OpenWater Energy Newsletter #1-2023

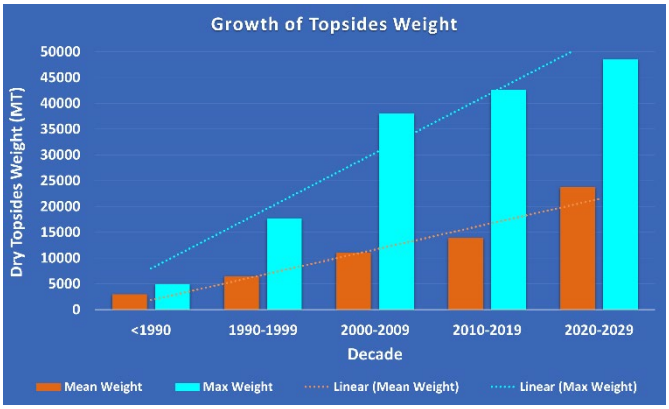
Three Important Trends in the FPSO Industry

1. Introduction

The FPSO industry is constantly evolving to meet market needs as new oil & gas provinces are discovered and new technologies deployed. This newsletter discusses three important long-term trends which are shaping the industry, along with some of their implications.

2. The Growth in Topsides Weight

FPSO topside weights have steadily grown over the last 50 years, as FPSOs have become larger and more complex. From the 1990s to 2020, the mean topside dry weight increased from around 3,000 to 14,000 MT. However, the rapid increase in mega-FPSOs for Brazil and Guyana this decade has driven up the mean size to around 24,000 MT. Maximum topside dry weight has followed the same trend with a rapid increase this decade to peak at 50,000 MT today.



The reasons driving this increase in topsides weight include the following.

a) Larger processing capacities for the mega-FPSOs in West Africa, Brazil and Guyana to capture economies of scale.

b) Complex gas processing requirements for the high CO_2 pre-salt fields in Brazil.

c) ESG pressure to reduce emissions, leading to heavier equipment such as combined cycle gas turbines for power generation.

This weight increase has several implications.

Firstly, larger and heavier modules impose higher loads on the FPSO deck, making converted hulls more difficult to use. Beyond 25,000 to 30,000 MT of topside on a VLCC, it may be more economical to switch to a new build hull than to reinforce a converted hull. The heavier topside modules may also constrain the choice of module fabrication yards for load-out capacity, and module integration yards for the availability of suitable quaysides and heavy lift cranes.

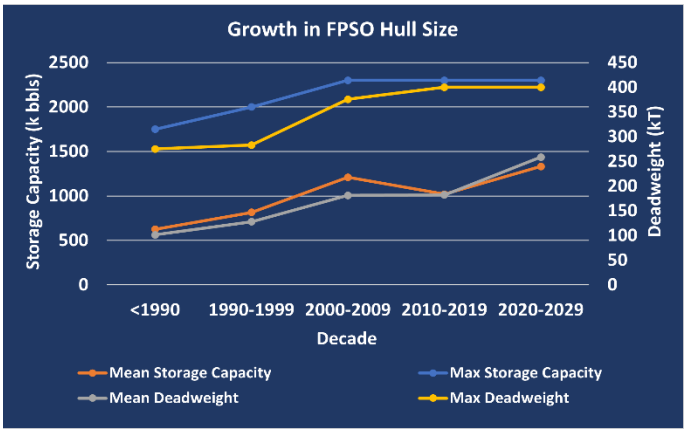
Secondly, larger topsides can require bigger FPSO hulls with more deck space to accommodate the modules and extra deadweight capacity. These factors can control the required hull size, rather than the oil storage volume needed.

Thirdly, higher POB levels are required to safely operate and maintain larger and more complex topsides. Although the latest digital and robotics technology can reduce the permanent crew, the offshore commissioning team and vendors for planned shutdown overhauls still require offshore bed space. We have seen the typical POB capacity increase from 80 some years ago to around 160 today.

And finally, typical project schedules have increased due to the longer period needed to integrate large topsides modules, and then pre-commission and commission them. Typical durations from module lifting to FPSO sail away have increased from 3 to 4 months in the past to around 9 months today.

3. The Growth in FPSO Hull Size

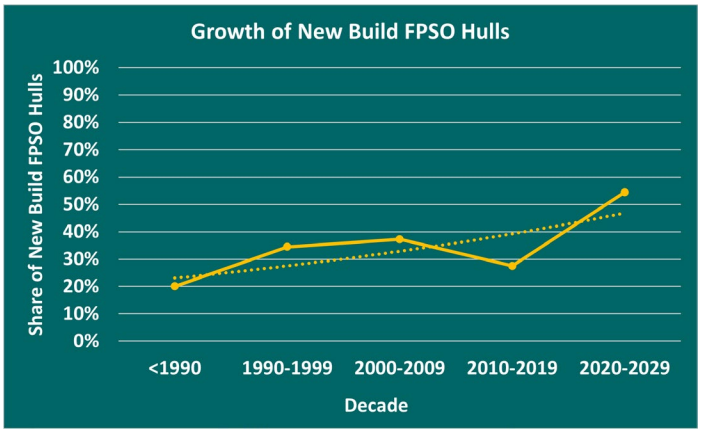
Just as the topside weight has increased, so has the mean hull size. This decade, the mean capacity of an FPSO hull is around 1.35 million bbl of crude oil storage and 258,000 dwt. However, the largest hulls are now ULCC-sized with up to 2.3 million bbl of oil storage and around 400,000 dwt [Ref 1, 2].



