

# Long Term Scheduling of Major Renewals

## Systematic Approach and Financial Applications

### Introduction and objective

Major system renewals and capital replacements are critical to any asset operator. It is no coincidence that outstanding operators often are recognised by their ability to develop and maintain long term plans [1].

This study focuses on long term maintenance scheduling with particular emphasis of Floating, Production, Storage and Offloading (FPSO) vessels. As much of the remaining offshore oil and gas resources are situated in frontier areas, often with limited infrastructure, the tendency to go for FPSO solutions is increasing rapidly. FPSOs are in many cases, not designed to spend their complete lifetime on a single field. Information regarding future renewal activities is therefore particularly crucial when considering re-deployments and new commercial opportunities, as these capital expenditures (CAPEX) heavily affect company bottom lines.

The objective of this study is to establish a work process where the operation management can obtain systematic overview over the vessel ageing processes and include obsolescence issues along with those of physical degradation. Adding to this, it is to be examined how such information can be utilised in depreciation and FPSO redeployment tender calculations.

### Teekay Petrojarl

Teekay Petrojarl is the largest FPSO contractor in the North Sea and the fourth largest leased FPSO operator in the global market [2]. It operates in UK, Norwegian and Brazilian waters.

The company owns six ship shaped vessels (plus one under construction) and three cylindrical units of Sevan type. Vessels are generally leased to oil companies on what is called lease and operating (L&O) contracts.



### References

- [1] E. Okstad, J. Vatn and R. Bye. Maintenance management and optimization of FPSOS. In European safety and reliability conference, pages 592–598. ESREL, 2010.
- [2] Teekay Corporation 2014. FPSO <http://www.teekay.com/business/fps/default.aspx>. Viewed 12/02/2014.
- [3] T. M. Andersen and M. Rasmussen. Aging management: Monitoring of technical condition of aging equipment. In ICMEs, pages 238–241. International cooperation on marine engineering systems, 2003.
- [4] G. Catherine. Analysis of options in FPSO contracts. Master's thesis, Université Paris - Pantheon-Sorbonne, 2011.
- [5] KPMG. Impact of IFRS: Shipping. Report, 2012.
- [6] IFRS. International Accounting Standard 16 - Property, Plant and Equipment. International Standard, 2009.

### The ageing parameter

Annually, operation engineers set a parameter for each component, based on information from condition monitoring, inspections and other information in the CMMS or by specific requests from maintenance-/procurement personnel. The ageing parameter can then be established for subsystems and systems by aggregating hierarchically according to the SFI structure. Each component and subsystem is weighted by their assigned criticality. When this is done, the ageing situation for the system can be analysed by using a top-down approach, to find if there are any obvious strengths and weaknesses on component level or on subsystem level. This approach is based on the Technical Condition Index framework [3].

