CATAPULT Offshore Renewable Energy

OffshoreWind IndustryCouncil

OFFSHORE WIND INDUSTRY PROSPECTUS

OCTOBER 2018

THE UK HAS OVER 1800 TURBINES PROVIDING 7.2GW CAPACITY, POWERING APPROXIMATELY 6.5 MILLION HOMES AND 6.2% OF UK ELECTRICITY IN 2017

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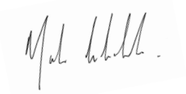
ABOUT THIS PROSPECTUS

This prospectus has been prepared by ORE Catapult and the Whitmarsh Supply Chain Review Team on behalf of the Offshore Wind Industry Council (OWIC).

Special thanks to Scottish Power Renewables, Innogy, MHI Vestas and Siemens Gamesa Renewable Energy.

THE UK NOW HAS THE LARGEST OFFSHORE WIND GENERATION CAPACITY IN THE WORLD

INTRODUCTION



MARTIN WHITMARSH
Former CEO of McLaren Group and F1 Team Principal

I am delighted to have been appointed by the Offshore Wind Industry Council to lead a review of the UK offshore wind supply chain. This review aims to identify opportunities for UK firms to win a greater share of the growing domestic and global offshore wind market.

Although I'm new to offshore wind, I see similarities with the automotive sector where over 25 years, I witnessed the development of a world leading motorsport industry which I believe created the catalyst for the renaissance of automotive development and manufacture in the UK. It's fascinating to see the maturing of offshore wind energy as a new industrial sector and to understand the huge future business potential in and beyond our waters. The need for this technology is obvious and to recognise the progress that has already been made in demonstrating its practical and economic viability is very exciting. I was therefore delighted to become involved and hopefully bring some of the tremendous opportunities to the attention of existing and new British businesses.

You may not know it, but offshore wind energy is a major UK success story. With Government support and world leading business expertise, the UK now has the largest offshore wind generation capacity in the world and the sector is currently the UK's 4th largest infrastructure building program. Offshore wind is on course to generate 10% of the UK's electricity by 2020 and the industry has a target of generating over a third of the UK's electricity requirements by 2030 and over half by 2050 as the UK moves away from fossil fuels and towards a more electric future. Offshore wind technology has now demonstrated that it is cost-effective and is now part of the mainstream.

The United Kingdom should now be building upon its world leadership in deployment of offshore wind energy to exploit the substantial export opportunity. Markets around the world are developing offshore wind as the world moves away from fossil fuels towards a cleaner future of decarbonised power, heating and transport. If the UK is to take advantage of the growing worldwide opportunity it is imperative that business now develop and own the intellectual property to do so.

The development of the world's first floating wind farm at Peterhead off the north-east coast of Scotland demonstrates the leadership of the British Offshore Wind Sector, but also opens the opens the possibility of technology not previously considered suitable for offshore wind energy. This is creating opportunities for smart UK businesses to develop their offshore wind expertise and access a growing global market. Industry expects a fivefold increase in UK exports to £2.6bn per year, and it has been estimated that a further £55 billion will be invested in offshore wind energy by 2030.

I see the opportunity for UK businesses to enter or expand their commitment to the rapidly growing offshore wind sector as exciting and substantial. We have in so many fields demonstrated the ability to innovate and respond to new challenges. It's clear that the offshore wind sector can benefit from knowledge and learning in other sectors. These opportunities won't only be for 'traditional' offshore wind suppliers involved with components like turbines, foundations, boats and cables, but also in manufacturing techniques, robotics, drones, sensors and big data to name just a few.

SUPPORT FROM UK GOVERNMENT

CLAIRE PERRY STATEMENT

The UK is leading the transition to a low-carbon economy. In doing so we want to maximise the advantages for UK industry from this transition and to ensure we benefit from the innovation and investment that will be required to meet our climate ambitions. As part of this the UK has helped to realise an extraordinary coming of age for the global Offshore Wind sector, and is poised to reap the reward in new export markets, alongside building on our successes at home.

The Government recently announced a new wave of support for the offshore wind sector, committing to an additional 1-2GW of offshore wind per year in the 2020s. The UK supply chain is strong and will continue to expand to service this demand, but I believe there is much more we can do to ensure this Government's commitment to offshore wind translates into a comprehensive industrial success story. I want to see the UK supply chain increase its global competitiveness by building on areas of strength, capitalising on our world-leading research base to drive innovation, creating new British manufacturing capability and attracting new supply chain players to the UK – while continuing to drive down costs. I hope Martin's experience from other sectors can help the offshore wind sector understand what it can do to meet these new opportunities and build on historic levels of investment in growing the UK supply chain, creating high value jobs across the country. I look forward to seeing how the sector responds to his findings.

Yours sincerely,

The RT Hon Claire Perry MP
Minister of State for Energy and Clean Growth

CROSS SECTOR OPPORTUNITIES

£2.5 TRILLION
INVESTMENT IN WIND ENERGY BY 2040

OFFSHORE WIND IS THE CHEAPEST LOW CARBON ROUTE FOR LARGE SCALE DEPLOYMENT IN THE UK

THE COST OF ELECTRICITY GENERATED FROM NEW OFFSHORE WIND PROJECTS HAS FALLEN BY 50%

OPPORTUNITIES FOR INNOVATION

OFFSHORE WIND GLOBAL MARKET IS RAPIDLY EXPANDING

1 OFFSHORE WIND – THE STORY SO FAR

Energy policy must address three major challenges; climate change, security of supply and affordability. Offshore wind provides solutions to these with low carbon, regionally independent and low-cost electricity generation. The sector is developing rapidly with a pipeline of new projects, strong investment and a fast-growing supply chain. It is a sector that is full of opportunity and now is the perfect time to get involved.

