FLOATING OFFSHORE WIND CENTRE OF EXCELLENCE

FLOATING OFFSHORE WIND: COST REDUCTION PATHWAYS TO SUBSIDY FREE

CATAPULT
Offshore Renewable Energy

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CONTENTS

1. INTRODUCTION

Floating offshore wind will play a key role in the UK achieving its net zero ambition in 2050. The scale of this role will be defined by Government policy and cost reduction in the broader offshore wind industry.

In this report, we aim to map the pathway to subsidy-free floating offshore wind in the UK. The potential scale of deployment is huge, with a wide geographic spread of projects in waters around Scotland, Wales, the South West and North East of England. Based on GIS mapping, we identify potential zones for floating offshore wind development and establish deployment profiles that meet, and exceed, targets for Net Zero.

Cost reduction is analysed to assess the impact of uptake of rapidly developing technology, supply chain competition and decreasing cost of capital. Based on this analysis, we present a set of recommendations to support the industry and accelerate cost reduction.

1.1 INDUSTRY ENGAGEMENT

A crucial element of this work has been industry engagement. Members of the Floating Offshore Wind Centre of Excellence have provided critical input and review. This report has also received detailed input to assumptions from organisations across the existing and future floating offshore wind supply chain as well as various financial stakeholders.

We would like to thank the following companies for their input into this study:

- Atkins
- BAM Nuttall
- First Subsea
- Global Energy Group
- Green Giraffe
- Green Investment Group
- JDR Cables
- MHI Vestas Offshore Wind
- Ramboll
- Seaway 7
- Siemens Gamesa Renewable Energy

The following organisations are the industrial partners in the Floating Offshore Wind Centre of Excellence...

CIP Copenhagen Infrastructure Partners
EDF ENERGY
equinor
ESB
Green Investment Group RIDG
NORTHLAND POWER
MAINSTREAM RENEWABLE POWER
OW OCEAN WINDS
RWE
SCOTTISHPOWER RENEWABLES
sse Renewables
TOTAL

2. OUR APPROACH

The approach adopted for this study has incorporated a combination of GIS mapping, deployment analysis, bottom-up cost modelling, industry consultation and learning rate analysis.

The methodology is outlined here and described in detail in the body of this report.

- GIS mapping to identify UK sea areas with highest potential for floating offshore wind
- Refinement of identified areas to create shortlist of zones for early floating offshore wind deployment
- Estimation of deployment potential (in MW capacity) for each shortlisted zone
- Further development of ORE Catapult's existing bottom-up floating offshore wind cost model
- Supply chain and industry engagement to update modelling technical, cost and financing assumptions
- Use bottom-up cost model to rank shortlisted zones from lowest to highest LCOE
- Generate rational deployment profiles across the shortlisted zones, balancing deploying on the lowest LCOE sites first with spreading deployment to ensure development activity is distributed to minimise environmental impacts and maximise the social-economic benefits
- Estimation of learning rates for each key cost centre in DEVEX, CAPEX, OPEX and DECEX
- Identification of drivers and estimation of trajectory for floating offshore wind cost of capital
- Development of Cost Reduction Pathways financial model to combine deployment profiles, site cost estimates and learning rates

3. INPUT FROM GIS MODEL

UK waters encompassed by the UK Exclusive Economic Zone (EEZ) limit were considered in the analysis. A wide range of GIS layers were used in the detailed analysis, with bathymetry being the foremost consideration when selecting sites appropriate for FOW.

For this study, sites with water depths between 75 – 150m were considered as preferable for early FOW deployment. Water depths outwith this range are suitable for the technology, however shallower waters will have to compete with bottom-fixed offshore wind, and deeper water will incur higher costs.

Figure 1 shows the vast areas of UK waters suitable for FOW, highlighted in green. Nine zones were identified as having preferable site conditions, particularly those with high wind speeds and proximity to a grid connection. FOW will not be restricted to these zones by any means, but the zones present suitable conditions that we expect to be representative of near-term UK FOW projects.

