FEATURE

# MALAYSIAN OFFSHORE CONSTRUCTION INDUSTRY: OVERVIEW & OUTLOOK

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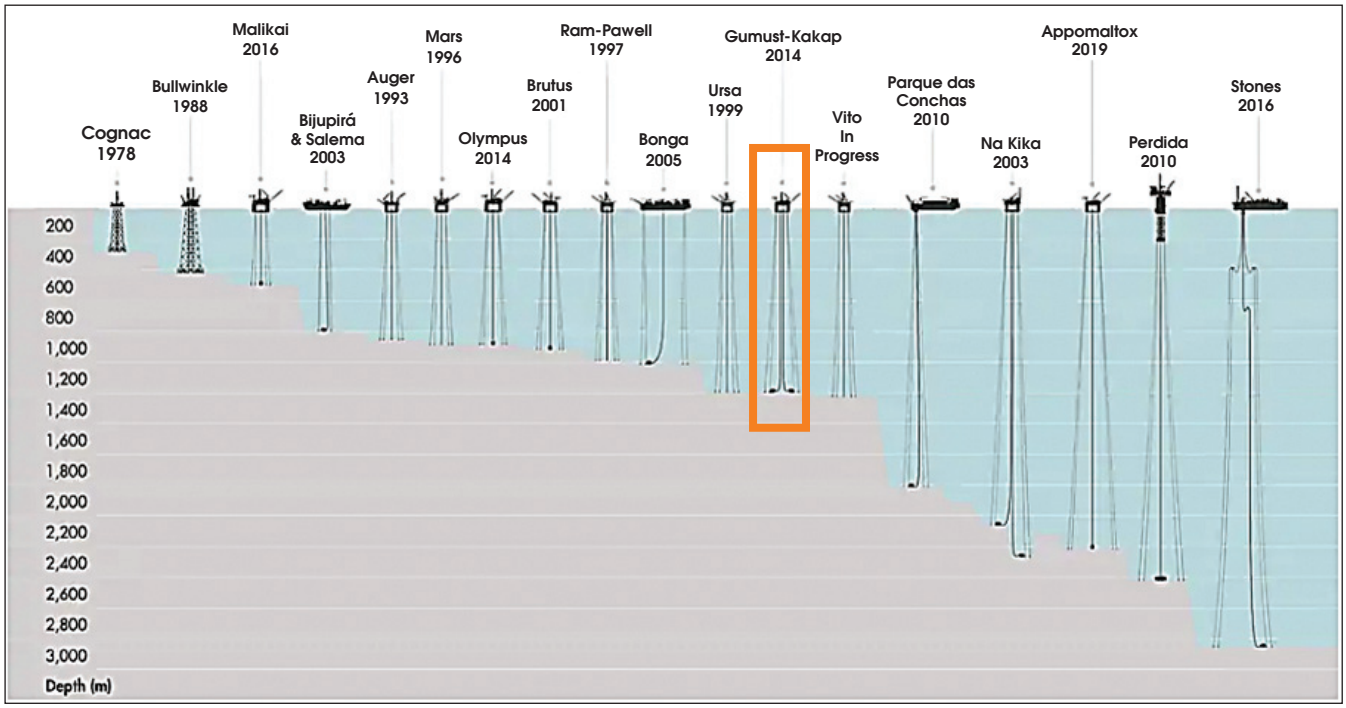


*Figure 1: Deepwater Milestone (Shell, 2014)*

Through its major contractors, Malaysia has completed the construction of many oil and gas facilities, which include substructures, inter-platform bridges, booms, wellhead topside platform, central processing platforms, compression platforms, living quarters, process skids and modular compression skids.

There are five major constructors, often referred to as fabricators: Sapura Energy Fabrication Yard (SEFY), Malaysian Marine Heavy Engineering (MMHE), TH Heavy Engineering (THHE) and Brooke Dockyard and Engineering (BDE).