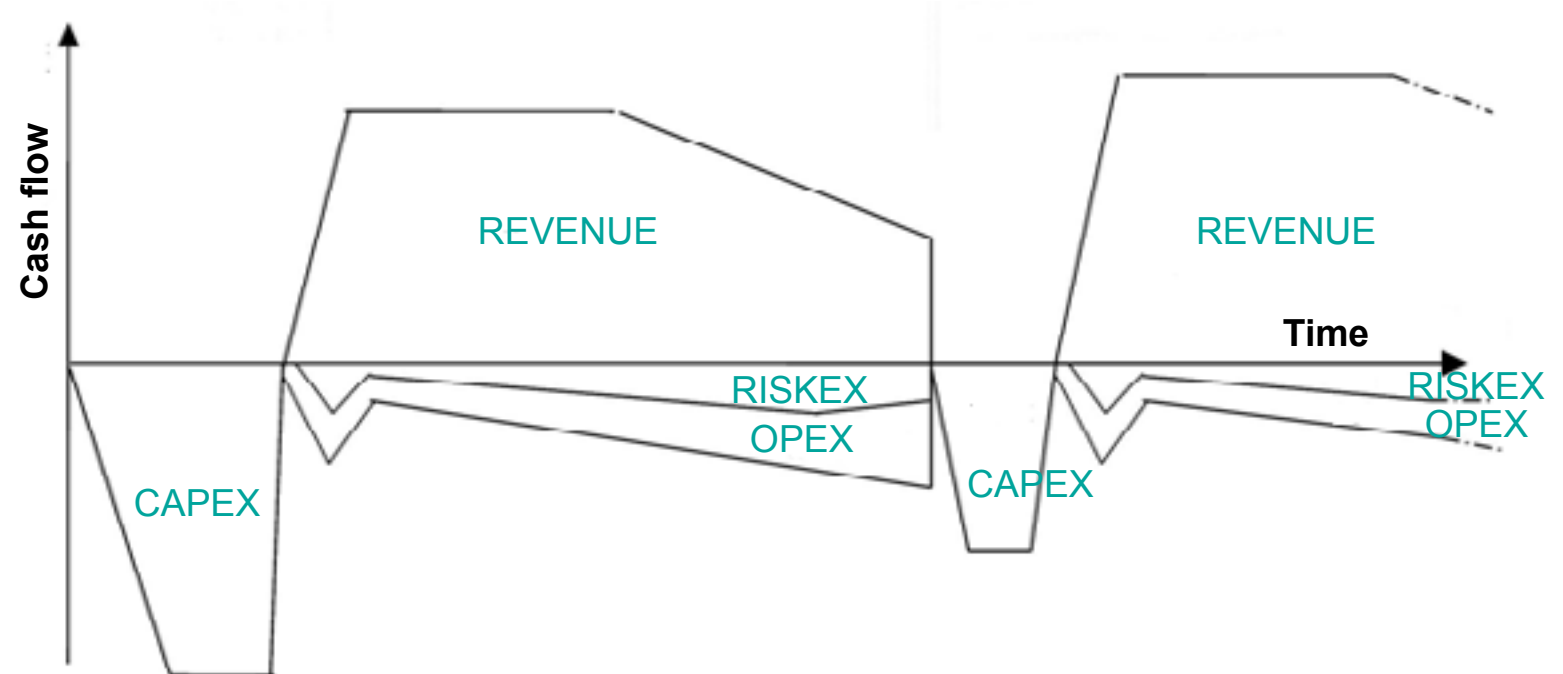
$$AP_{i,W} = (100 - AP_{Ageing,i}) \cdot W_i$$

$$AP_{sbs,j} = (100 - \sum_{i=1}^n AP_{i,W})$$

$$AP_{sys} = (100 - (\sum_{j=1}^m (100 - AP_{sbs,j}) \cdot (\sum_{i=1}^n W_{ij}/n_j)))$$

### Utilisation in the redeployment tender process

The traditional approach used by FPSO contractors for pricing lease contracts is to apply the Discounted Cash Flow (DCF) method. This cost driven approach is based on the cost estimates of capital expenditure required to provide the FPSO at the given requirements and on estimates of operational expenditures required to operate the FPSO at the needed availability throughout the contract [4]. By applying the ageing parameters, long term schedule, cost estimates and NPV predictions can be established.



### Utilisation in depreciation

Deprecation is the difference between an assets acquisition cost and its estimated residual value. In the FPSO business, judgements for remaining useful lives tend to be driven by the remaining reserves associated with the oil field [5], however this is not necessarily correct. Since vessels consist of systems with different useful lives, the systems (or even components) should be depreciated separately to achieve desired accuracy, according to IFRS [6]. If the estimated useful life of a vessel, system or component is reduced, it will increase the constant quarterly depreciable amounts. The ageing parameter should contribute positively in this respect. If the company utilises this parameter actively in their estimates of useful lives of systems or major components, it may provide a more accurate vessel residual value. This may entail advantages such as reduced tax and increased financial predictability.