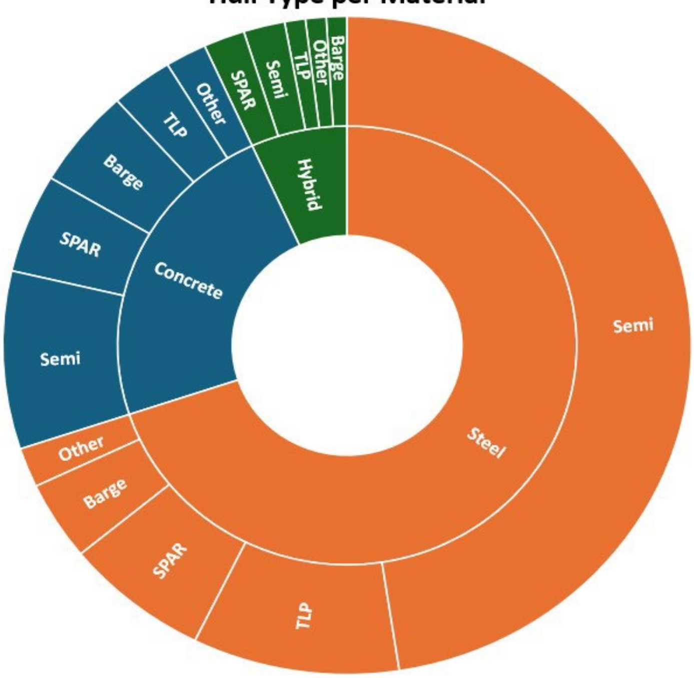
The case for consolidation in the FOW Foundation market

Newsletter #2-2024

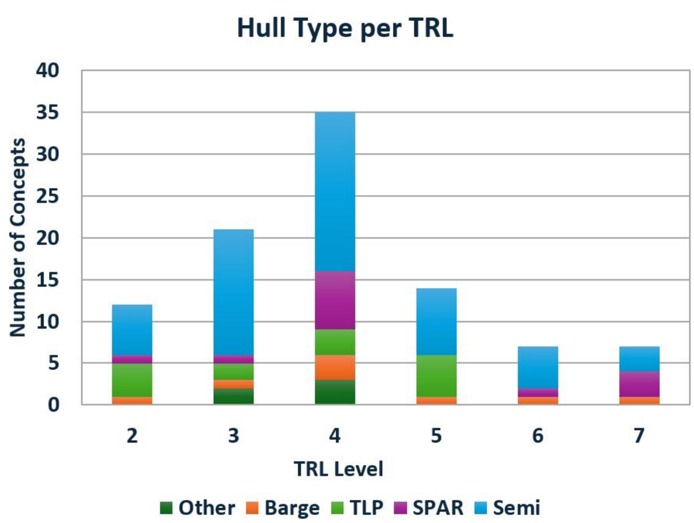
The Floating Offshore Wind (FOW) technology market is getting very crowded. We have seen a tsunami of new floating foundation designs over the last few years, and we are currently tracking 96 different FOW concepts being proposed to project developers. Of these, around 60% are being actively developed and marketed, whereas 40% have been inactive for the past few years.



Some of these 96 concepts are offered in either steel or concrete, which increases the total number of potential hull solutions in our database to 103. This can be broken down into 72 based on steel hulls, with steel semi-submersibles being the dominant technology (47 concepts), and 24 concrete hulled concepts, again with semi-submersibles being most prevalent (9 concepts). A further 7 concepts are fabricated from a combination of both steel and concrete.

The hull concepts also span a wide range of technical maturity. Using the Technology Readiness Level (TRL) process with a scale of 1 to 9 (derived from NASA and ISO 16290) we have estimated the maturity of each technology, which is shown in the distribution below. There is not yet a unified definition of TRL for FOW, so in our last Newsletter (Ref 1) we defined our TRL scale, where TRL 8 and 9 refer to Commercial Farms of at least 200 MW capacity. No such farms have yet been built, so no concepts have reached these TRL levels, in our view.

Our analysis shows that the largest number of concepts are at TRL 4, which we define as technology validated at Laboratory scale. Only 14 concepts have reached or exceeded TRL 6, which requires at least one prototype or demonstrator to be installed and operational offshore – these represent 8 semi-submersible concepts, 4 spars and 2 barges. One other concept (a TLP) is installed offshore, and start-up is imminent, so the number will soon rise to 15. This implies that the 81 other concepts have not yet reached the stage of a demonstrator/prototype installed at sea.



Our analysis also shows that the average time to progress from a successful model test to a pilot or demonstrator unit operating at sea is around 6 years (with a range from 3 to 10 years). Moreover, a reasonably sized demonstrator of, say, 8 MW may have an installed cost of over US$30 million for a first-of-a-kind prototype design. Given that 14/15 different concepts have already been installed and have operated offshore, it will be increasingly difficult to find finance to progress more concepts through the prototype and demonstrator phases. This could leave many of the less mature technologies "stranded" and unable to progress through the next (expensive) stage gates beyond model basin testing.

Technology providers are using a range of different techniques to overcome these hurdles. Several aim to become project developers and obtain opportunities on which they can deploy their technology. Others are rationalising their portfolio of foundation technologies to focus only on the concepts with the highest potential or are pooling resources and ideas with others in joint ventures. We believe that such consolidation in the market is necessary but is progressing far too slowly. For many of the smaller players, it may soon become a matter of "consolidate or die."

