

PROJECTED REQUIREMENTS FOR FPSOs OVER THE NEXT FIVE YEARS

Article by Jim McCaul in the
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Floating Production, Storage and Offloading vessels (FPSOs) are the most common type of floating production system. They account for 65% of oil/gas production floaters now in operation or available. We look below at what drives this sector and how many additional units will be required between 2014 and 2018.

Why FPSOs?

FPSOs offer many advantages over other production floaters. They have field storage capability and can be used in locations economically inaccessible to pipeline infrastructure. Water depth is not a constraint – FPSOs operate on shallow to ultra-deepwater fields. They also operate in environments ranging from benign to harsh. FPSOs are less weight sensitive than other floating production systems and the extensive deck area of a large tanker provides flexibility in process plant layout.

Pros and Cons of FPSOs	
<u>PRO</u>	<u>CON</u>
<ul style="list-style-type: none"> • Have field storage and can be used in remote locations – self contained • Not water depth limited -- can operate on shallow and ultra-deepwater fields • Less weight sensitive than other types of FPSs • Deck area allows flexibility in process plant layout • Quick disconnect turrets enable emergency relocation • Leasing commonly used to transfer risk from field operator to contractor • Surplus/aging tankers can be used as conversion hull • Can be modified/redeployed following field depletion 	<ul style="list-style-type: none"> • Subsea tiebacks create higher well maintenance costs • Turret/swivel machinery is complex and failure a major problem • Deck motions can complicate process plant operation and cause downtime • Motion also causes FPSOs to be less riser friendly than other FPSs • Cost and delivery surprises are common when converting tankers to FPSOs • Optimistic residual value assumptions can result in big write-offs • Redeploying an FPSO is not as easy as it may appear

Surplus and aging tanker hulls can be used for conversion to an FPSO. FPSOs can be modified and redeployed following field depletion. Units fitted with quick disconnect turrets can

be moved during typhoon/hurricane activity. Leasing of FPSOs has evolved into an industry-accepted procurement practice to transfer financing burden, construction risk, residual value risk and operational responsibility to a contractor.

But FPSOs also have disadvantages. Subsea tiebacks associated with FPSOs generally bring higher well maintenance costs. Complex turret/swivel machinery used on weathervaning FPSOs is expensive and failure of the turret/swivel can be a major problem. Use of older tanker hulls for conversion can cause unexpected cost overruns and delays. Redeploying an FPSO is not as easy as it may appear. Each field is different, often requiring major modifications to processing plant and mooring system.

Growth in FPSO Inventory

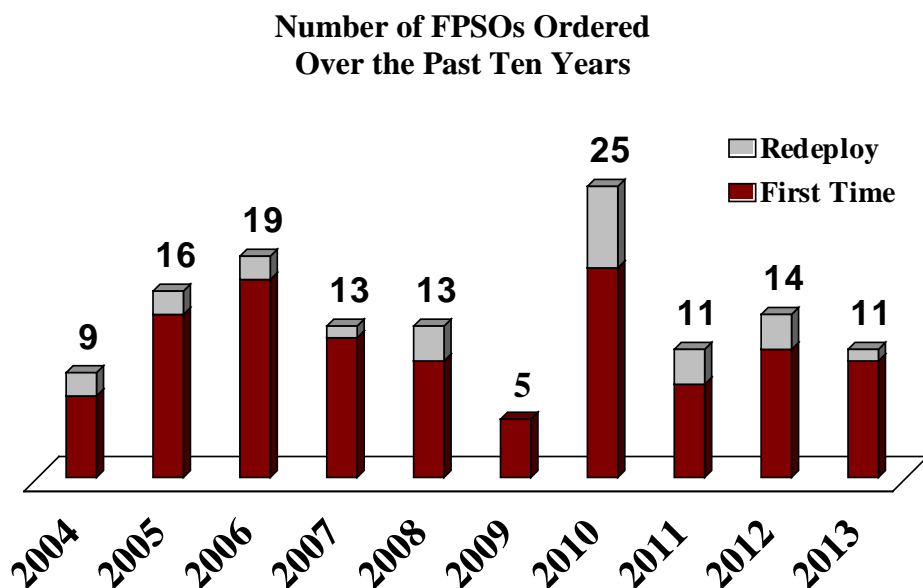
The number of FPSOs in operation or available for deployment has increased 96 percent over the past ten years. This figure reflects delivery of new FPSOs and scrapping of aging units during this period. The net result has been an increase of 85 FPSOs between end-2003 and end-2013. With deliveries planned in 2014, the number of FPSOs will grow another 14 units by the end of this year – assuming no existing units are scrapped.

