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WHITE PAPER

How far can we push deep-water fixed offshore wind?

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Executive Summary

Seaway7 is active in the delivery of all three types of deep-water wind foundations: fixed-bottom, floating and Other Deep-water Offshore Wind (ODOW). This paper discusses the installation challenges, relative strengths and installed costs of these technologies from a technology-agnostic perspective.

The key findings are as follows:

1. Fixed-bottom jackets remain a viable solution well beyond 60m.
2. Split pre-piled jackets are approximately 20% lower cost than ODOW and floating concepts up to 120m.
3. Current offshore wind support mechanisms generally do not account for the additional costs associated with increasing water depth for fixed wind.
4. For deep-water fixed-bottom projects, adapting foundation concepts to make use of the existing vessel fleet may be more practical than relying on a future generation of larger installation vessels.
5. A substantial UK and international market exists in water depths between 60m and 120m.
6. The principal barrier to deeper-water offshore wind deployment is increasingly turbine installation rather than foundation technology.

While floating wind will play a critical role in unlocking deeper-water offshore wind resources in the long term, deep-water fixed-bottom solutions have the potential to complement floating wind in intermediate water depths where they remain technically and economically viable.

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1. Introduction

A widely held view within the offshore wind industry is that fixed-bottom foundations are technically and economically viable only in water depths of up to around 60m, with deeper waters considered the domain of floating wind. Seaway7 currently holds the world record for the deepest installation of a fixed-bottom wind turbine foundation, achieved in 58.6m of water on the Seagreen project.

However, the economics of floating wind remain challenging, prompting a re-evaluation of this assumption as the industry seeks to unlock vast offshore wind potential in waters deeper than 60m.

As a technology-agnostic company, Seaway7 are actively exploring cost-effective pathways to enable offshore wind development in deeper waters. We do not favour fixed-bottom, floating or any specific foundation solution. Rather, we support the technologies that can most effectively deliver large-scale offshore wind deployment and affordable, secure energy supply.

Based on our assessment of the economics of fixed-bottom, floating and hybrid foundation concepts, we believe there is significant potential to extend the deployment of conventional fixed-bottom foundations into deeper waters than is common today. We also believe that the technological advancements required to achieve this are less complex, closer to commercial

readiness, more readily deployable and ultimately more bankable than many alternative solutions.

This conviction forms the basis of this white paper.

2. The UK Perspective

Outside China, the UK is the largest and most mature offshore wind market in the world. It has been a key trend setter in terms of deeper-water wind projects due to the water depths surrounding the British Isles, combined with its long history of offshore construction.

The UK's Contracts for Difference (CfD) scheme has been instrumental in establishing the country as a global leader in offshore wind. Under the latest auction round, Allocation Round 8 (AR8), the government has maintained the same Administrative Strike Prices (ASPs) as in AR7. For fixed-bottom offshore wind, the ASP is set at £113/MWh (2024 prices), while floating wind is set at £271/MWh.

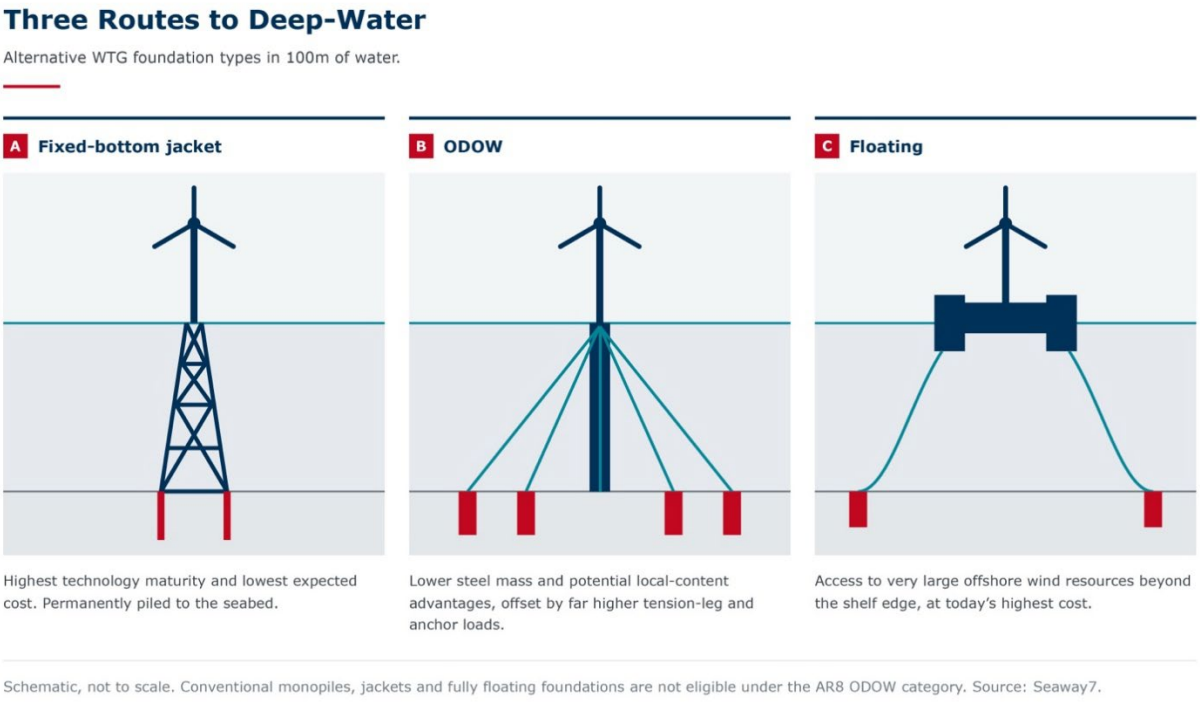
Although successful bids are expected to come below these levels, the cost gap between fixed and floating wind remains substantial. Floating wind costs are expected to fall over time as projects scale up and the technology matures. Given the vast seabed areas suitable for floating wind, it remains an important long-term option for energy security. Deep-water fixed-bottom solutions should therefore be viewed as a complement to, rather than a replacement for, floating wind, extending the range of water depths in which offshore wind can be deployed economically. However, widespread deployment will ultimately depend on achieving competitive costs for consumers.

Recognising this challenge, the UK Government has introduced a new category in AR8: Other Deep-water Offshore Wind (ODOW). ODOW sits in the same funding pot as floating wind and benefits from the same ASP.

The aim of ODOW is to encourage offshore wind solutions in water depths greater than 50m, potentially extending to around 120m while supporting the development of technologies that can compete with both conventional fixed-bottom and floating wind in the long term. While the initiative is primarily intended to support hybrid foundation concepts, it applies to fixed structures that incorporate innovative or buoyant designs to reduce loads while remaining permanently connected to the seabed. Conventional monopiles, jackets and fully floating foundations are not eligible under the scheme.

