ETP: Challenges for Upstream Oil & Gas Sector

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Launched on 25 September 2010, Malaysia's Economic Transformation Program (ETP) encompassed the plan to bring the country to the status of a high income economy by 2020. Managed by the Performance Management and Delivery Unit (PEMANDU), an agency under the Prime Minister's Department, the ETP looked at raising per capita income from US$6,700 to at least US$15,000, meeting the World Bank's threshold for a high income nation. ETP is built on 12 National Key Economic Areas (NKEA).

Figure 1: The 12 NKEAs that builds up the ETP

The Oil, Gas and Energy Sector is one of the 12 (NKEA) in the programme. Figure 1 shows the 12 NKEAs. Each NKEA has a list of Entry Points Projects (EPP) that supports the NKEA. There are 13 EPPs that stipulate the goals to be achieved by the year 2020 in the Oil, Gas and Energy Sector NKEA. It is one of the major elements in the programme.

Figure 2 shows that the Oil, Gas and Energy NKEA contributed 17% of the nation's GDP (Gross Domestic Product) in 2013 and, on average, one-fifth of the GDP over the past decade. The 12 NKEAs actually command 70% of the Gross National Income (GNI). The 13 EPPs in the Oil, Gas & Energy NKEA are expected to provide an incremental GNI of about RM131.4 billion out of the RM523 billion in the all 12 NKEAs. The Oil, Gas and Energy NKEA is also expected to create an additional 52,300 jobs by the year 2020.

In this article, we will discuss only the first 3 of the 13 EPPs in the Oil, Gas & Energy NKEA which are identifiably the core Upstream Oil & Gas business.

REJUVENATING EXISTING FIELDS THROUGH ENHANCED OIL RECOVERY (EOR)

Excerpt from the factsheet: "EPP 1 encourages the use of Enhanced Oil Recovery (EOR) - a technique that uses gas, chemical injection or thermal flooding - to improve oil recovery from industry norms.

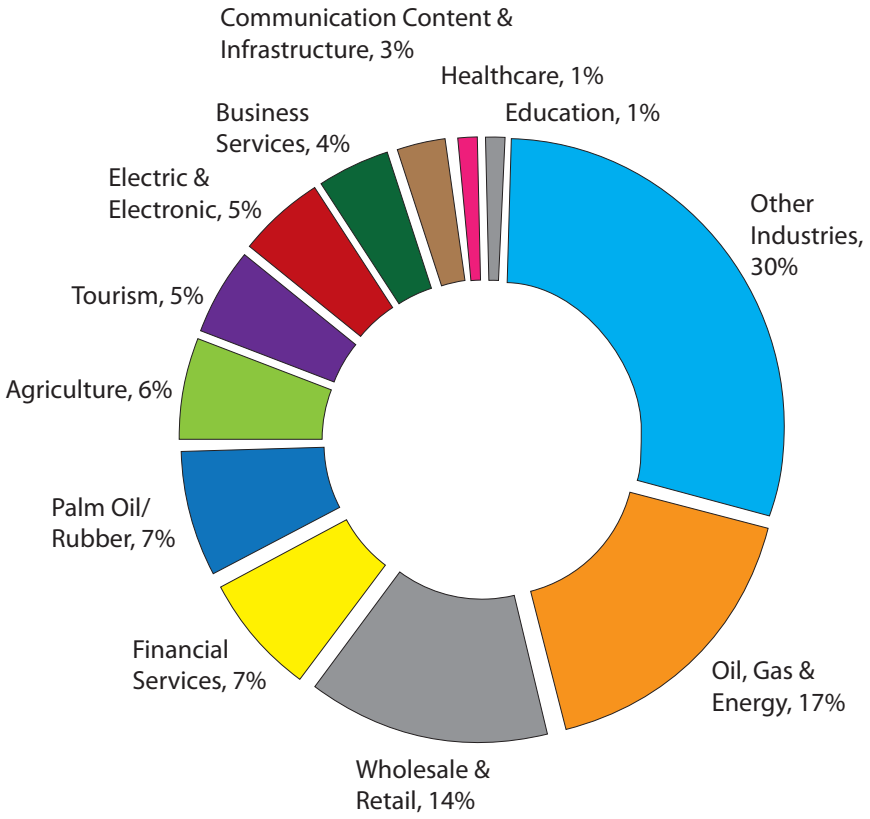

Figure 2: Malaysia GDP Structure, based on NKEA Sectors (FY2013) (Data source: Department of Statistics Malaysia)

What exactly is EOR? There are three levels of well development. "Primary" refers to all the conventional development wells, which can deliver less than 30% of the oil recovery factor. "Secondary" refers to the Improved Oil Recovery (IOR), which can deliver 30-50% of the recovery factor, using the method of water-flooding or pressure maintenance. "Tertiary" or better known as the Enhanced Oil Recovery refers to the most complex method of bringing the hydrocarbon to the surface. This method has proved to be effective in some development programmes conducted in other parts of the world, with the recovery factor reaching 50-80%.