The UK has the largest installed capacity of offshore wind in the world thanks to a supportive regulatory and policy framework; in early August 2018 there were 1,837 turbines installed in UK waters with a total generating capacity of 7.2GW, enough to power over 6 million homes. This provides a strong knowledge base to enable UK companies in the offshore wind sector to thrive as world leaders in a high growth global market. The reality has changed from the question "How can we afford to mitigate climate change with offshore wind?" to "How can we afford not to?".

This prospectus provides an overview of the offshore wind sector, highlights the scale of the opportunity and provides some guidance on how to get involved.

1.1 GLOBAL DEMAND FOR LOW CARBON ELECTRICITY

The Paris Agreement in 2015 bound 195 countries, representing 90% of global economic activity, in a deal to limit the risk and impacts of climate change. It is estimated that over £10 trillion of public and private investment in the global energy sector alone will be required by 2030 for signatories to meet their targets.

The drive to reduce carbon emissions requires a transition to low carbon electricity generation. The demand for low carbon electricity will be strengthened as other sectors such as transport and heat are increasingly electrified. Deployment of renewable energy generation is a key part of the solution with wind and solar power providing the largest contribution. Investment in wind power generation is forecast to be over £2.5 trillion between 2017 and 2040 according to Bloomberg New Energy Finance.

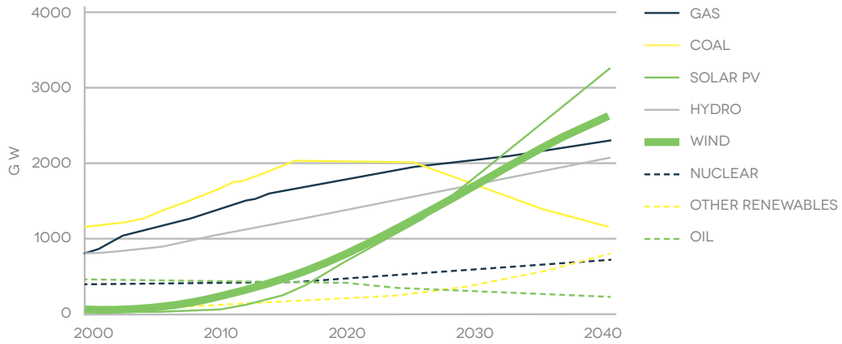


Figure 3: *Forecast installed electricity generation IEA World Energy Outlook 2017*

1.2 OFFSHORE WIND COST REDUCTION

One of the main drivers for the forecast growth of offshore wind is the rapid reduction in costs. In the UK's Contract for Difference (CfD) process, offshore wind developers bid for a guaranteed price with government funding the difference between the bid price and the wholesale price of electricity. The 2017 CfD auctions saw a 50% strike price reduction over the previous 2015 auction round with a winning project at £57.50/MWh. The German and Dutch markets have both approved subsidy free projects.

Figure 1: *Offshore wind cost reduction in auction rounds.*

The cost of offshore wind in the latest auction rounds is approaching £50/MWh. This is significantly less than the 2025 cost forecasts for nuclear and less than new build gas generating plant. Even when the additional costs of intermittency are included, renewable energy from offshore wind, onshore wind and solar photovoltaic is now the cheapest way for the UK to meet its carbon reduction commitments.

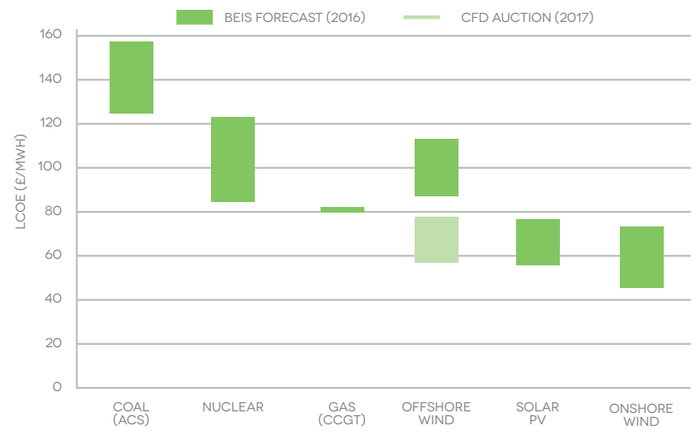


Figure 2: *Offshore wind costs compared to other forms of electricity generation.*

1.3 OFFSHORE WIND MARKET GROWTH

1.3.1 UK

The UK leads the world in both installed and planned offshore wind capacity, with over 7GW installed by June 2018 and almost 30GW under development. The UK offshore wind capacity represented 36% of the global market at the end of 2017. The UK is committed to delivering 15% of its final energy consumption from renewable energy by 2020, which translates into approximately 30% of electricity generation. Offshore wind is a cornerstone to achieving this through its scalability and affordability.

