FINANCING

Floating Offshore Wind

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Contents

Introduction

Amidst a backdrop of a rapidly increasing focus on the impact of climate change from governments, regulators, investors and the general public, the move to a sustainable net-zero economy has moved to the top of the agenda for both politicians and industry.

Good progress has been made in decarbonising power generation to date, however there is still great scope to improve, with potential for further decarbonisation, along with reducing emissions from the heating, transport and industrial sectors. To drive change, industry and financiers must start embracing new and disruptive technologies to support the transition to a net zero economy. In this report and as part of MUFG's Low Carbon Series, we consider recent developments in the nascent floating offshore wind sector and the role Commercial banks can play in enabling floating offshore wind projects through financing.

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Fixed offshore: market maturity

With a compound annual growth rate for new installations of 24% since 2013 globally[1], many will agree that the market for (fixed) offshore wind has undergone a steep growth trajectory, with Europe leading the charge and contributing 75% to all offshore wind installations worldwide, followed by Asia.

That rapid development trajectory has been accompanied by cost savings which, when combined with certain attributes of offshore wind such as high capacity factors and greater environmental and social acceptance (relative to other mature onshore renewables) and economic benefits across the supply chains, has now made offshore wind a very appealing and competitive source of green electricity.

With that in mind, we consider some of the key enablers that have allowed the fixed-bottom offshore wind sector to establish itself as one of the prominent generation technology for renewable energy.

Subsidies and government targets

Since very early on, Europe took the leadership in the development and growth of offshore wind. The sector has benefitted from strong government support with stable regulatory frameworks and subsidies – the early form being Feed-in Tariff (e.g. EEG FiT in Germany) or Green Certificates (e.g. Renewables Obligations in the UK). This initial support encouraged the development of new offshore wind technologies and progressively their competitiveness with other renewable energy technologies.

As competitiveness and investor confidence in the asset class improved, many European countries, including the UK, France, Germany and the Netherlands, switched to a Contract-for-Difference (CfD) subsidy scheme in which project subsidies are awarded through competitive tenders, with many other countries in Europe now having similar schemes in planning.

Whilst continuing to provide good incentives for investment and keeping banks and investors on board, such schemes have ultimately pushed project developers to be more competitive, leading to an optimisation across the entire supply chain and therefore significant cost reduction (including the cost of financing).

This has been so effective that newer fixed offshore wind projects are able to demonstrate a credible business case with significantly reduced levels of subsidy or even in some instances zero subsidy[1].

Technological advances

The competitive environment provided by the subsidy schemes as mentioned above meant that developers had to squeeze as much as possible out of a given turbine across its lifetime. To minimise the fixed cost component (e.g. installation, Operation & Maintenance) per unit of electricity generated (i.e. the levelised cost of electricity), each wind turbine installed needed to generate more electricity.

This has brought us from a world where we saw tens of 3MW wind turbines in a farm a decade ago, to near-hundred turbines in a farm, each with a bigger size, greater efficiency and rated capacity currently as high as 12-15MW.

Along with these economies of scale, large amounts of operating data and experience have allowed developers and operators to better understand turbine performance and determine which maintenance best practices keep these machines running for as long as possible.

Finally, as some older projects approach the end of their design lives, project participants are also in a position to better evaluate the decommissioning or repowering options.

Supply chains

The strong business case created by a combination of (i) subsidies and government policies supporting a sufficient pipeline of projects, (ii) a race for technological innovation and (iii) the need to develop an expertise for appropriate risk allocation has provided supply chain participants with the necessary confidence to make significant strategic investments in the sector. The sustained demand has helped to achieve efficiencies at each point as well as across the entire chain.

When the industry was starting to scale up, developers gravitated towards Engineering, Procurement and Construction (EPC) contracts, an execution structure from the oil & gas industry.

[1] Examples of Hollandse Kust Zuid and Noord in the Netherlands, and He Dreiht, Borkum Riffgrund West, and OWP West in Germany

However, the type of risks and number of different parties involved meant that, in fact, there was no one party willing to provide a fully wrapped EPC – and interface risk became one of the key risks that developers, banks and investors alike had to assess in great detail.

Nowadays, a multi-contract structure has become common and widely accepted – in the round, it means an optimised platform for project delivery.