These are first-tier, local based, major construction contractors which have obtained the licence to operate by PETRONAS (MOCA, 1990). Over the years, they have fabricated multiple local and international projects. Some notable oil and gas construction projects in terms of size and technology are Kikeh Truss Spar, Gumusut Kakap Semi-Submersible Floating Production System, Tapis Enhanced Oil Recovery Unit and Malikai Tension Leg Platform.

## KIKEH TRUSS SPAR

Kikeh field, located 110km off Sabah with a water depth of 134m, is the first deepwater production and first Spar constructed in Malaysia. Kikeh Spar is also the first unit installed outside the Gulf of Mexico. Murphy Sabah Oil Company awarded Technip full engineering, procurement, construction, installation and commissioning (EPIC) contract and MMHE was responsible for the construction. The truss spar or Dry Tree Unit (DTU) is 142m long and 32m in diameter.

Although not a huge spar when compared to those in the Gulf of Mexico, Kikeh Spar is probably one of the largest

from a standpoint of well count, having 24 well slots. The spar will incorporate a tender assisted drilling rig to drill and complete the Kikeh wells. In 2007, MMHE successfully completed Malaysia's first deepwater facility construction. As it was also the biggest deepwater facility ever built in the country at that time, this was an important milestone in our oil and gas construction history (Dechant & McFadyen, 2008; Webb, Selamat, Omar, Desormeaux, & Moran, 2008).

## GUMUSUT KAKAP SEMI-SUBMERSIBLE FPS

Gumusut Kakap is the first deepwater semi-submersible Floating Production System (FPS) in Malaysia. Located 120km off the Sabah coast, Gumusut Kakap field comprises 19 subsea wells, with oil exported to an oil and gas terminal in Kimanis, via a 200km-long pipeline. Water depth in the region is about 1,200m. The project had its first production in October 2014.

Gumusut Kakap, Asia's largest offshore deepwater facility, was constructed by MMHE. Viewed from above, it covers an area the size of 1.5 soccer fields. It was built with 676km of stainless steel tubes, enough to run the distance from the north of Peninsular Malaysia to the southern tip.

The construction team achieved the world's largest and heaviest onshore lift award for this project. The 23,000-tonne Gumusut Kakap topside was lifted onto the hull, marking a significant milestone in our oil and gas construction industry. (Shell, 2014; Technology, 2014).

The Gumusut Kakap Semi-Sub FPS, the largest such facility in the world that was fully built and integrated on land, left the MMHE yard in Pasir Gudang in May 2013. This is also the biggest structure ever undertaken by MMHE and was successfully constructed utilising approximately 40 million man-hours and the direct involvement of approximately 5,000 personnel {Today, 2013 #266}.

## TAPIS ENHANCED OIL RECOVERY

Enhanced Oil Recovery (EOR) is the extraction of crude oil from an oil field which cannot be extracted using techniques such as thermal, gas injection and chemical injection (DOE, 2018). Tapis is one of the largest oil fields in the Malay Basin and has been in the production for 40 years, since 1978. It is also one of the oldest fields in Malaysia.

Tapis EOR project is the first large scale EOR project in South East Asia. (Selamat, Teletzke, Patel, Darman, & Shuhaimi, 2008). ExxonMobil Exploration and Production Malaysia Incorporated (EMEPMI) co-owns the field with PETRONAS Carigali. The EOR technology using Water Alternating Gas (WAG) injection was designed to improve production with an estimate of over 180 million barrels oil reserve for at least another 25 years (Malaysia, 2017; Selamat *et al.,* 2008). Tapis EOR is fully designed and constructed by local contractors. The construction of the CPP was successfully completed by MMHE in 2014 (Malaysia, 2017). The construction of the jacket was carried out by Sapure Energy Fabrication Yard. The 5,500-tonne jacket being the substructure for the main central processing facility of the EOR project is the heaviest jacket installed in Malaysia. The main component of the project is the Tapis R central processing platform which comprised a large integrated deck structure with living quarters for 145 personnel and is equipped with 11 million cubic m (390 million cubic feet) per day (MMcf/d) gas compression and 270,000 barrels per day water injection facilities, production-processing equipment, and utilities systems. Tapis R is also the first platform installed by ExxonMobil Exploration and Production Malaysia Inc. using the float-over method for its topsides.