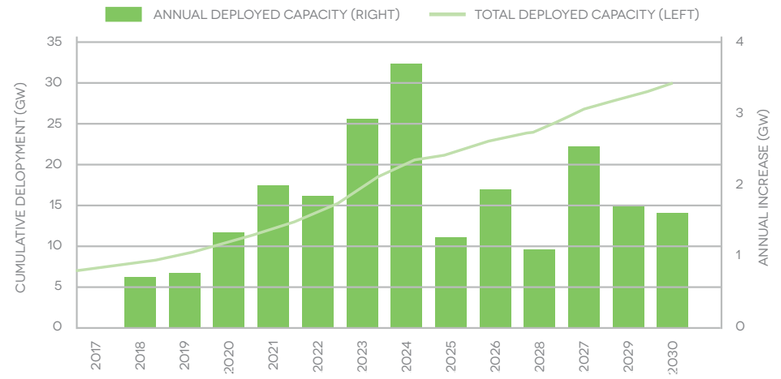


Figure 4: *UK offshore wind forecast (capacity) under the Sector Deal Vision*

The first offshore wind farms were developed near to shore (5 to 20km) in relatively shallow water depths (less than 30m). Sites were located off the coasts of Walney, Morcambe Bay, Moray, Hull, East Anglia and more, where favourable seabed and logistical conditions exist. These early sites used turbines rated at less than 4MW.

As the sector progressed, larger turbines (6 to 9.5MW) have become available and advances in substructures (monopiles and jackets) have enabled deeper sites (30m to 50m) to become viable **(Figure 5)**.

The Crown Estate and Crown Estate Scotland manage the leasing of seabed around the UK and both organisations are planning further leasing rounds to enable UK capacity to reach 30GW by 2030 **(Figure 6)**. Future sites will include extensions to existing sites along with sites further from shore (over 200km) and as floating platforms become cheaper could include deep water sites in higher wind locations.

Figure 5: *Turbine types*

UK OFFSHORE WIND FARM DEVELOPMENT STATUS

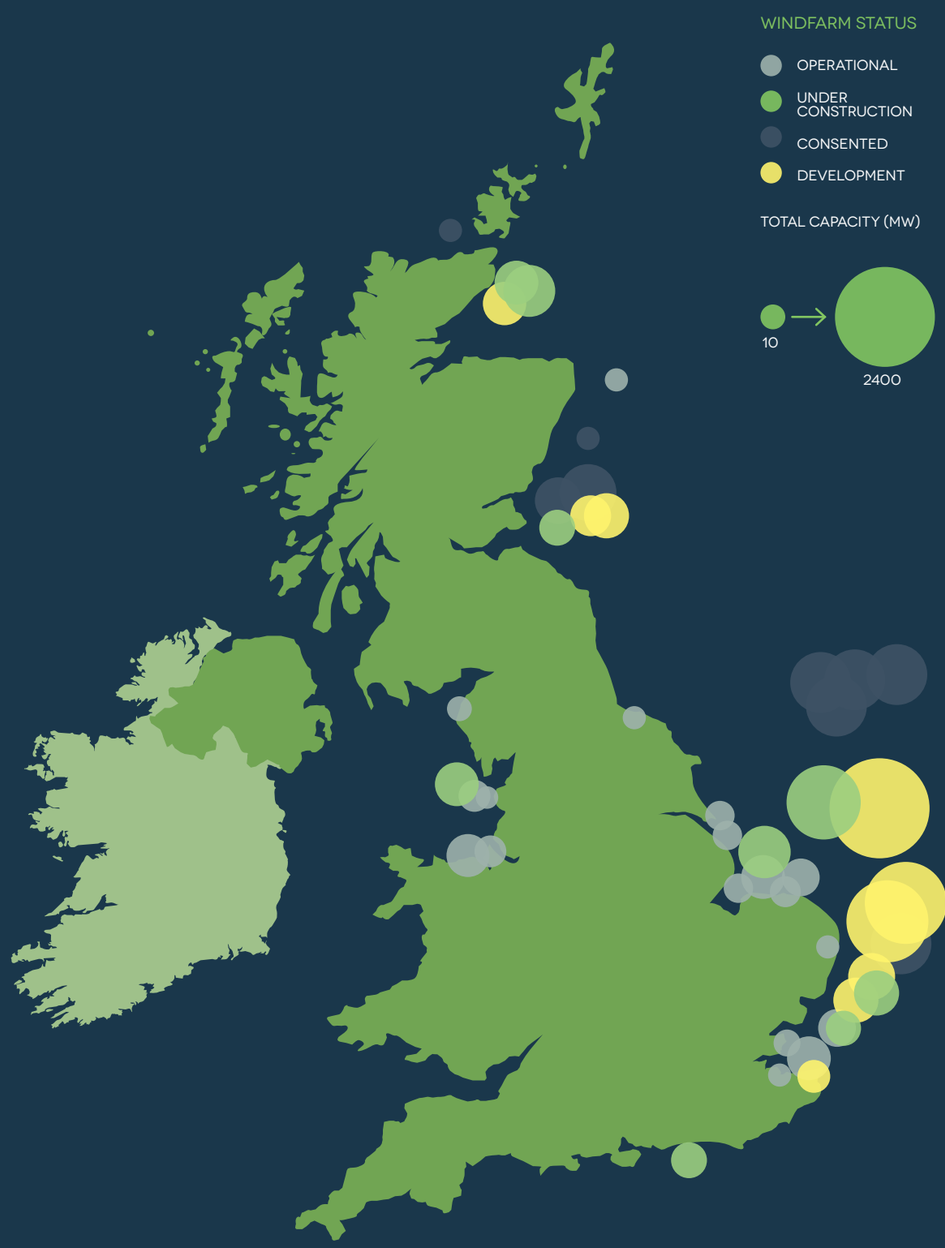
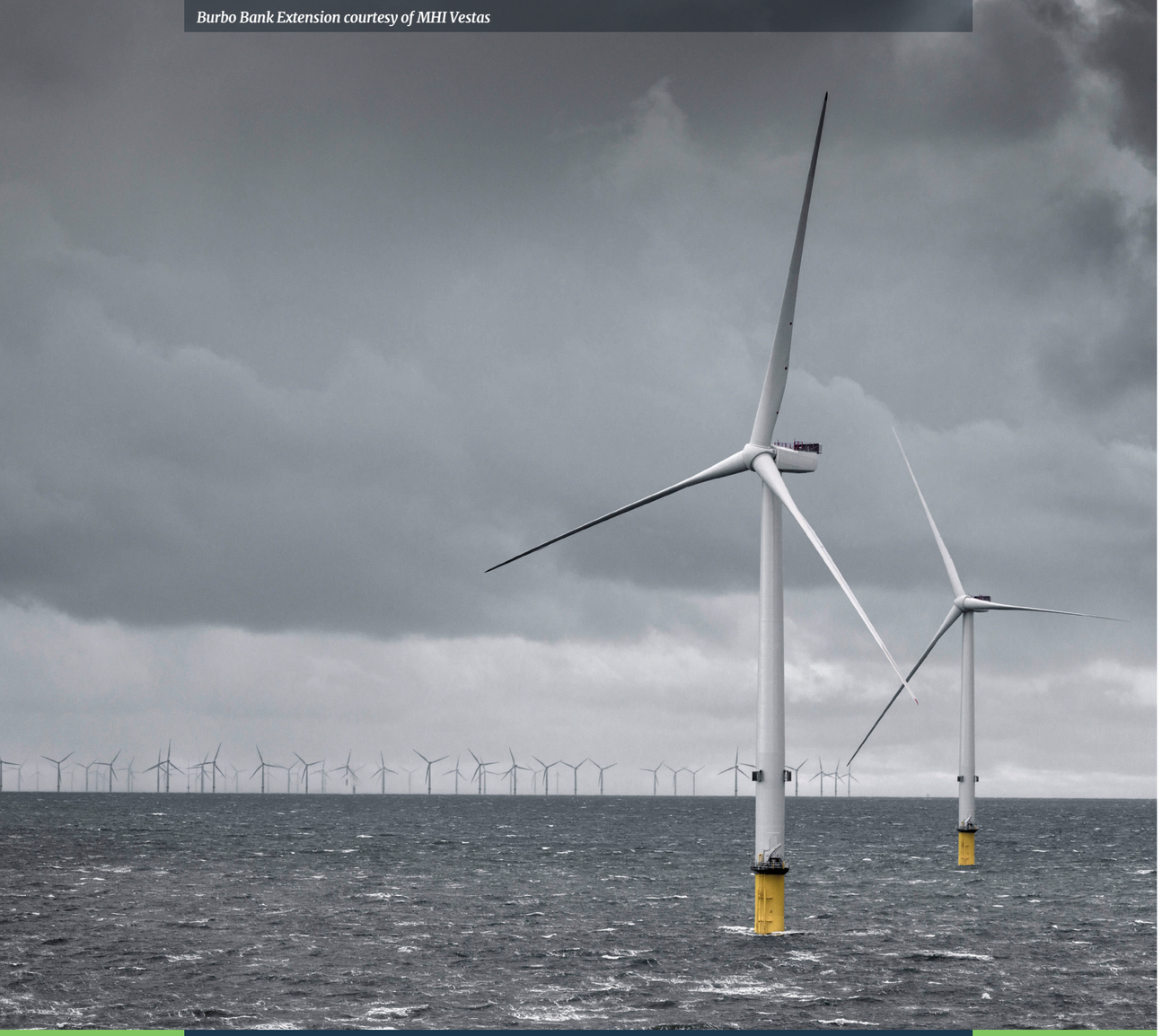


