long-term industrial strategy for the sector. In recent years, the strength of the UK's offshore wind market has been successful in attracting multinational businesses to build manufacturing plants in the UK, creating good quality long-term jobs.

Over the last 10 years, as the offshore wind sector has undergone substantial development, these early investors and multinational companies have acquired extensive industry knowledge. As a result, there are insufficient UK businesses that have developed intellectual property and industry know-how. This will hinder the ability of UK business to capitalise on the substantial export opportunities that are becoming more evident as the offshore wind is adopted to a greater degree around the world.

The current aim, set out in the government's 'Offshore Wind Sector Deal'²⁵, of 60% offshore wind content to be delivered by UK developers is a strong target. Previously such targets have been successful in encouraging developers to use UK businesses. However, there is a need to consider how to maximise the value added to society as a whole. In order to do this, considerations of what form of content is incorporated into offshore wind projects by UK developers, for example the amount of innovation. By only setting targets for the overall contribution of UK developers to the offshore wind supply chain there is a lack of encouragement from government for UK based research

and development to be incorporated into the supply chain. This development of UK based R&D is vital for creating valuable intellectual property and system integration knowledge as it enables the expansion of the UK's offshore wind export capacity.

There is a need to expand on the government's target of 60% of offshore wind content to be delivered by UK developers, by specifying a requirement that a percentage of the total capital cost of offshore wind supply chains needs to incorporate intellectual property developed and owned by UK companies. This will push the market in a direction that will support UK businesses in developing intellectual property and therefore increasing their export potential.

FUNDING LANDSCAPE FOR OFFSHORE WIND R&D

With the UK government pledging a record increase in public investment in research and development, there is real opportunity for businesses and RTOs to advance their capacity for innovation with support from public funding. The aim of the government is to create an environment where research and innovation is widespread through the revitalisation of the science, research and innovation landscape in the UK, creating the world's most innovative economy.

Within governments plan for growth 'Build Back Better'²⁷, they recognise that 'not all growth is created equal' identifying three key areas that growth is to be driven in: levelling up the whole UK; supporting a vision for a global Britain and supporting the transition to net zero. This, coupled with the 'Ten Point Plan for a Green Industrial Revolution', where the government sets out clear targets and intentions to turn the

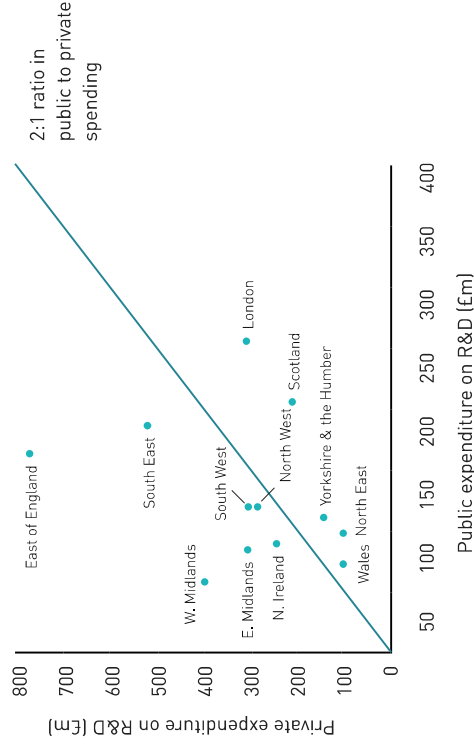


Figure 1: R&D expenditure per capita by NUTS region, 2017²⁶

UK into the world's number one centre for green technology and finance, with specific support for the expansion of offshore wind, it is exceptionally clear that the UK government's industrial strategy is heavily committed to green growth, with offshore wind being a key player in achieving such growth.

The Business Secretary announced the launch of The Advanced Research and Invention Agency (ARIA) in February 2021. The agency is set to be an independent research body that will fund high-risk, high-reward scientific research, led by world-leading scientists. The agency will be afforded the freedom to identify and fund transformational science and technology rapidly, with the goal of delivering funding to the UK's most pioneering researchers

with flexibility and speed, supporting their work while avoiding unnecessary bureaucracy.

With the ever increasing focus on research and development and the increase of available public funds there is a consequent de-risking in all sectors to invest in producing valuable and innovative intellectual property. This is particularly true for the offshore wind sector, with the government's 'Ten Point Plan for a Green Industrial Revolution' and the government's plan to 'Build Back Better' focusing on achieving net zero, there is clear demonstration of the commitment to facilitating and encouraging research and development for technologies that aid with reaching net zero.

²⁵ www.gov.uk/government/uploads/system/uploads/attachment_data/file/66487/de-087-44ce-8ba06c082cc57c.pdf
²⁶ www.scienceandinnovation.gov.uk/static/uploads/66487de-087-44ce-8ba06c082cc57c.pdf
²⁷ assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/798403/PIG_Final_Web_Accessible_Version.pdf

SKILLS

The offshore wind sector is a good potential source of employment and currently provides approximately 10,000 jobs²⁸ throughout the UK. As the sector matures there will be increased demand for highly skilled workers in a broad range of disciplines throughout the UK. In the process of advancing offshore wind installed capacity to the targeted 40GW by 2030, estimates show that as many as 60,000 jobs could be produced, including those related to manufacturing. This is an exciting target but in order to meet it, it is imperative that the UK's offshore wind skills base is developed throughout the supply chain.

