



UK Offshore Wind: Realising the Sector Deal Opportunity

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June 2019

CATAPULT
Offshore Renewable Energy

Background

In March 2019, the UK Government and offshore wind industry agreed a Sector Deal, securing offshore wind's position at the heart of the future UK energy mix as a large-scale, low-carbon form of electricity. In this series of four Analysis & Insight papers, we explore the key challenges and opportunities presented in delivering the Sector Deal.

This first paper sets the context of the current and future outlook for UK offshore wind, introducing the main aspects of the Sector Deal and outlining the topics to be addressed in the remainder of this series.

Headlines

- The Offshore Wind Sector Deal secures offshore wind's position at the heart of the future UK energy mix as a large-scale, low-carbon form of electricity. It provides forward visibility of future Contracts for Difference rounds, with support of up to £557m across regular auctions into the 2020s, enabling long-term planning and investment in the UK supply chain.
- There are sufficient projects commissioned and in the pipeline to meet the Sector Deal's 30GW by 2030 ambition. This target, as well as the 2050 target of 75GW, set by the Committee for Climate Change in their Net Zero report, is not only achievable but will also generate significant value for the UK economy.
- We expect offshore wind's levelised cost of energy to continue its downward trend, driven by cost reduction through deployment and increased turbine performance.
- Co-ordinated action between industry and Government has the potential to benefit the supply chain, resulting in an even stronger industry. The UK's strengths in research and development and innovation will create further opportunities for UK companies to excel in new areas of the domestic and global markets, capitalising on the UK's world-leading position.

The Offshore Wind Sector Deal



Burbo Bank Extension Offshore Wind Farm. Image: Ørsted

UK Sector Deals

The Industrial Strategy, published by the UK Government in November 2017, aims to put the UK at the forefront of the industries of the future. It is focused on four crosscutting policies, referred to as Grand Challenges, which underpin all activities under the banner of Industrial Strategy. These are artificial intelligence and data economy, future of mobility, clean growth, and an aging society.

Within the Industrial Strategy, the Department for Business, Energy and Industrial Strategy (BEIS) announced Sector Deals as a way for the government to directly support productivity growth in specific industries. To date, Sector Deals have been agreed with the aerospace, artificial intelligence, automotive, construction, creative industries, life sciences, nuclear, offshore wind and rail industries.

The Sector Deals aim to create significant opportunities to boost productivity, employment, innovation and skills. The Offshore Wind Sector Deal links specifically with the Clean Growth Grand Challenge.

Offshore Wind Sector Deal

The Sector Deal¹ secures offshore wind's position at the heart of the future UK energy mix as a large-scale, low-carbon form of electricity. Announced in March 2019, it provides forward visibility of future Contracts for Difference (CfD rounds with support of up to £557m across regularly scheduled auctions into the 2020s, which will enable long term planning and investment in the UK supply chain. In return, it sets out ambitious targets for the industry to be a global leader and maximise its advantages for UK industry.

1. The Sector Deal sets ambitions to deliver 30GW of installed capacity by 2030. This means more than doubling UK offshore wind capacity in seven years, an average of 2.2GW per year between 2023 – 2030. This will elevate offshore wind to a leading power source for the UK, providing a

1 Industrial Strategy: Offshore Wind Sector Deal, HM Government

low-carbon solution to both tightening emissions targets and the need to replace ageing infrastructure in the current energy mix while demand for electricity increases.

2. The Sector Deal also highlights opportunities to create UK jobs and growth in the domestic supply chain. Industry has committed to increase UK content to 60% by 2030, including increases in the capital expenditure phase, resulting in 27,000 jobs by 2030, with the majority of these in coastal communities and a focus on increasing representation of women in the offshore wind workforce to at least a third.

3. Ongoing innovation in the sector is driving cost reduction and producing exportable goods and services. By 2030, there are Sector Deal ambitions to increase exports fivefold to £2.6bn per year.

UK Offshore Wind

Offshore Wind in the UK in 2019

The UK offshore wind industry in 2019 is an exciting place. Offshore wind's share of UK electricity production has grown rapidly in the last decade, from 0.8% of UK electricity in 2010 to 8% in 2018. As of June 2019, the installed capacity is 8.5GW. A further 2.9GW is under construction and 11.3GW has consent², putting the UK on track for an operating capacity of 11GW by 2020 and 14.5GW by 2023.

