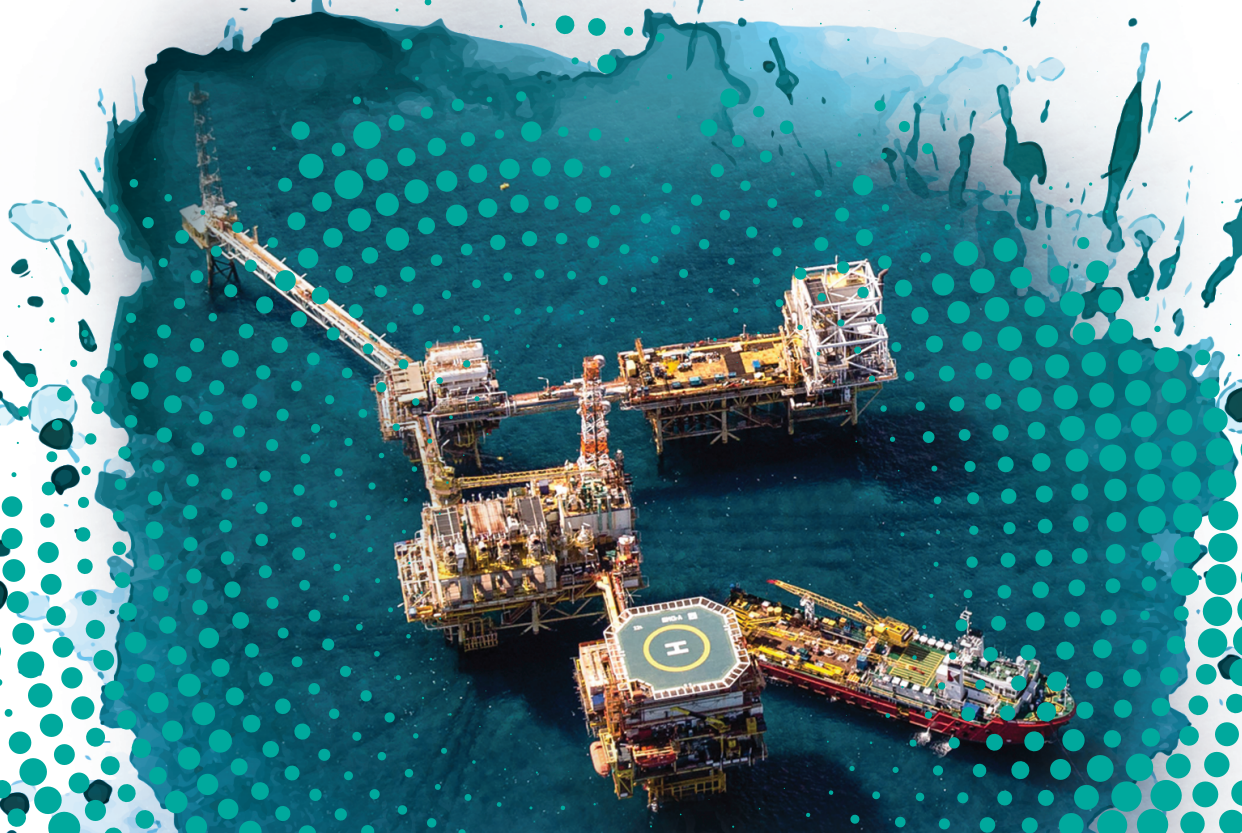




PETRONAS



PETRONAS
ACTIVITY OUTLOOK
2019-2021



Cautionary Statement

This Report was developed based on currently available information from internal and external sources. PETRONAS believes that the expectations of its Management as reflected by such forward-looking statements are reasonable based on information currently available to it. PETRONAS makes no representation on the accuracy or completeness of any information provided in this Report and expressly disclaims any liability whatsoever arising from, or in reliance upon, the whole or any part of its contents. PETRONAS undertakes no obligation to update or revise any of them, whether as a result of new information, future developments or otherwise.

Accordingly, readers are cautioned not to place undue reliance on the forward-looking statements, which speak only as of the date they were made.

Images are for illustrative purposes only.

Released in December 2018.

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Upstream Malaysia



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Downstream Malaysia



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FOREWORD



Samsudin Miskon
Vice President
Group Procurement

Dear Partners,

We are pleased to present to you this year's edition of the PETRONAS Activity Outlook, which will provide insights on our four key areas – **Pace, Collaboration, Going Digital and Competencies**.

The **year 2018** has seen greater volatility in oil prices with Dated Brent rising to US\$86 per barrel in early October from US\$67 per barrel at the onset of the year. In early December, Brent declined by 30% to US\$57 per barrel due to oversupplied market. Nonetheless in 2018, generally the actual level of activities performed are as projected.

Greater market volatility is expected to persist in 2019. **PETRONAS maintains its prudent view on the industry outlook** and will respond with cautious optimism particularly on new capital projects.

The **three-year outlook** portrays **growth in Brownfield** activities particularly in Rigs category and its supporting services, for example, Marine Vessels. Base activities in Maintenance is projected to increase for both Onshore and Offshore in tandem with this outlook. **Integrated group-wide Onshore Plant & Facilities Turnaround will build local players' capability that yields value optimisation.**

The five special features **In The Spotlight** this year are **Technology as Differentiator, Pace through "DeeWOW"** (Digitally Enhanced and Exciting Way of Working), **New Opportunity in Decommissioning** and the **inaugural** sharing of the **Malaysia OGSE Talent Landscape** that calls for industry intervention to move into the cutting-edge era. Human Capital development should rise along with digitalisation. The **Status of Key Contracts** are revealed to provide industry players **sufficient time to give competitive offerings** through new technology adoption and strategic partnership.

Collaboration is fundamental for the industry to shift forward. Together, we can pull our weight to create a better and brighter future for all players in this industry.

Thank you.

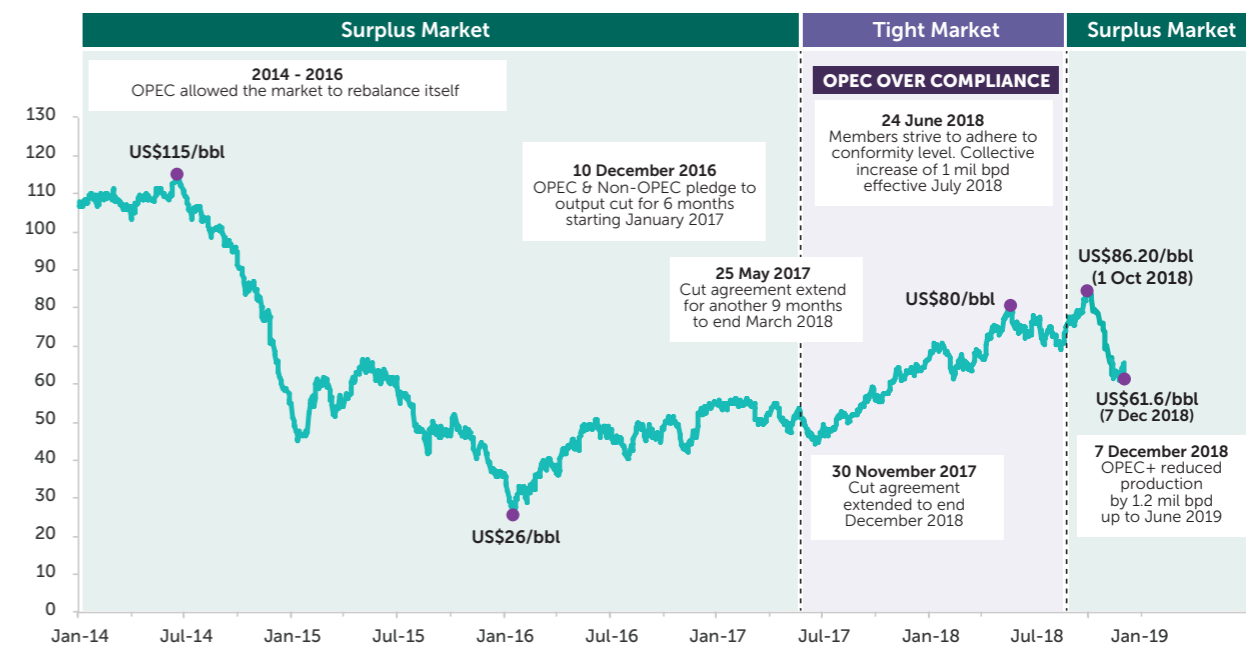
INDUSTRY OVERVIEW

PETRONAS Carigali Dulang Platform
Offshore Terengganu, Malaysia



GREATER MARKET VOLATILITY TO PERSIST

Daily Dated Brent Price (US\$/bbl)



Source: Platts, SR Analysis



Since the last update of the PETRONAS Activity Outlook (PAO) 2018-2020, oil prices have exhibited greater volatility despite improvement in price level. In 2018, Dated Brent has averaged **US\$72 per barrel (as at 7 December 2018)**, compared to average 2017 price of US\$54 per barrel, a 33% annual increase.

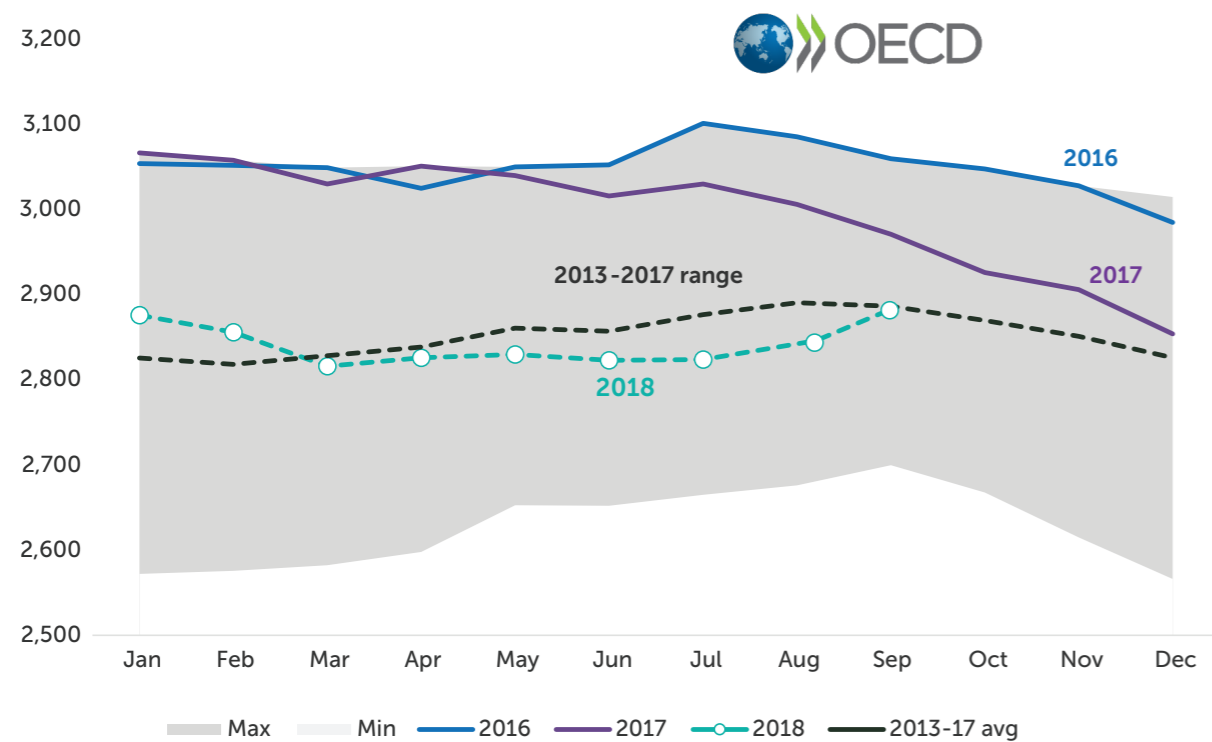
Oil prices have been fluctuating in 2018 from year-high of US\$86.2 per barrel in early October to lowest of US\$57 per barrel in end November as the global oil market turned from tight to oversupply.

Extension of production cut by OPEC+ to end 2018 has managed to stabilise the global oil market. Commercial oil inventories for the Organisation for Economic Cooperation and Development (OECD) countries have declined sharply to below the five-year average of 2.8 billion barrels in March 2018. However, towards the end of year, the global oil market turned into surplus resulting in oil prices weakening to below US\$60 per barrel. This was driven by demand concern and increased supply from the US. Production from the US continue to grow, hitting a record-high of 11.7 million bpd in November 2018 to average 10.9 million bpd in 2018. OECD oil stocks increased by 63 mil barrels from March 2018 to 2.9 billion barrels at the end of Q3 2018, indicating a surplus market.

On 7 December, OPEC+ pledged to extend the production cut to June 2019 with participating members in OPEC reducing output by 800 kbpd and non-OPEC 400 kbpd, with the intent to stabilize the oil market. However, the growth of US tight oil production and expectation of global oil demand growth, amidst the concern on trade war and weakening emerging markets' currencies will influence the global oil market in 2019.

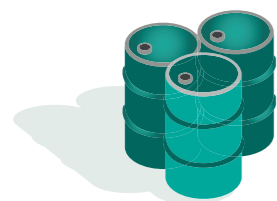
TOWARDS END-2018, OIL STOCKS HAVE RISEN CLOSE TO THE FIVE-YEAR AVERAGE LEVEL INDICATING OVERSUPPLIED MARKET

Monthly OECD crude & petroleum products stocks (mil bbls)



Source: IEA (Nov '18), EIA, SR Analysis

KEY FACTORS SHAPING THE OIL MARKET



US sanctions on Iran could remove between 1 to 1.5 million bpd of oil from the market

On 8 May 2018, US have reinstated sanctions on Iran after Washington withdrew from the Joint Comprehensive Plan of Action (JCPOA), commonly known as the Iran nuclear deal. For this round of sanctions, US have toughened its stance by asking several countries to reduce Iranian oil imports to "zero" by 4 November 2018.

Post deadline, US granted waivers to eight countries (China, India, South Korea, Japan, Italy, Greece, Taiwan and Turkey) to import oil from Iran for another 180 days. It is one of the factors that had led the oil price to fall from US\$86/bbl in early October to a range of US\$60/bbl in November 2018 as the waiver had put a bearish sentiment to the oil market, reversing the earlier sentiment that market could tighten further.

At the time of this report (November 2018), there is still some caution on the waivers as it is only temporary, expiring in March-April 2019. Extension of the waiver will depend on US outlook on the oil market balances and the volume the countries are allowed to import from Iran. The countries still need to prove they are diversifying away from Iran.