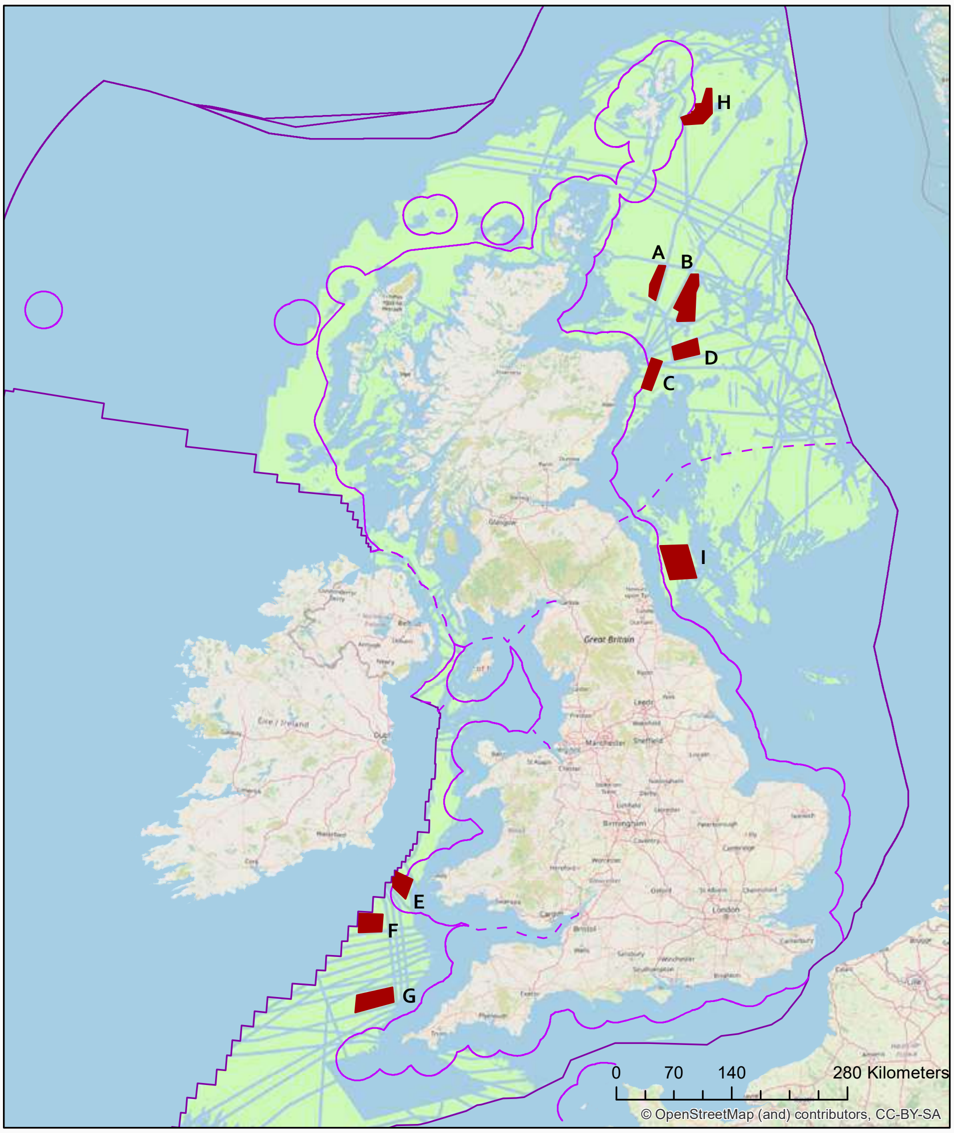
These nine zones are shown in Figure 1, marked on the map as zones (denoted A - I).

- Five in Scotland (A, B, C, D & H) – 9.6 GW
- Two in Wales (E & F) – 3.2 GW
- One in NE England (I) – 3.9 GW
- One in SW England (G) – 2.6 GW

In total, this analysis identified a potential near-term pipeline of 19.3GW.

The GIS modelling was carried out in reference to the Scottish Government's draft sectoral marine plan. Since this work was done, the sectoral marine plan has been finalised with some changes to the development areas available to offshore wind in Scotwind leasing zones. Zones A, B and H in this report are based on available Scotwind zones NE8, NE7 and NE1 respectively. All three zones have reduced in size – Zone A by ~ 20%, Zone B (NE7) by ~ 40% and Zone H by ~ 5%. This change has not been reflected in the modelling done in this study but would decrease the available capacity at that zone.

The corresponding key site parameters for each of the zones are shown in Table 1. A high-level energy density of 3MW per square kilometre was used to estimate the maximum capacity of each zone. LCOE is based on the cost estimated today with no learning rate applied.



LEGEND	
🟥	FOW Deployment Areas [A-I]
—	UK 12 NM Limit
- - -	UK Adjacent Waters Limits
—	UK FFZ Limit
🟩	Valid FOW Area - see constraints
🟦	Invalid FOW Area - see constraints

CONSTRAINTS	
Valid bathymetry range:	75 - 150 m
Mean annual wind speed: (at 150 m altitude)	> 10 m/s
Mean annual significant wave height:	< 3 m
Oil & Gas infrastructure:	1NM exclusion zone
Telecommunication cables:	1NM exclusion zone
Military danger zones:	Excluded
Renewable energy infrastructure:	Excluded

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Reference Scale: 1:6,000,000

Figure 1: GIS map with identified floating wind development zones

3.1 ZONE ANALYSIS AND RANKING

To understand the relative attractiveness of each zone based on cost, a 500MW site using 15MW turbines was modelled at each zone, reflecting the specific site parameters.