The industry does not need so many technology concepts, as is obvious from the above reference to 47 different versions of a steel semi-submersible foundation. To rationalise and consolidate, it is important to identify the strongest overall concepts in each category and, where possible, seek opportunities to combine two or more complementary technologies. For this, we must rank each of the 103 foundation designs.

In OpenWater Renewables Ltd (OWRL) we have, therefore, created a proprietary tool to rank FOW foundation concepts "FOW_RANK" which compares the strengths and weaknesses of various concepts.

We rank each concept in 40 different criteria, which are then grouped into 7 key areas.

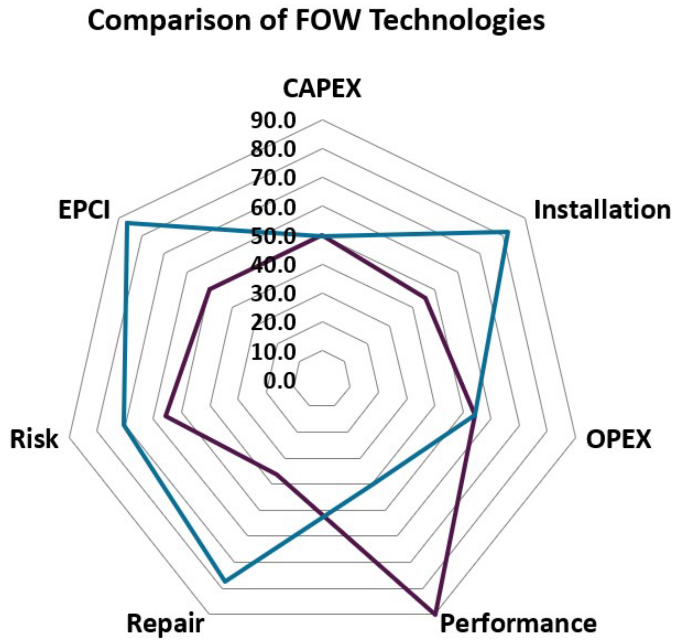
- CAPEX (including weight, materials, fabrication, transportation, assembly, mooring, etc.)
- OPEX (including ballast, mechanical components, surface coatings, accessibility, etc.)
- Ease of Installation (including towing, temporary equipment, heavy lift requirements, etc.)
- Ease of Major Repair (including disconnection, reconnection, and towing)
- Performance (including motions, trim and yaw control, etc.)
- Risk (including TRL, CRL, financial strength, etc.)
- EPCI (including experience and strength, yard partnerships, schedule requirements, etc.)

The FOW_RANK tool has weighting factors for each of the 40 criteria, which can be adjusted from our default levels to reflect the specific challenges of any project.

This allows easy comparison of concepts for project-specific applications, to identify the highest-ranked choices.

However, we can also use FOW_RANK to look for opportunities for consolidation in the market, as shown in the example on the following page. (All criteria are normalised so that a high score is best).

The blue concept scores well in terms of risk, EPCI strength, and ease of installation and repair, but low to average in other areas, whereas the purple concept scores highly for performance, but low to average in most other areas. If elements of these concepts were combined, marrying the high-performance features of one with the strengths of the other, the offering would be more attractive than either of the two individual concepts.



The benefits of such consolidation of two (or more) FOW technologies can potentially include.

a) Eliminating duplication of effort and costs by targeting resources and funding at a reduced number of concepts,
b) Pooling client contacts, prospects, and target projects,
c) Combining the best features of two (or more) concepts to achieve a more performant and competitive solution,
d) Reducing risk by focusing on fewer prototypes, and most importantly,
e) Accelerating the trajectory to a lower LCOE, from all the above.

But to improve the accuracy of FOW ranking, and hence the potential benefits of consolidation, the industry urgently needs a better understanding of two critical areas.

Firstly, we need more data for the true long-term O&M cost of FOW structures, especially steel-hulled units in harsh environments. The possible need for periodic disconnection and inshore overhaul, or even dry docking, would have a major impact on the field LCOE.

Secondly, a better understanding of the relationship between nacelle motions and turbine reliability is critical. The initial experience in this area is worrying, and we believe that a detailed analysis of the recent failures should be quickly made public for the benefit of the industry.

We address these two aspects in FOW_RANK by using appropriate weighting factors and running sensitivity analyses to assess the impact on LCOE. However, the industry needs more clarity on these two critical aspects to ensure that the correct choices are made for future projects.

In conclusion, we believe there is an urgent need for more consolidation in the FOW foundation market to help drive down LCOE. This may also avoid losing some exciting concepts before they can progress to the offshore demonstrator stage.

OWRL is pleased to offer our FOW_RANK tool to project developers to support project conceptual decision-making and to technology providers to help identify the best-fit opportunities for consolidation.

Glossary

CRL	Commercial Readiness Level
FOW	Floating Offshore Wind
LCOE	Levelized Cost of Electricity
OWRL	OpenWater Renewables Ltd
SPM	Single Point Mooring
TLP	Tension Leg Platform
TRL	Technology Readiness Level

References.

1. OWRL Newsletter #1, available at https://www.openwaterrenewables.com/wpcontent/uploads/2024/04/01-2024-Key-Considerations-in-FOW-Concept-Selection.pdf

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