More than 7,200 people are directly employed in the offshore wind sector in a number of locations across the country. To date, the UK's growing offshore wind supply chain is delivering 48% UK content of the lifetime value for UK projects which reached final investment decision between 2010 and 2015³. At the same time, exports from UK offshore wind-related goods and services amounted to £500m in 2017.

Costs have reduced significantly in the last five years. Projects participating in auctions this year (2019) will be expected to deliver electricity at £56 per MWh⁴ or less, compared with £119.89 for the first allocation round in 2015. This puts pressure on the industry to continually improve designs and generate innovative, low-cost solutions to maximise electricity production. One of the main ways this is already happening is through scale. Turbines are getting bigger, as illustrated in Figure 1. The average turbine rating five years ago was 4MW, compared with an average turbine rating of 7MW for turbines coming online today and 9.5MW for turbines in projects currently under construction. Project size, shown in Figure 2, is also increasing from an average of 300MW in 2014⁵ to 966MW in 2019 and is expected to continue to grow further in the future.

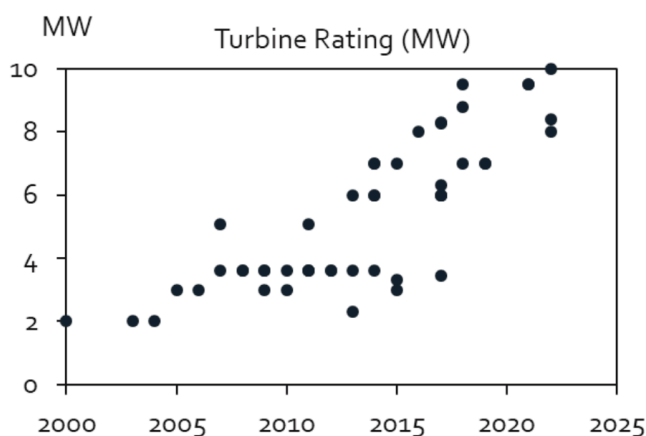


Figure 1: Turbine Rating (MW) versus year of first power.

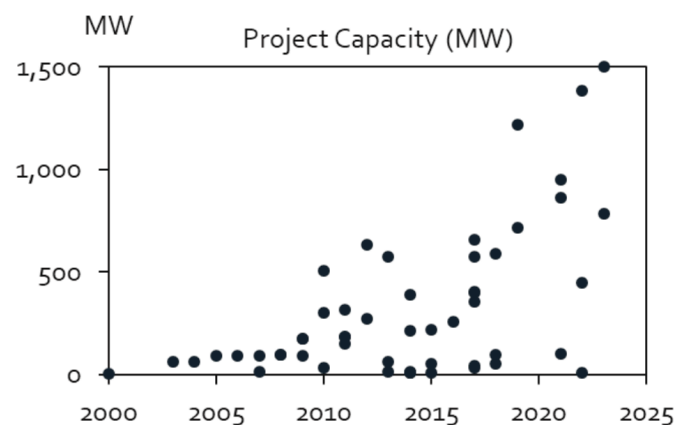


Figure 2: Project Capacity (MW) versus year of first power.

2 As of June 2019, based on data from RenewableUK.

3 Offshore Wind Industry Investment in the UK: 2017 Report on Offshore Wind UK Content, RenewableUK.

4 Strike prices for offshore wind projects delivering 2023-24 has been set at £56/MWh, and at £53/MWh for those delivering 2024-25.

5 Excluding demonstration projects.

UK Project Pipeline

The Crown Estate's Offshore Wind Operational Report 2018⁶ showed that at the end of 2018, the UK had a consented pipeline of 8.0GW and an additional 11.2GW of projects in planning and development which could win CfDs and be operational by 2030. As illustrated in Figure 3, this is sufficient to meet targets for 30GW onstream by 2030 (note that the operational capacity in Figure 3 does not include recently added capacity from the Beatrice and Hornsea One offshore wind farms). Projects in English and Welsh waters are managed by The Crown Estate. Crown Estate Scotland manages projects in Scottish waters, denoted in Figure 3 in grey, with combined values given in brackets. Further leasing rounds are planned by both The Crown Estate and Crown Estate Scotland, which will provide a buffer against the risk of attrition and still allow the UK to meet 2030 targets.