FLOATING WIND ZONE	A	B	C	D	E	F	G	H	I
WINDFARM AREA (km²)	400	1,000	475	550	450	620	860	760	1,300
MAX PROJECT CAPACITY OF ZONE (MW)	1,200	3,000	1,425	1,650	1,350	1,860	2,580	2,280	3,900
AVERAGE WATER DEPTH (m)	97.5	110	105	107.5	115	105	90	115	95
DISTANCE TO CONSTRUCTION (ASSEMBLY) PORT (km)	185	200	180	200	60	90	155	350	85
DISTANCE TO O&M (MINOR) PORT (km)	95	105	25	65	60	100	85	50	85
GRID CONNECTION ZONE	East Aberdeenshire				Pembrokeshire		Somerset and Wessex	North Scotland	Solway and Cheviot
DISTANCE TO CABLE LANDFALL (km)	85	95	25	60	40	80	70	285	40
ONSHORE CABLE DISTANCE (km)	5	5	5	5	10	10	15	5	5
MEAN WIND SPEED AT SITE (@ 150M HEIGHT) (m/s)	11.2	11.2	10.8	11.15	10.65	10.65	10.4	11.25	10.1
ANNUAL MEAN SIGNIFICANT WAVE HEIGHT (m)	2.15	2.15	1.8	2.05	1.9	2.15	2.2	2.45	1.5
SEABED CONDITIONS	Sand	Sand + Mud	Sand	Sand	Sand + Gravel	Sand + Mud	Sand + Gravel	Sand	Sand
ZONE PRIORITY (BASED ON LCOE) (#)	6	8	2	4	1	5	7	9	3

Table 1: Site parameters for development zones identified with GIS modelling

These parameters impact the following variables:

- Anchor type reflects seabed conditions – gravel seabed requires piles whilst sand may use drag-embedded.
- Mooring line length and chain diameter reflects bathymetry, metocean conditions and turbine size based on estimated force on the structure
- Vessel operations (Installation and O&M) are impacted by distance to port and estimated weather downtime driven by metocean conditions
- Transmission system is driven by distance to shore, impacting cable costs and electrical losses
- Grid connection zone affects TNUoS charges, optimised with cable landfall choice
- O&M vessel strategy reflects economic choice dependent on project size, metocean conditions and distance from O&M port

At the foot of Table 1, the LCOE ranking of lowest cost (ranked 1) to highest cost site (ranked 9) is provided.

Note that Zone H, off Shetland, has the highest LCOE due to the working assumption that it would need to be connected the mainland GB grid in the timeframe being considered. In the future, where offshore hydrogen production and other off-grid solutions are being rolled-out, this zone will be more economically viable.

As all the shortlisted sites have high mean wind speeds, ranging from 10.10m/s to 11.25m/s, the two parameters which have the largest impact on LCOE are the distance to cable landfall, which determines the amount of export cable required for a project, and the average significant wave height which impacts the frequency of weather downtime during vessel operations. Excluding Zone H, the highest LCOE is just 13% more expensive than the lowest LCOE zone.

4. UK DEPLOYMENT PROFILES

4.1 APPROACH TO ESTIMATING DEPLOYMENT PROFILES

The pace of UK and global FOW deployment will impact the pace of cost reduction and so it is crucial to define appropriate FOW deployment profiles. Detailed near-term UK FOW profiles based on the GIS-based shortlisting have been estimated within the context of three UK total offshore wind deployment scenarios: 75GW by 2050; 100GW by 2050; and 150GW by 2050

A single scenario has been assumed for rest of the world (RoW) deployment, reaching 7GW deployed in 2030 (excluding the UK) and 52GW in 2040 (excluding the UK).

4.2 DEFINING THE NEAR-TERM PIPELINE

Based on the priority order established through the initial LCOE assessment, UK deployment profiles out to 2040 were built to reflect the most attractive sites being developed first. The annual and cumulative pictures for these scenarios are shown in Figure 2.

In the period 2027 – 2031 development has been restricted to zones that are currently available through seabed leasing, most notably the ongoing Scotwind seabed leasing round which includes zones A and B. Beyond 2031, the deployment profile has been chosen according to merit order, assuming generally that the lowest LCOE zones are developed first before moving on to other zones. As each zone has capacity for multiple projects, we have also ensured geographic diversity to ease pressure on the supply chain and maximise opportunity for economic and supply chain development. In the 100GW (16GW) scenario, the remaining capacity available within any individual zone is insufficient for a second large-scale project in 2039. To complete the deployment profile to the end of the 2030's, Zone B was selected for a further large-scale site as being representative of site parameters for a project in 2039 given that by that time Zone B could have been extended or a neighbouring zone identified and leased.

Project capacity has been optimised to maximise use of transmission assets which have a high proportion of fixed cost. Balance of system infrastructure is chosen according to site conditions.