Trend in Number of FPSOs in Service or Available

<u>As of End Year</u>	<u>Number of FPSOs</u>	<u>Growth Index</u> (2003 = 100)
2003	89	100
2004	97	109
2005	105	118
2006	111	125
2007	122	137
2008	144	162
2009	155	174
2010	155	174
2011	158	178
2012	165	185
2013	174	196
2014 (projected)	188	211

Trend in FPSO Orders

Contracts for 136 FPSOs have been placed over the past ten yearsⁱ – an average of just under 14 FPSOs annually. But the average disguises some significant variation. As many as 25 and as few as 5 FPSO contracts have been placed in a single year over the past decade. The low was in 2009, when the 2008/09 global financial collapse caused a hiatus in orders for all types of floating production systems. The high was in 2010 when Petrobras ordered the hulls for 8 serial FPSOs.



These orders have included a wide mixture of FPSOs – from \$2 to \$3 billion + contracts for large complex FPSOs like *Egina*, *Agbami* and *Usan*, to small \$100 to \$300 million units like *Balai Mutiara*, *Front Puffin* and *East Fortune*. They also include 12 standardized FPSOs ordered by Petrobras from local yards in 2010/2011 for future use offshore Brazil – 8 based on new hulls, 4 using tanker conversions.

Over the ten year period, 112 of the 136 FPSO contracts (82% of contract awards) have entailed construction or conversion of first time FPSOs. These FPSOs have not previously operated as production units. Another 24 contracts (18% of contract awards) have involved modification of existing FPSOs for redeployment to a new field. Typically the redeployment contract involves modification of the process plant and mooring system, plus general upgrade to the entire unit. The modification cost can easily exceed \$200 million.

Planned FPSO Projects

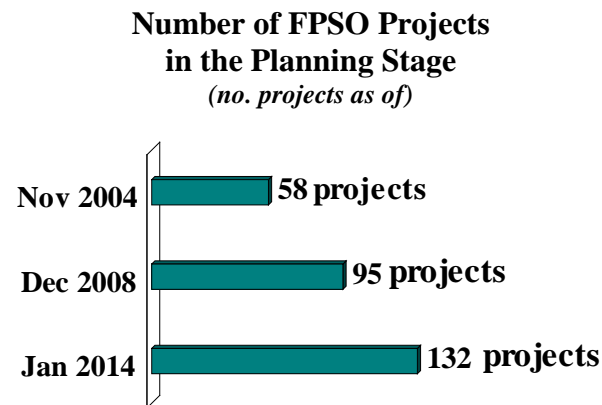
We are currently tracking over 130 deepwater projects in the planning stage that will likely require an FPSO for development. A few examples of FPSO projects in the planning stage are shown in Box1.