The next frontier: floating offshore

Many countries with coastlines are placing greater reliance on offshore wind as one of the key pillars in their strategies to realise their renewable energy targets over the coming decades. Whilst helping governments achieve these targets for the purpose of decarbonisation of power or reduction of air pollution, adoption of the technology can also provide potential synergies with "Power-to-X" technologies, for example using wind energy for the production of low-carbon hydrogen[2].

Based on current and proposed policy, analysis by the International Energy Agency[3] forecasts that global offshore wind capacity is set to increase five-fold by 2030 and fifteen-fold over the next two decades. This growth is underpinned by policy support across a number of regions – particularly European countries benefitting from access to the North Sea, the USA with state-level targets and federal incentives, and subsidy schemes in development in the Asia (Japan, Korea, China and Vietnam).

Nevertheless, constraints arise from the cumulative impacts of an "all-fixed" deployment: one of the most obvious is that fixed foundations are limited to waters where sea bed depths are less than 50-60m. Other impacts include environmental issues (habitats), or conflicting use of the sea (military / defence, radar, fisheries, other local economic activities such as commercial shipping).

The level of demand coupled with such aforementioned constraints sets a scene whereby developers will need to consider floating offshore wind as a means to unlock new sites located in deeper waters. Whilst it is a given that some of the geographies already active in offshore wind will pursue floating installations, it can also be expected that those geographies in which offshore wind is not as mature and for whom fixed-bottom technology could not be justified – for example, the west coast of the USA, Korea and Japan – will also start to engage.

In that context, we summarise below what we consider to be the key developments in the floating offshore space, along with what we consider to be the key financing aspects and how commercial banks could play a role in financing floating offshore wind projects.

Technology: where is innovation expected?

Whilst we can expect further technological innovations in wind turbine technology (and certainly adaptations from models initially designed for fixed-bottom applications), it is the foundation technology which is where we expect real innovation will take place and, to some extent, offshore transmission assets (dynamic cables).

Whilst floating foundations have been used for decades in the oil & gas industry, changing the topside from a process platform to a wind turbine presents its own set of challenges. The main challenge relates to the global motion of a floating platform using the six degrees of freedom implied by wind and waves, and in dealing with the resulting stresses on turbines and other components of the structure while achieving an optimal energy yield.

There are a number of floating structures being assessed in pilot schemes – the one(s) emerging victorious will depend on how quickly these challenges of marrying the turbine to the floating foundation are understood and overcome.

Key players: who is active in this space?

Whilst we expect the existing players in the fixed offshore sector to branch into floating, we are seeing the emergence of some additional players:

- Oil & gas majors who have sought to diversify their businesses away from hydrocarbons and towards renewable energy, in a world where environmental considerations are at the forefront of investors' minds and the public eye alike.

- Large utilities seeking to build portfolios of renewable assets, particularly given the priority of power decarbonisation on government agendas.

- Newer technology and service players: those who have been at the forefront of the floating sector, combining the technical and servicing expertise necessary for pilot projects.

- Players who had previously considered fixed offshore but then did not participate may now re-evaluate an entry into the floating space in search of higher returns.

Given that floating technology could be deployed almost anywhere, we also expect a greater collaboration of these larger players with local players, as stakeholder management will be key: particularly in discussions for access rights and permits, where localisation targets could be set in order to bring jobs, economic benefit and expertise.

Evolution and adaptation of supply chains: business as usual?

After an initial phase where we saw prototypes made of a single turbine being validated (e.g. WindFloat, Hywind demo, Floatgen to name a few in Europe), the market seems to have now entered into a second phase whereby the pre-commercial projects are extended into an array of several turbines, looking to demonstrate the feasibility of the technology and cost effectiveness, ahead of the first large scale deployments expected from the mid-2020s. The 2020 Energy Transition Outlook[4] published by DNV GL considers that floating offshore wind projects will reach 255GW of installed capacity globally by 2050. Such a large project pipeline coupled with significant projected cost reductions should provide players with the necessary confidence to invest in and optimise the floating wind supply chain.

Initial projects have opted for turbine agnostic solutions and rely on current serial production for turbines, while opting for bespoke fabrication for floating modules. The current dominant turbine manufacturers are therefore likely to maintain a head start as the floating sector achieves scale and leverages existing supply chains. Nevertheless, new fabrication processes will be needed for the foundations.