There are three methods of EOR (Sohrabi):

- Chemical Water Flooding using polymer, surfactant, alkaline and low salinity fluids.
- Miscible Displacement using CO2 injection, hydrocarbon injection, nitrogen and flue gas flowing
- Thermal Recovery using hot water drive, steam drive, cyclic steam stimulation, steam-assisted gravity drainage, in-situ combustion (fire flood) and thermal simulation (electric induction heating).

As the champion of EPP, national oil firm Petronas has introduced new arrangements in production sharing contract (PSC) terms to attract and reward companies or investors using the EOR techniques. EOR projects are undeniably very expensive. The high implementation cost makes it difficult to convince Production Sharing Contract (PSC) contractors to embark on EOR investment for the fields. Despite the EPP being expected to contribute significantly in this NKEA, there are many challenges associating with Enhanced Oil Recovery programmes.

All candidate fields for the EOR projects have been producing for a significant number of years, some of them for more than 30-40 years like Tapis (1978), Baronia (1975) or Baram (1969). These ageing platforms pose a high safety risk to access and high cost of modification to make them suitable for the EOR programme. The Platform Rejuvenation workscope can include structure strengthening, addition and replacement of facilities equipment, conductor replacement and/or addition and any other requirement to make the platform safe for an EOR facility. Another alternative is to build a new platform. This may or may not necessarily mean higher cost compared to platform upgrading work. A balance between the potential benefits and facilities required to achieve the programme objectives must be studied prior to endorsement of the programme for execution.

EOR is mainly about injecting fluids into the formation, to push the slow moving or leftover oil in the existing or new wells, to the surface. To do that, additional wells will be required (injectors). These tend to be more complex than the conventional well because of the length (the push is from the outer side of the perimeter) and the angle it has to penetrate the formation (depending on the injection concept). Complexities arise because gas, oil, and water are segregated by densities with gas being at the top, followed by oil and water. Theory of fluids movement may

Figure 3: The 13 EPPs that supports the Oil, Gas & Energy NKEA

not act necessarily behave the way we want it to be; inject gas to push down the oil, or inject water to push up the oil. In addition, formation in most areas is interbedded with only a thin column of oil segregated by shale.

Moreover the material to be used in these wells is expensive. This is because the chemicals or even water to be injected into the formation can be corrosive. So, instead of just carbon steel material, some level of chrome material may be required, depending on the life of the well, producing conditions, formation characteristics and other factors which affect the material corrosion levels. Chrome material can easily be up to 6 times more expensive than the carbon steel.

Another challenge is the fact that all the fields are offshore. Everything becomes more expensive and more complex, from the construction of the EOR facility to the logistics of the supply and material. Add to that the weather condition. Although not as severe as in the North Sea, our sea conditions may also cause non-productive time in operations.

EOR expertise is another issue. Generally, we still lack expertise in the oil and gas sector. EOR is a very specific expertise in the oil and gas sector, from Geology and Geophysics, Reservoir Engineering, Drilling Engineering and other areas which focus on EOR experience and research.

Therefore rejuvenating existing fields through enhanced oil recovery is not an easy challenge to meet due to the high cost of the programme, safety risk in accessing existing platforms, high cost of modification, complexities of the offshore environment and insufficient technical capabilities. In meeting this challenge, Petronas has created the Exploration & Production Technology Department (EPTD) to focus on EOR research as well as establish the Enhanced Oil Recovery Centre (EORC), an unincorporated joint venture between Petronas Carigali and Shell to facilitate and provide focus on implementation of the programme (ETP Annual Report).

DEVELOPING SMALL FIELDS THROUGH INNOVATIVE SOLUTIONS

Excerpt from the factsheet: "Petronas is working with the industry to tap the potential of Malaysia's small fields, each of which hold at least 30 million barrels of recoverable oil. The national oil firm reviewed production sharing contract (PSC) terms to provide sufficient incentives for operators of small fields, and also sourced for exploration and production (E&P) operators which specialise in developing small fields."

More than 90% of the world's oil fields are classified as small and these hold just 3% of reserves. A small oil field is defined as one with less than 25 million bbl of reserves. More than 90% of the world's gas fields are classified as small and hold 12% of total reserves. A small gas field is defined here as one with less than 0.25 tcf of reserves (Sandrea).

In daily conversation, the terms small field and marginal field are quite interchangeable and usually refer to the same field that has the characteristics of what is defined as small and marginal field.

Based on the definition by the USLegal.com, marginal field refers to an oil field that may not produce enough net income to make it worth developing at a given time. However, should technical or economic conditions change, such a field may become commercially viable. It is usually associated with small pockets of hydrocarbons which have a plateau of a few years. Marginal fields have several parameters that affect them. These include environmental concerns, political stability, access, remoteness and, of course, the price and price stability of the produced gas/liquids.

Small fields have small reserves or volume of hydrocarbon in the formation. In order to extract the hydrocarbon, there will be development cost or costs incurred to obtain access to "proved reserves" and to provide facilities for extracting, treating, gathering and storing the oil and gas. More specifically, development costs, including depreciation and applicable operating costs of support equipment and facilities and other costs of development activities (Sewell).