Box 1 –Examples of FPSO Projects in the Planning Stage

<u>Discovery</u>	<u>Country</u>	<u>Field Operator</u>	<u>Water Depth (meters)</u>	<u>Estimated Production Start</u>
<u>Africa</u>				
Chissonga	Angola	Maersk	1355	2017/18
Bonga Southwest	Nigeria	Shell	1200	2020/21
Nsiko	Nigeria	Chevron	1768	2020/25
Elephant	Congo	CNOOC	550	2020/25
Bobo	Nigeria	Shell	2480	2020/30
<u>Brazil</u>				
Oliva/Atlanta BS-4	Brazil	Queiroz Galvao	1560	2017/19
Carcara BM-S-8	Brazil	Petrobras	2027	2018
Espadarte Module III	Brazil	Petrobras	750	2020
Libra Complex	Brazil	Petrobras	2200	2020/30
Franco Leste	Brazil	Petrobras	1800	2019
<u>Other Regions</u>				
Ayatsil/Tekel	Mexico	Pemex	120	2016/18
Maximino Cluster	Mexico	Pemex	2500-3000	2018/22
Gohta	Norway	Lundin	342	2020/25
Sea Lion	Falklands	Premier	415	2019/20
Belud	Malaysia	Hess	155	2015/16
Bunga Dahlia/Teratai	Malaysia	Petronas	65-70	2016/18
Ubah	Malaysia	Shell	1430	2018/20
Ande Ande Lumut	Indonesia	Santos	73	2016/18

Each project in the planning stage is unique and the list includes a wide spectrum of storage size, topsides plant capacity and mooring system. VLCC-size FPSOs with 100,000+b/d processing plants will be needed on major projects in Brazil, West Africa and the Mexican side of the GOM. Most will be spread moored, some will be fitted with turret mooring. Smaller FPSOs with 30,000 to 50,000 b/d processing plants will be required for marginal projects in SE Asia, North Sea and elsewhere, most requiring turret mooring systems.

The number of FPSO projects in the planning stage has more than doubled over the past ten years. In late 2004 there were 58 projects in the visible planning pipeline that potentially required an FPSO as the development solution. By December 2008 the number had increased to 95 projects. Now there are 132 projects potentially requiring an FPSO.



These figures reflect the number of projects in the planning stage on each date. Some projects will require multiple FPSOs – e.g., Libra could require up to 12 FPSOs. If the figures represented potential FPSO orders, the growth over the past ten years would be greater.

Future FPSO Requirements

Between 140 and 150 additional FPSOs will be required should all 132 currently visible projects proceed to development. But this requirement needs to be adjusted to take into account field development options, project cancellations, project timing and emergence of not-yet-visible projects

- Around 10% of visible projects have several possible production solutions. We anticipate that around half of these (or 5% of the 132 projects) will not ultimately produce an FPSO requirement.
- Some visible projects will be cancelled or deferred following further appraisal. Based on the number of projects included in our 2004 planning list that failed to proceed to development, we anticipate that 15% of the 132 projects in the current list will ultimately not proceed to development.
- Not all of the visible projects are within the five year forecast window. Based on an analysis of the planned projects, about 65% appear capable of advancing to the final investment decision by end 2018. The FID in the remaining 35% will likely be after 2018.

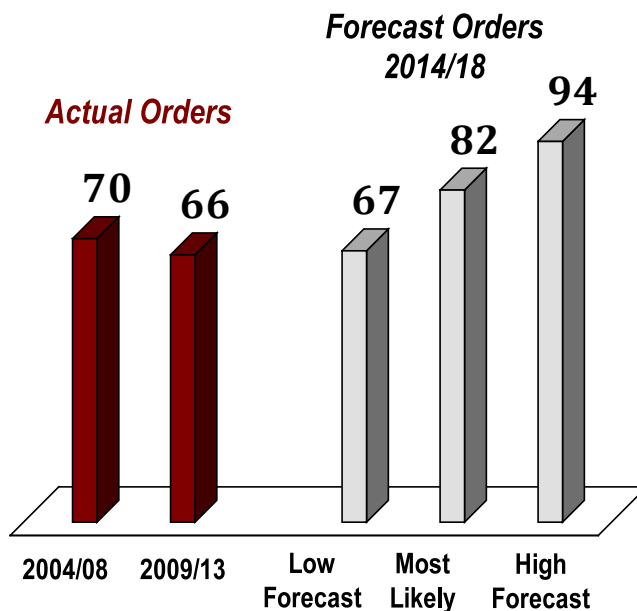
- Additional fast track projects will undoubtedly emerge over the next several years. Most will involve small to mid-size FPSOs to exploit marginal fields. Based on FPSO orders placed over the preceding five years we anticipate that 5 to 15 additional FPSOs will be required over the next five years for “yet to be visible” projects.