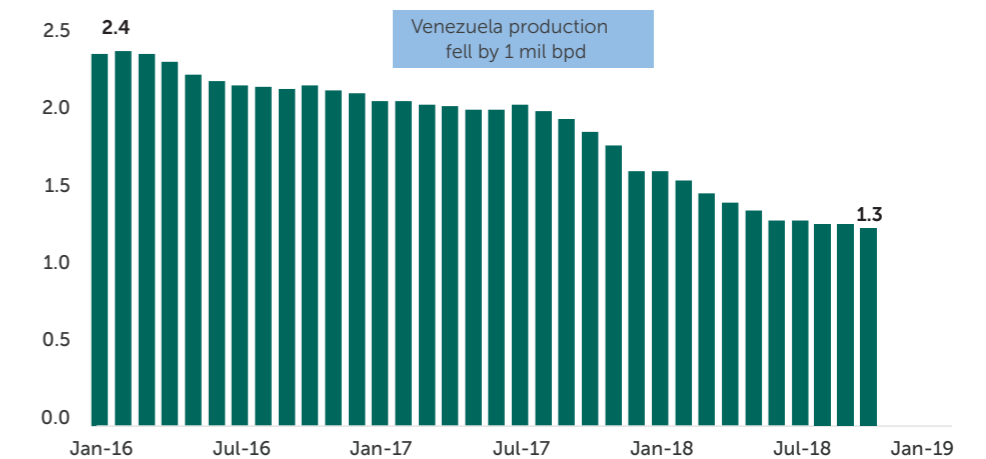
There are a lot of uncertainties especially with the upcoming OPEC meeting in early December to discuss on whether the output cut extension agreement will be renewed.

The decision from that meeting, should the production cut is set to be extended through 2019, could boost the oil price. However, if there is no unified agreement between the countries, market could continue to be bearish. Thus, we still foresee that oil is "On the Path to Recovery, Risks Remain".

Ongoing Geopolitical Instability in Oil Producing Countries

Within the OPEC countries, oil production in key producing countries is unstable due to economic crisis (Venezuela), series of attacks at the oil facilities (Libya and Nigeria) and natural declines (Angola).

Venezuela monthly crude oil output (mil bpd)



Source: IEA

OPEC & Non-OPEC Production Coordination and Spare Capacity

Since January 2017, OPEC and Non-OPEC, also known as OPEC+, have extended the production cut timeline twice to end in December 2018. OPEC+ maintained to cover supply shortage from Iran and Venezuela from countries with spare capacity such as Saudi Arabia, UAE, Kuwait and Russia. The market remains concerned over OPEC's ability to cushion the impact of shortage. This could increase volatility and magnify the risk premium in oil prices.

Risk of Slowdown in Oil Demand

Oil demand growth is expected to be at risk as soaring oil prices and weakening Emerging Markets currencies could lead to higher oil import bill. There is also a risk of demand erosion due to escalation of trade disputes between US and China.



IN THE SPOTLIGHT: 5 FEATURES



TECHNOLOGY AGENDA

Lab Facilities, PETRONAS Research Sdn Bhd (PRSB),
Bangi, Selangor

TECHNOLOGY AS DIFFERENTIATOR

Unlocking Value with Technology Focus Areas

An abundance of oil and gas resources is not a guarantee for long-term economic prosperity. Thus, it is imperative for players and nations to look into means to ensure sustainable growth by unlocking challenging resources and replenishing our funnel economically to sustain our production and integrated value chain. Similarly, we must seek to improve assets' productivity and efficiency, as well as manage cost in order to continue sweating our assets to generate maximum value from every hydrocarbon molecule that we have extracted in a responsible, safe and reliable manner.

1. Unlocking challenging resources and replenishing our funnel economically

The days of "easy" oil and gas are long gone. Our resource portfolio is becoming more diverse and challenging. Towards unlocking these challenging resources and replenishing our funnel economically to sustain our production and integrated value chain, PETRONAS adopted the following approaches to increase exploration success:

- **Geo-Imaging Technology** will allow us to improve drilling success to deliver new upside potentials, reducing the risk of prospects as well as placement costs.
- **Carbon Capture Utilisation & Storage (CCUS)** technology unlocks high CO₂ fields to add significant gas production. The ability to monetise high CO₂ gas resources economically is important to ensure production sustainability.
- **Enhanced Oil Recovery (EOR) technology** shows significant potential in unleashing a substantial amount of hydrocarbons from existing oil fields economically.

2. Improving Cost, Productivity and Efficiency performance

Maturing assets will need continuous support and enhancement to maintain their optimum productivity and cost-efficiency. Mass deployment and rapid replication of in-house and off-the-shelf technologies are applied to improve productivity, efficiency and cost.

PETRONAS is actively seeking ways to deploy technology in terms of digital, data analytics, automation, and robotic solutions in our assets such as **Facilities of the Future (FOF) programme**, which will address brownfield assets with 50 per cent operational expenditure reduction target by 2026, specifically in surface operations, maintenance, and logistics. This will change the way we operate our assets and technical requirements.

Successful application of these technologies will be the source of differentiation and a competitive edge for PETRONAS.

Facilities of the Future

The transformational possibilities from hyperconnected enterprises have spawned exciting, groundbreaking initiatives throughout many organisations, including but not limited to:

- Hyperconnectivity
- Digital Automation
- Robotics
- Autonomous Repair Drones
- Remotely Operated Vessels (ROVs)
- Artificial Intelligence (AI)
- Machine Learning (ML)

3. Enabling new business and revenue streams

Technology will propel growth in integrated business models through the generation of new sources of revenue:

- **Fluid Technology Solutions™** holds the potential to generate substantial revenue from new fuel products with F1 technologies that can be harnessed for other applications.
- **Specialty Chemicals** are amongst the broad range of petrochemical products developed in the Pengerang Integrated Complex, which has a petrochemical production capacity of 3.3 million mtpa.

COMPREHENSIVE APPROACH TO TECHNOLOGY

Enlarging Technology Funnel

PETRONAS' effort in enlarging the technology funnel via multiple avenues including in-house R&D, Innovation Gateway, Technology Challenge, Collaboration and Corporate Venture Capital has resulted in a substantial increase in the number of input and output of the technology funnel.

Technology Marketplace:	67 open-sourced technology products	31% endorsed for immediate application at businesses
Technology Challenge:	74 proposals from three latest, market-wide challenges	
Technology Focus Areas Partnership:	40 industries	10 varsities
Corporate Venture Capital (CVC):	Major and boutique investments in niche applications	

Intensifying Capability and Talent Development

A global recruitment drive and diversity building through **Scientist Development Programme** to produce 1:2 PhD scientists and researchers respectively by 2022.

In-house R&D:	3X R&D projects from	7 technology programmes
Local and international recognition and acknowledgement:	23 product awards	11 related accolades won by PETRONAS staff
Intellectual Property:	3X more patents	217 patents accorded to-date in 2018
FOF Deployment:	3 robotic applications	



INNOVATION GATEWAY @ PETRONAS

Have a technology you want to share with us? Scan the QR Code and submit your products to our Technology Marketplace and your innovative solutions in our next Technology Challenge.

*"I am pleased to see positive traction amongst industry players from our initiatives such as the PETRONAS Technology Challenge, and Technology Marketplace. There are innovations everywhere, and therefore I encourage industry players to move out of the comfort zones and challenge yourselves. The next **BIG IDEA** could be yours."*

MAZUIN ISMAIL
SENIOR VICE PRESIDENT
PROJECT DELIVERY & TECHNOLOGY
PETRONAS



PETRONAS Technology Gallery at PETRONAS Research Sdn Bhd (PRSB), Bangi, Selangor

GOING DIGITAL

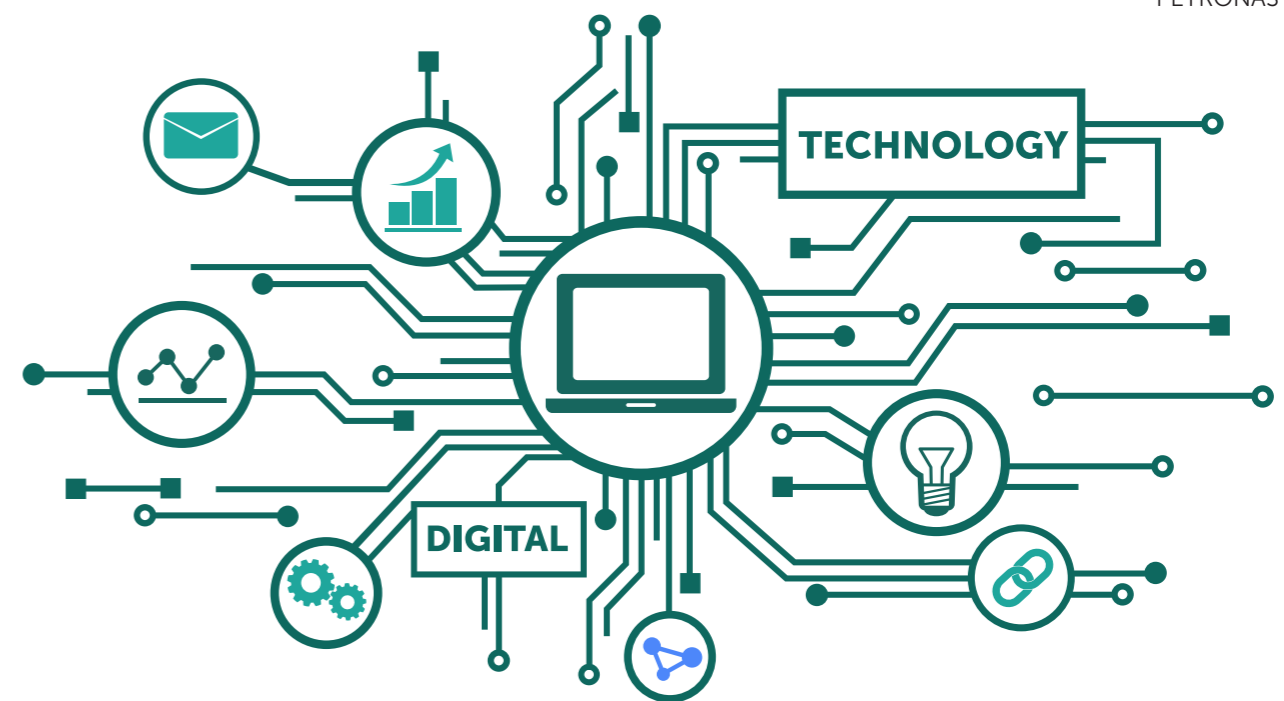
PETRONAS' DIGITAL JOURNEY

The oil and gas industry continues to transform as economic, technological and environmental factors drive changes across the value chain. Digital advancement is one of the key factors underpinning our business transformation.

PETRONAS is fully embracing this disruption head-on, as it recognises that going digital is not just about technology, but about culture and mindset. It is about being outcome-driven and about being obsessed with serving customers. Thus, our key objective is to remove customer frictions and serve even the latent, unmet needs of our customers, whether they are internal or external.

"PETRONAS is on a journey to orchestrate digital transformation across the organisation. Our ultimate aim is to make digital entrenched in the way we work. We aim to be a data-driven organisation, fundamentally changing the way we work to deliver new value. Our digital projects span across the value chain, from wells to plants, to customer-facing businesses"

WAN SHAMILAH SAIDI
CHIEF DIGITAL OFFICER
PETRONAS



Digital Procurement is a primary example of transformation at the core. We aim to push boundaries, by being data-driven and adopting new ways of working, in the procurement value chain of planning, transacting and managing inventories. Making the impossible possible, whilst creating a delightful user experience is becoming a new way of working for our procurement teams.

In essence, digital presents immense potential to capture and create new value. It will naturally open up new dimensions for collaboration between teams, and with our partners and suppliers, guided by data. Ultimately, organisations can be bolder in pushing boundaries and scaling new heights.

Shifting our mindset by adopting new ways of working to transform into greater heights

EMBRACING THE KEY BEHAVIOURS..



...TO CREATE A DIGITAL MINDSET

1. **Push the Boundary on Value at Pace**
2. **Challenge the Status-Quo**
3. **Change is Constant. Do Not Fear Change, Be Agile & Embrace It**
4. **It's OK to Fail But Fail Fast and Fail Small**
5. **We are One Team with the Power of Collaboration**

DIGITALLY ENHANCED AND EXCITING WAY OF WORKING IN PETRONAS PROCUREMENT "The DeeWOW"

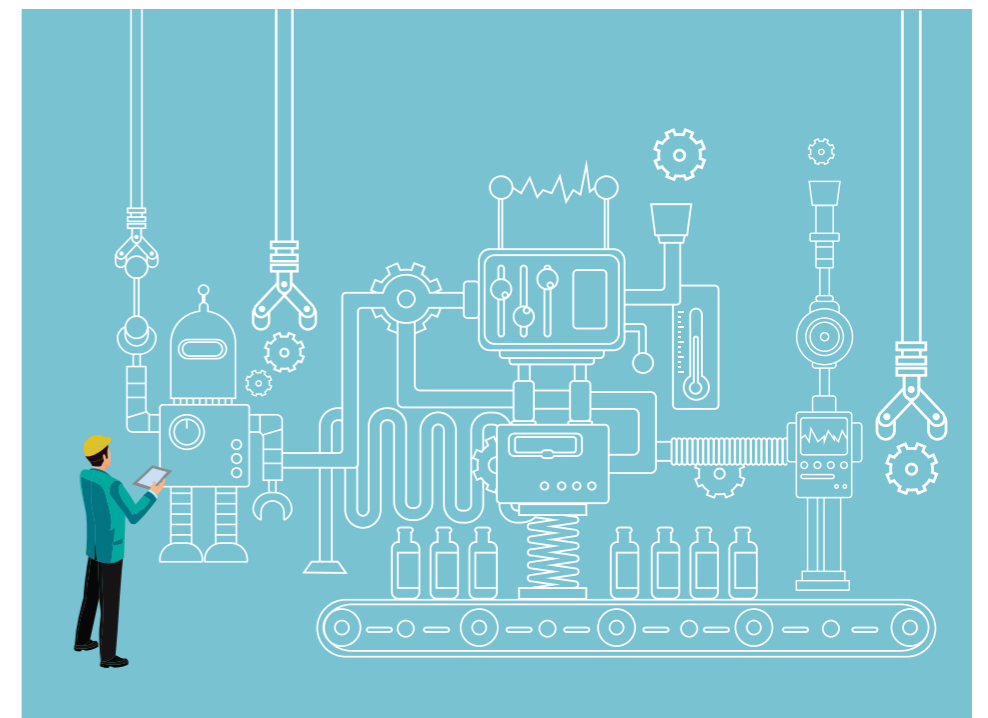
The world has changed, and there is no turning back. For the majority of organisations around the world, digital disruption is no longer an impending concern but the new normal. PETRONAS sees massive potential in digital, how it can unlock significant change and value.

One of the major impacts of this digital transformation is the cultural shift which will require PETRONAS to continuously challenge the status quo, experiment new ways of working and get comfortable with failures. This also means that we have to move away from the conventional long business processes as technology will force us to change the way we work.



Data lies at the core of digital. Today, the world's top performing companies are harnessing data for insights to make sharper and faster decisions, and ultimately unlock new values. It is PETRONAS' aspiration to become a data-driven organisation and Procurement is on its way to be part of this historical journey.

Being data-driven is not about seeing a few canned reports at the beginning of every day or week; it's about giving the decision-makers the power to explore data independently, even if they are working with big or disparate data sources.



Digital Procurement will transform the way we interact with our partners in the following ways and more.

ACTIVITIES	CURRENT PRACTICE	FUTURE
Bid Submission	<ul style="list-style-type: none"> Manual submission via physical documents 	<ul style="list-style-type: none"> Online submission via guided pages
Vendor Evaluation	<ul style="list-style-type: none"> Periodic report card on every six months 	<ul style="list-style-type: none"> Online and real-time performance reporting
Vendor Registration & Licensing	<ul style="list-style-type: none"> Manual submission 	<ul style="list-style-type: none"> Online registration and seamless approval
Material Purchase	<ul style="list-style-type: none"> Purchase Requisition (PR) to Purchase Order (PO), sourcing for every purchase 	<ul style="list-style-type: none"> Amazon-like web-based catalogues, system-based with minimal sourcing involved

Industries are embracing technology to reshape their operating landscape and reap the benefits of improved productivity, higher efficiency, and increased cost-savings. The oil and gas industry is not a stranger to this and is progressing towards digital maturity.