3. Technology Options for Deep-Water Wind

The three routes to deep-water wind and the principal strengths of each approach are summarised below.



Foundation technology types for deep-water wind

Fixed-bottom Jacket: Highest technology maturity and lowest expected cost.

ODOW: Lower steel mass and potentially local-content advantages.

Floating: Access to a very large offshore wind resources beyond the shelf edge.

The remainder of this paper compares these technologies as deep-water offshore wind solutions, examining their relative costs, risks, and technology readiness to determine the most practical and economically attractive pathway for deployment.

3.1. ODOW Technologies

There are a number of developers of ODOW concepts at various stages of technology readiness, for example:

- **OSI Renewables, FTLP+**
- **Marine Power Systems, Pelaflex**
- **Neretek**
- **Entrion Wind, FRP**

Seaway7 also has its own ODOW concept, known as TLS (Tethered and Landed Spar), for which there is a published patent [1].

Many of the ODOW technologies can trace their genealogy back to the use of cable guyed caisson designs, known as Tarpon, that were first used in the oil and gas industry in 1987 with patents originally owned by Stolt Comex Seaway. That technology has been used on approximately 60 oil and gas projects around the world and has a good track record.

Stolt Comex Seaway and Seaway7 are connected through a long corporate history and lineage and Seaway7 has looked at this technology for several years. The concept offers a potentially attractive route to extending monopile type structures into much deeper waters while maintaining control of the overall system dynamics and going some way to managing the costs. However, the stiffness requirements and loads acting on the guy wires are significantly greater in offshore wind application than those used in the Tarpon designs from oil and gas. This increases the cost and complexity of the anchors, wires, tensioning system and installation activities relative to floating wind.

The primary attraction of the ODOW solutions is that the central primary structure is lighter than the floating or deep-water jacket alternatives, reducing fabrication costs. However, these benefits may be partially offset by the cost of the foundations, anchors and other support systems required below the seabed to maintain structural stability, increasing both cost and complexity.

A further advantage is that the stiffness and overall structural behaviour are more similar to those of a fixed-bottom foundation, minimising turbine dynamic amplification compared to floating wind.

From a supply-chain perspective, ODOW designs may also offer higher levels of local content than floating wind, particularly in manufacturing.

3.2. Deep-water Fixed-Jackets

A jacket is a lattice steel frame with three or four legs sitting on piles or suction caissons driven in to the seabed. It is a proven concept that has been successfully applied several thousand times in the oil and gas industry. Looking at that industry, there are jacket structures that have been installed in well over 300m of water. One example is the Bullwinkle platform in the Gulf of Mexico which is in 412m of water.

On that basis, fixed-jacket foundations can be engineered for water depths far beyond approximately 60m currently typical in offshore wind projects. In practice, the limiting factors are installation, feasibility and economics, rather than any fundamental engineering constraint.

To evaluate deeper-water jacket structures, Seaway7 has built models using 15MW and 20MW turbines in water depths of 40m, 60m, 80m, 100m and 120m in Scottish weather conditions. These models were built in Bladed and Sesam and benchmarked against existing structural designs. They can be used in early engagement and technology development studies and have been used in the following cost comparison.

Offshore wind has developed an efficient method for the installation of offshore jackets that has become widely adopted. Here the jackets are transported vertically then lifted into pre-installed piles on the seabed and a grouted connection made.



Vertical Jacket Lift on Beatrice Offshore Windfarm

There are practical limits as to how tall the structure can be in order to be lifted in this configuration. As the water depths increase the number of vessels that can carry out these lifts reduces. In about 65m of water, you run out of monohull crane vessels with sufficient lift capacity and are left with a very small number of more expensive semi-submersible crane vessels. The principal challenge is therefore not the jacket itself, but the installation method.

By introducing a mid-height connection and splitting the jacket into two sections, the lift height and lift weight can be significantly reduced. This greatly increases the number of vessels capable of performing the installation and extends the practical application of jacket foundations into deeper waters.

This is summarised in the following table showing the global number of heavy lift vessels that can carry out these operations as a vertical lift.

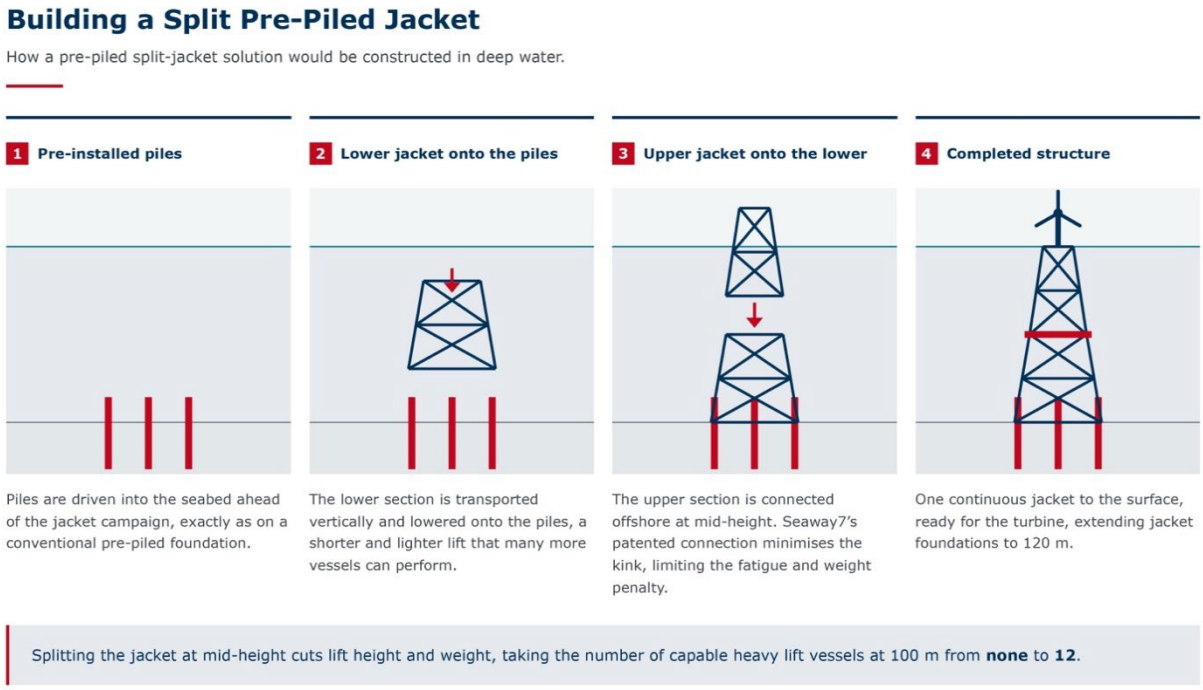
Water Depth (m)	Jacket	
	One Piece Lift	Split Two Piece Lift
40	20	20+
60	15	20
80	1	15
100	-	12
120	-	10

Summary of Number of Heavy Lift Vessel Available for Installation Globally

The key question is therefore not whether structures can be engineered for these water depths, but whether the industry should rely on the development of a new generation of larger installation vessels or adapt foundation concepts to make better use of the existing global fleet. Split-jacket concepts offer one potential route to extending deployment into deeper waters without depending on future vessel development.