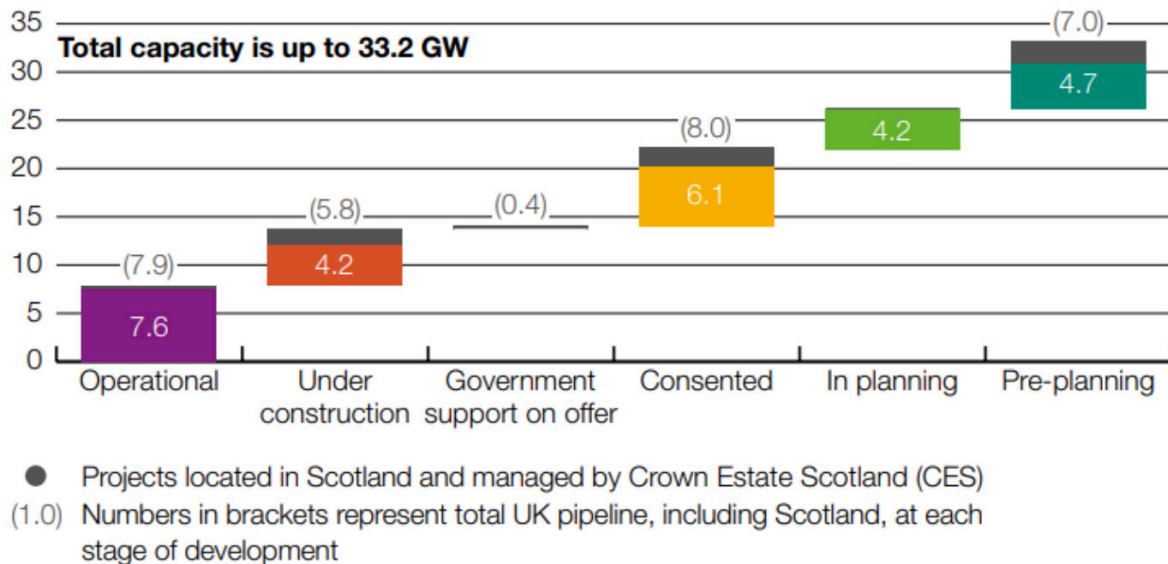


Figure 3: UK offshore wind development pipeline - Q1 2019 (February) - The Crown Estate Offshore Wind Operational Report 2018.

UK Offshore Wind in 2030

While recent cost reductions have been driven primarily by increasing turbine ratings, increasing supply chain competition and reducing cost of capital, looking to the future, ORE Catapult expects that the levelised cost of energy (LCoE) will continue to reduce through further increases in turbine ratings and increasingly through larger projects and optimised operations. This is shown in Figure 4 (below), based on deployment of 30GW by 2030 and 75GW by 2050. As well as cost reduction, reductions in LCoE are driven by increasing turbine performance. By 2025, we expect new operating assets to have net capacity factors in excess of 50% (though this is also location-dependent). This can be attributed to larger, more efficient turbines, higher wind sites further from shore, and more advanced operating strategies.