Figure 6: *UK offshore wind farm locations*

1.3.2 GENERATING CAPACITY
EUROPE, USA, ASIA AND THE REST OF THE WORLD

COUNTRY	GW 2018	GW 2030	COMMENTS
United Kingdom	7	30	See previous section
Europe (excl. UK)	9	40	There is significant installed offshore wind capacity in Germany (5.5GW), the Netherlands (1.1GW), Denmark (1.3GW) and Belgium (1GW) and there will be continued development of North Sea and Baltic Sea regions. Wind Europe have developed scenarios for over 70GW outside UK.
China	3	100	China has plans for massive growth in offshore wind leads Asia's offshore wind market. Current installed capacity is 3GW in the South China Sea but China will become the world leader in terms of installed capacity in the mid-2020s and with ambitious plans from regions such as Guangdong has potential for over 100GW by 2030. The Chinese market includes many non-European turbine OEMs including Shanghai Electric, Envision, Sinovel and Goldwind.
United States	0	10	The United States of America (US) has 30MW of installed generating capacity but 22,000MW in planning. The US has lagged Europe due to a strong supply of cheaper onshore renewable energy alternatives and site characteristics that are technically challenging due to ground conditions and deep waters. The market is now picking up pace with government support at state-level development. The current focus of offshore wind activity is off the Eastern seaboard. The first operational offshore wind farm is the 30MW Block Island Wind Farm (December 2016). Massachusetts requires its utilities to buy 1.6GW of offshore wind by 2027. The 800MW Vineyard project (located south of Martha's Vineyard) is on track to begin in-state construction in 2019. Site types on the Westcoast are more suited to deep-water foundation solutions, representing a good opportunity for floating foundation technology providers.
Taiwan	0	6	Taiwan has driven growth of offshore wind and awarded contracts for 4GW with a further 2GW expected by 2025. These projects have seen major participation from European developers and contract wins for UK companies.
India	0	5	India has a strong onshore wind market and has been gathering momentum in offshore wind development. There is potential for a 3 to 5 GW offshore wind auction in 2018. For more information see the Supply Chain, Port Infrastructure and Logistics Study from the Facilitating Offshore Wind in India (FOWIND) group.
Rest of the World	0	20	The rapid cost reduction in European offshore wind is leading many other regions to develop programmes. Amongst these are Japan, Vietnam and Australia. The site conditions vary (sea depth, seabed conditions, extreme weather) and will drive different technology requirements.