PETRONAS has embarked on a journey to digitally transform its Procurement function to be future-ready. This means PETRONAS has taken a leap to enhance its source-to-pay procurement platform that brings the full, end-to-end procurement spectrum into one fluid workflow. Designed as a flexible, cloud-native and open platform, this allows PETRONAS to harness the potential of emerging technologies, including Artificial Intelligence (AI), big data, blockchain, and the Internet of Things (IoT) to achieve truly transformative business outcomes.

With these changes taking place, not only numerous changes in the existing PETRONAS sourcing and contract management processes can be seen, PETRONAS is also taking a step further by leveraging digital to enhance collaboration with vendors across the industry. In addition to the enhanced Vendor Development Programme (VDPx) initiative that was launched in August 2018, digital tools are enabling PETRONAS to better predict demand for categories of spend, enabling us to provide more accurate signals to our vendors. PETRONAS is also revamping the supplier management system to make it more seamless for vendors to perform business with PETRONAS through a transparent supplier portal.

Digital Procurement puts a special emphasis on strategic procurement so that sourcing can be done strategically to its best extent. Our aim is to have our staff focus on more strategic functions while operational processes will be backed by automation. Strategic procurement functions will be supported by multiple digital tools as accelerators to assist in planning and analysis which will lead to precise decision-making and prevents value leakages.

With this transformation, PETRONAS and its related parties including suppliers and vendors will be impacted and experience the new way of working by end of 2019 to early 2020. Hence, let us get ready and be part of the journey.



PETRONAS Real Time Visualisation Centre (PRTVC)



DECOMMISSIONING

DRIVING LOW COST, BUILDING SKILLS & EXPERTISE

PETRONAS Carigali Tangga Barat Platform, Offshore Terengganu, Malaysia

Capturing Tail-End Values

What is Decommissioning?

Decommissioning is an activity to restore a previously producing site to a safe and environmentally stable condition which comprise:

- **Well Abandonment** is to prepare a well to be closed permanently usually after logs have determined that there is insufficient hydrocarbon to make production activities commercially viable, or after production operations have drained the reservoir.
- **Upstream Facilities Decommissioning** is to permanently make safe the facilities such as WHP & CPP and Subsea Tree, FPSO/FSO and Vent platforms at the end of production lifecycle or when there is insufficient hydrocarbon to make production activities commercially viable.

Opportunities in Decommissioning

Decommissioning is a rapidly developing market sector in the oil and gas business, with major potential and risks. It is a commitment to ensure proper Decommissioning efforts to minimise impact to our environment.

The key business driver for Decommissioning is cost management where opportunities to capture value span from late-life asset management to final decommissioning through collaboration, innovative technology and reuse/repurpose opportunities.

Focus areas:

- Value engineering
- Innovative removal method
- Collaboration across stakeholders ie authorities, operators and OGSE players

Decommissioning in Malaysia presents an interesting growth opportunity. Activities are expected to intensify as considerable assets have been operating beyond 40 years.

Malaysia O&G Asset Dimension

Facilities Distribution and String Inventory

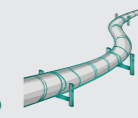


>300 platforms
>10000km pipelines
>3900 well strings

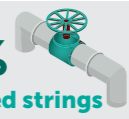
11% is operating more than 40 years



8% is operating more than 40 years



11% depleted strings
 200++ wells confirmed to be plugged and abandoned permanently



Uncertainty in oil price
 Challenges in balancing the oil price with the operational expenditure



Depleting reserves
 Remaining prospects and the risks that come with it



Potential market spend
 Various forecast suggested that Malaysia will be spending an enormous sum in the next 5 to 10 years



Associated Services

The following key services are required for Decommissioning:

Well Abandonment

- Drilling Rigs
- Hydraulic Workover Units (HWUs)
- Offshore Support Vessels (OSVs)
- Lifting Services
- Third Party Drilling Services including Slickline, Cementing, Fishing, Perforation-Wash-Cement etc.

Upstream Facilities Decommissioning

- Engineering Services
- Decommissioning yard/facility
- Transport and Lifting Services
- Decommissioning cutting services e.g.: Diamond Wire Cutting, Abrasive Water Jet Cutting, etc.
- Other Services such as Underwater, Decontamination, Remediation, etc.

Most of the required services are readily available but local OGSE players are expected to offer innovative cost effective business model to support Decommissioning requirements.

Decommissioning yard and facility is a requirement

Yard service providers shall be in compliance with relevant Acts, Regulations and Guidelines that may be applicable to the nature of work, technically suitable for Decommissioning activities, covering the following criteria:

Site Facilities

1. **Location** - Sea access for transportation, adequate deep draft quay proximity to supply chain e.g. waste treatment plant, smelting plant, specific area for dismantling and storage.
2. **Equipment** - Lifting cranes, cutting tools, liquid pumps, weighing station, Self Propelled Moduler Trailers (SPMT).
3. **Dismantling area** - Containment area to collect hazardous liquid and marine growth, covered area for Naturally Occuring Radioactive Material (NORM), dust handling and decontamination on works, water treatment system, segregation area for scraps and non-scraps.

Company Management System which covers:

1. HSEMS including occupational health and environment management
2. Management of contaminated steel and equipment
3. Pollution prevention
4. Waste water management
6. Liabilities management
7. Cumulative impact of activities and risk assessment
8. Quality management



Decommissioning Activity Outlook

Well Abandonment with different complexities

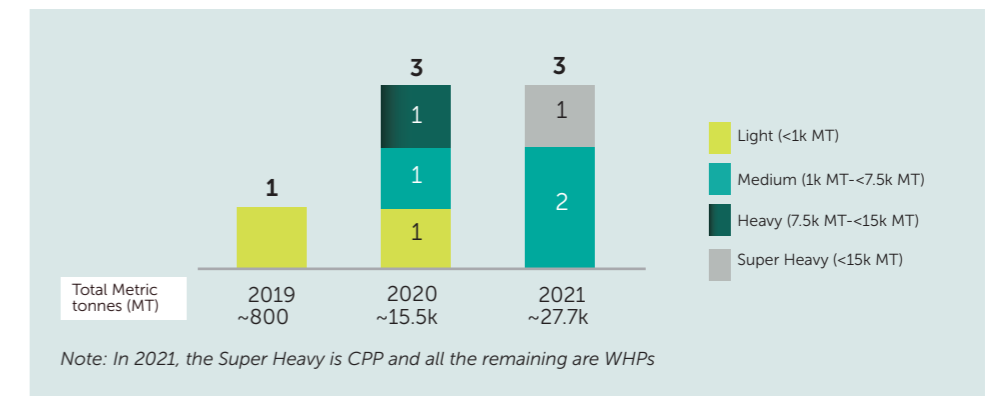
~50 Wells in 2019

~40 Wells in 2020

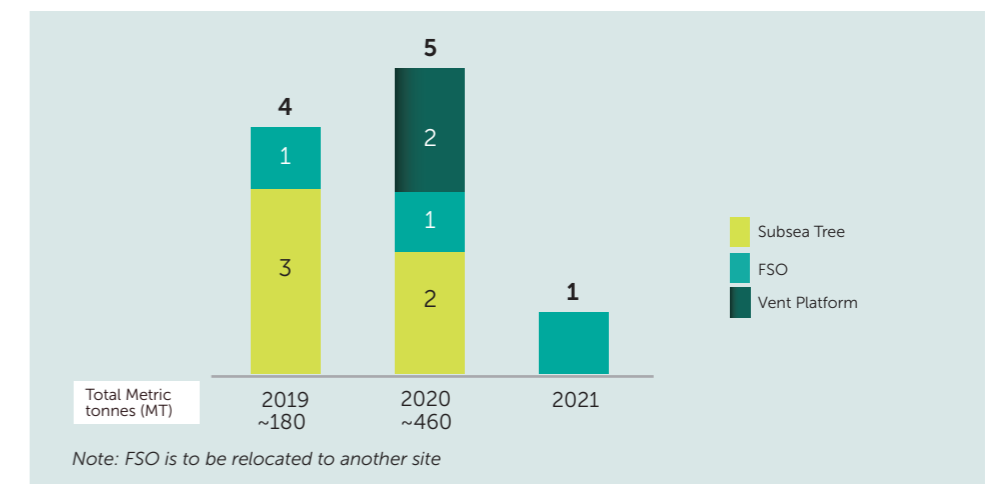
~60 Wells in 2021

Upstream Facilities

WHP & CPP (Topside & Jacket)



Subsea Tree, FSO and Vent Platform



TALENT LANDSCAPE

Sabah Sarawak Gas Pipeline (SSGP), Sarawak, Malaysia



MALAYSIA OGSE TALENT LANDSCAPE

A closer look into the current landscape and its three-year outlook

In 2018, PETRONAS embarked on an inaugural study to outline the Malaysia OGSE Talent Landscape with better clarity. A first-of-its-kind study of such scale, it covers PETRONAS vendors that play critical roles in core categories.

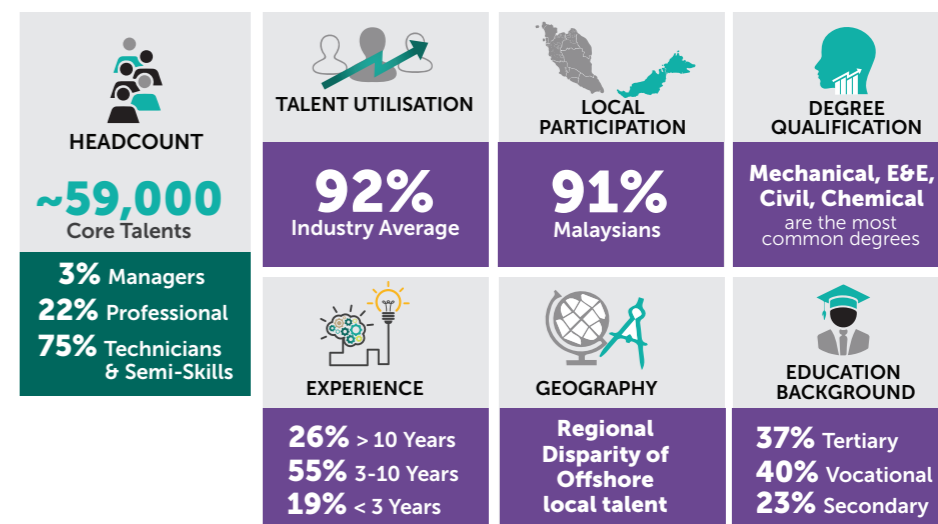
Study Sampling

Reaching out to over 83 key vendors and more than 500 smaller vendors to gain talent insights covering 27 different skill sets and 14 key categories from a total of 633 key positions extracted from PETRONAS key contracts. These are the key positions for our OGSE players to conduct services within the core categories.

This study **identifies talent shortages and excesses** across the industry based on categories and skill sets to aid players in making key decisions to manage workforce planning, improve skill demand projection and highlight talent competency gap in skills and qualification to meet industry needs.

The outcome of this study will help create an optimum and competent workforce in the industry.

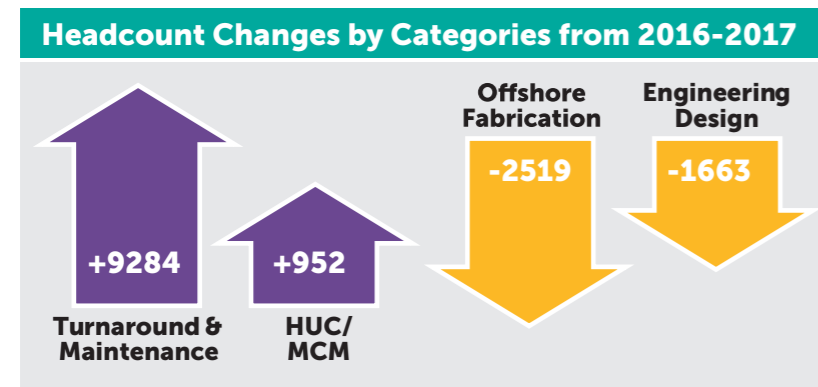
Quick Takes for OGSE Talent Landscape



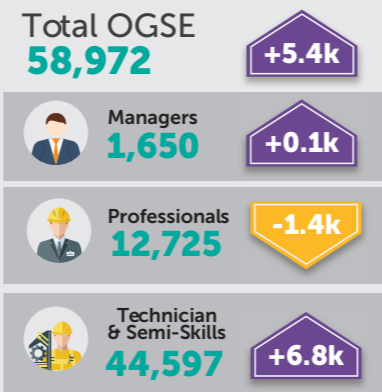
1. Talent Migration & Attrition

The outcome of our study allows us to better understand **talent dynamics** during the low oil price period whereby talents migrated from Offshore related projects (Offshore Fabrication) to maintenance related categories (Turnaround & Maintenance) that provide a more stable demand during low oil price. The biggest migration in 2016 to 2017 was from the category of Technicians and Semi-Skilled Workers such as Riggers, Fitters, Inspectors, Operator & Technical Support skill sets.

Professionals faced the highest attrition impacting 1,400 talents in 2017 due to fewer opportunities in Engineering Design, Wells and Marine Vessels.



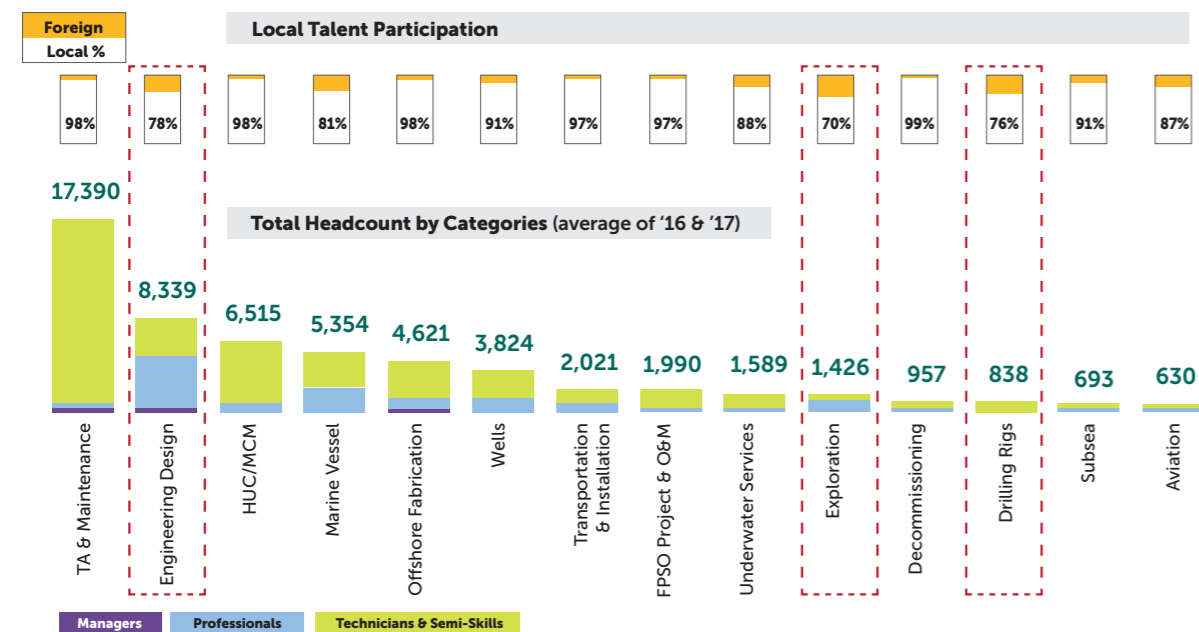
Finding Snapshot



Note: Figures based on normalisation from 40 per cent sampling.