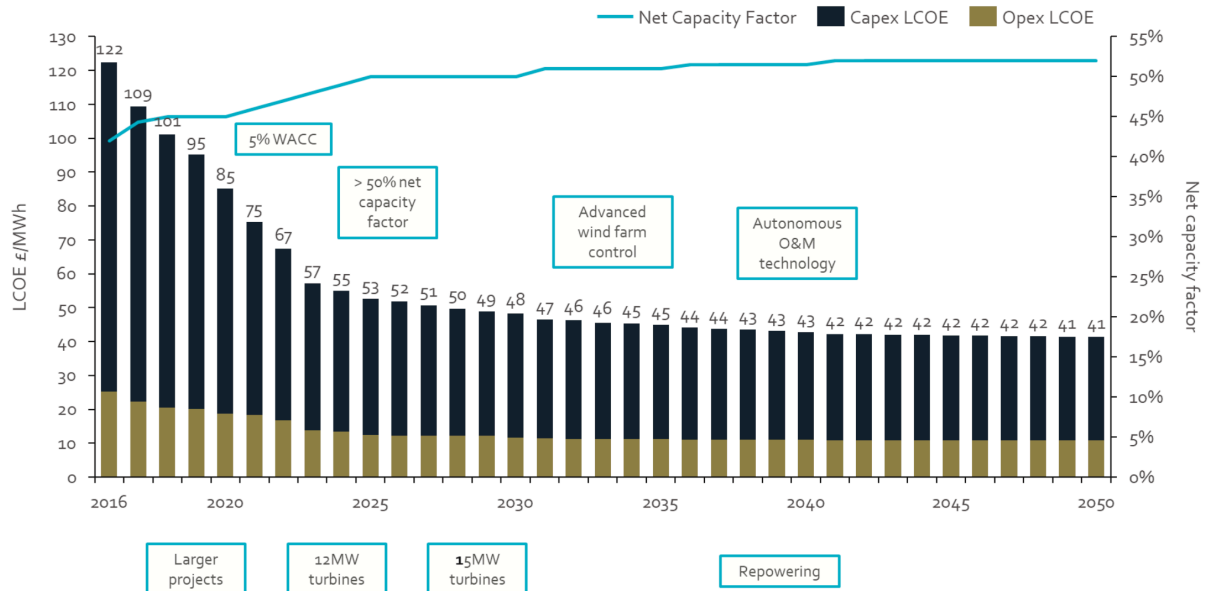


Figure 4: LCoE reduction pathway

We are already seeing clusters in development and construction, for example East Anglia and Hornsea. Larger sites have a proportionally lower expense for fixed costs such as project management, vessel mobilisation and grid connection. It may also extend economies of scale, whereby the supply chain is able to manufacture a large order for components at a lower incremental cost as well as potentially reducing margins on the basis of firm, large orders.

Offshore wind has reached a level of maturity that has opened up the market to new investors willing to make a low-risk, long-term investment for a lower return. In 2017, infrastructure funds, pension funds and asset managers accounted for 35% of offshore merger and acquisition activity in Europe, up from 27% in the previous year, according to Wind Europe⁷. The Catapult expects that projects may have a weighted average cost of capital of around 5% by 2023 and possibly even lower in the future, compared to historic estimates of 9%⁸.

7 Financing and Investment Trends: The European Wind Industry in 2017, Wind Europe

8 Cost Reduction Monitoring Framework: Quantitative Assessment Report, ORE Catapult

Enabling the Sector Deal Ambitions

Over this series, we will explore what needs to happen to enable the Sector Deal vision and what opportunities this growth could generate for the UK economy. The series will focus on addressing four challenges facing the sector.

Sustainable Cost Reduction

In the near-term, the industry's challenge is to secure cost reduction and supply chain to get 20GW constructed in the 2020s. Larger turbines are seen as key to producing more electricity while reducing costs through less infrastructure. However, larger turbines use larger, heavier components that can be manufactured by a limited pool of companies and require vessels with greater lifting capacities, or innovative thinking to develop new installation and operation processes. In addition, there are wider economic uncertainties that can impact costs, such as interest rates, vessel day rates, and tax regimes.

Achieving sustainable cost reduction is closely tied to the other challenges associated with meeting Sector Deal targets. Companies are under a lot of pressure currently to minimise costs, which can limit their ability to invest in future facilities. In some circumstances, sourcing components and labour from abroad may be cheaper, whilst there are greater benefits to the UK by investing in the domestic supply chain and local workers. However, this investment can only be realised when companies can see a return on their investment, through a strong pipeline of domestic projects coming through and a viable route to export. Longer-term partnerships between project developers/owners and the UK supply chain may provide a way to alleviate this short-term cost pressure and enable domestic growth.

Opportunities and challenges for the UK supply chain

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 2050⁹. Alongside the growing UK market, global offshore wind capacity is estimated to reach as much as 154GW by 2030, providing a huge opportunity for UK companies to export goods and services.