Other installation approaches have been successfully applied in the oil and gas sector. For example, large jackets can be transported horizontally and upended offshore before installation. However, this approach does not readily translate to offshore wind. The scale of deployment in wind farms means that the associated heavy-lift vessel requirements and installation costs would need to be repeated across dozens of foundations, making the concept difficult to justify economically. Further, equipping each jacket with the necessary flotation systems would be prohibitively expensive.

The diagram below illustrates the split-jacket installation sequence proposed for deeper-water applications. The lower jacket section is first installed onto pre-installed piles before the upper section is lifted and connected offshore.



How a pre-piled split-jacket solution would be constructed.

Split-jackets are not a new concept for offshore wind. A similar solution was deployed at the Block Island Wind Farm in the United States in 2015, where five jacket foundations were installed using a split-jacket configuration to accommodate local crane-vessel limitations.

The solution we would propose in deeper water is a little different, but there is an extensive industry track record in connecting jackets to pre-installed piles subsea, and very similar approach can be taken for jacket-to-jacket connections subsea.

In addition, Seaway7 has developed and patented a connection method which minimises the kink in the jacket, reducing the impact on the fatigue design of the structure and therefore the overall weight impact and cost [2].

Fabricating jackets in multiple sections is already common practice in offshore wind. The upper jacket is usually fully coated and needs to fit into a paint hall. There are also benefits of carrying out the mechanical and electrical outfitting of the upper jacket at lower elevation. When complete the upper jacket is then lifted on to the lower jacket and welded together before load-out. The main difference here is that the connection is made offshore.

A good example of this was on the Beatrice project in Scotland, where one of the fabricators, Smulders, built the upper jackets at Hoboken in Belgium. These were then transported to Wallsend in the UK where they were lifted on to the locally fabricated lower jacket. The same approach was also adopted on the Moray East project.



Connecting upper and lower jackets onshore in the UK (Smulders)

An advantage of the split-jacket approach for deeper-water projects is that smaller components can be assembled, marshalled and loaded out from a wider range of port facilities and the need for large onshore craneage is reduced. There is also a benefit that a split-jacket solution serves construction facilities with limited air draft access.

4. Cost Comparison Between Concepts

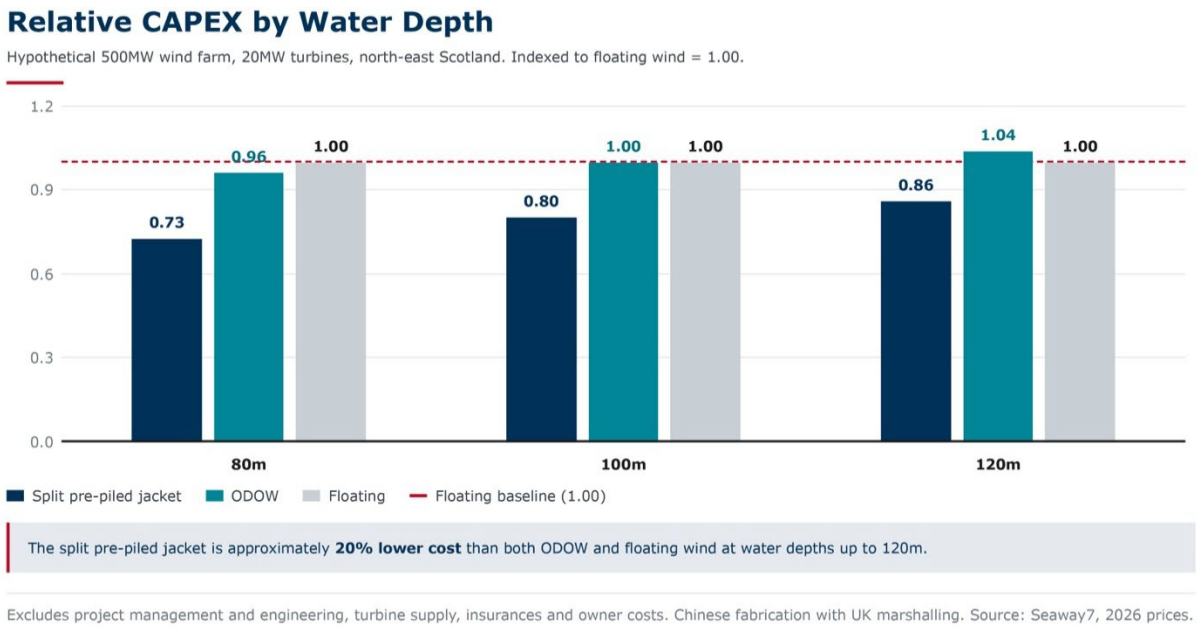
Based on Seaway7 experience delivering EPCI projects and benchmark analysis of pricing data, a comparison has been undertaken between jackets, ODOW and floating wind foundation technologies. The comparison is based on a hypothetical 500MW wind farm comprising 20MW turbines across three representative water depths: 80m, 100m and 120m. The site location is assumed to be in north-east Scotland.

The comparison is intended to provide a directional assessment of relative costs using a consistent set of assumptions across all three technology categories, rather than a definitive estimate of project CAPEX. For floating wind, the analysis is based on a representative concept reflecting one of the most common foundation approaches currently being developed commercially. For ODOW, the analysis is based on a range of publicly known concepts with similar characteristics and cost drivers, using an indicative design intended to be representative of the wider technology category. The same assumptions have been applied across all three technologies wherever possible to provide a balanced comparison. It assumes fabrication is

carried out in China and includes transportation to the UK with marshalling in the UK for all three foundation solutions.

Pricing includes procurement of foundation, mooring system, inter-array cables and transportation and installation of the foundation, mooring system, inter-array cables and turbines. It excludes project management and engineering, supply of the turbine, insurances, and other owner-related costs which are assumed to be similar for all three options. All pricing is presented in current 2026 terms.

The results are presented relative to floating wind for water depths of 80m, 100m and 120m.



Relative CAPEX comparison of different technologies

In summary, there is relatively little difference in overall cost between the ODOW and floating wind concepts, although the make-up of the pricing is quite different. This is discussed in further detail below.