Burbo Bank Extension courtesy of MHI Vestas

THERE IS SIGNIFICANT OPPORTUNITY TO GREATLY EXPAND THE SUPPLY CHAIN THAT SERVES UK PROJECTS FROM COASTAL CLUSTERS, AND EXPORT TO GLOBAL MARKETS ESTIMATED AT £30BN PA BY 2030

2 THE OPPORTUNITY

The UK's world-leading position in terms of offshore wind deployment represents a significant opportunity for UK companies to gain market share. This is particularly true for O&M activities but it also provides a springboard to enable the UK experience to unlock export potential as the global market expands.

2.1 UK PROJECT OPPORTUNITIES

The UK's growing offshore wind supply chain has already delivered many successes, including blade and cable manufacturing facilities, which have delivered British-made components to our most recent UK projects. This has helped us achieve almost 50% UK content in these projects.

As a highly skilled industry that has major hubs in coastal communities across the UK, the industry is well placed to create jobs and boost productivity and earning power in regions in the UK that are most in need of economic growth. This creates opportunities for new business to enter the offshore wind supply chain.

The total (domestic and export) market for UK-provided offshore wind could exceed £10.5bn in 2050 in a high scenario. In the Sector Deal Vision, the total (domestic and export) market for UK-provided offshore wind is expected to reach £4.9bn annually by 2030 and £8.9bn by 2050.

Offshore wind projects are among the largest infrastructure projects in the UK, and they are increasingly delivering our low-cost, low-carbon electricity. There is significant opportunity to greatly expand the supply chain that serves UK projects from coastal clusters, and export to global markets estimated at £30bn pa by 2030.

UK-based supply chain companies lead the world in key services such as design, development, blade design and manufacturing, operations and maintenance and array cabling. However, to meet the growing market demand, businesses providing these services need to anticipate the emergence of larger contracts, larger products and larger projects.

There is significant opportunity for the UK supply chain to grow in areas largely serviced or supplied from overseas at present, including towers, foundations, nacelles, sub-station topsides and export cables. Long project lead times and investment horizons limit the changes to supply chains that can occur near-term, particularly for manufacturing and assembly. However, preliminary analysis suggests that an ambitious and coordinated programme of supply chain innovation and support could raise the UK share of UK projects beginning in 2030, to around 60% **(Figure 7)**. Consistent partnership between developers, OEMs and UK government - focused on maintaining and growing UK productivity and competitiveness, in addition to creating and developing new technologies – is essential in order to realise this potential.

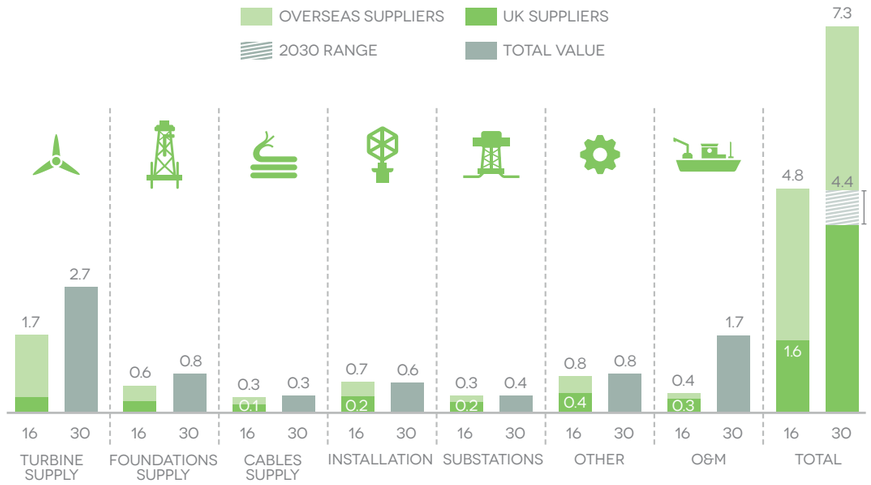


Figure 7: *Total estimated annual value of the UK offshore wind market by component, £bn1*

The potential for growth is bolstered by the confidence of suppliers to make high impact investment in facilities in the UK. For example, Ørsted's £6 billion investment in offshore wind farms off the Humber, will create hundreds of long-term high-skills jobs in the Humber region. In addition, a combined investment of £310 million from Siemens Gamesa Renewable Energy (SGRE) and ABP in state-of-the-art wind turbine assembly and blade manufacturing plants has taken place in Hull creating up to 1000 jobs directly and indirectly in the supply chain. High-profile investment in UK capability has also been demonstrated by MHI Vestas Offshore Wind (MVOW) who has had blade manufacturing on the Isle of Wight since 2013 employing more than 300 people **(Figure 8)**. Additionally, MVOW has committed a c.£1m investment over 4 years to a significant skills programme that provides an independently recognised composite qualification and has also collaborated with local stakeholders and manufacturers, including GKN Aerospace, to establish the Centre of Excellence for Composites, Advanced Manufacturing and Marine (CECAMM). The company has also repurposed a former oil-fired power station at Fawley into a paint and logistics large-scale blade facility'. In addition to these high impact investments there is a thriving supply chain of UK companies supporting all aspects of the windfarm. Further examples of these can be found in the Further Reading section.