Many UK businesses active in the industry are SMEs offering specialised services to a small number of clients. To meet the growing market demand, the emergence of larger contracts, and larger assets, they will need to scale up operations to avoid bottlenecks in production. Suppliers will also need to upskill staff to understand, and provision for, future technology needs. A further challenge will be seizing the future supply chain opportunities in the sectors that are largely serviced/supplied by overseas-based companies e.g. turbines, electronics, foundations and export cables.

To raise the UK supply chain share of UK projects to 60% by 2030, the industry will need to understand which supply chain sectors to target in order to increase UK content and grow productivity and competitiveness, in addition to creating and developing new technologies.

Wider system integration

Though all generation technologies incur some system costs, it is well recognised that variable renewable generation will impose additional costs on the wider system through the need for additional back-up capacity and balancing services.

Our internal analysis based on installing 75GW by 2050 to achieve the Committee for Climate Change’s (CCC) Net Zero goals¹⁰, paired with the wider National Grid’s Future Energy Scenarios, illustrated in Figure 5, anticipates that meeting Sector Deal capacity targets will see offshore wind replace gas as the leading form of installed electricity generation in 2031, with new installations peaking in the late 2020s.

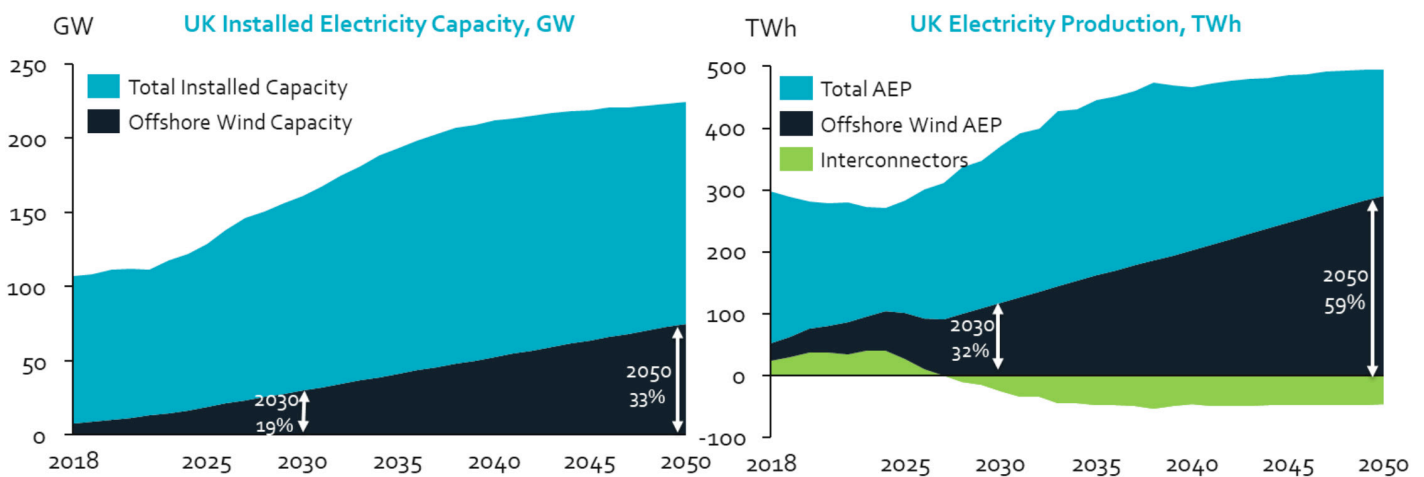


Figure 5: Offshore wind deployment forecast based on Sector Deal targets assuming 30GW by 2030 and 75GW by 2050
Installed Capacity (l), Electricity production (r)

By 2023, offshore wind could be the main form of electricity production in terms of TWh produced as nuclear plants are decommissioned and gas plants curtailed to being used as peaking plants during periods of high demand. If the Sector Deal’s 30GW by 2030 ambitions and the Committee on Climate Change (CCC)’s net zero targets for 75GW by 2050 are met, offshore wind could supply 32%¹¹ of electricity generation by 2030 and 59% by 2050. Incorporating this degree of variable renewable energy will require new thinking as to how the energy system is managed. According to National Grid’s forecasts, nuclear will continue to play a central role in the electricity mix and storage could provide up to 15% of grid capacity by 2050, along with greater connection to adjoining markets through interconnection. The UK is expected to be a net exporter of electricity from 2028.