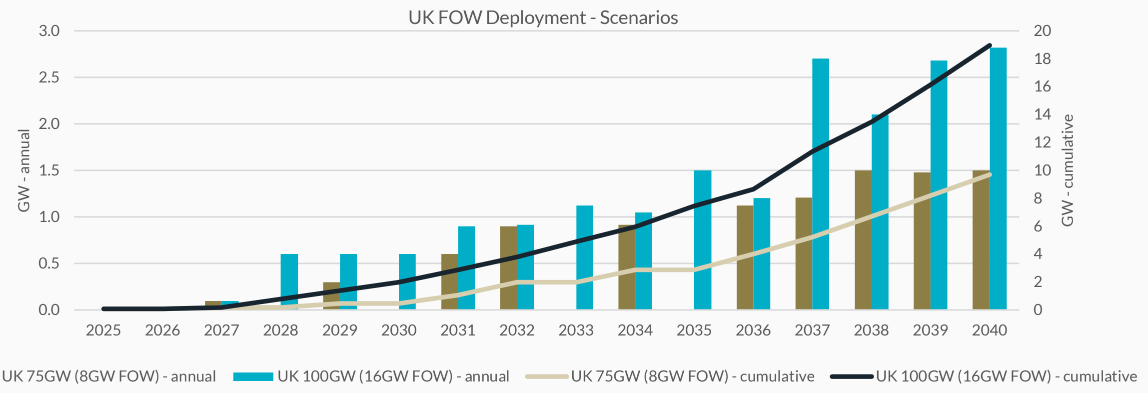


Figure 2: UK FOW deployment

4.3 75GW AND 100GW SCENARIOS

4.3.1 100GW

Based on the overall rate of UK offshore wind deployment to meet 100GW by 2050, where we estimate 64GW by 2040, 16GW of the identified 19.3GW FOW pipeline could be deployed by 2040 with an average annual deployment rate of 1.3GW per year from 2028 (increasing from 600MW in 2028 through 1.5GW per year by 2035 and up to 3GW per year in 2040).

4.3.2 75GW

The 75GW scenario assumes that similar sites are built out as the 100GW scenario, but with gaps between projects and increased focus on the sites with lowest LCOE. This leads to installed FOW capacity by 2040 of 8.1GW, at an average annual rate of 730MW per year from 2029.

4.4 REGIONAL DEPLOYMENT

The geographic spread of deployment to 2040 is shown in Figure 3 (8GW FOW) and Figure 4 (16GW FOW). Several projects marked for deployment in the early 2030s are located in Celtic Sea and North East England. A seabed leasing round through The Crown Estate within the next two years is needed to unlock access to these attractive FOW sites. Slower progress in this critical early milestone could jeopardise Net Zero targets and lose the UK's early lead in the industry.

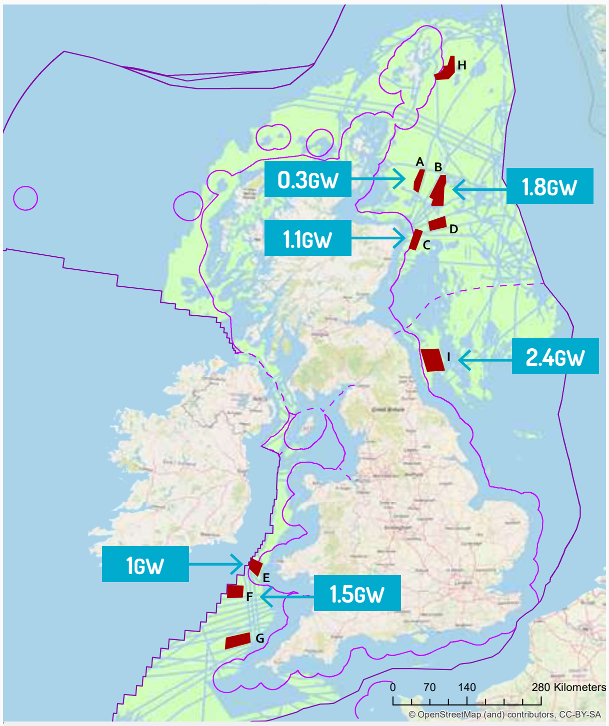


Figure 3: 8.1GW of FOW deployment by 2040 in 75GW scenario

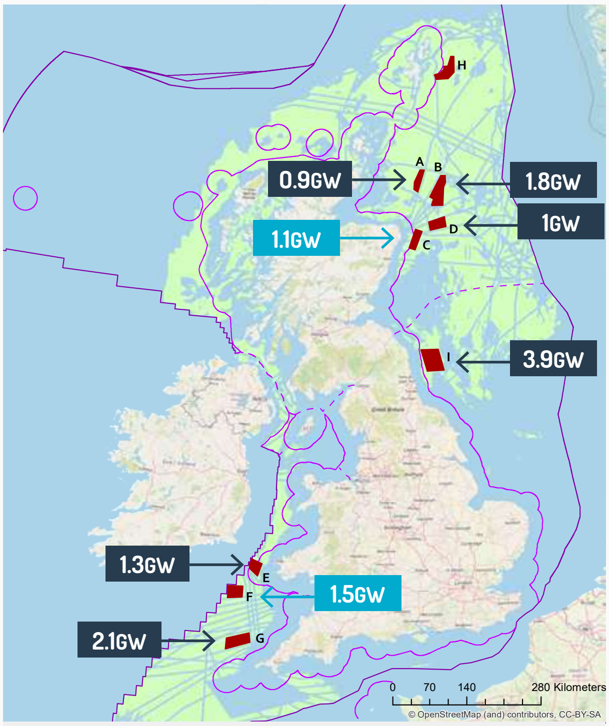


Figure 4: 16GW of FOW deployment by 2040 in 100GW

5. KEY COST DRIVERS

This section outlines our approach to estimating and applying current and future cost drivers in the bottom-up cost model and the Cost Reduction Pathways model.