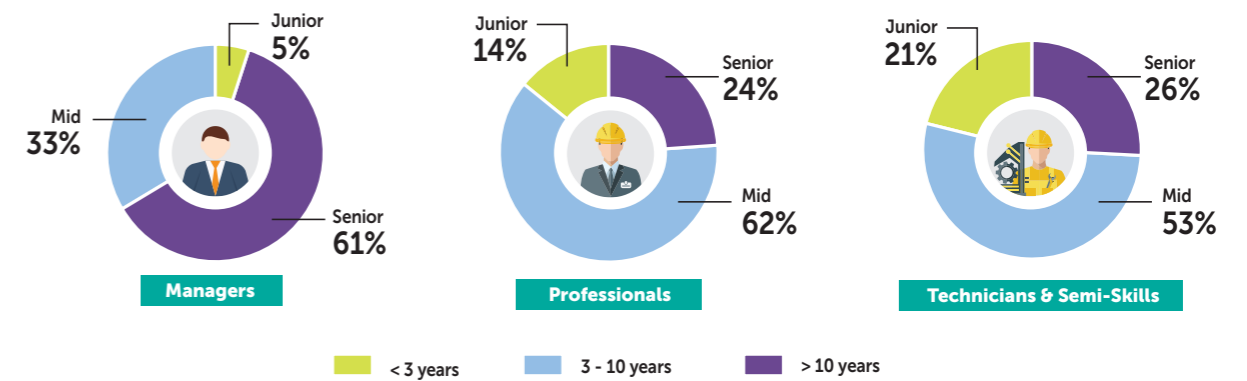
2. Local Talent Participation

Local participation is high across categories. **Turnaround & Maintenance employs the most local Technicians and Semi-Skilled talents. Drilling Rigs, Exploration and Engineering Design present opportunities to further increase local participation.** It is worth noting that the Engineering Design category employs the most professionals and a larger number of foreign expertise.

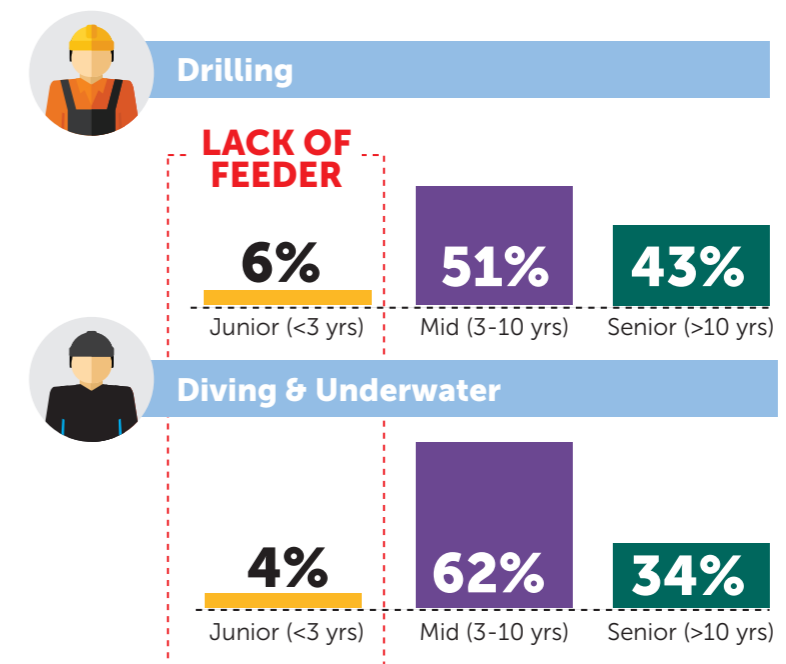


3. Talent Experience Gap

Our industry can benefit from a good mixture of junior and experienced seniors to ensure sustained capability and capacity. Generally, this industry has a good mix of junior entrants and experienced talents.



However, **Drilling and Diving & Underwater** skill sets have a notable experience gap as they are mostly filled by seniors with more than 10 years of experience and a lack of feeders. This requires urgent intervention by the industry for long-term sustainability.



4. Skill Imbalance

Getting relevant local talents for Offshore-related categories in Sabah and Sarawak remains a challenge but presents opportunities for local skill development.

Overcoming Current Challenges

Our industry must focus its efforts and collaborate to elevate the capabilities of the local workforce, with the following ways forward:

- **Accelerating junior entrance in Drilling and Underwater Services skill sets.** The two skill sets suffer from lack of local training providers and updated syllabus for competency certifications.
- **Easing the migration of common skills in offshore and onshore** such as Riggers & Fitters through proper scheduling and sequencing of activities allows optimisation, minimises pinching and provides job sustainability.
- **Attracting young Sabahans and Sarawakians to join offshore-centric programmes** offered at the existing O&G training facilities.
- Introducing **specific programmes to upskill local talents** in areas where our local players currently rely on foreign expertise. This is where the industry and training institutions can collaborate by providing technical expertise and financial support.
- Setting up training facilities to meet local vendors' internal talent demands. A greater collaboration between industry players, training institutions and government agencies can further **propel these independent small-scale solutions** towards a grander version to serve the whole industry.

Projected Three-Year Talent Outlook

Improved activities following market recovery will increase the demand projection from 58,000 to 80,000 talents. However, the impact of technology and digital is expected to increase labour productivity and reduce the manpower projection.

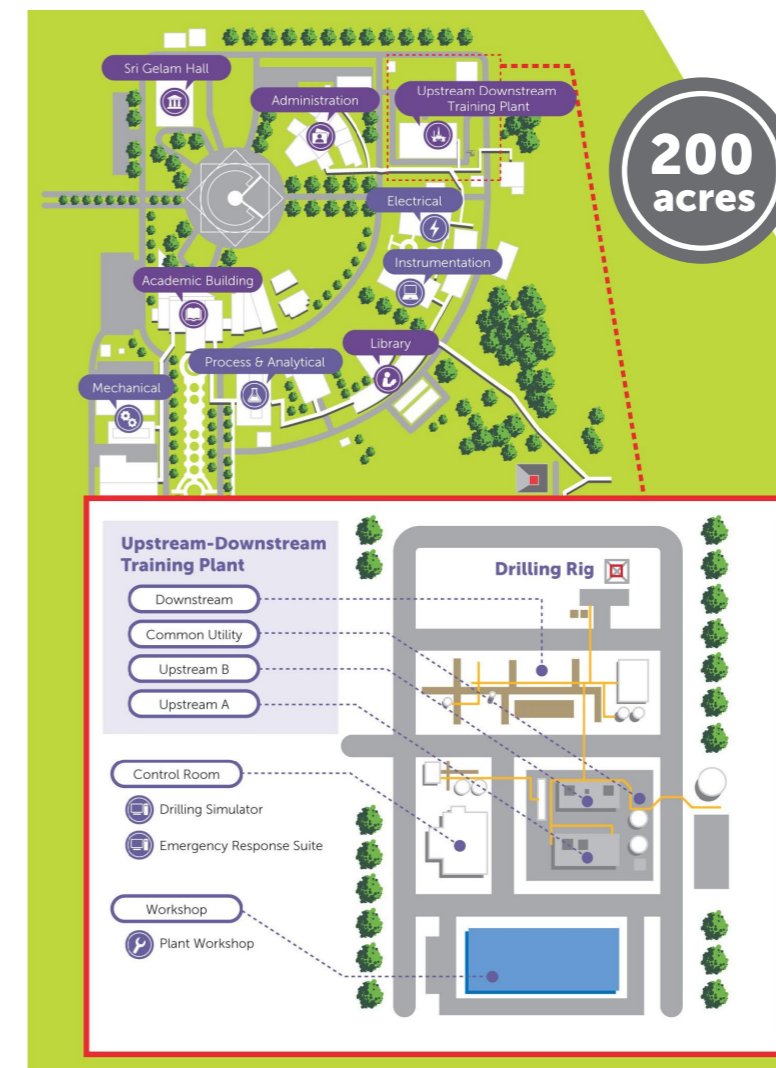
The whole ecosystem must plan early to ensure timely and sufficient talents are available to meet future demand for Industry 4.0 Revolution & Facilities of the Future. The 2018 World Economic Forum Report noted that the top 10 emerging talents is related to Industrial Revolution 4.0 such as Data Analysts & Scientists, AI, Machine Learning Specialists, Big Data Specialists and other related professions.

Look out for the three-year directional talent outlook for the respective key categories in the next segment

Upstream Downstream Training Plant

A GAME CHANGER

Institut Teknologi Petroleum PETRONAS (INSTEP) is a state-of-the-art technical training institution located by the shores of Malaysia's East Coast. Established in 1981, the facility was built to accelerate the development of human capital in the oil and gas industry through experiential learning in a simulated real-world training environment



Scan QR Code for INSTEP Virtual Tour
www.instep.my

INSTEP

INSTITUT TEKNOLOGI PETROLEUM PETRONAS



World Class Training Facility

Over **35 years** of oil and gas technical training experience

More Than **14,000** technical professionals trained since **1981**

Serving Clients From Over **35 countries**

Training Capacity **1,700** Trainees per year

Integrated **Upstream and Downstream** training facility

Real-World Training Environment to produce job-ready engineers and technicians

Industry-driven **Development Programmes** for engineers and technicians

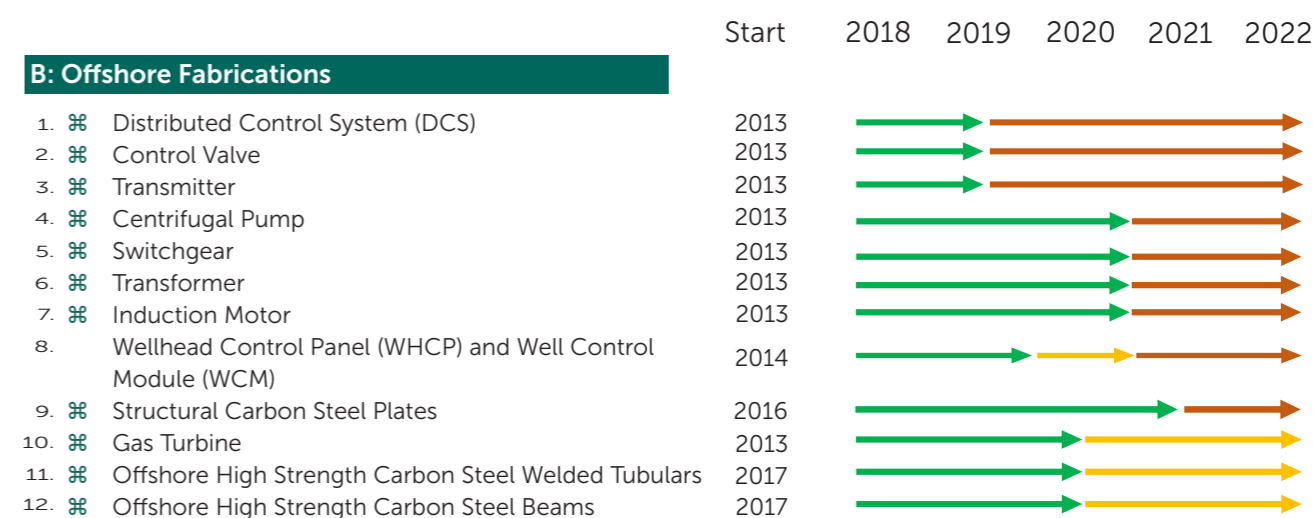
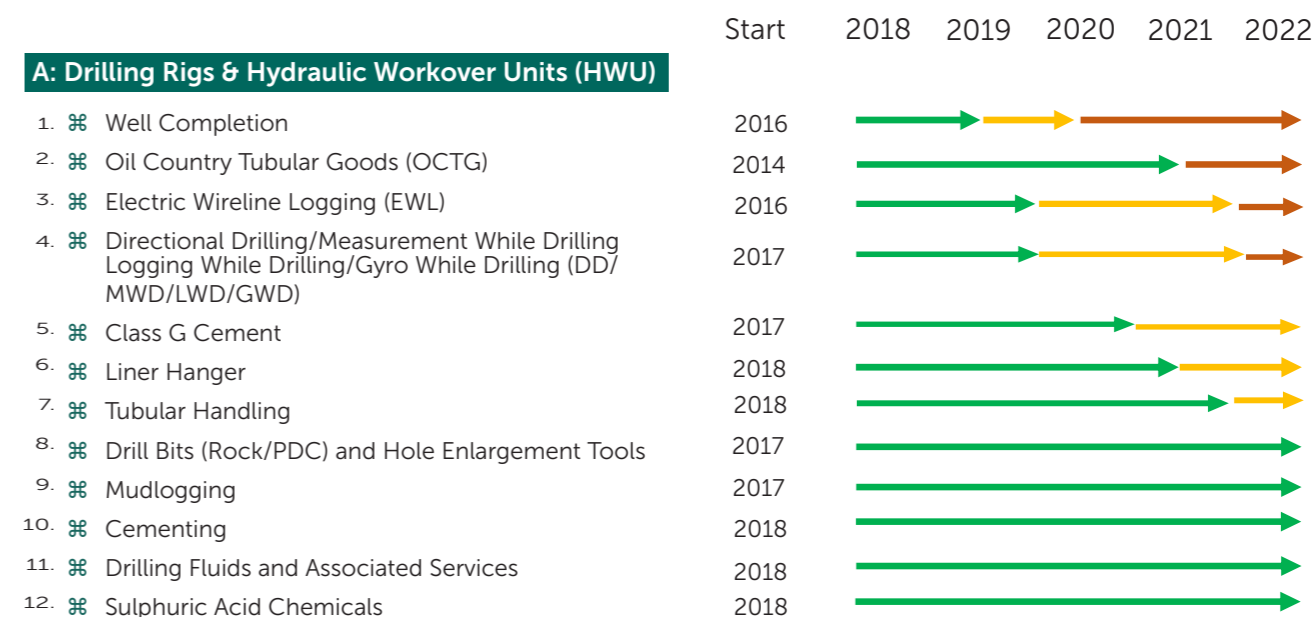
Competency-Based **Assesment & Certification** for industry workforce

Petroleum Technology **Programme** in Exploration & Production, Mechanical & Inspection, Process & Analytical, Electrical and Instrumentation

CONTRACTS OUTLOOK

PETRONAS Major Contracts in Key Categories & its Associated Services

This is the first time PETRONAS is sharing the list of major contracts in key categories and its associated services with the objective to provide industry players sufficient lead time to offer competitive proposals. As many of these key contracts are due for re-tendering in 2020-2021, this would be a good time for players to strategise on new technology offering and strategic partnership including manning, financial support, etc.



