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FLOATING OFFSHORE STRUCTURES

5.1 INTRODUCTION

The offshore petroleum industry practically began in the late 19th century. The development of oil and gas exploration expanded from onshore production to shallow water production, in which the water depth is limited not to be more than 420 m. The present-day production activity can now be expanded to the deep and ultra-deep waters whose depth range exceeds 420 m because the oil and gas resources at the onshore and shallow water regions are limited and almost fully explored. To support the market demand for oil and gas as the main source of energy production materials, oil and gas companies are pushed to open and explore new fields that are far away from the shore.

Owing to the production activities being shifted farther away into much deeper water, the conventional fixed jacket platform is no longer feasible for such activities. This can be easily understood by presenting a scenario in which a jacket platform needs to be installed in the deep-water region with a water depth of 800 m, compared to a common jacket platform usually installed in a 100 m water depth. Putting aside the complicated engineering designs, even in terms of materials alone, the deep-water jacket will cost 8 times more to procure steel. Adding on to it, the cost of fabrication, transportation, and installation will also increase.

5.2 BASIC DESIGN PRINCIPLES

Floating offshore structures were then introduced to overcome the issues mentioned in the above scenario. The floating offshore structures are also commonly used as production, storage, and export platforms, alongside an exploration platform. A detailed description of the function of these platforms is tabulated in Table 5.1. In the following sections of this chapter, the details of floating offshore structures will be elaborated.

Table 5.1 Functions of floating offshore structures

Platform type	Description
Exploratory platform	The exploration drilling process is an important step before beginning the development of drilling. Exploration drilling is essential for obtaining actual temperature measurements and rock samples and retrieving fluid samples for chemical analysis. Examples include Jack Up, Semi-submersible, MODU etc.
Production platform	Stay on station during the service life for the production activities. Examples include Jackets, GBS, and Floating production units.
Storage platform	Desirably used to store the crude oil temporarily at the offshore site before transferring it to the shore for processing. Examples include FSOs and FPSOs.
Export platform	Used to transfer the crude oil to the shore for processing. An example is a Shuttle Tanker.

5.2.1 Types of Floating Offshore Structures

Generally, floating offshore structures can be classified as Floating Production Storage and Offloading (FPSO), semi-submersibles, Tension Leg Platforms, and Spar. These conventional structures were modified with the passage of time to enhance their performance further. The designs and configurations of these structures are elaborated on in the upcoming text.

1. Floating Production Storage and Offloading (FPSO)

Generally, an FPSO is one of the ship-shaped structures commonly used. Besides FPSO, there are other types of ship-shaped structures in operations as well, which include Floating Storage and Offloading (FSO); Floating, Drilling and Production, Storage and Offloading (FDPSO); and Floating Storage Regasification Unit (FSRU).

The Ship-shaped structure is a preferred solution for deep-water exploration; the oil and gas companies are also exploring the possibility of having it in shallow and ultra-shallow water. The reasons behind this idea are that such a structure can provide ample space for a work area, deck load for storage capacity, structural strength, mobility and relatively low construction cost. Many of the FPSOs were converted from oil tankers to address the concept of sustainability. Figure 5.1 shows an example of the rehabilitation and conversion of an old tanker named Yasa Golden Horn to the FSO Golden Star in the fabrication yards of Southern Malaysia.