5.1 TURBINE RATING

The largest technology cost driver for offshore wind projects is the turbine rating. While global deployment grows exponentially, we may expect the introduction of larger turbines to accelerate. However, turbine technology is outpacing the supporting technology required to install it. The industry is at a turning point where new cranes and vessels need to be developed to withstand the height, reach, and lifting requirements of these structures, which may slow the pace of advances. The industry may reach a point at which the cost of fabricating and installing these larger components may outweigh the benefits of larger turbines.

Turbine rating and project capacity increases over time to reflect expected commercial maturity in each commissioning year and adoption of new technological advances. It has been assumed that 15MW turbines will be used in UK FOW from around 2030 and 20MW turbines from 2037.

5.2 LEARNING RATE

Learning rates are one of the principal methods to estimate future costs based on precedent either within the technology, or comparable technologies. A learning rate indicates the fractional reduction in the cost for each doubling of cumulative capacity. For this analysis, a learning rate is applied at a component level made up of three individual factors, based either on UK only or global deployment:

- Technology innovation
- Supply chain competition
- Economies of scale

The learning rate is applied only once 1GW installed capacity has been reached as there is expected to be limited learning applicable to all first-generation projects based on the wide range of substructure and project types being pursued in the 2020s. Learning rates have been estimated and applied to project costs. These draw on innovation roadmaps published by the Offshore Wind Innovation Hub[1] and the European Technology Innovation Platform on Wind Energy (ETIP Wind)[2] as well as our understanding of key supply chain dynamics. The weighted average learning rate is 9.5%. Cost reduction has also been assessed for a scenario with limited innovation, which results in a weighted average learning rate of 5.9%.

5.3 TRANSMISSION CHARGES

Offshore wind projects currently pay two electricity transmission network charges - The Balancing Services Use of System (BSUoS) charge reflects the costs of balancing the system and the Transmission Network Use of System (TNUoS) charge covers the building, operation and maintenance of the transmission system. TNUoS charges are dependent on where in the country a generator is connecting to the grid, and charges are consistently higher in Scotland.

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[1] https://offshorewindinnovationhub.com/

[2] https://etipwind.eu/roadmap/

The nine FOW zones identified are spread across four National Grid generation zones. The TNUoS charges applied in the analysis are based on 2019/20 rates, however these rates are expected to increase over the next five years based on the recently published Five Year View[3]. These price increases hit particularly hard on the East Aberdeenshire zone (Relevant for FOW zones A – D). If the 2025/26 forecast charge of £30.23 per kW is used instead of the 2019/20 rate of £15.64 per kW, this increases LCOE by up to 6.8% for sites being constructed in the mid-2030s. The proportional effect is much greater in the future as costs are expected to reduce in all other areas whilst TNUoS increases.

Notably, this year's five-year forecast has higher future costs that the previous year's forecast. If forecasts continue to change, the unknown cost of transmission charges proves a considerable risk for project developers locking in a fixed strike price and may result in higher margins to protect returns against rising transmission charges.

5.4 COST REDUCTION FOCUS AREAS

A small number of cost reduction opportunities stand out, which can have a large impact on areas which account for a large share of project costs:

5.4.1 Substructure manufacture

FOW substructures to date have been largely bespoke with a wide range of designs. Advances in fabrication and assembly facilities and processes, such as advanced manufacturing and robotic welding, along with targeted port investment will have a significant impact on project cost.

5.4.2 Mooring line design and installation

Improvements in design standards, standardisation of components, use of novel materials (including synthetic rope) and optimisation of array layouts all have cost reduction potential. A more integrated design interface between anchors, mooring system and substructure would enable further benefits and speed up installation and major repair operations.

5.4.3 Minor repairs and preventative maintenance

FOW is expected to benefit from similar innovations as bottom-fixed (e.g. increased automation, UAV's, drones, etc). This is particularly valuable to FOW as many of the sites are in less accessible environments than bottom-fixed turbines. Modifications need to be developed for positioning systems for CTVs, service operations vessels (SOVs) and helicopters to account for the motion of floating wind turbines to minimise personnel risk.

5.4.4 Development costs

Front end engineering design costs could rapidly decrease as numerical models are improved and design processes are more streamlined and standardised. Some development costs, such as stakeholder engagement, surveying and consenting have high fixed costs which will reduce significantly when spread across larger projects.

5.4.5 Array cables

Design of cable connection systems may be optimised to reduce the time taken to connect and disconnect cables. Cable design may also be improved to withstand the different loadings dynamic cables are under in site conditions at FOW sites. Higher voltage array cables will be beneficial for projects using higher rated turbines to increase the number of turbines on strings. This will require innovation in both static and dynamic cable design.

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[3] https://www.nationalgrideso.com/charging/transmission-network-use-system-tnuos-charges

5.5 VISIBLE PROJECT PIPELINE

The impact of having visibility of a future project pipeline cannot be understated. CfD auctions have brought prices down by reducing revenue risk in a project, allowing project developers to proceed with a capital-intensive project with a long-term, low-risk return. In the same way, project visibility will assist the supply chain to invest in new facilities to support the construction and maintenance of FOW sites.