The split pre-piled jacket solution is estimated to be approximately 20% lower cost than both the ODOW and floater at water depths up to 120m.

To provide further insight into the analysis, we have compared the cost of primary steel fabrication separately and presented the results here for 100m water depth. As expected, the floating foundations have the highest primary steel fabrication cost. The jacket solution is more than 20% lower cost and the ODOW is more than 40% lower.

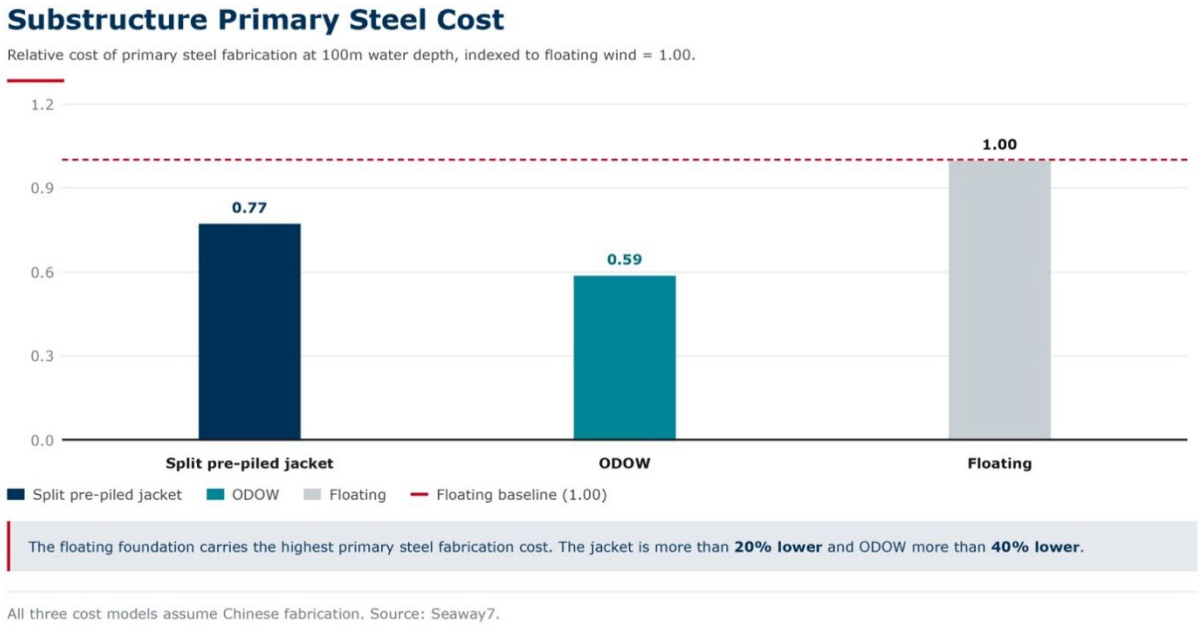
All three cost models are based on Chinese fabrication. If one of the concepts, for example ODOW, were instead to be manufactured in the UK, then the relative economics would likely change significantly, depending on local fabrication costs.

Benchmarking against a floating wind concept, the split pre-piled jacket has no moorings, but it has heavier piles than required to anchor a floating foundation. In contrast, the loads in the ODOW tension legs are approximately three times greater than the equivalent mooring lines

and this results in much larger anchors and increased mooring line cost. In addition, the associated installation costs are significantly higher.

If ODOW technology is to achieve a lower overall cost than floating wind, optimisation of the design and installation of the mooring system is likely to be the key area for cost reduction. The analysis indicates that split pre-piled jackets have a strong basis for economic competitiveness in water depths up to 120m.

It should also be recognised that all three concepts interact with the seabed, and therefore the relative cost comparison is highly site dependent. Variations in seabed conditions can have a significant impact on foundation, anchoring, and installation costs.



Comparison of CAPEX on Primary Steel



5. Funding

In the UK, a project requiring jacket foundations in 60m of water currently competes for a Contract for Difference (CfD) on the same basis as a project using monopile foundations in 20m of water. This does not fully reflect the reality that foundation costs increase significantly with water depth. Historically, this has been partially offset by the fact that deeper water sites often benefit from stronger and more consistent wind resources. A good example is Berwick Bank, which proved competitive in Allocation Round 7 (AR7) despite its greater water depth and higher grid connection costs.

Beyond 60m water depth however, the economics change considerably. Floating wind experiences a substantial increase in cost without a corresponding step change in wind resource. This reflects a combination of factors, including lower technology maturity, higher financing costs, and the relatively small scale of projects delivered to date.

The results of this assessment are summarised in the below and illustrated in the accompanying graph comparing strike price against water depth. For Allocation Round 8 (AR8), deep-water fixed-bottom solutions are effectively excluded, except where they can compete within the conventional fixed-bottom pot. By contrast, ODOW has been categorised within the floating wind pot. Under the current framework, it is therefore unlikely that we will see fixed-bottom foundations deployed significantly beyond today's practical limit of around 60m water depth.

This is noteworthy because deep-water fixed-bottom solutions appear capable of delivering substantially lower costs than both ODOW and floating wind over a much wider range of water depths. As a result, there is a strong case for adapting support mechanisms to recognise the impact of water depth on project economics and to encourage deployment of lower-cost technologies where they remain technically viable.

One potential approach could be to introduce a water depth adjustment within the CfD mechanism. For illustrative purposes, a water-depth adjustment of £10/MWh for every additional 10m of water depth beyond 60m could be applied. If the average AR7 strike price for fixed-bottom projects up to 60m water depth were £90/MWh, projects located in 60-70m water depth would receive a £10/MWh uplift, increasing incrementally to a strike price of £150/MWh for projects in 120m water depth.

Even at these illustrated adjusted levels, deep-water fixed-bottom projects remain at significantly lower cost than current floating wind alternatives. Such a mechanism could also be highly cost-effective for consumers, as it would apply only to the relatively small proportion of capacity located in deeper waters while unlocking access to a substantial additional pipeline of fixed-bottom development opportunities.

Comparison of AR7 Results

Awarded strike price, administrative strike price and water-depth range for each AR7 project.