A number of key questions need to be addressed to understand what level of storage is necessary and what form that should take, between interconnection, batteries, pumped storage, or new technologies such as connecting electric vehicles onto the grid. There may be demand side response measures that enable reduced storage, or a move to balance the grid at a more localised level. These factors could cause the cost of grid balancing services to increase.

10 Net Zero: The UK’s Contribution to Stopping Global Warming, Committee on Climate Change, May 2019.

11 Assuming 50% net capacity factor is achievable by 2030.

Roadmap beyond 2030

The Catapult’s analysis has shown that 30GW by 2030 should be achievable within the Clean Growth budget and that deployment of further conventional offshore wind beyond 2030 (if not before) should be achievable at a cost on a par with, or lower than, current forecasts for future wholesale electricity prices¹². Projections for UK electricity demand will require total UK generating capacity of between 190 – 270GW by 2050¹³ so that there is no lack of demand for further affordable, domestic, low-carbon electricity. Low-carbon energy resource is available to be tapped to meet this demand.

However, as the simplest sites are commissioned, the cost of further offshore wind may increase as projects are deployed in increasingly challenging site conditions. To exceed 50GW of offshore wind on the grid, or reach towards the offshore wind capacity of 75GW indicated in the recent CCC Net Zero report, will likely involve some level of floating wind and/or far-offshore sites. This will require investment in facilities to deploy additional floating wind, including deep water ports and the implementation of measures to overcome significant electrical losses when moving power over long distances offshore.

Beyond 2030, there may be an overhaul of the way we control and operate wind farms. Autonomous systems and turbine-level wind farm control will maximise turbine output and increasingly enable preventative rather than reactive maintenance strategies. By 2040 it is anticipated that there will be more than 2,400 turbines in British waters over 20 years old, with the potential to replace turbines – or, more drastically, replace infrastructure in life extension projects.

12 “Conventional” describes bottom-fixed turbines with a simple grid connection.

13 Projections for UK electricity demand based on range of National Grid Future Energy Scenarios, July 2018.

Conclusions

There are sufficient projects commissioned, and in the pipeline, to meet the Sector Deal's ambition of 30GW by 2030. The recent Government announcement that regular CfD auctions will be held throughout the 2020s is a big positive for the industry: it will encourage investors to make long-term commitments to the UK and have projects ready to develop beyond 2030 to continue growth. Our ongoing analysis indicates that 30GW by 2030 and 75GW by 2050 is not only achievable but could also generate significant value for the UK economy.

Offshore wind project costs continue to fall, and we expect these to be on a par with wholesale electricity price by 2030 (if not earlier). Costs are primarily coming down through larger turbines, larger sites, innovation, and a reduction in the perceived risk of offshore wind projects (both technological and economic). However, there are key challenges related to manufacturing and installation of larger-rated turbines and operating in sites in more challenging environments.

To integrate a higher proportion of variable renewable energy in the grid, a number of upgrades to the transmission system are necessary. Batteries are placed to become a fundamental instrument for regulating grid frequency and managing supply and demand fluctuations to create a more flexible transmission and distribution system. In addition, progress in electric vehicles and smart grid technology are opening up more flexibility in electricity demand.

With co-ordinated action between industry and Government, the UK offshore wind supply chain will develop into an even more thriving industry. To date, the UK's growing supply chain has key strengths in areas including blade, tower and cable manufacturing, final assembly and operations and maintenance. Our strengths in research and development and innovation will create further opportunities for UK companies to excel in new areas of the domestic and global markets, capitalising on the UK's world-leading position.

All of these challenges and opportunities will be analysed over this series of papers.

Future papers in this series:

- Sustainable Cost Reduction
- Opportunities and Challenges for the UK Supply Chain
- Wider System Integration
- Roadmap Beyond 2030.

Author Profile



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