Many of the highest impact opportunities require significant private investment which can only be realised if there is a clear demand through a succession of projects. Investment in substructure fabrication as highlighted above, could create new job opportunities as well as reducing costs by embracing innovation to support both UK projects and exporting globally.

Along with investment in innovative facilities, a visible pipeline may also bring new supply chain players to the market, increasing competition and providing additional supply chain capacity to serve a rapidly growing market.

Projects need to be spread evenly, both in timeline and in geographic diversity, to avoid bottlenecks that may increase competition for limited manufacturing and port facilities. This could also have the effect that facilities are used at a high capacity, which will reduce the cost of running the facility and reduce staff turnover rather than experiencing peaks and troughs.

6. COST OF CAPITAL

6.1 COST OF CAPITAL OVERVIEW

Cost of capital is considered in this study as the weighted average cost of capital (WACC) applicable to financing UK floating wind projects. All values modelled and quoted for the study are in real terms, consistent with the basis of the cost estimations.

6.1.1 Resulting cost of capital estimates for UK floating offshore wind

The resulting costs of capital for both UK floating offshore wind and UK bottom-fixed offshore wind are shown together with the relevant deployment profiles in Figure 5. Note that the UK deployment profiles shown are an average of the 75GW (8GW) and 100GW (16GW) scenarios to show a single trajectory to avoid further complicating the chart.

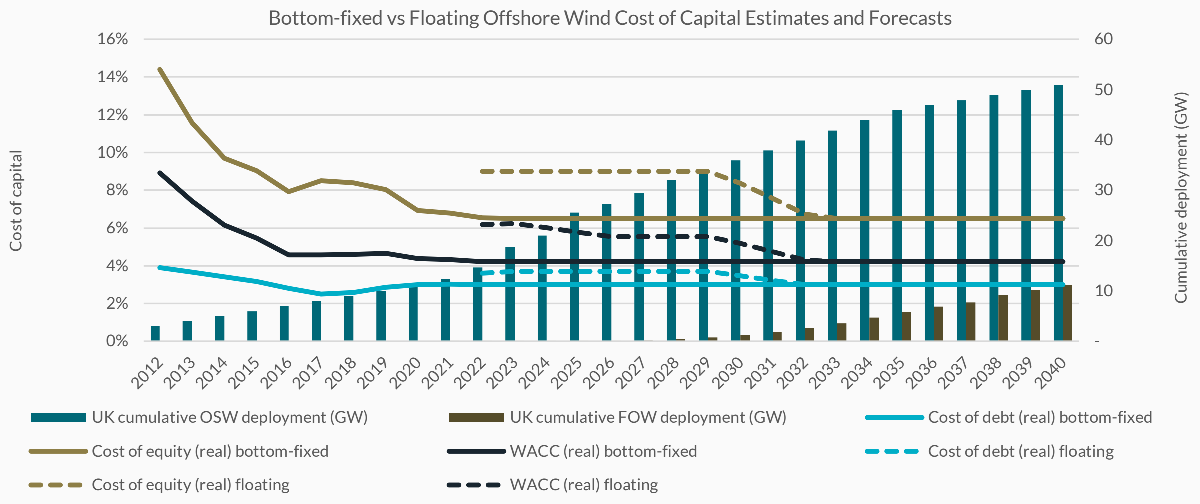

Figure 5: Bottom-fixed vs floating offshore wind cost of capital

This is showing that by the time the first commercial-scale projects (500MW +) could be deployed in the UK around 2029-2030, we expect WACC of ~5.5%, reducing to a steady state of 4.2% by 2033 with around 4GW installed capacity.

This shows a clear acceleration in the reduction of cost of capital for floating offshore wind compared to bottom-fixed. The main factor driving this is that floating offshore wind can “piggy-back” on much of the technology, operational and asset management experience already demonstrated by bottom-fixed offshore wind (eg. same turbine technology) and by offshore oil & gas. Much of the learning is transferable between industries and the risks are much better understood today than 10 years ago for bottom-fixed offshore wind.

7. COST REDUCTION

7.1 COST REDUCTION PROFILE

The project deployment and cost profiles were modelled to estimate the cost reduction potential of FOW in the UK in the context of the 75GW(8GW) and 100GW(16GW) UK deployment scenarios described in section 4.2, the learning rate assumptions described in section 5.2 and the cost of capital assumptions described in section 6.

A summary of the cost reduction impact is given below.