In terms of project execution, considering the inherent locational flexibility offered by floating technology, it could be expected that the foundations, like wind turbines, are manufactured away from the project site and subsequently towed to port yards for assembly and load out for final installation.

From an O&M perspective, there could be the potential for creating O&M "hubs", in which different projects' wind turbines could be retrieved from service for maintenance works, though probably only in the case for major maintenance. Again, these alternative execution strategies could provide the necessary economies of scale and pave the way for full scale deployment.

Subsidies

Floating offshore wind is still nascent with a high cost per MW relative to fixed-bottom offshore wind, with a lack of experience and scale reflected in higher risk premiums leading to higher cost of capital. Floating offshore wind therefore struggles to compete alongside fixed-bottom projects.

Recent European projects have only been able to take their final investment decision thanks to support from subsidies and other government-backed grants (e.g. NER300 or EIB InnovFin funds at EU level).

The general consensus across industry is that such support is necessary for floating projects. Whilst projects remain fairly small scale for the time being, it is expected that once a threshold for scalability is reached, a similar if not better trajectory to push boundaries, drive down costs and realise supply chain efficiencies as observed for fixed-bottom will be achieved.

> *Subsidies - example of the UK[5]:*
>
> *A potential solution could be a dedicated support mechanism allowing floating developers to compete between themselves. This was suggested in a recent public consultation undertaken by BEIS.*
>
> *In the absence of such competitive tension, it may be the case that the growth of the floating market will be stifled, in which only those players with strong balance sheets and a strategic desire for floating are likely to dominate.*
>
> *We note as at November 2020, the UK government has announced that the next CfD round is aiming to offer a capacity of 12GW across all technologies, an upward revision from 5.8GW. However, the capacity for each pot is yet to be confirmed, and it is expected that floating offshore will be competing alongside other such "less established" technologies, rather than having its own subsidy pot.*

Financing considerations

To date, we have not observed any floating offshore wind project successfully raise non-recourse project finance debt from commercial banks. There has been a significant number of small scale, pilot projects in development in recent years – particularly in France and the UK – that will aim to achieve their final investment decision milestones in the near future and may look to introduce some commercial bank debt in their capital structure.

As the pipeline and scale of individual projects develops in the coming years, financing requirements will become clearer and projects are expected to increasingly access the project finance debt market.

Whilst we consider that a majority of the bankability considerations for a floating offshore wind project will be similar to fixed-bottom, the key aspects when assessing project finance in the context of a floating offshore wind project primarily revolve around new technology risk, construction and operation risks.

Technology: a priori bankable

By virtue of the experience drawn from the oil & gas and fixed-bottom offshore wind sectors, commercial lenders should not find themselves in completely unchartered territory with floating offshore wind. In fact, offshore wind lenders have demonstrated an ability to analyse and accept some degree of technology risk.

Yet, at this moment in time, the association of different proven technologies together on a single floating wind unit is considered novel and lacking sufficient successful track record for project finance lenders to rely upon with sufficient confidence.

The technical interfaces between each of the sub-elements (i.e. turbine, substructure, and mooring system) are not as well understood and areas such as hydrodynamic stability of the platform, station keeping, fatigue behaviour and long-term impacts on each sub-element will likely require some kind of risk-mitigation. For example:

- During development, obtaining design certification will not be a panacea but provide some comfort to banks that design risks are well understood and managed.
- During construction, suitable contractual protections and testing campaigns to keep contractors incentivised to fix teething issues will also add comfort that the system will effectively operate as intended.
- During operation, one of the key risks will be any accelerated wear and tear on the turbines due to

additional stresses and loads. The engagement and coordination of the turbine and foundation suppliers at design stage is important, and a collective willingness to provide additional warranties would carry high value for banks.

Lenders need to go through an education process to move up the learning curve structure around unknowns and mitigate a new typology of risks. A good degree of transparency and open dialogue with developers can assist banks in that process, but in any event careful and extensive due diligence by an independent technical adviser will be required.

In the early stage of development of the sector, we expect banks to be technology agnostic but they will focus their efforts on the novelties and unknown areas of the design selected for a given project.

For designs that have been demonstrated on-site (even at a smaller scale), sharing experience and lessons learnt help increase lenders' confidence in the technology. For those designs that have not been fully demonstrated, banks may give credit to experience gained and lessons learnt from applications in other sectors (such as oil & gas) if it is demonstrated that floating wind specificities have been appropriately addressed in the design. Compliance with certain recognised floating offshore wind guidelines, design standards and recommended practices from reputable certification bodies can also bring additional comfort.

