

No longer just a ship



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FPSO

Robert Dorey, Offshore Director writes: Readers of the *Standard Bulletin, Offshore Special Edition* will be aware that the club has a significant offshore entry and that FPSOs constitute around 60% of the Standard Club's offshore tonnage. We are often asked questions about FPSOs by our conventional cargo carrying shipowner membership, and I am pleased that our Charles Taylor Energy colleagues were able to contribute below their perspective on the development and challenges from a broader perspective.

Introduction

Exploration and production (E&P) projects in the oil and gas energy sector have for many years utilised the newest offshore technologies in their developments. The pioneers of early offshore development projects had a vision whereby oil and gas could be extracted from deeper and more hostile seas around the world. It became evident that as known field resources were depleted, development into more complex marginal fields would be necessary, coupled with the need to maintain field economics.

During the period through the 1960s and 1970s operators invested significant funds in the construction of fixed offshore production platforms. These included pile-driven steel and concrete gravity structures secured to the seabed and used as hubs for drilling wells and extracting hydrocarbons, then processing and exporting them as commercial oil and gas resources. These fixed structures were placed in water depths of up to 1,400 feet and were originally designed for service life cycles up to 25 years. As technology improved, many platforms were granted life extensions, with operators using these technological advancements to drill directionally and produce from numerous satellite reservoirs remote from the fixed structures. However, this solution had limitations and a defined life span.

Floating Production Systems (FPS)

The offshore industry started to turn its attention to alternative production facilities that would enable it to extract and process oil and gas with greater flexibility, whilst maintaining field economics in an increasingly competitive market. This led to the birth of the first floating production systems (FPS), which provided the flexibility to produce oil and gas from wells in deeper water depths without incurring the costs of expensive fixed structures. The world's first floating production unit (FPU), a converted semi-submersible drilling rig, was installed in the Argyll Field in the North Sea during 1975. Hailed a success by operators and contractors, significant investment was injected by the industry into the technology that would be needed to expand the productivity of such a marine-based system. Further FPS developments followed in which conventional marine vessels, including bulk crude supertankers and semi-submersible vessels such as drill rigs, were retrofitted with topside process equipment, subsea production, and marine and export pipelines, with the prospect of converting these into economically viable FPS units. With an increasing focus on developing technology, one of the main breakthroughs was the implementation of flexible risers, and the first FPS to use these was the Balmoral Field in 1986.

Floating Production Storage and Offloading Unit (FPSO)

As FPS technologies evolved, the units became more complex and the birth of the floating production storage and offloading unit (FPSO) arrived. This new generation vessel allowed operators to not only produce from the subsea completions but to store and load oil on to shuttle tankers. They allowed more economic distribution of products by sea whilst combining that with the ability to export produced gas via pipelines.

The first of these new generation FPSO systems was the *Gryphon A* FPSO. A built-for-purpose vessel with a drag chain turret and state-of-the-art flexible riser systems, this unit was installed in the North Sea during 1993 with 14 wells. Over the years, this has been extended to accommodate five fields with 35 subsea wells.

Turret system technology continued to evolve and the next major innovation was the retrofitted dynamic marine swivel design, which allowed conventional mono-hull tankers to be converted into FPSOs, thus reducing the build time. In the late 1990s, contractors purchased numerous bulk tankers that were no longer required for crude oil transportation and began converting them in the huge shipyards in South East Asia to meet the market demands for FPSOs.

During the latter part of the 1990s, technology had moved along and the first concrete FPU's were commissioned. These were a barge-like design with flat bottoms that were able to operate as FPSOs in shallow waters in areas such as West Africa where vessel hydrodynamics are not an issue. Their simplified beam porch riser technology can be utilised which allows high-capacity systems with multiple production and distribution lines to be operated. An example is the *FPSO Akpo*, which operates in shallow water.

Floating Liquid Natural Gas Units (FLNG)

In recent years, the offshore oil and gas industry has moved in to the construction of floating liquid natural gas units (FLNG), utilising state-of-the-art bespoke production technology on a scale that just 20 years ago could only be conceptualised.

Conclusion

So where does this take the oil and gas industry going forward? Today, technologies continue to develop to address diverse solutions for complex and marginal fields, including produced fluids such as LPG and LNG, and remote geographic locations from the Arctic Circle to the tropical waters. New technologies allow operations in deeper water depths and more hostile environments, such as the Gulf of Mexico, and allow operators to develop economic solutions for high-pressure and high-temperature oil and gas reservoirs.

At the time of writing this article, there are some 286 floating production units currently operating worldwide, 65% of which are FPSO or FLNG vessels. Of these, 64% are conversions and 36% are newbuilds, with 58% contractor and 42% operator owned and operated. The largest unit is some 116,000 tons with a storage capacity of 2 million barrels of crude oil, and a production capacity of 160,000 barrels of oil and 5 million cubic metres of gas a day.

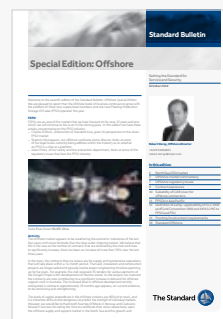
Over the next decade, it is estimated that some \$40bn will be invested in the current technologies and the next generation of FPS units. As the demand for energy continues to grow and operators look to operate in more remote and harsher environments, one can only see the continuation of the development of the floating production unit market.

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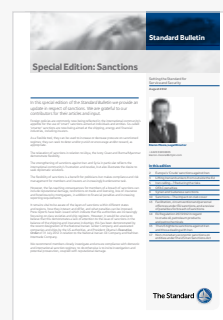
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