## MALIKAI TENSION LEG PLATFORM (TLP)

Malikai field is located about 100km off Sabah in water depths of about 500m. It is Shell's second deepwater project in Malaysia, after Gumusut-Kakap in 2014. Malikai TLP platform is the first TLP in Malaysia. Malikai TLP is also Shell's first TLP designed and fabricated outside the Gulf of Mexico. It is regarded as Shell's first TLP to be coupled with a Tender Assisted Drilling (TAD) rig, as opposed to using a permanent dedicated rig, which allows cost savings.

The TLP is moored to the seabed 500m underwater by a group of tethers or tendons at each corner, which are held upright in tension. The 27,500-tonne TLP comprises a 13,800-tonne topside and a 13,700-tonne hull. The topside houses production decks, with a capacity of 24 well slots, and living quarters. The TLP is wholly designed and fabricated in Malaysia, via a joint-venture between Technip and Malaysia Marine and Heavy Engineering (MMHE). The project had a very innovative topside and hull integration method which used a Mega Jack and Skid System that lifted the topside 40m above ground and skidded it 90m horizontally to set it on the hull structure. It took seven days to complete. (Ab. Majid, Mohd. Nor, & M. Hanafi, 2016; Asia, 2017; Si, Lim, Wong, & Choo, 2016). This engineering marvel was also the proud winner of The Institution of Engineers Malaysia (IEM) Outstanding Engineering Achievement Award in 2017.

For major oil and gas construction projects in Malaysia from 2010, please refer to Table 1.

## OFFSHORE CONSTRUCTION PROJECTS: OUTLOOK

### Shallow Water

From the recent activity outlook released by Petronas, about 11 or 13 Wellhead Platforms (WHP) and 1 Central Processing Platforms (CPP) are expected to be developed (PETRONAS, 2017). To keep costs low, the majority of new WHP developments may opt for a lightweight structure with minimum facilities. PETRONAS is expecting to develop a~20,000 MT Mobile Offshore Production Unit (MOPU). Local construction companies Sapura Energy Fabrication Yard (SEFY) and Malaysia Marine and Heavy Engineering (MMHE) are the front-runners to secure more new fabrication contracts (Inani, 2018).

*Table 1: List of Major Offshore Construction Projects in Malaysia*

| YEAR | CONSTRUCTION CONTRACTOR | PROJECT NAME | CLIENT | LOCATION |
|---|---|---|---|---|
| 2010 | MMHE | Kikeh Truss Spar | Murphy Sabah Oil Company | Offshore Sabah, East Malaysia |
| 2010 | Sapura Energy | West Belumut WHP – Jacket & Topside | Sapura (Formerly Newfield Malaysia) | Offshore Peninsular Malaysia |
| 2010 | Brooke Shipyard | SJQ-A Topsides | Sabah Shell Petroleum Company | Offshore Labuan Malaysia |
| 2011 | Sapura Energy | PM329 East Piatu Development Project | Sapura (Formerly Newfield Malaysia) | Offshore Peninsular Malaysia |
| 2011 | Sapura Energy | EPC Berantai Field Development Project – Topside & Jacket | Petrofac Malaysia | Offshore Peninsular Malaysia |
| 2012 | Brooke Shipyard | Merapuh - A Production Topside for SK309/311 Phase II | Murphy Sarawak Oil Company Limited | Offshore Sarawak, Malaysia |
| 2013 | MMHE | Gumusut-Kakap Semi-Submersible Floating Production System (FPS) | Sabah Shell Petroleum Company | Offshore Sabah, East Malaysia |
| 2013 | Sapura Energy | Patricia Satellite for SK309/311 Sarawak Development Project | Murphy Sarawak Oil Co. Ltd. | Offshore Bintulu Sarawak |
| 2013 | THHE | LADR-A Topside Fabrication | Sarawak Shell Bhd. | Offshore Sarawak, Malaysia |
| 2013 | THHE | D12DR Topside | Sarawak Shell Bhd. | Offshore Sarawak, Malaysia |
| 2014 | MMHE | Tapis Enhanced Oil Recovery (EOR) Project | ExxonMobil Exploration & Production Malaysia | Offshore Terengganu, Malaysia |
| 2014 | THHE | PM307 Bertam Field Development Project | Lundin Malaysia B.V. | Offshore Peninsular Malaysia |
| 2015 | MMHE | SK316 Project | PETRONAS Carigali Sdn. Bhd. | Offshore Sarawak, Malaysia |
| 2015 | THHE | Kinabalu Non-Associated Gas (NAG) Development Project-PCC | PETRONAS Carigali Sdn. Bhd. | Offshore Sabah, East Malaysia |
| 2016 | MMHE | Malikai Tension Leg Platform (TLP) | Sabah Shell Petroleum Company | Offshore Sabah, East Malaysia |