Combining these adjustments, we expect a requirement for 67 to 94 FPSOs over the next five years. This is the high and low range of FPSOs that could advance to the FID stage by 2018.

Where the actual number of orders falls within this range will be determined by the underlying market conditions that unfold over the next several years – extent to which oil prices rise or fall, availability of drilling equipment, barriers caused by local content policies, other supply chain constraints, cost escalation, access to project financing, relative attractiveness of investing in deepwater vs. shale/tight oil projects, etc.

In our forecast we have assumed three scenarios, each with varying assumptions about future underlying market conditions. Shown in Box 2 are the market assumptions in the most likely scenario. In this scenario we forecast orders for 82 FPSO orders between 2014 and 2018.

Forecast of Orders for Additional FPSOs over the Next Five Years



Box 2 – Forecast Assumptions in the Most Likely Scenario

- World output grows 3.5% to 4.5% annually over the next five years and financial flight in emerging economies from unwinding of monetary stimulus is constrained to a few countries and is short lived
- Global energy demand grows at an average rate of 1.5% annually over the near to mid-term
- Mideast tensions continue but no major oil supply interruption occurs
- Oil price expectations five to fifteen years out hover in the \$80 to \$100 range (in 2013 dollars)
- Shale/tight oil production grows rapidly in the US and spreads to other countries as the cost of bringing shale/tight wells to production keeps falling
- Recent day rate weakness in the UDW drill sector proves transitory and drilling contractors continue to place orders for drillships and UDW semis, but at a slower pace
- Supply chain capacity to provide production floaters gradually expands over the next few years, but constraints and bottlenecks remain, causing delivery delays and cost overruns
- Cost escalation in the deepwater sector continues, but at a tapering pace
- Local content targets in Brazil are loosened after the 2014 elections to reduce Petrobras cost growth and mollify shareholders
- Resale of the OSX FPSOs results in lenders being fully compensated for loan principal, but lenders see OSX as a warning and tighten debt financing terms in the FPSO sector
- Financial return from shale/tight oil projects attracts investment resources that would otherwise be channeled to deepwater projects, raising the hurdle for deepwater investments
- No major environmental event occurs involving a floating production system

We see the FPSO sector growing at an accelerating pace through 2018. The forecast of 82 orders is 24% higher than the number of orders placed over the past five years. Between 2009/13, 66 FPSOs were ordered. It should be noted that the global financial crisis in 2008/09 distorts the comparison. The crisis caused a one year hiatus in orders, lowering the past five year total. In the preceding five year period (2004/08) 70 FPSOs were ordered.

But our new forecast of FPSO orders is significantly lower than the forecast made by IMA last year. There we forecast orders for 100 to 140 FPSOs annually over the following five years, the best estimate being 120 units. Now we are forecasting 67 to 94 orders, with a best estimate of 82 units.