⌘ Pan Malaysia Contract ■ In Contract ■ Potential Extension ■ New Contract

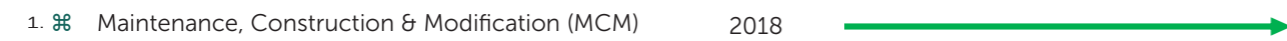
C: Linepipes and Flexible Pipes



D: Offshore Installations



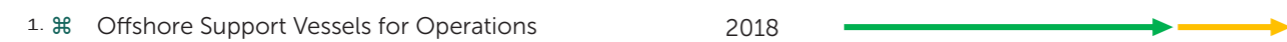
E: Hook-Up & Commissioning (HUC) and Modification, Construction & Maintenance (MCM)



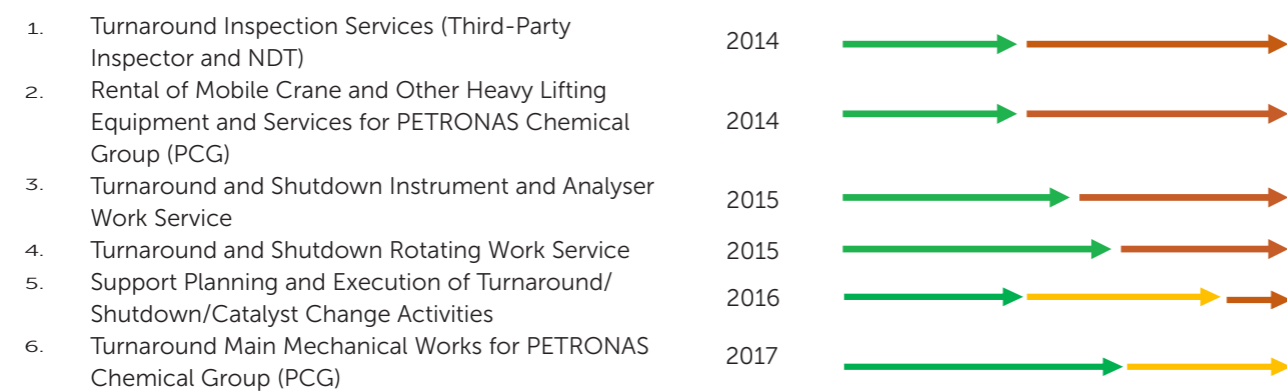
F: Underwater Services



G: Marine Vessels

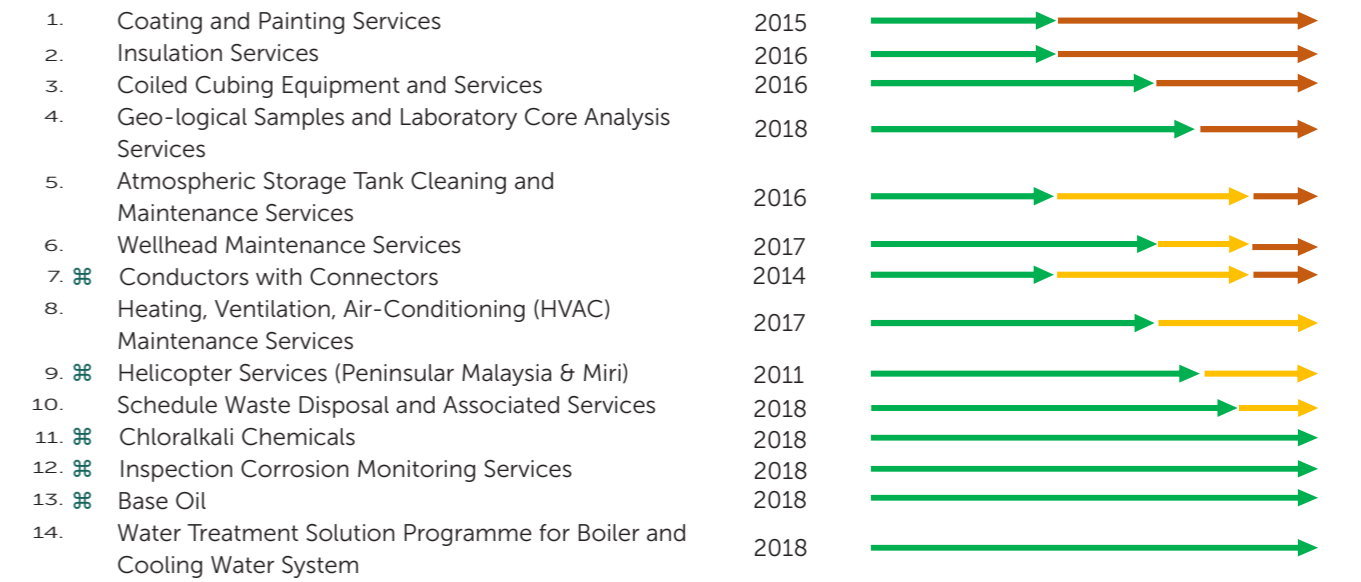


H: Plant Turnaround



☞ Pan Malaysia Contract ■ In Contract ■ Potential Extension ■ New Contract

I: Others



☞ Pan Malaysia Contract ■ In Contract ■ Potential Extension ■ New Contract

UPSTREAM MALAYSIA

PETRONAS Carigali NC3, SK316 Offshore Sarawak, Malaysia. This project achieved its first gas in 29 months after contract award - one of the fastest Offshore Gas Development Complex ever built.



METHODOLOGY

Scope of Coverage

This section provides activity outlook for **core categories**; serving as **leading indicators** to many other supporting services. Given the **interdependencies** of these activities, it presents **multiplier-effects** across the value chain.

For **Upstream**-related information, this Report covers the activity outlook for Malaysia. This includes activities from **PETRONAS Group of Companies** and other **Petroleum Arrangement Contractors (PACs)**. Activities governed under the Malaysia-Thailand Joint Development Area (MTJDA) are excluded from this Report.

For **Downstream**-related information, this Report covers the activity outlook for PETRONAS Group of Companies in Malaysia only.

Time Horizon

The Report provides information on activities within a **three-year period, from 2019 to 2021**. Information is accounted for when a **specific activity begins** and **not by contract award**. Using Offshore Fabrication as an example, we report the date of the first steel-cut instead of the date of Engineering, Procurement, Construction, Installation and Commissioning (EPCIC) contract award.

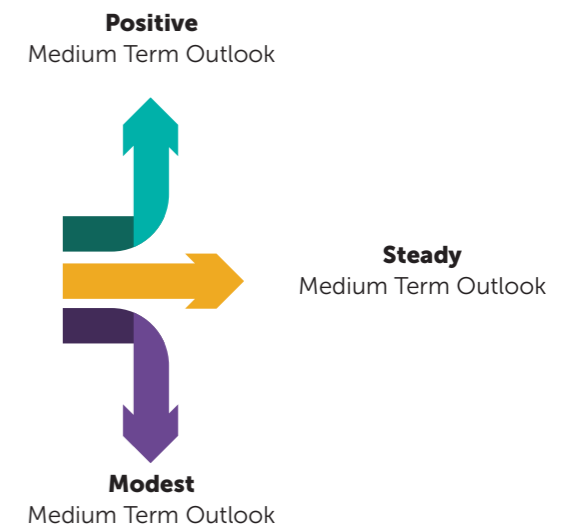
Outlook numbers include activities which may have been contracted at the time of reporting. Optimisation, sequencing efforts (e.g. impact of contracting strategy or long-term activity sequence) and multi-year activities are not reflected. For example, an installation project from December 2018 to January 2019 is only accounted for once in 2018.

Directional narratives are provided for the medium-term (i.e. post-2021), to support outlook analysis using the following signposts:

Low & High Case Scenarios

Outlook numbers for most categories are provided via a lower and upper band:

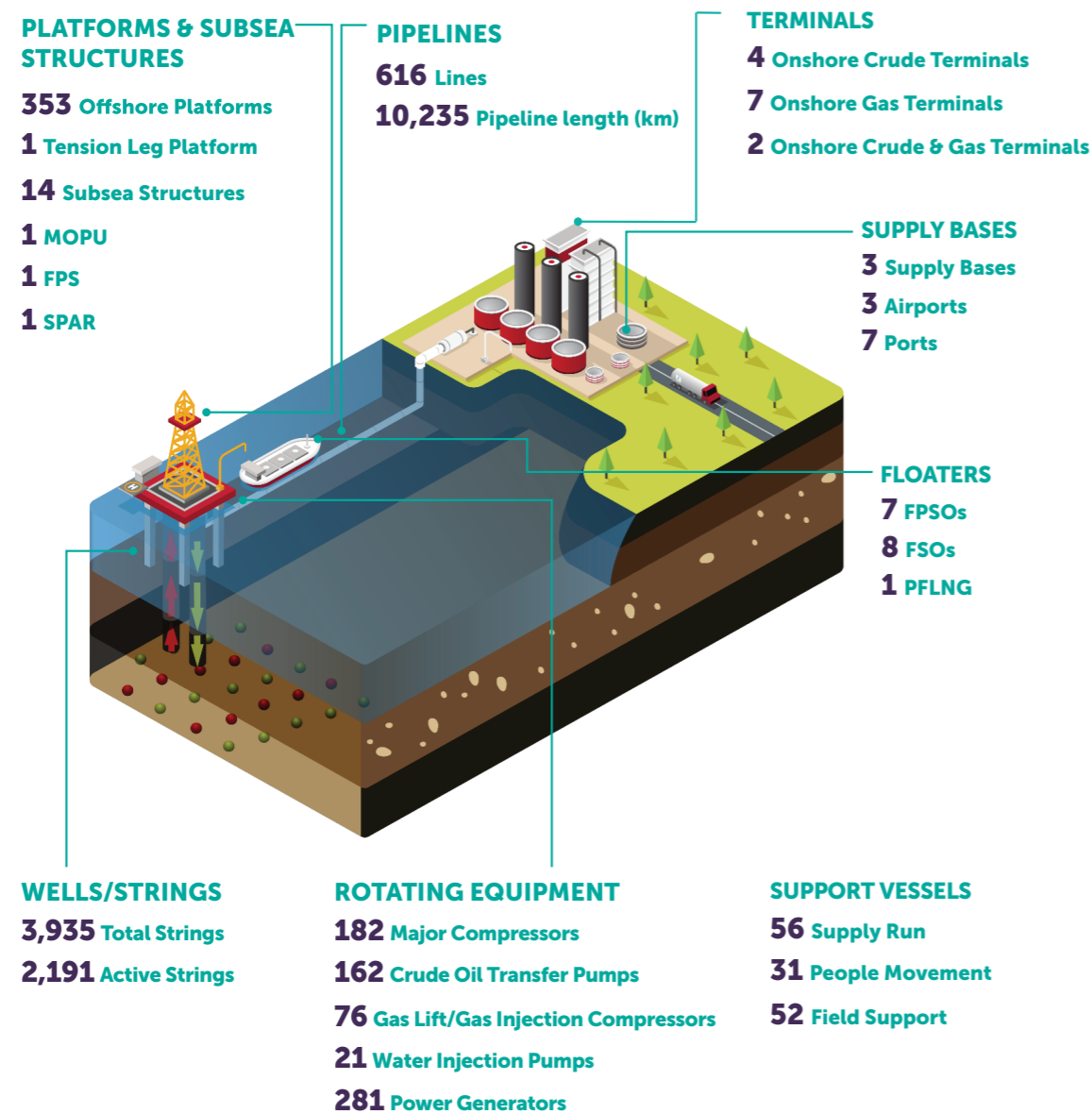
- **Low Case** – Activities with high probability of occurrence; high project maturity and certainty of requirement
- **High Case** – Activities with lower probability of occurrence; lower project maturity and certainty of requirement



UPSTREAM OVERVIEW

As the custodian of Malaysia's petroleum resources, PETRONAS is focused on pursuing sustainable value-driven production growth, monetising oil and gas resources, strengthening core capabilities and building niche competencies.

The below is a snapshot of Upstream Malaysia facilities dimensions, operated by 26 PACs as at March 2018.



PROJECT PORTFOLIO

An average of ~1.7Mboe/d production is forecasted over the next five years. Upstream Malaysia has a robust pipeline of potential projects focused on **developing new growth areas or "Greenfield Projects" and maximising ultimate recovery of existing fields or "Brownfield Projects"**. PETRONAS and its PACs will continue to mature potential Development projects technically and commercially, within its portfolio to sustain the desired production level.

Projection of Development portfolios between 2019 and 2021 are as follows:



GREENFIELD

~20 projects with ~30% of these projects being oil projects.

All with **new facilities** development.



BROWNFIELD

~30 projects with ~75% of these projects being oil projects.

~10% involve **new facilities** development.

Quick Reference for 2019 Upstream Activity Outlook

Drilling Rigs & HWUs

- 16-18 Jackups
- 3-4 TADRs
- 5-6 HWUs

Offshore Fabrications

- 5-6 WHPs
- 1-2 CPP

Linepipes/ Flexible Pipes

- 97km Carbon Steel
- 24-26km Flexible Pipes

Offshore Installations

- 8-9 projects for Heavylift barge
- 3-4 projects for Pipelay barge

HUC & MCM

- 4.9 Million man-hours for HUC
- 17.7 Million man-hours for MCM

Floaters

- 1 Aframax

Underwater Services

- DP2 Support Vessels
- 2-3 300m²
- 6-7 500m²
- 4-5 700m²

Marine Vessels

- 38-44 vessels for AHTS >100MT
- 67-72 vessels for AHTS =<100MT
- 49-52 vessels for PSVs/SSVs
- 80-83 vessels for FCBs

Decommissioning

- 1 WHP
- 3 Subsea Tree
- 1 FSO
- 50 Wells

Activity phase:

■ Exploration
 ■ Development
 ■ Operation
 ■ Abandonment

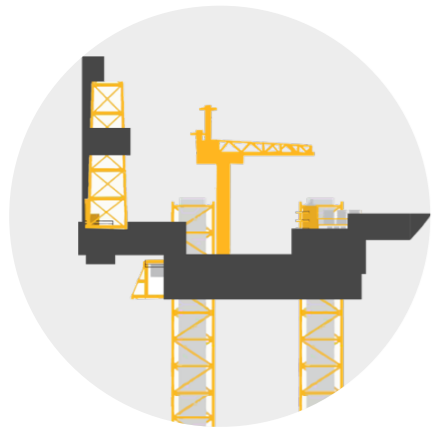


PETRONAS Carigali Angsi Platform
Offshore Terengganu, Malaysia

A Drilling Rigs and Hydraulic Workover Units (HWUs)

Drilling rig refers to the machine used to drill a wellbore. For the purpose of this Report, activity outlook will be provided for the most widely used drilling rig types in Malaysia i.e. Jackup Rigs and Tender Assisted Drilling Rigs (TADRs).

Workover refers to any well intervention process which helps to 'repair' the wells using an invasive technique.