*Source: (Brooke, 2018, MHB, 2018, Sapura, 2018a, THHE, 2018)*

*Kikeh Truss Spar*

*Gumusut-Kakap Semi-Submersible Floating Production System (FPS)*

*Tapis Enhanced Oil Recovery (EOR) Project*

*Malikai Tension Leg Platform (TLP)*

In 2018, Mubadala Petroleum sanctioned a RM1 billion-plus Pegaga gas development project in Block SK 320, off Sarawak. This is its first development in Malaysia. The project includes a central processing platform and a 130km subsea pipeline to Bintulu (OSEA, 2018). Offshore South East Asia (OSEA) also reported that another project was sanctioned in 2018, the early phase of Block SK408 offshore Sarawak, operated by Sapura Energy Berhad. The Gorek, Larak and Bakong fields will be developed with three wellhead platforms.

## Deepwater

Malaysia has a total shore exploration area of 565,555 sq. km, of which one-third is in deepwater (Khalid, 2006). Our deepwater potential remains under-explored, and only 3 billion barrels of oil equivalent (boe) of deepwater resource have been proven over the years. There is a potential untapped discovery of 7 billion boe to be explored and discovered (BMI, 2016). The depletion of existing fields as hydrocarbon production also creates a sizable market opportunity which accelerates exploration in Malaysian deepwater (Islam, Jameel, & Jumaat, 2012).

PETRONAS has a long-standing goal to transform Malaysia into a regional deepwater hub (PETRONAS, 2013). However, deeper water usually means greater challenges, so better technology and work methods need to be employed (Khalid, 2006). According to OSEA (2018) a recent deepwater Rotan gas project offshore Sarawak was awarded in 2018. The Rotan deepwater project will be the feedstock gas source for Petronas's second floating LNG vessel which is expected to start in 2020.

## Enhanced Oil Recovery (EOR)

PETRONAS identified 5 fields in offshore Sabah and Sarawak as well as 9 in Peninsular Malaysia where EOR technology could be implemented (PETRONAS, 2013). In an interview in 2014, the Vice President added that about half the country's producing fields have EOR potential (V.P. Petronas, 2014), with production from these fields to reach between 750 million and 1 billion bbls throughout the life of the field. As at 2016, there were 10 EOR projects in the process for development over the next 10 years (BMI, 2016). One significant project is PETRONAS' Bokor phase three EOR development offshore Sarawak (OSEA, 2018).

## SUMMARY

Mahatma Gandhi once said: "The future depends on what you do today."

This powerful message resonates well with oil and gas industry. Despite going through a tough two years, industry players have kept innovating and reinventing themselves with automation and digitalisation being the current focus.

On the local offshore construction landscape, PETRONAS remains confident and committed in harnessing and nurturing the capabilities and expertise of homegrown fabricators who have also taken up the challenge to achieve many success stories in showcasing the nation's engineering capability. With this positive outlook, there are tonnes of opportunities available for greater engineering achievements in the Malaysian Offshore Construction Industry. ■

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