Unit Development Cost (UDC) is the cost over recoverable reserves, where recoverable reserves can be about 30% of the total reserves. Meeting the UDC that is economical to be sanctioned can be a very challenging task. Most of the time, the projects are slashed. Therefore, these projects operate on a tight budget with no room for a change in the workscope or delays in the operations.

The oil & gas industry in Malaysia is quite mature. Most of the leftover fields have reservoirs that are thin layered and compartmentalised and it is very challenging to access the hydrocarbon in these thin layers.

Platform structures, facilities and the cost of transporting the hydrocarbon to the terminal are still the major cost of a field development. In a small field, we need to scale down the elements as well as the cost. Suitable platform design and facilities requirement concept need to tie in with the drilling requirement. Small structures such as MOPU (Mobile Offshore Production Unit), CSP (Conductor Supported Platform), monopod and many other new concepts are available in the market these days. It is a challenge to find a fit of these concepts to aproject when there is a limited budget to work on.

Another major part of the cost is the drilling. In a two-or-three-well development, the cost of drilling can be up to 40-45% of the total development cost. There are about 40 contracts that make up a drilling operation. Each one goes through a rigorous procurement process and negotiation. It is very difficult to negotiate when you do not have the volume.

Therefore, developing small field is very challenging due to the tight budget, reservoir and well design complexities, high platform and facilities cost and high drilling cost.

To date Petronas has, in line with the ETP, awarded 6 Risk Service Contracts (RSC) to develop these small fields.

- Berantai field to Petrofac and Sapura Kencana Petroleum Bhd. in January 2011.
- Balai-Bentara cluster offshore Sarawak to a consortium comprising Roc Oil Malaysia (Holdings) Sdn. Bhd., Dialog Group Bhd. and PETRONAS Carigali in August 2011.
- Kapal, Banang and Meranti cluster to Coastal Energy KBM Sdn. Bhd. in June 2012.
- Tembikai-Chenang cluster to VESTIGO Petroleum in October 2013.
- Tanjong Baram field to EQ Petroleum Developments Malaysia Sdn. Bhd. and Uzma Energy Venture (Sarawak) Sdn. Bhd. in March 2014.
- Ophir field to Ophir Production, a joint venture company between Octanex Pte Ltd, Scomi D&P Sdn. Bhd. and VESTIGO Petroleum Sdn. Bhd. in June 2014.

The award of RSCs for other fields has stopped temporarily due to the slump in oil price.

INTENSIFYING EXPLORATION ACTIVITIES

Excerpt from the factsheet: "EPP will boost new and sizeable discoveries to maintain Malaysia's position as one of Asia's top oil and gas producers. Production sharing contract (PSC) terms will be reviewed and new petroleum contract arrangements introduced to expedite exploration investment projects."

Exploration activities are important, because, if there are significant discoveries, it increases reserves. Exploration wells that encounter dry holes will just incurexploration cost, costs in identifying areas that may warrant examination and in examining specific areas that are considered to have prospects of containing oil and gas reserves, cost of drilling exploratory wells and exploratory-type stratigraphic test wells. The chances of success are usually very low. Based on the paper released by the IFP School, the following are the chances of success of an exploration well:

- New areas (with no previous exploration): 10 to 20%
- Geologically known areas: 20 to 30%
- Areas close to production zones: Around 60%.

Based on these chances, the challenge then is in deciding whether to invest about US$30 to US$50 million on an exploration well.

Traditionally exploration wells are supposed to be a vertical well directly drilled to the target. With development in technology, this has changed. Now there is more than one target, where they are not inline. This requires directional drilling. It is an increased risk operation to drill complex wells in an environment that we have minimal knowledge of. Another added complexity is wanting to "save" the well for future production if it's found to be commercially attractive. Special technology is required for such a requirement and, no doubt, there is an increase in risk as well as cost.

Therefore, intensifying exploration activities is very important but a challenging task for the oil and gas sector to achieve, given the high costs and low chances of success, requirement to explore risky locations and having more complex wells.

Petronas, as the champion of these three initiatives as stated above, will continue to work to offer attractive packages to the capable parties to develop and bringing success to the NKEAs. In conclusion, the oil & gas industry contributes significantly to the building of Malaysia and realising Vision 2020. Let us be part of the success stories! ■

IEM DIARY OF EVENTS

Title: Talk on Supervision of Bored Pile Installation

19 November 2015

Organised by : Geotechnical Engineering Technical Division
Time : 5.31 p.m. – 7.30 p.m.
CPD/PDP : 2

Title: 1-Day Course on "Health, Safety & The Environment in The Industry"

23 November 2015

Organised by : Marine Engineering & Naval Architecture Technical Division
Time : 9.00 a.m. – 5.30 p.m.
CPD/PDP : 6.5

Kindly note that the scheduled events below are subject to change. Please visit the IEM website at www.myiem.org.my for more information on the upcoming events.