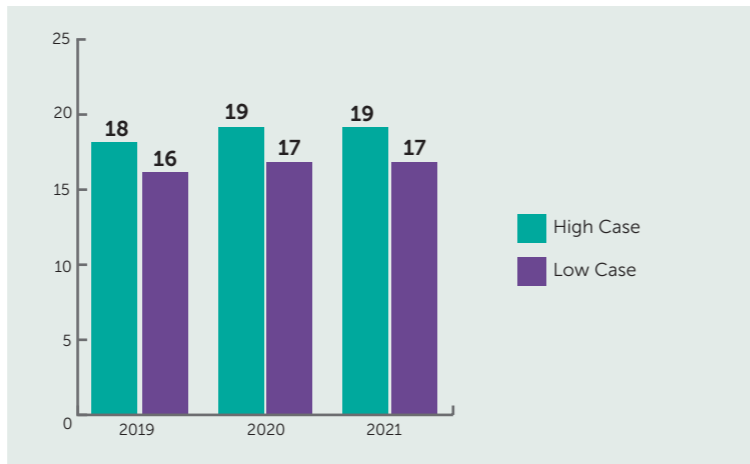
Jackup Rigs (JURs)

Activity Phase: Exploration, Development, Abandonment

Application: The most common type of offshore rig due to its flexibility. Jackup Rigs are self-elevating with removable legs that can be extended ("jacked") above or below the hull.

Associated Services: Supporting vessels, OCTG, third-party drilling services e.g. drilling fluids, DD/MWD/LWD, wellheads, drill bits, cementing, fishing, slickline, etc.

No. of Rigs: Three-Year Outlook



- Notes:**
- As at Oct 2018, there was an average of 9-10 JURs in Malaysian waters.
 - Outlook includes activities which may have been contracted out, based on specific activity requirements; at the time of reporting.
 - The number includes the requirement for JUR during Well Abandonment activity.
 - Outlook numbers are based on full-year utilisation. Actual numbers may vary based on campaign duration and/or optimisation, project deferment or cancellation.

Medium Term Outlook – Post 2021

- Positive outlook in JURs are mainly driven by focus on quick monetisation capturing opportunity in volatile markets. More Brownfield projects - in particular Infill Drilling, are to be carried out.
- It is imperative for local JURs to remain competitive, to withstand cost pressures from international players.



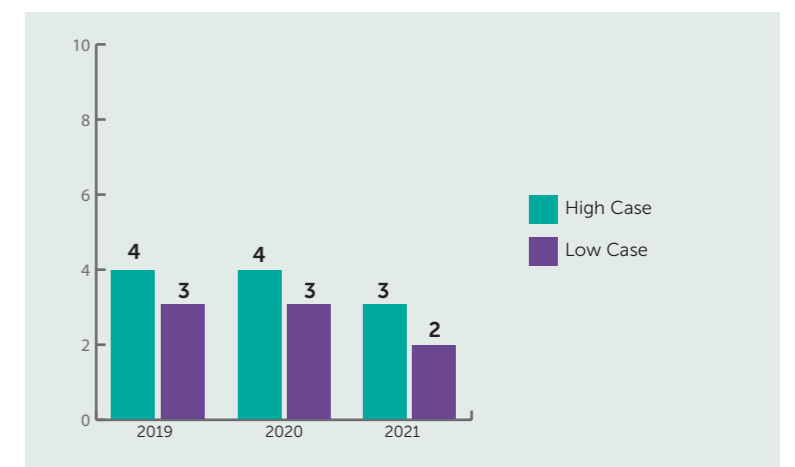
Tender Assisted Drilling Rigs (TADRs)

Activity Phase: Development

Application: Typically used on platforms designed for tender assisted rigs where there is an approachability limitations.

Associated Services: Supporting vessels, OCTG, third party drilling services e.g. drilling fluids, DD/MWD/LWD, wellheads, drill bits, cementing, fishing, slickline, etc.

No. of Rigs: Three-Year Outlook



- Notes:**
- As at Oct 2018, there was an average of 2-3 TADRs in Malaysian waters.
 - Outlook includes activities which may have been contracted out, based on specific activity requirements; at the time of reporting.
 - Outlook numbers are based on full-year utilisation. Actual numbers may vary based on campaign duration and/or optimisation, project deferment or cancellation.

Medium Term Outlook – Post 2021

- Steady outlook can be expected for TADRs, mostly from Infill Drilling campaigns.
- For Development projects, requirement is highly dependent on platform design and cheaper options like Jackup Rig.



Did you know?

For Infill Drilling projects, typically rig types are chosen based on the original rig type used during Development drilling.



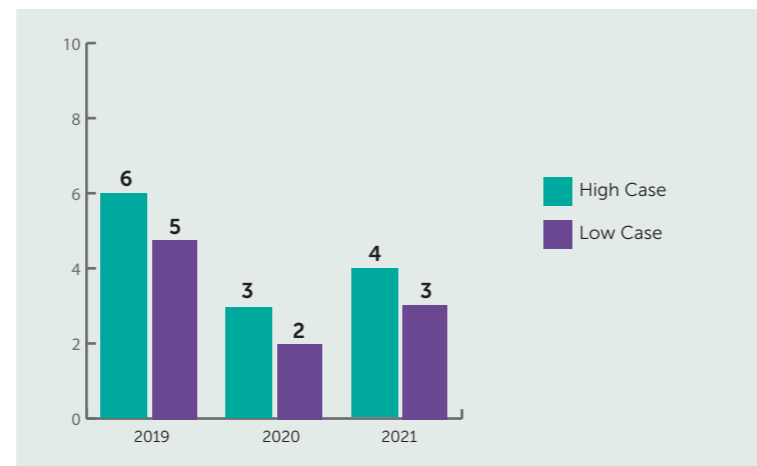
Hydraulic Workover Units (HWUs)

Activity Phase: Operation, Abandonment

Application: Performs various workover operations e.g. well casings and casing levels repair, sand cleanout, change out completions, etc.

Associated Services: Supporting vessels, slickline, wellhead services, cementing, fishing, e-line etc.

No. of HWUs: Three-Year Outlook



Notes:

- As at Oct 2018, there was an average of 2-3 HWUs in Malaysian waters.
- Outlook includes activities which may have been contracted out, based on specific activity requirements; at the time of reporting.
- The number includes the requirement for HWU during Well Abandonment activity.
- Outlook numbers are based on full-year utilisation. Actual numbers may vary based on campaign duration and/or optimisation, project deferment or cancellation

Medium Term Outlook – Post 2021

- Steady outlook for HWU. HWU can be used for Well intervention either for well re-activation or abandonment; both are sensitive to oil price dynamics.
- Its application is driven by cost competitiveness as it can be substituted by rig-less solutions.

Category Talent Insights

Industry to provide more opportunities for local fresh talents entering into this category. In addition, this is an opportunity for local personnel to be trained to occupy senior positions in rigs operations; reducing dependency on foreign talents.

B Offshore Fabrications

Offshore Fabrications refer to construction of offshore structures (e.g. Topsides, Jackets) and first steel-cut as the indicator for commencement of construction activity.



Wellhead Platforms (WHP)/ Central Processing Platform (CPP)

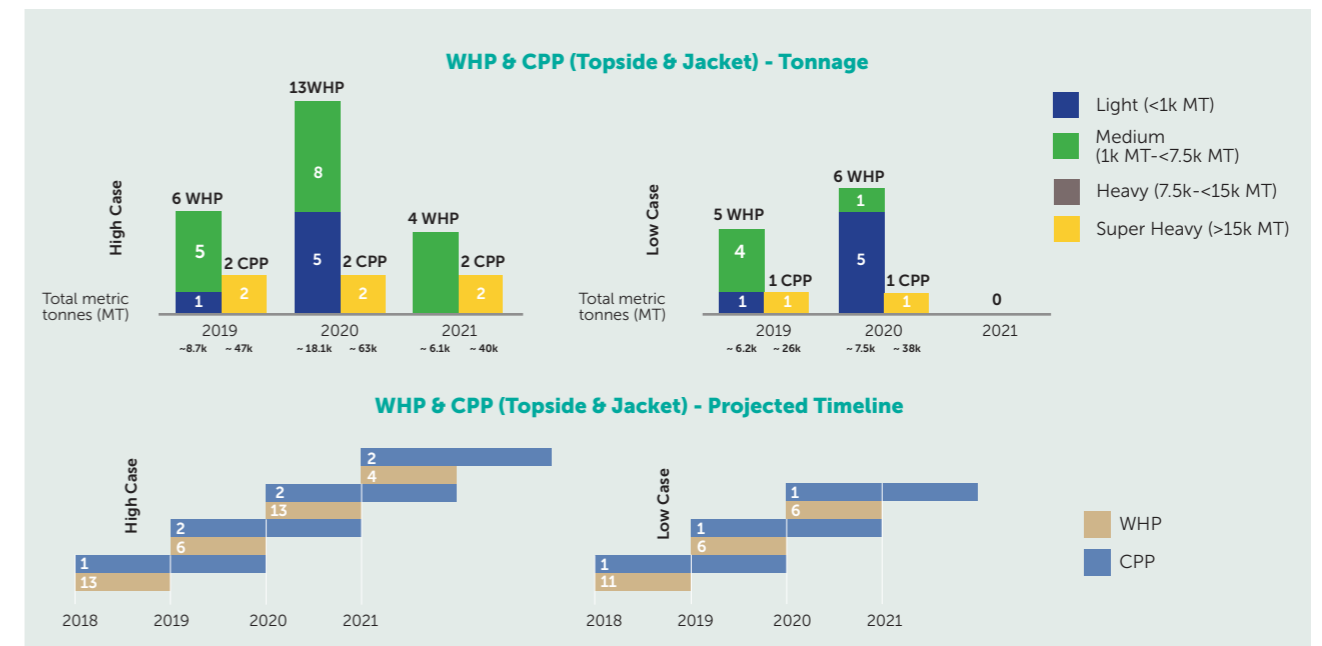
Activity Phase: Development

Application (WHP): Used to produce oil/gas or serve as a platform for drilling activities. Typically, it is linked to CPPs or Floaters.

Application (CPP): Processes oil, gas, and water from WHPs and transports to point of export. Normally act as the centralized platform for entire field complex.

Associated Services: Engineering, Structural Steel, bulk materials (e.g. piping, cables, etc.), equipment supplies (e.g. mechanical, Electrical, Instruments, etc.)

No. of Structures: Three-Year Outlook



Notes:

- As at Oct 2018, there are 10 WHPs and 1 CPP undergo construction.
- Weight (Tonnage) provided above is for Topside & Jacket and excludes Piles & Conductors.
- Outlook includes activities which may have been contracted out at the time of reporting. A new Frame Agreement is currently being established to cater for future requirements throughout Malaysian waters.

Category Talent Insights

High migration to Downstream during low oil price period. Semi-skilled especially Riggers/ Fitters and Inspectors can benefit from ease of cross-migration within sector, for job sustainability.

Medium Term Outlook – Post 2021

- Steady outlook is expected for WHPs. With the stable movement of oil prices, more new Development projects which are currently in planning, will mature.
- Modest outlook can be expected for CPPs, as cost competitiveness drives Development projects to opt for WHP tie-ins to existing nearby facilities, instead of fabricating new CPPs.
- Fabricators and engineering design consultants are encouraged to collaborate, eventually building an in-house expertise to build local end-to-end capability.

C Linepipes

Linepipes and Flexible Pipes are used to transport oil or gas between facilities. For the purpose of this Report, Linepipes refer to supply of Carbon Steel (CS) Linepipes.



Linepipes (Rigid)

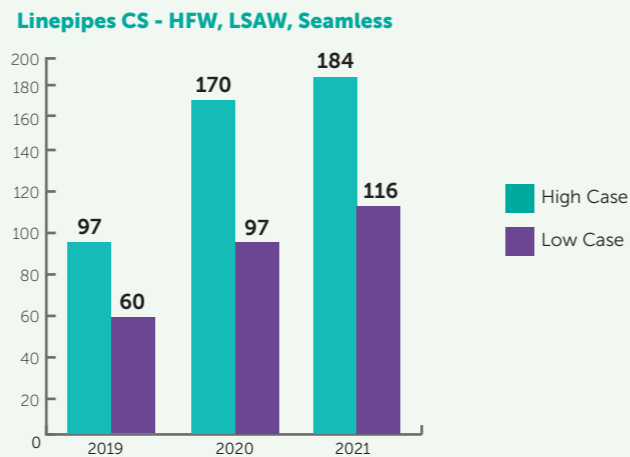
Activity Phase: Development

Application (Linepipes): Generally used for longer distance, typically from platform to onshore plant.

Application (Flexible Pipes): Generally for shorter distance, typically for inter-platforms.

Associated Services: Engineering, pre-commissioning services, logistics, coating services (only for Linepipes)

Total Length (km): Three-Year Outlook



Notes:

- As at Oct 2018, there were 97km linepipes procured.
- Outlook includes activities which may have been contracted out at the time of reporting – for new development projects only, excluding pipeline replacements, water & process pipes. Flexible Pipes, outlook excludes umbilical & pipe spool.
- For Linepipes, a groupwide Frame Agreement was established with panel of vendors and is expiring in the near future.
- For Flexible Pipes, a Frame Agreement was established for PCSB only and is also expiring in the near future.

In addition, requirements for:

- Linepipes Cladded Corrosion Resistant Alloy – 2-3km in 2019 and 25-30km in 2020.
- Flexible Pipes – 24-26km in 2019. Many projects plan to utilise flexible pipes for inter-platform in 2019.

Medium Term Outlook – Post 2021

- Steady outlook for Linepipes CS. It is still seen as the main option for longer distance pipeline requirements.
- A healthy competitive tension is highly encouraged in Flexible Pipes segment.



Did you know?

Non-Metallic Pipes (NMP) are gaining traction for Pipeline Replacement Project, as its quality and cost is seen as a good alternative to the traditional selection.

D Offshore Installations

For the purpose of this Report, Offshore Installations refer to activities involving the installation of structures (i.e. WHPs and CPPs) and pipelines using installation barges.

Activities are measured in terms of number of projects for each type of barge. Number of offshore days for each activity may vary.



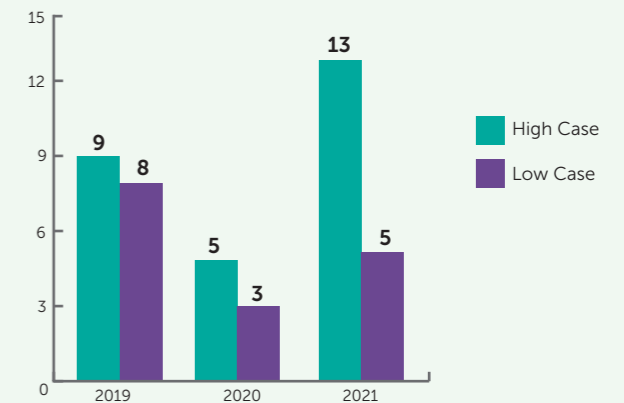
Structural Installation – Heavylift

Activity Phase: Development

Application: Used for installation of jackets (for WHPs and CPPs) and topsides (for WHPs).

Associated Services: Supporting vessels, diving and ROVs, welding and NDTs.

No. of Structural Installation: Three-Year Outlook



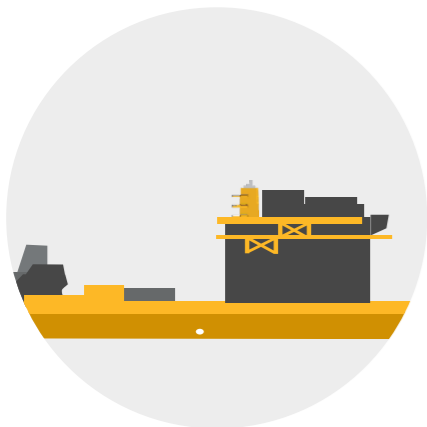
Notes:

- As at Oct 2018, there were 3 Heavylift campaigns.
- Outlook number is measured by number of campaigns/projects and its duration may vary.
- Outlook includes activities which may have been contracted out at the time of reporting. Utilisation can be via Frame Agreement or bundled under EPCIC scope.
- Frame Agreement for panel of Heavylift & Pipelay barges will expire in 2019/2020.