PROJECT	CAPACITY	TYPE	CFD	ASP	WATER DEPTH RANGE
Berwick Bank B	1,380MW	Fixed	**£89.49**	£113.00	39–68m
Awel y Mor	775MW	Fixed	**£91.20**	£113.00	15.2–41.9m
Dogger Bank South East	1,500MW	Fixed	**£91.20**	£113.00	17.5–38.2m
Dogger Bank South West	1,500MW	Fixed	**£91.20**	£113.00	18.4–28.3m
Norfolk Vanguard East	1,545MW	Fixed	**£91.20**	£113.00	21–47m
Norfolk Vanguard West	1,545MW	Fixed	**£91.20**	£113.00	21–47m
Erebus	100MW	Floating	**£216.49**	£271.00	65–85m
Pentland	92.5MW	Floating	**£216.49**	£271.00	66–102m

0m 20m 40m 60m 80m 100m 120m

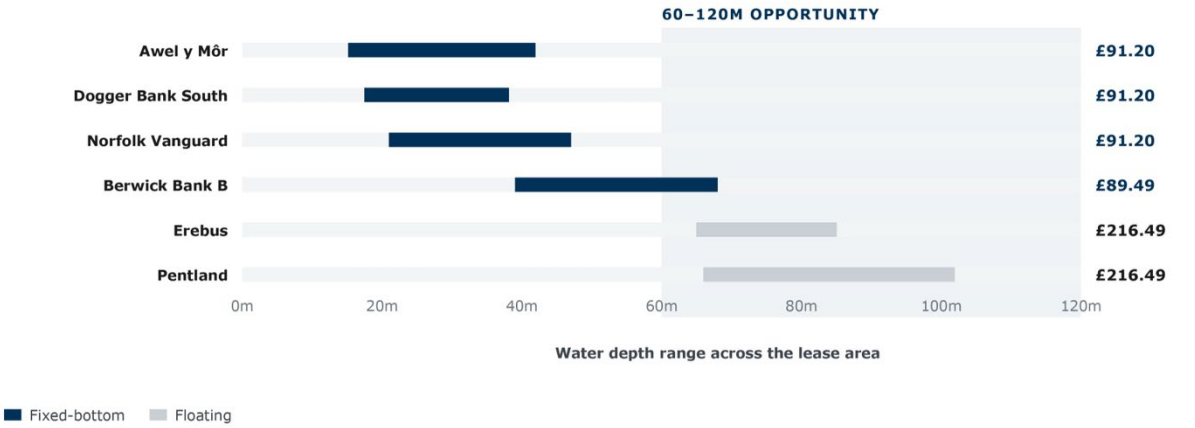
Fixed-bottom projects cleared between **£89.49** and **£91.20/MWh** against a £113.00 ceiling. The two floating projects cleared at **£216.49/MWh** against a £271.00 ceiling.

Source: Allocation Round 7 results, as tabled in the white paper. Prices in 2024 terms.

Comparison of AR7 results

AR7 Results against Water Depth

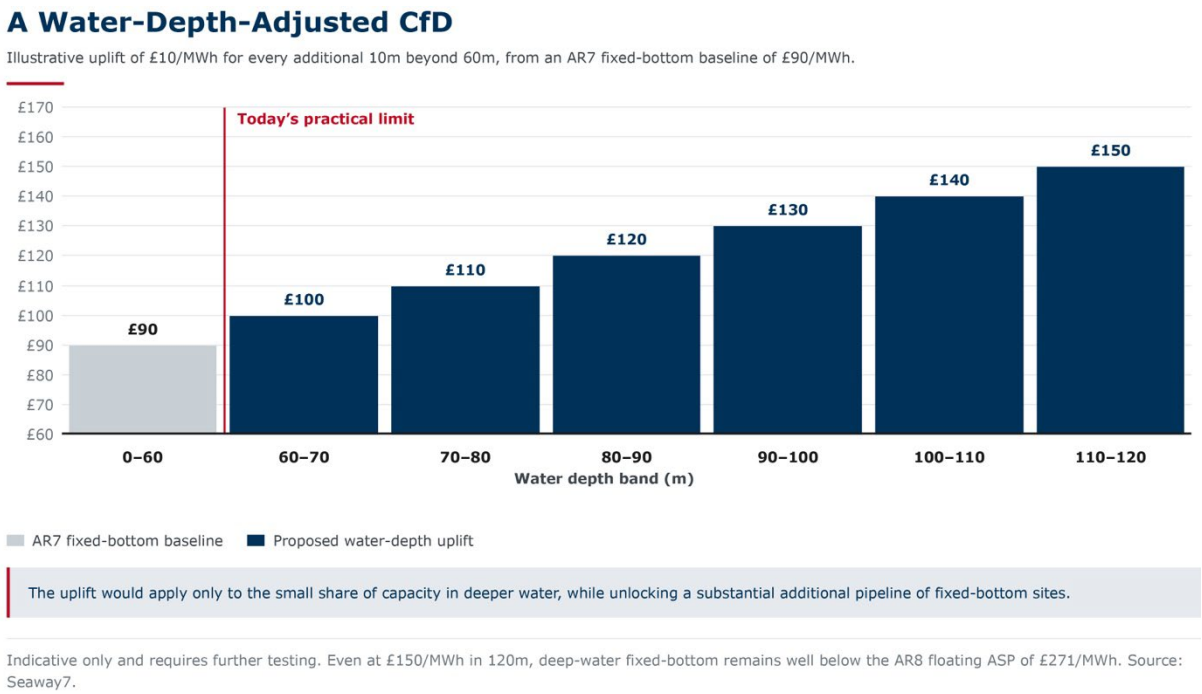
Awarded strike price across each project's water-depth range (2024 prices).



Berwick Bank B cleared at **£89.49/MWh** in up to 68m of water, while floating projects in similar depths cleared at **£216.49/MWh**.

Bars span the shallowest to deepest water within each lease area. Source: Allocation Round 7 results.

Comparison of AR7 Results and Water Depth



Indicative only and requires further testing. Even at £150/MWh in 120m, deep-water fixed-bottom remains well below the AR8 floating ASP of £271/MWh. Source: Seaway7.