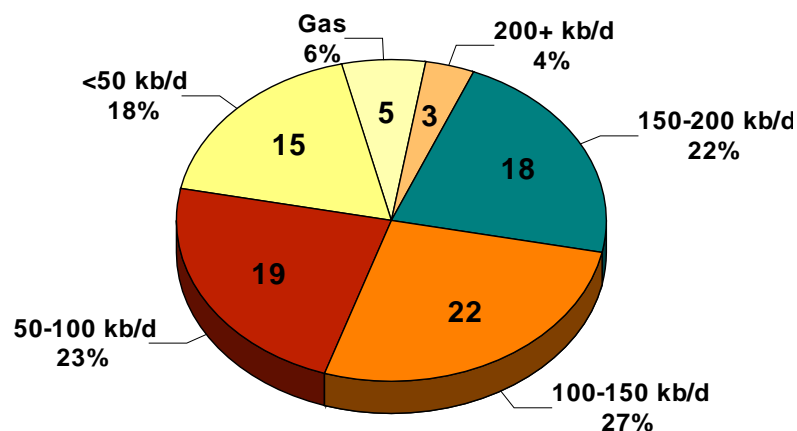
Why the big drop? Over the past year it has become clear that supply chain and other constraints are much stronger than previously thought. Deepwater project start opportunities keep growing – evidenced by the growing backlog of projects in the planning stage. But capability limitations in the supply chain, increasing project complexity, escalating costs, access to financing and bottlenecks created by local content targets have been worsening. These factors have been constraining – and will continue to constrain – deepwater project starts.

Another reason for the drop is the growing diversion of oil company available investment resources to shale/tight oil and gas projects. Alternative opportunities to invest in shale/tight oil and gas development are eroding investment in deepwater development. There have been recent examples of deepwater projects being postponed or cancelled as a result of projected project return being lower than alternative uses of investment funds. We see the diversion of resources becoming greater over the next several years.

Composition of Future FPSO Orders

Based on an analysis of FPSO projects in the visible planning pipeline, we anticipate that 27% of the projected FPSOs will have 100-150 kb/d topsides plants, 22% 150-200 kb/d plants, 4% 200+ kb/d plants and 23% 50-100 kb/d plants. The remaining 24% will be smaller oil processing units or gas FPSOs.

**Composition of Topsides Plant Capacity
In the Most Likely FPSO Forecast**



Using FPSO orders over the past ten years as a distribution benchmark, we expect 26% of projected FPSO orders to involve purpose built units, 56% to be based on conversion hulls and

18% to involve redeployment/modification of existing units. Purpose built units will be weighted toward larger FPSOs with plant capacity exceeding 100,000 b/d. FPSOs built on conversion hulls will be spread over a wider spectrum of plant topsides capacity. Redeployed FPSOs will be primarily in the smaller topsides capacity, with a few in the 100 to 150,000 b/d range.

Composition of Future FPSO Orders by Purpose Built Units, Converted Tankers and Redeployed Units

Topsides Plant (kb/d)	Total FPSOs	Purpose Built	Converted Tankers	Redeployed FPSOs
<50	15	2	5	8
50-100	19	5	11	3
100-150	22	5	14	3
150-200	18	8	10	0
200+	3	2	1	0
Gas	5	0	5	0
Total	82	22	46	14
	100%	26%	56%	18%

This anticipated composition is based on the most likely scenario. Differences in the high and low scenarios will be primarily in the number of smaller and intermediate size FPSOs to be ordered. In the high scenario, a larger percentage of the orders will be smaller units supplied by leasing contractors utilizing converted tankers. The opposite will apply in the low scenario.

Projected FPSO Capex

Capex associated with FPSO orders over the next five years is projected to total \$91 billion in the most likely scenario. Around 38% of the Capex will be for purpose built FPSOs, 56% for FPSOs converted from existing tankers and 6% modification of redeployed FPSOs.

For questions or further information, please contact Jim McCaul at imaassoc@msn.com.

ⁱOnly FPSO contracts requiring construction or conversion of new production units or modification/redeployment of existing units are included in the count. Contract changes for movement from one field to another of FPSOs contracted for extended well test/early production are not counted. Contracts for speculative FPSO orders are counted in the year of the first field assignment – with the exception of a speculative order where the FPSO is still without a field and the contract is counted in the original year of order (2007). Cancelled contracts are not included.