Figure 8: *MHI Vestas blade manufacturing plant, Isle of Wight*

2.2 GLOBAL EXPORT POTENTIAL

There is a significant opportunity for the UK to export offshore wind engineering expertise, components and services to the large European offshore wind market and rapidly expanding global market including China and the USA **(Figure 9)**. Current exports are approximately £0.5bn in 2017 but this has the potential to reach £2.6bn by 2030. By developing local production capabilities, technical expertise and supporting supply chains, the UK can gain competitive advantage in the offshore wind export market.

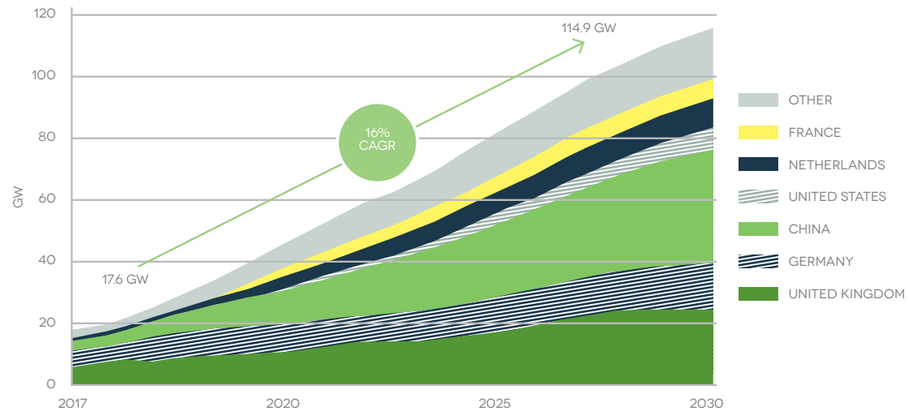


Figure 9: *Global offshore wind cumulative installation forecast to 2030 [Bloomberg New Energy Finance]*

CWIND

CWind based in Chelmsford has supplied vessels and turbine technicians to work on offshore wind projects in Germany, Denmark, Belgium and the Netherlands in 2017, with contracts ranging from £40,000 to £7,500,000.

JDR CABLES

With manufacturing facilities in Hartlepool and Littleport and a service centre in Newcastle, **JDR Cables** has supplied power cable products and services to three German offshore wind farms in 2017.

2.3 CROSS-SECTOR SYNERGIES

The offshore wind industry is a relatively young sector with much of the core technology evolving from solutions used in the onshore wind market. There has been a significant input from the oil and gas sector particularly in relation to installation and offshore operations. Conventional power generation engineering has supported turbine design and the aerospace sector has provided experience of composites and manufacturing.

There are many more areas where knowledge from other sectors will be of significant value to the offshore wind sector and where skills can be transferred to and from the industry. In particular, advances in materials, manufacturing, power electronics, robotics and AI all have potential applications. Table 1 highlights some of the potential synergies but it is expected that many more opportunities for cross sector transfer will be identified.

Table 1: *Cross-sector technology transfer opportunities*

	AEROSPACE	AUTOMOTIVE	OIL & GAS	SPACE	NUCLEAR
Materials	✓	✓	✓		✓
Manufacturing	✓	✓	✓		
Robotics		✓	✓	✓	✓
Health and safety	✓	✓	✓		✓
Reliability	✓	✓			
Asset management	✓				
Harsh environments			✓	✓	✓
Metocean	✓			✓	

2.4 TECHNOLOGY TRENDS

Innovation has been at the heart of the offshore wind industry's remarkable success in driving cost reductions. However, further advances are required to continue to deliver for a global market. The sector is currently developing solutions to meet requirements for larger turbines and deeper water sites.

The most significant area of cost reduction for offshore wind turbines comes from increased rotor diameter and subsequent power output per unit. The first wave of offshore development used 2 to 4MW turbines. As the success of offshore wind increased, new platforms from 6 to 9MW have been developed and this is the range that is currently being deployed. The latest round of auctions for projects to be installed in 2020 onwards are based on the anticipated development of 10MW+ turbines and announcements have been made by the leading turbine OEMs to confirm that these are now under development.

Turbines of 10MW+ will require blades of over 100m compared to existing commercial blades of 80m. The increased turbine power will also have implications for the design and installation of towers and substructures as well as O&M and electrical infrastructure **(Figure 10)**.

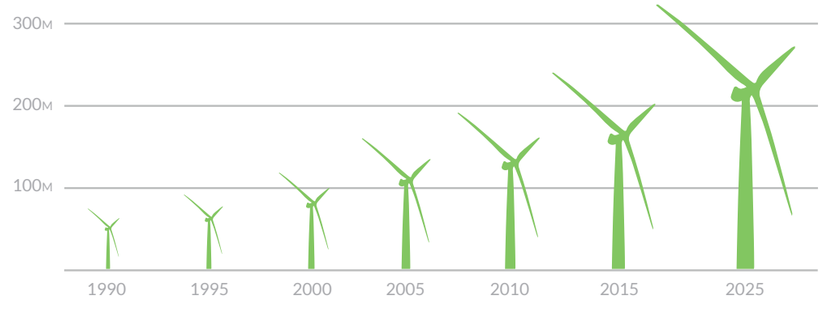


Figure 10: *BNEF Figure – turbine development.*

Offshore Wind Innovation Hub

"THE HUB IS THE UK'S PRIMARY COORDINATOR FOR INNOVATION, FOCUSING ON OFFSHORE WIND ENERGY COST REDUCTION AND MAXIMIZING UK ECONOMIC IMPACT"

The Offshore Wind Innovation Hub (OWIH) gathers input from an industry-led technical advisory group and has developed a set of technology roadmaps that highlight areas for future innovation. **Table 2** summarises some of the key areas of innovation.