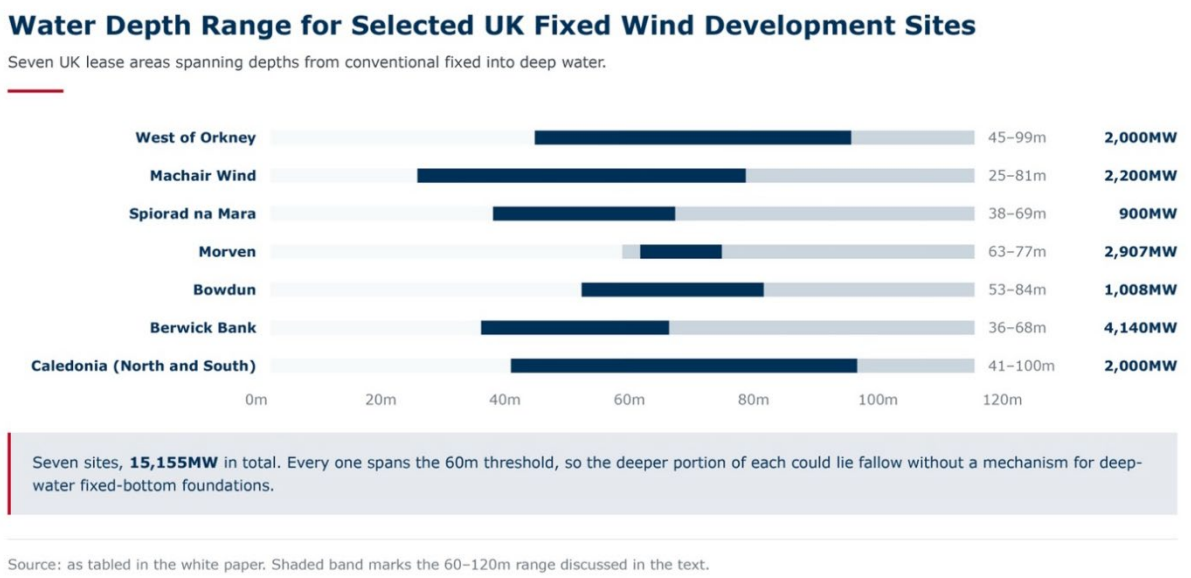
Possible Top Up Scheme for Deep-water Fixed Wind

6. Is There a Market?

The opportunity extends beyond individual projects. There is a substantial market in the UK and internationally within the 60-120m water depth range where deep-water fixed-bottom solutions could remain technically and economically viable.

There are two potential markets for deep-water fixed-bottom wind foundations.

The first is within existing offshore wind lease areas that span across water depths that would traditionally be considered ranging from fixed to floating. If we look just at the UK there are several, a good example is the Caledonia site, where water depths range from approximately 40m to 100m. While the shallower portions of these sites (40-65m) will be built using conventional fixed wind foundations, monopiles or jackets, the deeper areas (65-100m) could potentially lie fallow due to the higher costs associated with floating wind. In addition, current CfD arrangements do not readily support projects that span both fixed-bottom and floating wind development categories. However, if there were a mechanism in place to support fixed-bottom foundations in deeper water then the developer can maximise what they can deliver from a lease area.



Water Depth Range for Selected UK Fixed Wind Development Sites

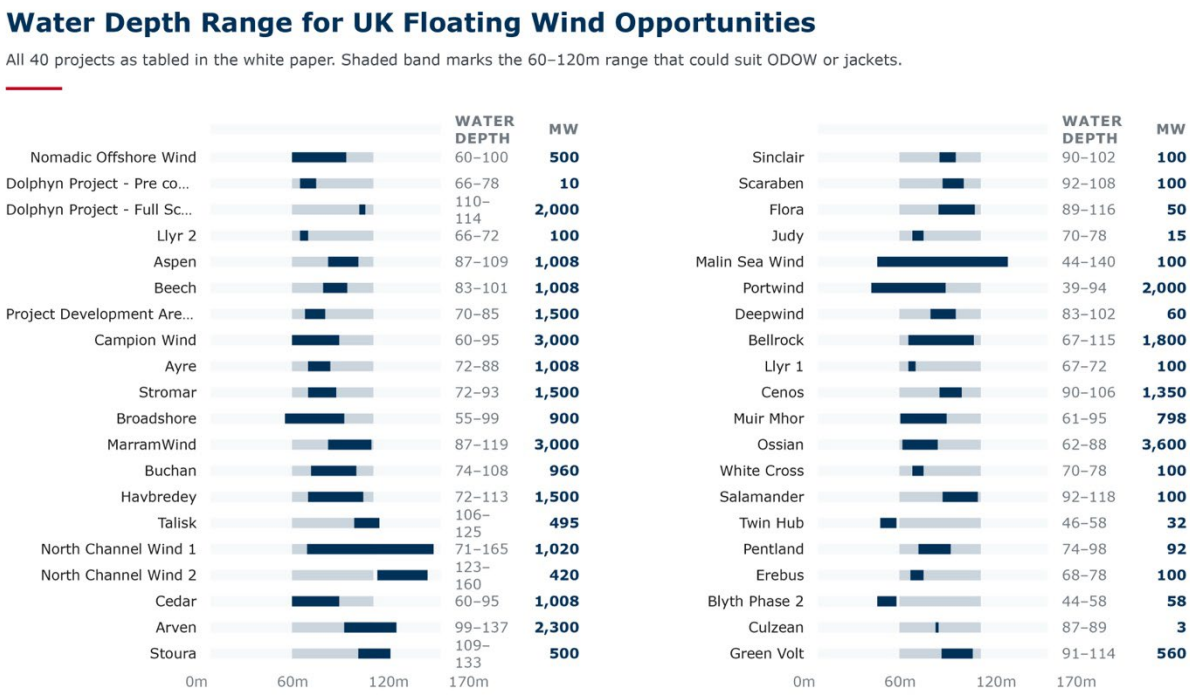
The second market comprises sites in the shallower end of the current floating wind market, sites currently considered suitable for floating wind but located in water depths where deep-water fixed-bottom solutions may still be technically and economically viable. Focussing again on the UK market, most of the continental shelf lies in less than 150m, creating substantial potential for this technology.

To illustrate the scale of the opportunity, the figure below summarises known UK floating wind projects located in water depths that could potentially support ODOW and deep-water fixed-bottom solutions, building on ORE Catapult's assessment of the UK market [4,5].

The assessment includes known UK floating projects in various stages of development located within the 60-120m water depth range that could suit ODOW or jackets. It does not include sites which may become available in the upcoming leasing rounds in the UK Sector of the North Sea, which would include additional sites with water depths up to 95m.

Beyond the UK, similar opportunities exist in a number of offshore wind markets with comparable water depth ranges, including Ireland, France, Sweden, Estonia, Japan and Taiwan. Taken together, these opportunities represent a substantial potential market for deep-water fixed-bottom foundations in both the UK and international offshore wind sectors.

While both markets present significant opportunities, there remains a need for demonstrator sites to bring technologies to market and improve the bankability of new solutions. Demonstrating a technology through a standalone project is challenging, particularly at full scale where both a turbine and grid connection are required. In most cases, it is more practical and cost-effective to deploy a demonstrator alongside a commercial offshore wind project. Appropriate support mechanisms are therefore important to encourage developers to trial new technologies within live project environments, helping to accelerate deployment and build investor confidence.