- Project life is assumed to increase from 25 years to 30 years in 2030. This reduces LCOE in 2030 by 6% versus retaining the 25-year project life assumption
- Capex reduces 65% between 2027 and 2040 in the 75GW (8GW) scenario, and 64% in the 100GW (16GW) scenario in the same timeframe. Although we would expect cost reduction to be higher in the scenario with higher deployment, it is also impacted by the site parameters of the projects being deployed. That is, in the 100GW (16GW) scenario, the pace of deployment means challenging sites will be built out earlier, which partly offsets the greater learning rate-driven reductions
- OPEX reduces 36% from 2027 to 2040 in the 75GW (8GW) scenario, and 32% in the 100GW (16GW) scenario in the same timeframe, due to the same drivers as CAPEX
- Net capacity factor generally increases over time due to higher turbine ratings. However, it is also very site dependent, impacted by average wind speed, metocean conditions at site and distance to onshore O&M facilities. Net capacity factor increases by 2.9% from 2027 to 2040 in the 75GW (8GW) scenario, and 6% in the 100GW (16GW) scenario driven by especially high wind speeds at Site B in 2039

The LCOE profiles are compared with the BEIS low wholesale electricity price forecast in 2020 terms in Figure 6.

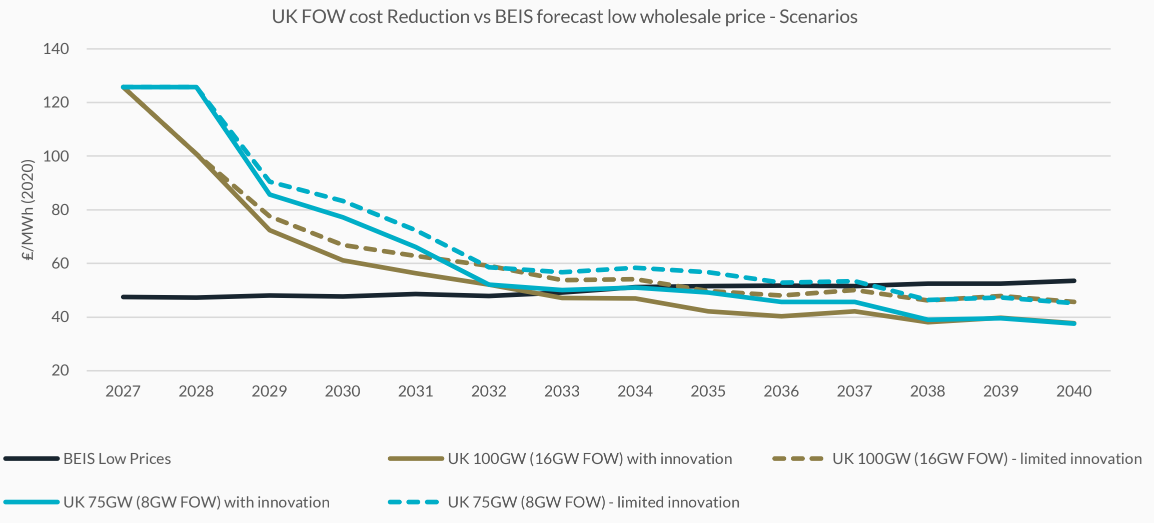

Figure 6: UK FOW cost reduction vs BEIS forecast wholesale electricity price

Deployment is a critical cost reduction driver in the early commercial phase of the technology. LCOE is 20% lower in 2030 in the 100GW (16GW) scenario versus the 75GW (8GW) scenario. By 2040, the LCOE is roughly the same in the two deployment scenarios.

Whilst early cost reduction is largely deployment driven, longer term cost reduction is achieved through higher innovation. Without innovation, LCOE is approximately 10% higher in 2030 and 20% higher in 2040 in both scenarios.

LCOE for the 75GW scenario only fully converges with the 100GW scenario in the late 2030s. There may be a brief earlier convergence around 2032 following 2 years of similar deployment levels but LCOE diverges again, driven by slower deployment in the 75GW scenario, with a single 915MW project being installed between 2033 to 2035 versus 3,670MW in the same time frame in the 100GW scenario. The learning rate impact of this additional deployment yields a 2% reduction in LCOE. Convergence is linked to a steady UK pipeline (although still lower in the 75GW / 8GW FOW scenario), illustrating the importance of pipeline consistency as well as volume, particularly with the UK having up to 20% of global deployment in 2040.

This analysis considers cost reduction alone. When considering both delivering Net Zero and UK GVA, an accelerated UK deployment rate in the early 2030s is key, as other FOW markets rapidly commercialise. Rapid deployment of FOW in the UK is key to reducing the cost of FOW in the UK in the short term (2020-2035). It is also likely to be key to maximising UK GVA in the medium and long term. In particular, the significant export opportunity may be lost if the UK is a slow starter in the industry.

8. CONCLUSIONS

This report was commissioned by the Floating Offshore Wind Centre of Excellence to develop a number of Floating Offshore Wind cost reduction pathways to subsidy free levels. These pathways were developed within a specially developed FOW cost reduction pathways model. This model has produced the outcomes outlined in this report, but also provides a resource for use in future project activity.

SCALE OF DEPLOYMENT

The UK has a large marine expanse with attractive site conditions for FOW, spread across several regions. Based on GIS mapping, we have identified a potential near-term pipeline of 19.3GW.

Detailed near-term UK FOW development profiles have been estimated within the context of three UK offshore wind deployment scenarios: 75GW, 100GW and 150GW total offshore wind by 2050.