Table 2: *Future technology trends for offshore wind*

INNOVATION	UK IMPACT
Advanced O&M	Establishing the UK as a world leader in predictive maintenance for the offshore wind sector and building on UK excellence in Robotics and Artificial Intelligence.
Blade technology and materials	Building on the strong materials knowledge in the UK and the current blades manufacturing bases in Hull and Isle of Wight
Electrical subsystems and cables	Enabling leadership in higher voltage export cables and dynamic cables, with applications to wider markets for electrical infrastructure
Integration with future energy systems	Enabling the use of offshore wind for grid ancillary services; integration with flexible, whole energy systems, including wind to hydrogen for heating and transport;
Disruptive technologies	Building on UK industry leadership in floating wind and generator design
Manufacturing optimisation	Developing substructure and tower designs that are suited to UK facilities enabling increased productivity of UK manufacturing

The UK is a powerhouse of innovation; leading in many key technology aspects needed to improve operations, develop new turbines and facilitate disruptive innovations required to drive economic growth. A continued and dedicated effort to support innovation is the key to sustaining and improving upon the impressive progress to date in reducing costs, delivering high value exportable goods and services and creating new opportunities for emerging high-tech industries. For example, the use of unmanned aerial vehicles (UAVs) for blade inspections has become an increasingly desirable option over traditional manual inspection methods; transforming it into a safer and more efficient data collection process **(Figure 11)**

Figure 11: *ORE Catapult's UAV blade inspection at Levenmouth Demonstration Turbine in Scotland.*

3 SEIZING THE OPPORTUNITY

To engage in the offshore wind sector, it is useful to understand the major project phases and the structure of the supply chain. The following sections provide an overview of these areas.

3.1 PROJECT LIFECYCLE

Offshore wind farms are some of the largest construction projects in the UK accounting for 21% (£4.1 billion) of construction contracts in 2016. The initial development of projects is usually by utilities with the necessary balance sheet to cover the early investment risk.

A typical offshore wind farm project consists of a 3 to 5-year development phase followed by a 2-year construction phase and a 25-year operational phase. The construction phase of an offshore wind farm (turbine manufacture, balance of plant manufacture and installation) is the most capital intensive and includes about 56% of lifetime costs. O&M activity (including transmission costs) accounts for up to 40% or lifetime costs and offers a significant opportunity for UK industry.

3.2 SUPPLY CHAIN STRUCTURE

There are several alternative approaches to project ownership but typically developers will recycle capital by selling stakes in operational projects to develop further wind farms. The operational phase of an offshore wind farm presents lower financial risk than projects in development and construction, and ownership of offshore wind farms by institutional investors at the operational phase is becoming commonplace.

The project developer will typically procure the design, supply and installation of turbines from the turbine OEM and one or more Tier 1 equipment and installation contractors. The following diagram shows the relative costs of the major contract packages **(Figure 12)**.

Contracts for manufacture and construction are usually signed two years before construction although in some cases, large supply contracts are sourced earlier via strategic framework agreements or strategic company alliances. The manufacture of balance of plant equipment and installation services may be signed later than turbines but designs are finalised early on in this process.

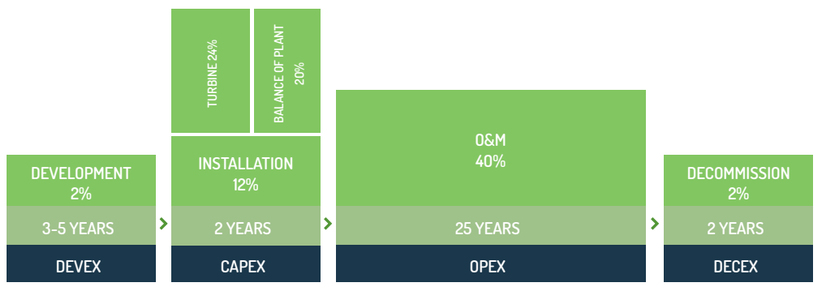


Figure 12: Lifetime costs for a typical offshore wind farm

3.3 SUPPORT FOR SUPPLY CHAIN GROWTH

3.3.1 POLICY

The UK Government's Clean Growth Strategy recognises the low carbon benefits of offshore wind and singles it out as a sector where the UK has world leading expertise and technology. This reputation is built on the remarkable growth of the sector and has resulted in government commitment to provide £557m of subsidy support in future auctions. In July 2018, it was announced that auctions will be held every two years from May 2019 and are expected to deliver 1GW to 2GW each year throughout the 2020s. The need for continued development of offshore wind is supported by the Committee for Climate Change which recommends the targets for the UK's carbon budget.

Offshore wind is also prominent in the UK Government Industrial Strategy which recognises that the growing offshore wind market is one of the biggest export opportunities. The world market for offshore wind is estimated to reach £30bn by 2030 and £55bn by 2050. With UK companies already leading in capacity and expertise the opportunity for success in exporting services is huge.

The Department for International Trade (DIT) can support companies with UK Export Finance to enter the competitive European market. DIT also offers a range of support such as facilitating relationships with investors and supporting development strategies with UK businesses to win contracts oversees. The UK has demonstrated its significant export potential and is providing expertise to growing offshore wind markets overseas.