The reasons for this increase are similar to those given above for topsides weight. Larger processing capacities require more storage volume to maintain a reasonable offloading frequency. But the larger and heavier topsides need more deck space and deadweight capacity.

The increase in hull size is also driving a shift away from the traditional 30% to 40% of new buildings used in the global FPSO fleet. In the current decade, this has increased sharply to around 50%, driven by the need for large production capacity units with a long design life in West Africa, Brazil and Guyana.

Moreover, in recent years there has been a worrying increase in older converted FPSOs that have required lengthy shutdowns to repair hull integrity issues following small oil spills, including MODEC's MV14, SBM Offfshore's Cidade de Anchieta and Jadestone's Montara Venture [Ref 3, 4, 5]. This may also be a factor in the shift towards more new build hulls, especially for projects which require a long design life.



One of the main implications of this move to larger new-build hulls is the risk that project schedules will increase, as they have a longer delivery time than the topsides modules. To mitigate this, the hull can be standardised and ordered in advance of FID, to take it off the critical path. SBM Offshore has done this very successfully with their Fast4Ward programme [Ref 6], and other FPSO contractors are now following this lead [Ref 2, 7].

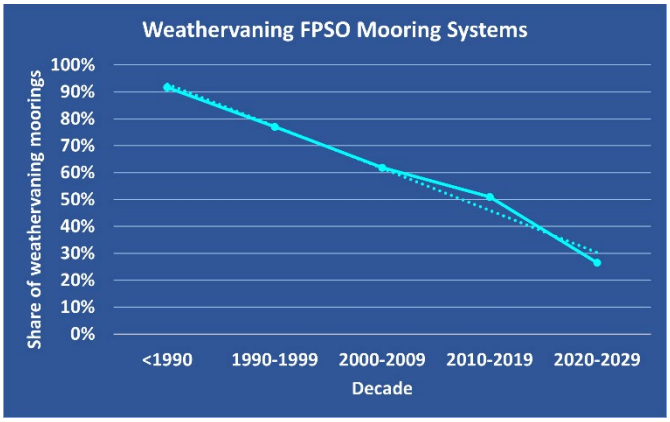
The FPSO industry was slow to adopt standardisation, but these large new-build hulls are an ideal opportunity to apply this principle.

4. The Decline of Weathervaning Mooring Systems

There is a wide range of mooring options available for FPSOs (and FLNGs) in two basic categories.

a) Weathervaning mooring systems, where the vessel rotates to align with the prevailing weather conditions. This category includes internal and external turrets, jacket soft yoke moorings, submerged yoke moorings, and several others. Many of these can be either permanently connected or disconnectable in case of extreme weather events.
b) Spread mooring systems where the vessel maintains a fixed heading.

Our analysis below shows that there has been an almost linear decline in the share of weathervaning mooring systems over 5 decades. Before 1990, more than 90% of FPSOs used some form of weathervaning mooring system, but this has dropped to only 25% in the current decade, with 75% of recent and new projects using fixed heading spread mooring.



There are several reasons for this trend, including;

a) The drive for a larger number of subsea risers and umbilicals, which are easier to accommodate on a spread moored vessel than a turret moored one.
b) Advances in spread mooring technology for deep water, using synthetic mooring rope in moderately harsh environments.
c) Enhanced tandem offloading designs for the directional Brazilian environment, using dual offloading stations and DP shuttle tankers.
d) Coupling spread moored FPSOs in West Africa with deepwater CALM buoys, to obtain an acceptable level of safety and availability for offloading operations.
e) Use of smaller spread moored circular FPSOs in some harsh environments such as the North Sea.

Weathervaning is still required for larger vessels in harsh locations or cyclonic/hurricane/typhoon conditions. Projects currently under construction or tendering with challenging turret mooring requirements include Bay du Nord in Newfoundland, Barossa in Australia and Johan Castberg in Norway, but these complex turret projects are becoming rarer than in the past [Ref 8, 9, 10].

The decline of weathervaning systems means that there are now fewer mooring system contractors working in the industry. In the past 20 years, mooring systems have been provided by 10 different contractors, but only half of these are still active today. With fewer projects, many are also diversifying into other areas, such as offshore renewable energy. This raises concerns about how to keep the expertise in complex mooring systems available for future challenging FPSO (and FLNG) projects.

5. Conclusions

As the FPSO industry evolves to meet market needs, three key trends have emerged – the growth in larger topsides and hulls and the decline of weathervaning mooring systems.

Larger topsides and new build hulls increase project CAPEX, schedule and risk profile so making projects more difficult to contract, manage and finance. To mitigate this, the Industry needs to increase its efforts to use more standardised designs and fewer bespoke solutions.

The decline in the number of weathervaning FPSO projects leads to fewer experienced contractors being capable of delivering these, with possible implications for future delivery capacity and cost escalation.

The next newsletter in this series will discuss some further trends in the FPSO and FLNG industries related to project execution.

All comments on this newsletter are welcome via info@openwaterenergy.com

6. Glossary

CALM	Catenary Anchor Leg Mooring System
ESG	Environmental, Social and Governance
POB	Persons on Board
ULCC	Ultra Large Crude Carrier
VLCC	Very Large Crude Carrier

7. References

No.	Title	Author, Publication, Organisation	Link
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