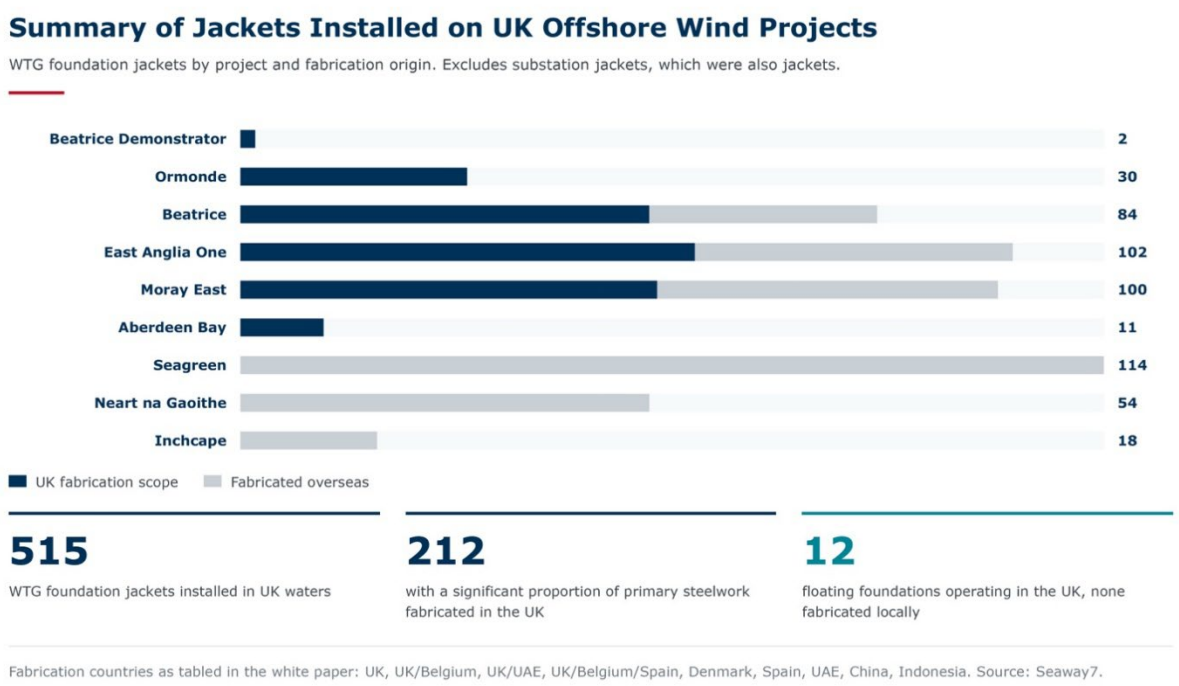
Water Depth Range for UK Floating Wind Opportunities

7. Local Gross Value Add Potential

A common argument in favour of ODOW and floating offshore wind is their potential for higher levels of local content and Gross Value Add (GVA). However, the UK is already a world leader in deep-water jacket project delivery, with a proven track record of delivering local economic value.

In recent years, jacket fabrication has increasingly moved towards Asia, driven by a combination of cost, capacity and manufacturing capability, particularly in China, as well as the relentless drive for lower cost delivery within offshore wind auctions. However, experience has shown that local fabrication can flourish where the right policies and support mechanisms are in place.

There is clearly a mature global supply chain for jackets. For projects in the UK, there is also a history of UK and European fabrication yards delivering jackets.

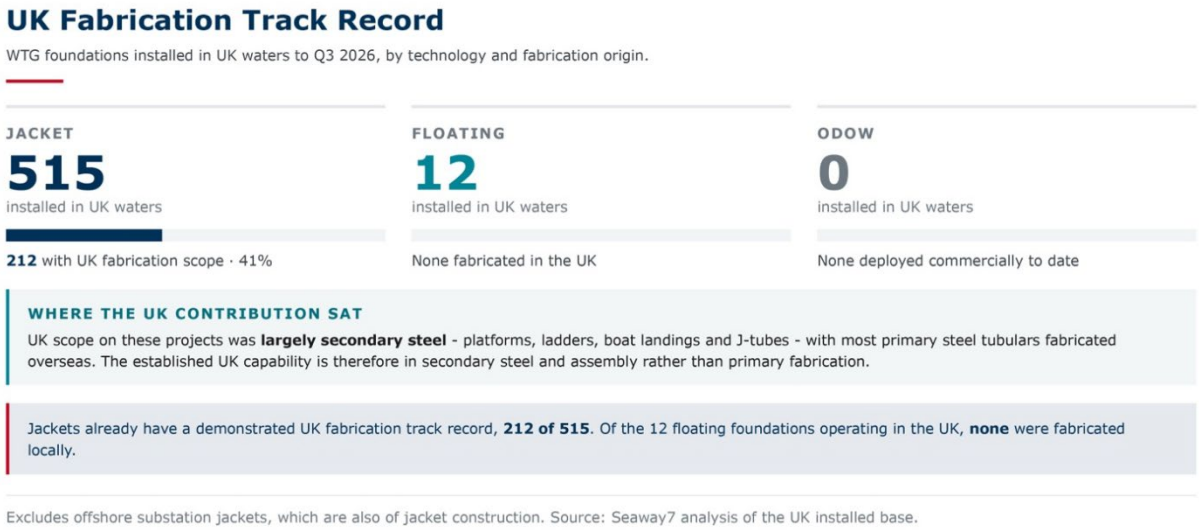


Summary of Jackets installed on UK Offshore Wind Projects

Of the 515 wind turbine foundation jackets installed in the UK to date, 212 included a significant proportion of primary steelwork fabrication in the UK. These figures exclude substations which were also supported by jacket sub-structures.

Of the 12 floating foundations currently installed in the UK, none were fabricated locally. There are currently no ODOW foundations being fabricated or installed. ODOW may ultimately create local value through a broader range of components, but jackets already have a demonstrated UK fabrication track record, whereas ODOW has yet be deployed commercially.

This raises an important question as to whether the barriers that have limited large-scale UK jacket fabrication would be materially different for floating wind or ODOW fabrication under similar policy support arrangements.



When reviewing innovation priorities, governments face a choice between supporting technologies capable of delivering economic value in the near term and investing in technologies to build future capability to unlock long-term value.

Jackets are the most mature technology of the three technologies considered in this paper. They can be deployed rapidly, supported by established supply chains, and offer a clear route to near-term economic value creation. This, combined with their relatively low cost, means that government investment in supporting deep-water fixed wind is likely to offer strong value for money.

Floating wind and ODOW represent longer-term investments. Both have the potential to create future economic value, but with less certain returns and value add, given their lower maturity today. Floating wind is considerably more mature than ODOW, while deep-water jackets are already at commercial level.

8. Technology Development Priorities for Deep-Water Offshore Wind

For split pre-piled jackets, very little technology development is required. The solution is based entirely on proven technologies with an established supply chain and operational track record. The primary opportunities lie in optimising installation methodologies and execution planning rather than developing new hardware.