Construction risk: not too dissimilar to fixed offshore wind

Whilst in the very early years the first offshore wind project finance lenders would not take any construction risk, the project finance market is now comfortable taking such risk, provided that they are properly mitigated via appropriate contractual protections and contingencies, and the developer's ability to mobilise highly skilled staff to ensure strong project management capable of facing unexpected construction events.

It would be surprising if commercial banks were to deviate from this position, although the construction and installation of a floating offshore wind farm may add some unusual complexity – whether in terms of logistics or installation methods – which would need to be addressed either via risk allocation to contractors or appropriate level of budget contingencies.

Similarly, commercial banks are used to the multi-contracting approach for offshore wind, and floating offshore wind projects are expected to carry on with the same approach, albeit with potential adjustment in either the number or scope of the packages.

From a bankability perspective, interfaces between contracts will need to be comprehensively explained and mitigated via a clear allocation of tasks and responsibilities as well as detailed handover procedures from each package to another, and appropriate level of contingencies.

Operational risk: the main unknown

Availability and maintenance activities will be the main aspects that commercial project finance lenders will likely consider in their bankability assessment:

- While energy production for floating offshore wind is expected to be similar or greater than fixed-bottom projects, the unique nature of the floating structure and the inherent movement of the turbines could potentially lead to issues around availability and production being lower than forecast.

  The lack of perspective about the operation of floating wind turbines could also be mitigated by appropriate contractual terms, warranties offered by manufacturers, and structural mitigants in the financing to provide adequate protection to lenders under the base case.

- O&M strategies for floating wind projects are expected to follow, to a large extent, those of fixed project. There will be new considerations in relation to certain unscheduled maintenance activities – particularly major repairs of turbines if they require towing the structures back to shore. The main challenge will be for lenders to identify the risks of these unscheduled maintenance events happening and eventually be able to quantify their impact on the cash flows, taking into account available contractual protections.

  The knowledge derived from O&M costs for fixed offshore wind may only be partially applicable to floating offshore wind, in which case banks will carefully consider the level of Opex contingencies.

Is there commercial bank liquidity for these projects?

It is anticipated that early floating offshore wind projects will continue to, at least partially, rely on funding available from public institutions (e.g. EU/EIB funds in form of grants or debt-like instruments, ECAs, etc.). These institutions are able to play a similar role as they did in the early stages of fixed-bottom offshore wind insofar as they can support the risk profile of a deal and assist the overall liquidity at the same time, and could act as a good catalyst in the first floating offshore wind project financing involving commercial lenders.

In theory, commercial banks' perception of the increased risk and quantity of "unknowns" may translate into more conservativism in the terms provided to projects relative to what would typically be seen for a conventional fixed-bottom offshore wind project – whether that is lower debt-to-equity ratio, higher debt cover ratios, margin premium, or inclusion of other structural mitigants and tighter covenants.

Key highlights and summary

- MUFG has been an active participant in the offshore wind sector since the very beginning: we have observed the development of a global market and emergence of a reliable renewable technology. With fixed-bottom having achieved market maturity, we consider the potential for floating wind will be the next headline topic in the ongoing search for innovation and yields.

- Whilst many of the fixed offshore enablers are expected to carry through to floating (technology, supply chain investments), we are indeed seeing new players enter the offshore wind space – oil & gas companies and large utility players, for example. Whilst fixed-bottom offshore wind is getting closer to parity and in some instances moving away from requiring subsidy, we do consider that government support mechanisms will be necessary to provide a competitive environment for floating developers to innovate and drive down costs. Ultimately, it will be a key determinant in how the floating market develops – either in a manner similar to fixed-bottom, or via dominant players with large balance sheets and a desire to develop floating on a strategic basis.

- We are excited by the prospects and opportunities offered by floating wind technology and look forward to seeing more projects seeking liquidity from commercial banks. Whilst many commercial banks will be familiar with wind turbine technology and floating foundations from the oil & gas space on a standalone basis, the marriage of the two technologies presents unique risks which lenders will need to get comfortable with. In the initial stages, a large part of this will be achieved by education and bringing lenders "into the process" to understand the technology and risk mitigants, though we expect that, as a track record and precedent is established, the latter will start to become more of a focus for lenders.

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