Increase in activity for WHP in 2018 directly correlates with increase in heavylift activity for 2019.

Medium Term Outlook – Post 2021

- Steady outlook for Heavylift barges can be expected in line with WHPs outlook.
- Decommissioning of Offshore Facilities increases activity level for Heavylift, subject to cost competitiveness.
- New technologies may exert cost pressures on traditional Heavylift barges.



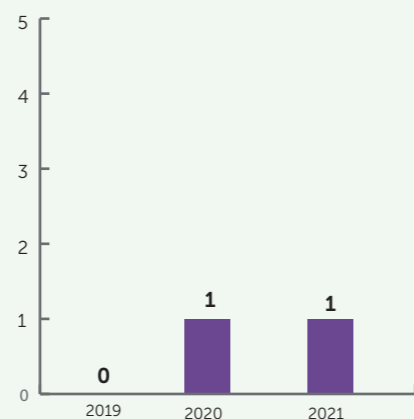
Structural Installation – Floatover

Activity Phase: Development

Application: Used for installation of heavier or integrated topsides (for CPPs)

Associated Services: Supporting vessels, diving & ROVs, welding & NDTs

No. of Structural Installation: Three-Year Outlook



Activity is expected to remain stable over the next three years, thus no High Case is provided.

Notes:

- Outlook number is measured by number of campaigns/projects and its duration may vary.
- Outlook includes activities which may have been contracted out at the time of reporting. Typically Floatover requirement is bundled under the EPCIC scope.



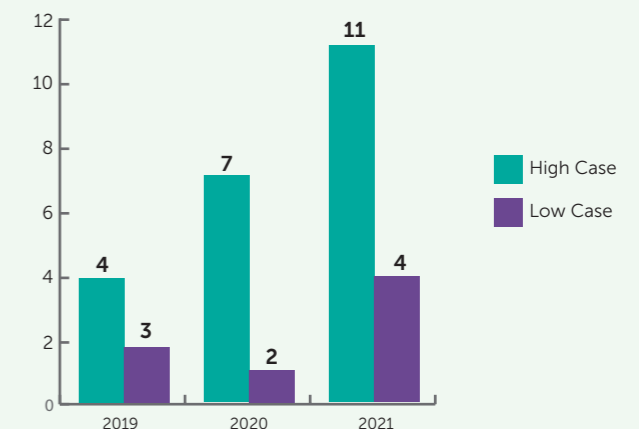
Pipeline Installation – Pipelay

Activity Phase: Development

Application: Used to install Linepipes (Rigid) for offshore Development projects and pipeline replacements during Operations.

Associated Services: Supporting vessels, diving & ROVs, fill joint coating services, welding & NDTs.

No. of Pipeline Installation: Three-Year Outlook



Notes:

- As at Oct 2018, there were 2 Pipelay campaigns.
- Outlook number is measured by number of campaigns/projects and its duration may vary.
- Outlook includes activities for new projects only, excluding pipeline replacements; which may have been contracted out at the time of reporting.
- Frame Agreement for panel of Heavylift & Pipelay barges will expire in 2019/2020.



Medium Term Outlook – Post 2021

- Modest outlook can be expected for Floatover barges with lower number of CPP projects being awarded.



Medium Term Outlook – Post 2021

- Steady outlook can be expected for Pipelay barges as it directly correlates with activity for Linepipes (Rigid) in new Development projects.



Did you know?

For a typical Offshore Development project (EPCIC), Offshore Installations cost is a key driver to overall project cost.



Category Talent Insights

Local talents in this segment especially semi-skilled are encouraged to look for opportunities in other categories; such as HUC & MCM and in Downstream sector such as Turnaround & plant maintenance.

E Hook-Up & Commissioning (HUC) and Maintenance, Construction & Modification (MCM)

Hook-Up & Commissioning (HUC) ties in all components of the facilities including all functioning tests and start-up of facilities.

Maintenance, Construction & Modification (MCM) covers activities related to the repair and maintenance of existing topside facilities. Typically, MCM campaign will be executed every five to eight years to ensure production sustainability.

Both HUC and Offshore MCM are grouped together, as they generally have similar manpower and equipment requirements. Given that both activities are labour intensive, activity outlook is stated in man-hour units.



Hook-Up & Commissioning (HUC)

Activity Phase: Development, Operation

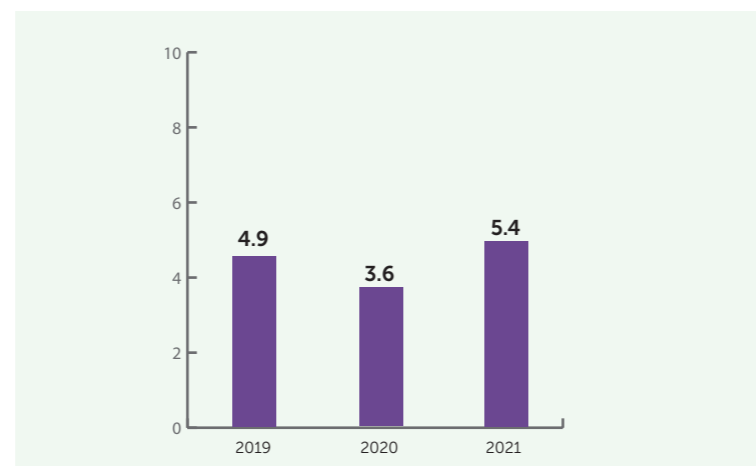
Application: Greenfield HUC involves works on newly installed platforms during Development stage. Typically bundled as part of EPCC/EPCIC contracts. Brownfield HUC involves works on existing offshore facilities and equipment; including rejuvenation/ redevelopment, general topside modification, infill drilling activity, etc.

Associated Services: Marine Spread (Accommodation work barge, workboat, FCB), logistic services, precommissioning services, inspection services etc.

Notes:

- Outlook includes activities which may have been contracted out at the time of reporting.

No. of Man-hours (Millions): Three-Year Outlook



Most activities accounted are for Brownfield HUC. HUC activities are expected to remain stable over the next three years, thus no High Case is provided.

Medium Term Outlook – Post 2021

- Steady outlook can be expected as Brownfield HUC will persist due to the increasing number of projects and ageing facilities; despite continuous effort to reduce cost via scope optimisation.



Maintenance, Construction & Modification (MCM)

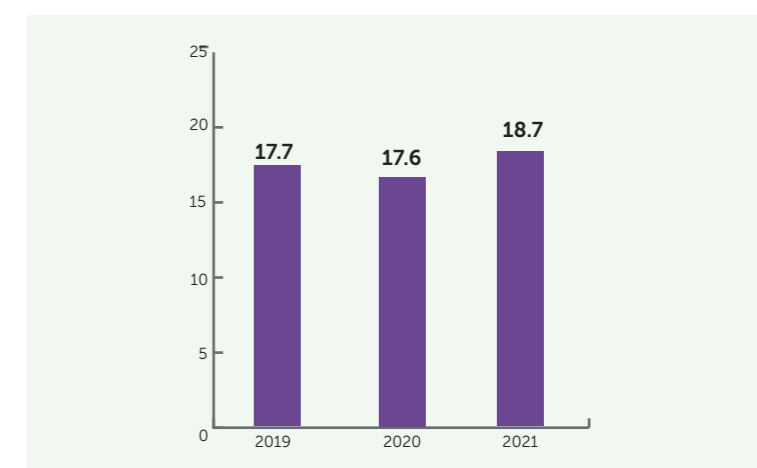
Activity Phase: Operation

Application: Formerly known as Topside Major Maintenance (TMM), MCM involves two types of activities for Offshore facilities:

- Scheduled Maintenance: Planned activities.
- Corrective Maintenance: Unplanned activities arising from unforeseen circumstances.

Associated Services: Supply Vessel, Inspection Services, Blasting, Painting Services etc.

No. of Man-hours (Millions): Three-Year Outlook



Activity is expected to remain stable over the next three years, thus no High Case is provided.

Medium Term Outlook – Post 2021

- Positive outlook can be expected for MCM activities due to the cyclical nature of maintenance activities; inclusion of less priority scope and increase of oil price has contributed to the demand for MCM work.
- However, cost pressure will continue to drive further scope optimisation/prioritisation.

Category Talent Insights

Industry players are urged to proactively plan and develop talent base to support uptrend in activities, especially for cross-categories skill sets such as Riggers/Fitters and Welders; to avoid talent pinching and sustainability of operations.

F Floating Offshore Facilities (Floaters)

For the purpose of this Report, **Floating Offshore Facilities (Floaters)** refer to Floating Production Storage & Offloading (FPSO) and Floating Storage & Offloading (FSO) units; non-fixed structures involved in processing and/or storage of hydrocarbons.



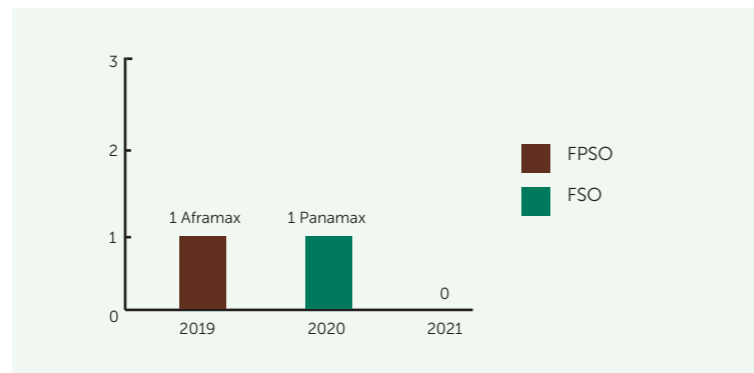
FPSOs / FSOs

Activity Phase: Development

Application: Used for production, processing, storage and offloading. FSO is essentially a simplified FPSO without the capability for oil or gas processing.

Associated Services: Engineering, structural steel, equipment supplies (e.g. mechanical, electrical, instruments, etc.), shipyards.

No. of FPSOs/FSOs: Three-Year Outlook



Activities are expected to remain stable over the next three years, thus no High Case is provided.

Notes:

- Outlook includes supply of Floaters (i.e. conversions and new-builds), which may have been contracted out at the time of reporting.
- For Floaters, contracts will be based on specific project requirements.

Medium Term Outlook – Post 2021

- Modest outlook can be expected for Floaters as fewer marginal fields and deepwater Developments project are in the pipeline.



Category Talent Insights

Minimal local talent impact from oil price market dynamics. Talent demand is expected to be stable and moderate.

G Underwater Services

For the purpose of this Report, **Underwater Services** category uses supply of Dynamic Positioning 2 (DP2) Support Vessel as leading indicator, excluding the supply of equipment and manpower; i.e. divers and vessel such as Hyperbaric Rescue Vessel (HRV) and Side Scan Sonar (SSS).



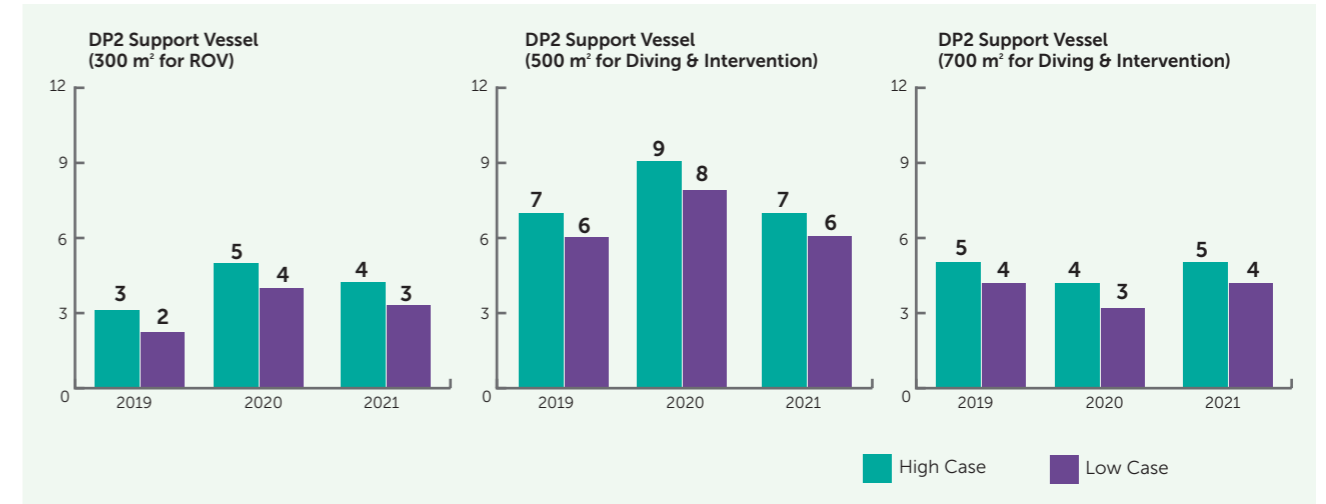
DP2 Support Vessel for Underwater Services

Activity Phase: Operation

Application: Inspection, Maintenance and Repair (IMR) activities for continuity of services, safety and integrity of underwater facilities e.g.: platform jackets, pipelines, subsea hardware, etc.

Associated Services: Support vessel, ROV, manpower, equipment etc.

No. of Campaigns: Three-Year Outlook



Notes:

- Outlook number is measured by number of campaigns and its duration may vary.
- A new groupwide Frame Agreement was established with a panel of vendors in 2018, which will expire in 2023.



Category Talent Insights

Industry shall provide more opportunities and ease participations of local junior newcomers into this category especially Saturation Divers.

Medium Term Outlook – Post 2020

- Stable outlook is expected for Underwater Services as activities are periodically scheduled.
- Local assets prioritisation will be exercised during execution.

H Marine Vessels

Marine Vessels offer a wide range of support services for Exploration and Development drilling, installation, HUC and Production. This Report only covers Anchor Handling Tug Supply (AHTS), Platform Supply Vessels (PSV)/Straight Supply Vessels (SSV) and Fast Crew Boats (FCB), as the most widely used vessel types.



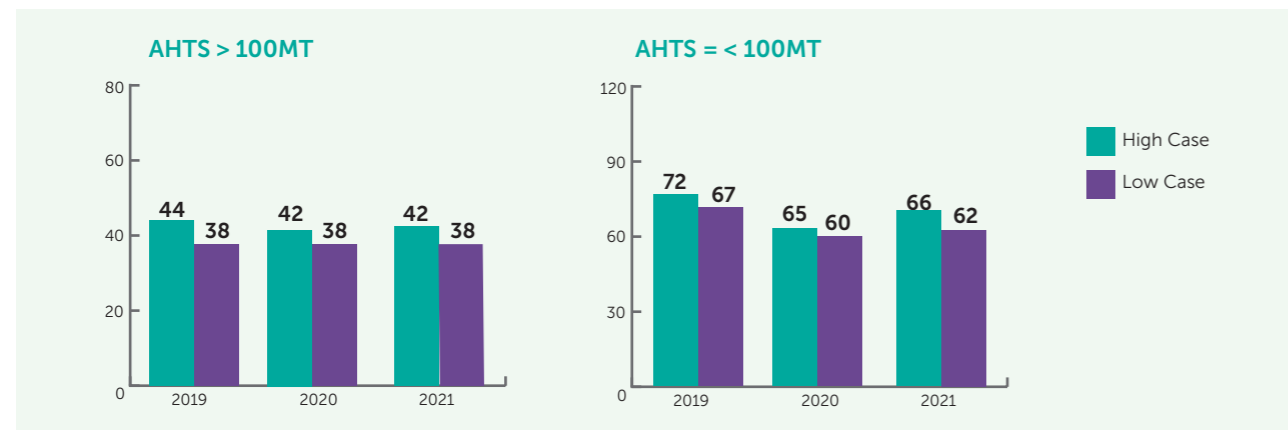
Anchor Handling Tug Supply (AHTS)

Activity Phase: Exploration, Development, Operation

Application: Typically used to transport supplies to and from offshore platforms/drilling rigs.