The Department of Business, Energy and Industrial Strategy is accepting applications from industry for a Sector Deal. OWIC have submitted a proposal on behalf of the UK offshore wind industry. This inspired OWIC to invite Martin Whitmarsh's review of the Supply Chain. His review will be accompanied by a range of work streams addressing; future supply chain products and services, productivity improvement, expansion and disruption and capacity development.

3.3.2 INNOVATION

Innovation support for the offshore wind sector is provided by UKRI, Innovate UK and directly from BEIS in the case of the Energy Entrepreneur Fund. The Offshore Wind Innovation Hub (OWIH), funded by BEIS and jointly delivered by the Offshore Renewable Energy (ORE) Catapult and The Knowledge Transfer Network (KTN) develops technology roadmaps and helps to coordinate for innovation funding for the offshore wind sector in the UK. The Offshore Renewable Energy Catapult provides test facilities, engineering skills and deep sector knowledge to support the growth of UK companies in the offshore wind sector.

3.3.3 REGIONAL

There are many regional programmes that can provide support for companies interested in working in the offshore wind sector. The following diagram provides a summary of these. Further information and guidance on support for companies looking to establish themselves in the offshore wind industry can be found in ORE Catapult's *'An Innovator's Guide to Finance & Funding'*.

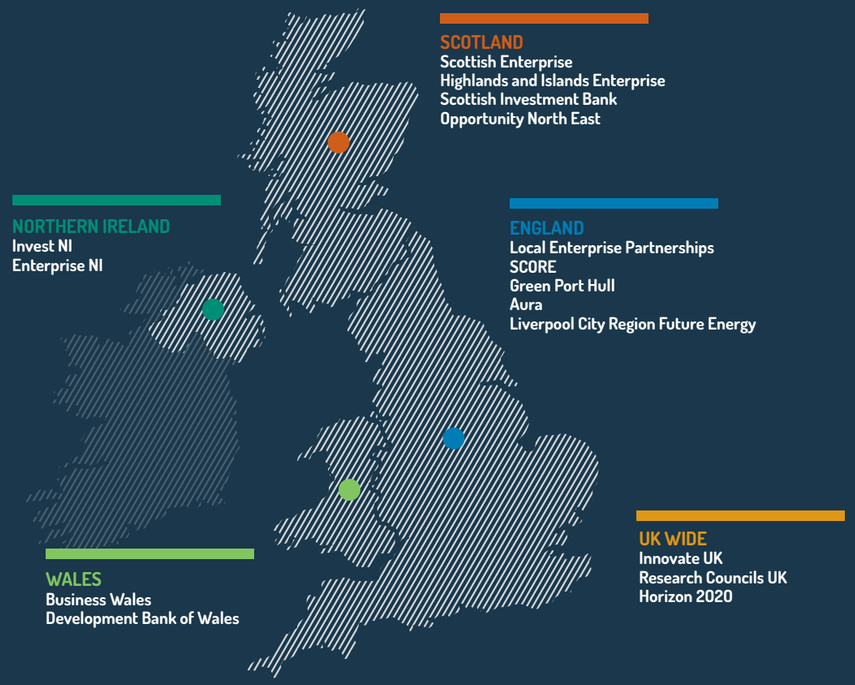


Figure 13: *Regional support*

4 HOW TO FIND OUT MORE

If you would like to learn more about UK offshore wind supply chain opportunities in your region, Martin and the Supply Chain Review Team will be hosting a series of UK Autumn Roadshows and would be delighted to see you at one of these events.

These OWIC industry-led events will be supported by ORE Catapult, the Offshore Wind Innovation Hub and the Operations & Maintenance Centre of Excellence. Further information along with the dates and locations will soon be available at **ore.catapult.org.uk** where you will also be able to register.

Alternatively, please contact the team at **owicsupplychaindevelopment@ore.catapult.org.uk** if you would like more information on the upcoming events or if you have any questions, comments or feedback on this document. We would be delighted to hear from you!

5 FURTHER READING

UK POLICY CONTEXT

UK Industrial Strategy
www.gov.uk/government/topical-events/the-uks-industrial-strategy
UK Clean Growth Strategy
www.gov.uk/government/publications/clean-growth-strategy

UK MARKET

Cost Reduction Monitoring Framework
www.crmfreport.com
Innovators Guides to…
www.ore.catapult.org.uk/work-with-us/smes
Renewable UK Reports
www.renewableuk.com/page/UKWEDhome
BEIS Electricity Generation Costs, Nov 2016
www.gov.uk/government/publications/beis-electricity-generation-costs-november-2016
The Committee on Climate Change, June 2018
www.theccc.org.uk/publication/reducing-uk-emissions-2018-progress-report-to-parliament

TECHNOLOGY TRENDS

Offshore Wind Innovation Hub
www.offshorewindinnovationhub.com
Offshore Wind Energy – *'Owners Workshop Manual'*
www.renewableuk.com/news/297780/Offshore-Wind-Energy---Owners-Workshop-Manual.htm

GLOBAL MARKET

International Energy Agency (IEA) – *'World Energy Outlook 2017'*
www.iea.org/weo
Bloomberg New Energy Finance – *'New Energy Outlook 2017'*
wwww.about.bnef.com/new-energy-outlook

INNOVATION SUPPORT

Scottish Enterprise
www.scottish-enterprise.com/services/develop-your-organisation/offshore-wind-expert-support-programme/overview
SCORE
www.scoregrants.co.uk
Green Port Hull
www.greenporthull.co.uk/business-support-investment
Offshore Wind Regenerating Regions – *'Investment and Innovation in the UK'*
An introduction to companies actively supporting the UK offshore wind sector.

Image courtesy of MHI Vestas

Offshore Renewable Energy

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