The only way that the UK skills base will be able to deliver the increased demand from the sector will be through collaboration and coordination across government, industry and educational institutions. It is especially important to engage on a regional level, as it is within the communities that will benefit from this expansion that have the best knowledge and resources for how to deliver the next generation of skilled workers within the offshore wind sector, capable of exporting skills and experience to the global market.

Expansion of the existing training schemes in offshore wind will be required to create a highly skilled workforce capable of meeting the increasing market demand. The offshore wind sector, should actively engage with universities and technical

colleges, to encourage an alignment with the requirements of the industry, and stimulate students to consider the sector for their future careers, better communicating the opportunity and different routes available into the offshore wind industry. The idea that success in engineering is only possible through a university degree is not the case; this needs to be communicated to young people and to the wider public. There are so many areas for involvement in offshore wind along the supply chain, along with many different paths into the industry.

The nature of job creation in offshore wind is that it produces large volumes of local employment in the operation and maintenance, and the construction and installation phases. It is important to ensure that job creation permeates all the way through the supply chain. This is especially necessary for delivering the government's target of 60% UK content in offshore wind projects. This content must come from all areas of the supply chain, including manufacturing and R&D.

When thinking about the long term development of skills for the offshore wind sector, early intervention is an area that needs to be explored. There is a wealth of talent in schools, individuals that if inspired can bring skills and innovative ideas to the industry. Efforts should be made to inspire children from primary school level and continue through all stages of the education system.



When thinking about growing the skills base in the UK it is important to note that the pipeline of talent that is coming from young people will not solve the problem or provide all the skills required for the industry. With the current decline in, amongst others, the aerospace and automotive industries, and with large numbers of redundancies being made, there is need for reskilling. This will provide a ready supply of skilled engineers to be active in the offshore industry in a short space of time.

A current challenge facing industry is how rapidly the world is changing, be this technologically, with capabilities always developing and changing; environmentally, with the ever growing climate crisis and

the question of net zero on all our minds; or economically, with the way we live our lives evolving and with it, adjustments in the demand and requirements of consumers. This ever changing landscape is resulting in a growing demand for a more responsive and flexible skill set. By creating a more modular system for delivering skills development, where education is comprised of shorter 'chunks' of learning, that can be delivered as and when it is needed. Alongside this modular approach to training it is essential that a means of accreditation is developed, allowing these modules to be built into higher level qualifications, forming a 'passport' that details the skills and qualifications of an individual so they can be recognised and identified by employers.

²⁸ renewablenow.com/news/study-sees-260-growth-in-uk-offshore-wind-jobs-by-2032-severe-competition-for-talent-63230/

CONCLUSION AND RECOMMENDATIONS

Net zero is looming, and meeting its ambitious timescale will not be easy. In order to reach this target, the way we generate electricity will need to change. Offshore wind is a particularly suitable alternative energy source for the UK, which is aligned with a rapidly emerging global market for the industry.

Offshore wind is a rapidly growing sector, with a booming global market demand. The UK's offshore wind sector is rife with opportunity with strong support coming from the government in the form of its 10 Point Plan for a Green Industrial Revolution and Build Back Better.

By being ahead of the rest of the world in terms of developing technologies and skills, the UK can create valuable intellectual property and expertise within the sector creating lasting economic and environmental benefit.

RECOMMENDATION 1

The support landscape for offshore wind needs to be simplified, along with better allocation of risk throughout the supply chain to decrease the burden placed on SME's and new entrants to the supply chain.

RECOMMENDATION 2

An investigation into the development of an offshore wind cluster in the Midlands should be explored further and considered by the offshore wind sector.

RECOMMENDATION 3

Adjacent sectors to offshore wind should recognise and understand the opportunity and advantages of pivoting into the offshore wind sector.

RECOMMENDATION 4

The Government must match private sector investment in the Midlands to the ratio that it does for the rest of the UK.

RECOMMENDATION 5

The current aim of 60% offshore wind content to be delivered by UK developers should be expanded to include a percentage requirement for the total capital cost of offshore wind supply chains to incorporate intellectual property developed and owned by UK companies.

RECOMMENDATION 6

The achievements and opportunities of the offshore wind sector need to be communicated clearly to government, the public, the media and other industries, in order to raise awareness of the significant opportunities available through involvement in the industry.

RECOMMENDATION 7

The industry should continue to invest in the right skills, and utilise the existing skills programmes while working with educational institutions to raise awareness of the opportunities for well paid, highly skilled, sustainable jobs in the sector.

APPENDIX

FUNDING ROUTES

INNOVATE UK AND KTN

www.gov.uk/government/publications/innovate-uk-funded-projects

LEPS

lep.org.uk/app/uploads/2020/09/LLEP-Annual-Report-201920-FINAL.pdf

UK ROADMAP

www.gov.uk/government/publications/uk-research-and-development-roadmap/uk-research-and-development-roadmap

ENGINEERING RESEARCH INFRASTRUCTURE

epsrc.ukri.org/newsevents/pubs/engresinfrastructureroadmap/

GOVERNMENT WHITE PAPERS

THE TEN POINT PLAN FOR A GREEN INDUSTRIAL REVOLUTION

www.gov.uk/government/publications/the-ten-point-plan-for-a-green-industrial-revolution

BUILD BACK BETTER

www.gov.uk/government/publications/build-back-better-our-plan-for-growth

OFFSHORE WIND: SECTOR DEAL

www.gov.uk/government/publications/offshore-wind-sector-deal

SEIZING THE OPPORTUNITY
**A REVIEW OF HOW THE MIDLANDS CAN
ENTER THE OFFSHORE WIND SUPPLY CHAIN**

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