Capturing the value of floating offshore wind

Words: Ming Hui Zhang, APAC Offshore Wind Segment Lead

Floating wind can deliver affordable clean power given the right policy support, according to new research from DNV. Offshore wind has moved rapidly along the cost learning curve to become a more competitive investment option than fossil-fuel energy technologies in some locations. Front runner Europe has the largest and lowest cost installed offshore wind capacity. Now, other regions are starting to embrace this type of offshore renewable energy (ORE), with some planning or additional licensing rounds for offshore wind farm developments.

Taiwan is shaping up to soon be the largest offshore wind market in Asia other than mainland China. Taiwan has pledged to ramp up installed offshore wind capacity by 15 GW between 2026 and 2035, to achieve a total of 20.7 GW by 2035.

There is also interest in less developed Asian nations such as the Philippines, which has ambitions to develop a successful offshore wind industry starting from zero installed capacity today. Among measures taken to spark investor interest, its government exempts investments in renewable energy from the usual 40% limit on foreign ownership in the Philippines. The recently issued Executive Order No. 21, s. 2023, signed on 19th April, aims to establish a policy and administrative framework for offshore wind development[1], validating the importance of government policy support.

Bottom Fixed Wind (BFW), the dominant offshore wind technology, is on average in waters about 25 km from shore in Europe and 7 km in Asia, areas where competition for using marine space is set to accelerate. DNV's recent Ocean's Future to 2050 report predicted a more than nine-fold increase in industrial demand for ocean space between 2018 and 2050, with the great majority of area occupied in mid-century being for offshore wind power.

This is where floating offshore wind (FOW) fits in. It can be installed with moorings in deeper waters further offshore, where average wind speeds tend to be higher, and marine spatial competition less. FOW is young and will require significant investment, but early signs are promising as the wind industry moves from ambition to action. DNV's Industry Insights research reveals that 60% of organizations with revenue-producing business in wind expect to increase investment in floating offshore wind in 2023.[2]

This trend is reflected in the increasing requests we receive to assist wind operators, fabrication yards, equipment suppliers and policymakers in understanding

how to speed the scale-up of FOW. DNV draws on its wide-ranging and long experience working with traditional and new energy industries and marine operations, and on insights generated by its own R&D and joint development projects with many industry players. It has been active in floating wind for 15 years.

The size of the prize

Based on current known and planned policies, regulation, and trends, our most recent annual Energy Transition Outlook (2022) forecasts that FOW will account for 15% of all offshore wind installed capacity in 2050. That would mean installing some 300 GW of FOW globally by mid-century, more than 3,000 times the capacity of today's largest floating wind farm, the 88 MW Hywind Tampen FOW project off Norway, which began delivering power in November 2022.

Looked at another way, the total forecast capacity of FOW in 2050 would require around 20,000 turbines, each mounted on floating units weighing more than 5,000 tonnes and secured with mooring lines that would, if tied end-to-end, wrap twice around the planet.

So, there is a large economic prize to be won for fabrication yards, shipyards, equipment makers, installers, other suppliers, and for nations chasing FOW's economic and energy transition benefits. Where, when, and how FOW scales commercially will depend on de-risking the economics, technology, logistics and operations.

To better understand how the industry views the challenges, DNV surveyed nearly 250 FOW experts globally, reporting the findings in Floating Wind: Turning Ambition into Action. It asked about investment criteria and mitigating risk; choosing technology concepts; supply chain challenges; sources of cost reduction; and timetables for subsidy-free full commercialization.

The top locational criteria for investing in FOW include actual market size, cited by 21% of respondents, regulatory and political stability (16%), and power grid suitability (12%), according to our report.

The top three criteria for choosing a technology concept were manufacturing costs (cited by 20%, environmental conditions (17%), and operations and maintenance costs (14%). Size/power rating (12%) and the experience of the designer (11%) were not insignificant.

The emphasis on manufacturing cost reflects the fact that the foundation and mooring system for a FOW installation is estimated to account for about 40% of the capital expenditure. While reducing material is important, one perhaps even more important cost factor is how this material is shaped into a floating wind foundation.

Supply chain risks

Lack of port infrastructure, installation vessel availability, and capacity are the top three supply-chain risks cited by FOW professionals in our report. This is also particularly acute in new markets outside of Europe where the supply chain is new and growing and is catered to the regional market.

Ports are key to cost-effective offshore wind and to enable related quayside and other onshore developments, creating the local economic benefits nations want and often require. In its December 2021 Report on a European strategy for offshore renewable energy (2021/2012 (INI)), a European Parliament committee underlined 'the importance of modern, sustainable and innovative seaports for the assembly, manufacturing and servicing of ORE equipment, and the considerable investment needed to upgrade port infrastructure, including transport terminals, and vessels to provide these services'.