We believe this approach is closer to commercial deployment and carries less technical and commercial risk than more innovative hybrid ODOW concepts. It also avoids many of the key challenges associated with floating wind, including complex mooring systems, offshore towing operations, and the associated installation and maintenance requirements. As a result, split pre-piled jackets could be deployed more rapidly and at lower overall cost, helping accelerate offshore wind deployment while reducing the cost burden on consumers.

A common challenge across all deep-water wind solutions, however, is the installation of the turbine onto the support structure offshore. For floating wind, the prevailing approach is to assemble the turbine and floating foundation quayside, or in sheltered inshore waters, before towing the fully assembled unit to site. However, this approach is difficult for some floating technology like Spars and TLP. In addition, major component replacement may require units to be returned to a port facility, which can present similar challenges for these technologies. Progress in turbine installation methodologies could therefore help address both initial installation and long-term maintenance requirements.

For fixed-bottom wind, turbine installation is typically carried out using jack-up vessels. These vessels have been adopted because they minimise relative movement between components during lifting operations, improving installation accuracy and reducing risk. However, as turbine sizes continue to increase and projects move into deeper waters, even jack-up installations are

becoming more challenging. In particular, crane tip motions increase with lift height, resulting in tighter weather windows, more complex operations, and potentially higher installation costs.

Developing efficient and reliable turbine installation methods therefore remains one of the most important opportunities for further optimisation and could unlock deeper-water offshore wind deployment.

In the oil and gas sector, jack-ups routinely operate in water depths of up to 120m, with some specialist units capable of working even deeper. However, offshore wind installation vessels have evolved differently. Wind Turbine Installation Vessels (WTIVs) are required to undertake frequent moves, often every two or three days, and must withstand significantly higher operational load cycles on their legs. As a result, they have generally adopted lighter, more agile ship-shaped designs rather than larger, heavier jack-ups commonly used in oil and gas.



Seaway Ventus Installing Wind Turbines

While it is technically possible to build larger WTIVs capable of operating in deeper waters, the economics become increasingly challenging as leg lengths increase, driving higher construction and operating costs.

The table below summarises the global WTIV fleet by water depth capability and turbine size, highlighting the limited availability of vessels capable of operating beyond 80m water depth. This represents one of the key barriers to the wider deployment of both deep-water fixed-bottom and ODOW technologies.

The maximum water depth where jack-ups can operate is a function of leg length, leg penetration into the ground, tidal range and seasonal weather conditions.

Water Depth (m)	Turbine Size	
	15MW	**22MW**
40	27	13
50	24	13
60	22	13
70	11	10
80	1	1
100	-	-
120	-	-

Summary of Global WTIV's Available for Installation

In our view, unlocking these markets will require the development of new turbine installation methodologies based on floating vessels rather than conventional jack-up technology. Achieving this will require close collaboration across the industry, particularly with turbine OEMs, whose support will be critical in developing and certifying new installation approaches.

The Carbon Trust has been at the forefront of this discussion through its Floating Wind Joint Industry Programme, which has focused on topics such as floating turbine installation and major component replacement strategies. Seaway7 has actively supported these initiatives, collaborated with several specialist technology companies, and developed its own intellectual property in this area.

More recently, Seaway7 announced a collaboration with WindSpider to advance innovative turbine installation solutions that are not constrained by water depth. Technologies of this type have the potential to remove one of the key remaining barriers to deep-water fixed-bottom and floating wind deployment, enabling projects to be developed in deeper waters while improving installation flexibility, reducing costs, and expanding the range of economically viable offshore wind sites.

In summary, the key to unlocking deeper-water fixed and ODOW technologies lies in the development of new turbine installation methodologies based on floating vessels. Close collaboration with wind turbine OEMs will be essential to develop, validate and certify these installation approaches.



WindSpider innovative turbine integration and lifting technology

9. Conclusions

The analysis demonstrates that there is significant potential for fixed-bottom wind technologies to be deployed in deeper waters than is commonly assumed today. In particular, split pre-piled jacket foundations appear capable of delivering lower overall costs than both floating wind and ODOW solutions in water depths of up to 120m.

Importantly, split pre-piled jackets require very little further technology development. The concept is based on established, proven technologies with well-understood design, fabrication and installation processes. While there remain opportunities to optimise execution strategies and installation methodologies, the technical pathway to commercial deployment is clear. As a result, the technology is likely to be lower cost, closer to commercial deployment and subject to significantly lower technical and commercial risk than more innovative hybrid ODOW concepts. It also avoids many of the challenges associated with floating wind and ODOW, including complex mooring systems, towing operations, and associated installation risks. Consequently, deep-water jackets have the potential to be deployed more rapidly and at a lower cost to consumers than floating wind alternatives.

The analysis suggests that turbine installation, rather than foundation technology, is now the principal barrier to deeper-water offshore wind deployment. A key challenge for the wider deployment of deep-water fixed-bottom, ODOW, and floating wind technologies is the development of efficient turbine installation solutions beyond the operational limits of conventional jack-up vessels. Greater industry focus and investment in floating installation methodologies for turbines will be essential.

Importantly, deep-water fixed-bottom foundations are not a substitute for floating wind. Floating wind will remain essential for the deployment of offshore wind in the deepest waters and for accessing the largest long-term resource opportunities. Deep-water fixed-bottom solutions instead have the potential to complement floating wind by extending the economic deployment of offshore wind into intermediate water depths.

Despite their apparent cost advantage, deep-water fixed-bottom solutions are not currently recognised within existing support mechanisms. Consideration should therefore be given to introducing a water-depth adjustment within future CfD allocation rounds, reflecting the additional costs associated with deeper-water developments. Such a mechanism could enable lower-cost deep-water fixed-bottom solutions to compete on a more equitable basis, accelerating deployment while delivering better value for consumers and supporting the continued expansion of offshore wind into deeper waters.

10. References

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11. Abbreviations

AR7	Allocation Round 7
AR8	Allocation Round 8
ASP	Administration Strike Price
CAPEX	Capital Expenditure
CfD	Contract for Difference
EPCI	Engineering, Procurement, Construction and Installation
FLOW	Floating Offshore Wind
FRP	Fully Restrained Platform
FTLP	Floating Tension Leg Platform
IP	Intellectual Property
LCOE	Levelised Cost of Energy
m	metre
MW	Megawatt
MWh	Megawatt hour
O&G	Oil and Gas
ODOW	Other Deep-water Offshore Wind
ORE	Offshore Renewable Energy
SME	Small/Medium Sized Enterprise

TLP	Tension Leg Platform
UK	United Kingdom
WD	Water Depth
WTG	Wind Turbine Generator
WTIV	Wind Turbine Installation Vessel