- **The 75GW** scenario assumes installed FOW capacity of 8.1GW by 2040, at an average annual rate of 730MW per year from 2029. The 75GW scenario is stop-start in nature and may not provide the continuous pipeline required by supply chain and project developers to invest, scale up and skill up, particularly when the regional distribution of projects is considered
- **The 100GW** scenario assumes 16GW could be deployed by 2040 with an average annual rate of 1.3GW per year from 2028 (increasing to 1.5GW per year by 2035 and up to 3GW per year in 2040). This provides a smooth deployment trajectory, and utilises almost the full identified pipeline (of most cost-effective development areas identified in this study)

- **The 150GW** scenario assumes the same FOW deployment profile as the 100GW scenario to 2040, with accelerated deployment in the 2040s. This is expected to include a higher proportion of non-grid connected projects, used as a power source for hydrogen production.

Note, the role of FOW in the 100GW (40% FOW) and 150GW (60%) scenarios is significant and highlights the importance of FOW for the UK should >100GW of offshore wind be required to deliver net zero. Achieving 100GW or 150GW of offshore wind will require significant developments in the wider energy system, including large-scale hydrogen production and increased inter-connection.

A single FOW development scenario has been assumed for global deployment, reaching 9GW deployed in 2030 (including the UK) and 71GW in 2040.

COST REDUCTION

Cost reduction in UK FOW will happen much faster than it did in bottom-fixed wind. It will benefit from using state of the art turbine technology and O&M innovations. It will also benefit from greater levels of competition for project financing, particularly in the development phase. This, in combination with the maturity of the broader offshore wind sector means the industry will have much lower cost of capital than bottom-fixed offshore wind at the same stage of commercial maturity. By the time the first commercial-scale projects (500MW +) are deployed in the UK around 2029-2030, we expect WACC of ~5.5%, reducing to a steady state of 4.2% by 2035.

UK FOW costs are expected to reduce quickly, driven by deployment in the early years. LCOE is 20% lower in 2030 in the 100GW scenario versus the 75GW (8GW) scenario. It should be noted that, over time, UK FOW becomes a decreasing proportion of global deployment and so cost reduction on the whole is driven more by global than UK deployment in the long term

When looking at FOW LCOE in isolation, accelerating deployment above the 75GW (8GW) scenario has a limited impact on cost reduction in the medium and long term. By the mid-2030s, costs are comparable in the two (75GW and 100GW) scenarios and are largely driven by available site characteristics. However, in the short-term deployment in line with the 100GW (16GW) scenario will result in costs reducing faster and importantly provide a consistent pipeline of project activity for the supply chain (encouraging long term investment in the supply chain, innovation and driving efficiencies). In addition, when UK GVA is considered this faster pace of deployment is critical in developing and maintaining a market leading position for the UK supply chain in FOW (attracting associated investment in innovation, supply chain capability etc).

Whilst innovation makes a contribution to LCOE reduction in the short term, its real impact is on longer term cost reduction. Without innovation, LCOE is approximately 10% higher in 2030 and 20% higher in 2040 in all scenarios. This innovation will also be key to maximising UK GVA from floating offshore wind, through higher UK content in UK projects and exports

Accelerating UK FOW deployment, mainly through larger capacity projects, from the point of subsidy-free, will maintain cost reduction momentum and, depending on the support regime in place in the 2030's, could allow repayment to the LCCC from projects operating at sub-wholesale prices.

9. RECOMMENDATIONS

The following recommendations are made with respect to supporting rapid cost reduction in UK FOW, whilst ensuring the industry also plays a key role in driving UK economic growth and delivering net-zero:

- Rapid deployment of FOW in the UK is key to reducing the cost of FOW in the UK in the short term (2020-2035). It is also likely to be key to maximising UK GVA in the medium and long term. The FOW industry in the UK should be supported to grow rapidly, alongside establishing a clear long-term vision for the growth of the industry.
- Early support for technology innovation should be provided as it will drive long-term cost reduction and maximise UK content in FOW projects. It will also be a key driver of UK GVA through exports of products and services. This is particularly important for substructure fabrication and assembly processes, mooring system and cable system design and manufacture and operations and maintenance.
- An offshore leasing round should be established in the next two years to facilitate access to the most cost effective FOW project areas in England and Wales, specifically the Celtic Sea and North East England.
- Of the pathways considered in this analysis, it is recommended the 100GW pathway should be pursued in the short-term until subsidy-free LCOE is estimated to be achieved; beyond this, deployment should be managed to ensure offshore wind is deployed most cost effectively to deliver net-zero, whilst simultaneously maximising UK GVA.
- Existing and new supporting policies should be actively managed to spread projects evenly to avoid competition for limited supply chain facilities and enable manufacturing and port facilities to run at a high capacity thereby reducing their running costs. This can be achieved through establishing a long-term vision for the industry and managing CfD (as relevant) allocation rounds in a regular and synchronised cycle. Providing visibility of a future project pipeline will also encourage supply chain investment in innovation and infrastructure and increase supply chain competition by attracting new players.

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