The report pointed out that ports are also onshore landing points for renewable offshore generated energy and the associated logistics, and as renewable energy hubs for electric offshore grid connection and cross-border interconnectors.

In just two examples from elsewhere, Taiwan and New York State in the US are among many locations that have identified the need to upgrade their ports to service future offshore wind developments, with the upgrading of the existing berth at the Taichung Port as an example where space has been set aside to cater to the planned projects in the coming few years.

It is, however, a question of whether the current planned space and specifications can be utilized for FOW, or if alternative locations would need to be identified. To allow the local industries to understand and develop competence to FOW, several pilot FOW projects have been developed to allow local players to gain experience before moving into utility-sized projects.

Installation vessel availability is a real and pressing concern for offshore wind developers. A study published last year warned that a worldwide shortage of three vessel types 'poses risk for [OW] project execution worldwide' between now and 2030.

The study identified a shortage of Foundation Installation Vessels (FIVs) and Wind Turbine Installation Vessels (WTIVs) by 2024 and 2025, with the greatest demand anticipated between 2028 and 2030. The researchers flagged up an even greater supply-demand gap for Cable Laying Vessels (CLVs) for the rest of the decade. They added: 'Forecasted shortages in supply versus demand may be bigger than presented due to large unforeseen events not taken into account in the analysis.'

In our view, supply will also be affected by the availability of vessels with the capacity to cope with the greater size and weight involved as single turbines for BFW become larger, up to 20 MW or even larger. Our own insights indicate that new technical, supply-chain, and logistical issues will arise as FOW also evolves toward larger wind farms (800+ MW) with bigger turbines (15+ MW). Investment risks will increase as wind technologies move into deeper waters, further offshore, in new metocean and market conditions.

Scaling floating wind

For FOW to scale up, its LCoE must fall as much and as quickly as possible. We forecast that levelized costs for FOW wind will fall almost 80% by 2050. This LCOE reduction comes mainly from the standardization, use of larger turbines, industrialization and larger wind farm sizes as outlined in DNV's report.

Approaching two thirds (60%) of respondents for our report believe FOW will reach full commercialization without subsidies by 2035. It is worthwhile asking if this timetable could be shortened in a world urgently needing to step up renewable energy production.

FOW needs more efficient and cost-effective solutions to known challenges if it is to match or surpass the rate of progress BFW has shown in reducing LCOE. FOW faces the familiar hurdle that many new technologies need to leap over: floating wind must be installed at scale if its cost is to reduce, but cost reduction is needed to get floating wind installed.

Some solutions to the challenges are technical, such as advanced turbine-controller design. Efforts are underway to optimize design, production, deployment, installation, operation and maintenance of FOW technologies. The modelling and testing will focus on key parameters such as turbine size, moorings, and platforms and towers.

Policy support

Governments can play key roles in making the FOW market attractive for investment. Their toolkit includes long-term, stable policy and regulatory frameworks, and collaboration through public-private partnerships to ensure adequate infrastructure such as power grids and ports.

Warnings over installation vessel shortages could herald higher charter rates. Vessel owners could simply order newbuilds, but various regulatory, financial, and market uncertainties complicate decision-making. Hence, governments and industries need to collaborate to ensure that adequate and sufficient installation vessels are available for cost-effective FOW developments.

There is also a role for governments in de-risking financing for innovation and demonstrator projects essential to ensure cheaper FOW, and in capacity building through supporting supplier development and workforce training.

To conclude positively, BFW has already been over a similar obstacle course and the lessons can, with the vital addition of firm intent and concrete action, catapult FOW towards full commercialization to support net zero ambitions.

www.dnv.com

References

[1] DNV. (2023) Floating Wind: Turning Ambition into Action. February 2023. www.dnv.com

[2] H-BLIX. (2022) Offshore wind vessel availability until 2030. Final Report, June 2022

Ming Hui Zhang

APAC Offshore Wind Segment Lead

Minghui has 10 years of experience in the wind and solar industry, where he has worked on numerous renewable energy projects in the Asia Pacific region.

Minghui is DNV's APAC Offshore Wind Segment Lead and is responsible for the renewables advisory business in Taiwan where he is currently dealing mainly with early project feasibility studies, energy assessments, meteorological monitoring campaigns, technical due diligence & project management services in the renewable advisory division.

He has been involved in the due diligence of renewable assets globally exceeding 5GW, focusing on the contractual and financial aspect of the projects, including recent due diligence of several offshore wind farms for international investors seeking equity investment into APAC projects.

Contact: ming.hui.zhang@dnv.com