Associated Services: Vessel inspection services, bunkering services, port services

No. of Vessels: Three-Year Outlook



Notes:

- Outlook includes activities which may have been contracted out at the time of reporting.
- A new Frame Agreement will be established to support Drilling and Development requirements. Remaining requirements will be catered via spot-chartered contract or bundled in main-contractor scope.
- Low case reflects the level of uncertainty in Drilling, Offshore Installation and HUC activities.



Did you know?

Long-term contract supporting Production requirements was awarded to Local Owner-Operators. This catalysed the much needed market correction.



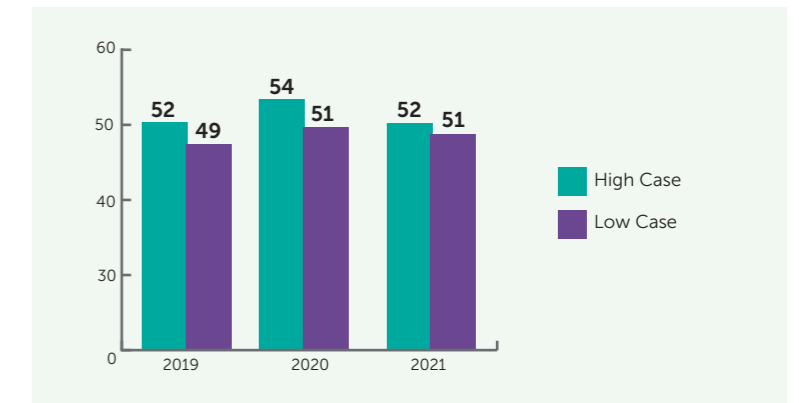
Platform Supply Vessels (PSVs) & Straight Supply Vessels (SSVs)

Activity Phase: Exploration, Development, Operation

Application: Transport equipment & supplies to offshore sites.

Associated Services: Vessel inspection services, bunkering services, port services

No. of Vessels: Three-Year Outlook



Notes:

- Outlook includes activities which may have been contracted out at the time of reporting.
- A new Frame Agreement will be established to support Drilling and Development requirements. Remaining requirements will be catered via spot-chartered contract or bundled in main-contractor scope.
- Low case reflects the level of uncertainty in Drilling, Offshore Installation and HUC activities.

Medium Term Outlook – Post 2020

- Positive outlook can be expected for PSVs/SSVs. Increase in Drilling activity will boost demand further for PSVs/SSVs.



Did you know?

Uptrend in activity presents window of opportunity for local shipyards and financial institutions to consider maintenance and dry-docking business segments.

Category Talent Insights

Uptrend presents opportunity for players to expedite growth of local talents as feeder into senior positions (such as Master, Chief Officer and Chief Engineer) by providing them the much needed experience.



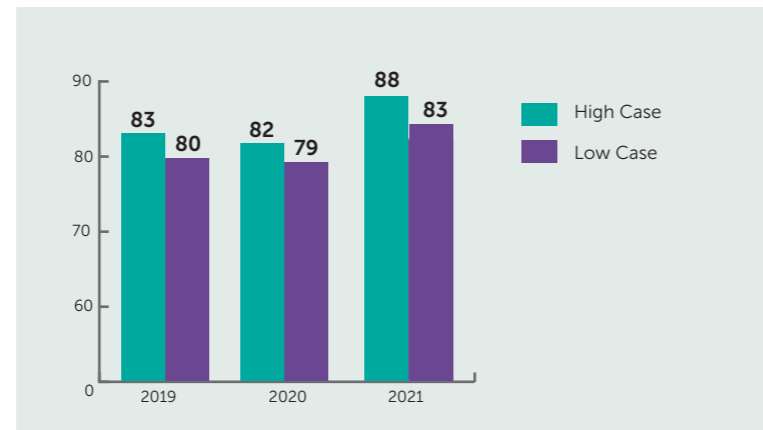
Fast Crew Boats (FCBs)

Activity Phase: Development, Operation

Application: A high speed vessel for the transportation of crew to offshore facilities

Associated Services: Vessel inspection services, bunkering services, port services

No of Vessels: Three-Year Outlook



Notes:

- Outlook includes activities which may have been contracted out at the time of reporting.
- A new Frame Agreement will be established to support Drilling and Development requirements. Remaining requirements will be catered via spot-chartered contract or bundled in main-contractor scope.
- Low case reflects the level of uncertainty in Drilling, Offshore Installation and HUC activities.



Medium Term Outlook – Post 2020

- Positive outlook can be expected for FCBs.
- Higher speed vessels (>30kn) or Catamaran design vessel with lower operating cost are seen as good alternatives to chopper.



For illustration purposes only



Special Market Insights

Positioning LNG as the preferred marine fuel of choice.

As a major player in the LNG business, PETRONAS is well-positioned to support the strategic intent for **Malaysia to become the regional LNG bunkering hub**. Efforts are now being put in place towards advocating LNG as the preferred marine fuel of choice. In close collaboration with industry associations like MOSVA, programmes are aligned to encourage migration; to develop necessary infrastructures to support a swift and effective migration of local (currently diesel-fueled) OSV fleet to LNG, as the cleaner option.

The first commercial LNG Bunkering is poised for start-up by second half of 2019 from RGT1 (Sg Udang, Melaka) and RGT2 (Pengerang, Johor), followed by KSB (Kemaman, Terengganu) and ASB (W.P. Labuan). Dual-fueled LNG-based engines are expected to be the future solution.

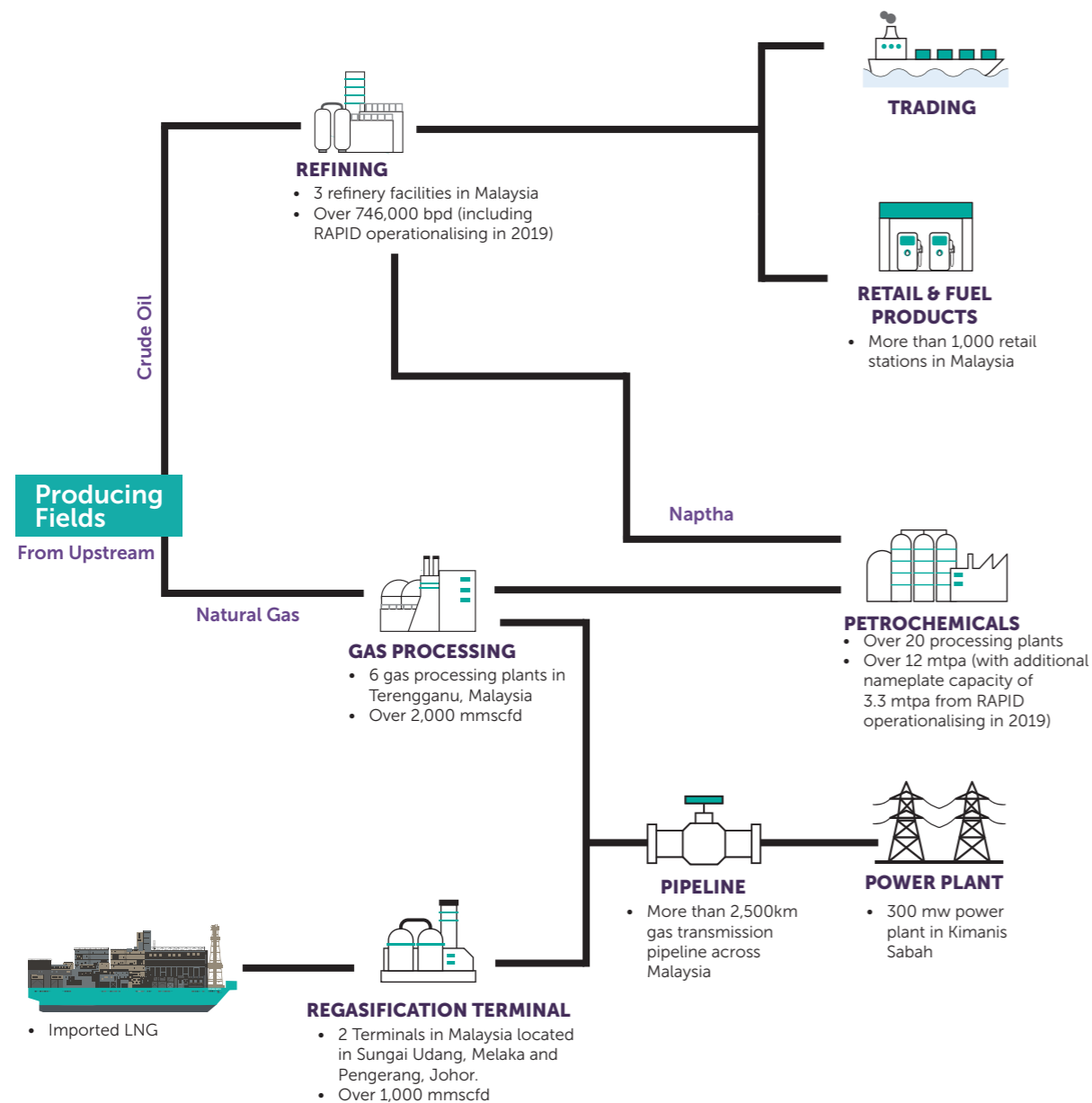


DOWNSTREAM MALAYSIA

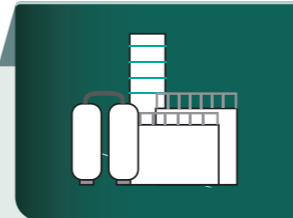
Malaysian Refining Company Sdn Bhd (MRC SB)
Melaka, Malaysia

DOWNSTREAM OVERVIEW

Downstream business comprises multiple businesses and plays a strategic role in enhancing value to molecules through an integrated operation, on the foundation of being operationally and commercially excellent. The diverse activities include refining, trading, and marketing crude oil and petroleum products as well as manufacturing and marketing petrochemical products for local and international consumption.



BUSINESS SEGMENTS

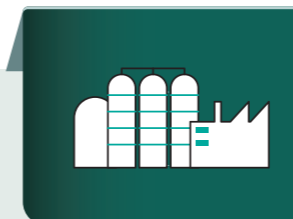


REFINING

PETRONAS has 546 kbpd of refining capacity of which 446 kbpd comes from our domestic operations, and the remaining from Durban, South Africa.

Activity Highlights:

- Our refineries in Terengganu and Melaka were designed to produce a range of petroleum products including gasoline, diesel and Jet A-1. PETRONAS is committed to supporting the clean-fuel agenda and is currently preparing its refinery in Melaka for the Diesel Euro 5 facility upgrade with the target completion in 2020.
- With the development of Pengerang Integrated Complex (PIC), the refining capacity will be expanded to approximately 220 kbpd of petroleum products, and will be ready for start up in 2019.



PETROCHEMICALS

PETRONAS is one of the largest chemical producers in Southeast Asia, with a production capacity of 12.7 million tonnes per annum. We are primarily involved in manufacturing, marketing and selling of a wide-ranging petrochemical products including olefins, polymers, fertilisers, methanols, and other chemical and derivative products.

Activity Highlights:

- With the development of PIC, the petrochemical capacity will be expanded by 3.3 million mtpa, venturing into the production of differentiated and specialty chemicals.
- Beyond 2020, PCG is planning to grow current business at least by about 25 per cent by adding value to its existing assets and moving further downstream. This includes extending the value chain by maximising value from molecules in PIC and existing complexes.



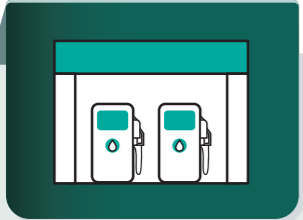
MIDSTREAM GAS

PETRONAS is Malaysia's leading gas infrastructure and centralised utilities company with core businesses in Gas Processing, Gas Transportation, Utilities and Regasification.

We process natural gas from offshore Peninsular Malaysia to produce sales gas, ethane, propane and butane for our customers. These processed gas are transported using the Peninsular Gas Utilisation (PGU) pipeline network to gas consumers in Malaysia and Singapore. Our capability includes the transportation of sales gas in small volumes to our customers in East Malaysia. We also own and operate regasification terminals in Sungai Udang, Melaka and Pengerang, Johor. In addition to that, we supply electricity, steam and industrial gases for our customers at Kertih Integrated Petrochemical Complex in Terengganu and Gebeng Industrial Area in Pahang.

Activity Highlights:

- The new LNG Regasification Terminal in Pengerang is a major strategic growth project for PGB. It provides fuel requirement for Pengerang Cogeneration Plant (PCP), one of six Associated Facilities as well as the entire Pengerang Integrated Complex (PIC).
- The LNG jetty is able to receive carriers up to 260,000 m³ and the two units of LNG Storage tanks with capacity of 200,000 m³ each



MARKETING & RETAIL

PETRONAS manufactures and markets a full range of high-quality automotive and industrial lubricant products in over 90 markets globally. Our commitment to develop superior fuel technology for our consumers

is solidified with the establishment of the Global Research and Technology (R&T) centre in Turin, Italy – the cornerstone of the improvement of our Fluid Technology Solutions. The state-of-the-art research hub is dedicated to developing solutions that move the world with better, more efficient fluid technology.

With over 1,000 stations across the country, we continue to grow through the strategic expansion of our business by incorporating the concepts of lifestyle and one-stop centre, offering our consumers fuel, community spaces, banking facilities and others. Our retail arm is also extended to South Africa and sub-Saharan Africa through Engen Petroleum Limited, a subsidiary of PETRONAS. Engen continues to have the largest service-station footprint in South Africa and remains the leading petrol station brand in the country.

PICOAT

Pengerang Integrated Complex OSH Administration Transformation

PETRONAS in collaboration with the Department of Occupational Safety and Health Malaysia (DOSH) launched a new framework in February 2018 which will **allow self-regulation in the management and operations of the Pengerang Integrated Complex (PIC)**.

The framework, known as Pengerang Integrated Complex OSH Administration Transformation (PICOAT), empowers PETRONAS to regulate and oversee the management, safe operations, and integrity of its assets and facilities in the complex.

The engineering design of PIC facilities purposefully included features with elements of self-governance in asset integrity and process safety. They include Corrosion Management Plan (CMP); Thickness Measurement Location (TML) with baseline readings taken during project construction; PETRONAS Instrumented Protective Function (P-IPF); PETRONAS Risk-Based Inspection (P-RBI); Electrical Safety and Operability Review (P-ELSOR) and Reliability Centred Maintenance (RCM).

Through PICOAT, regulatory processes will essentially be transferred from the regulators to the facility occupiers. Self-regulation via PICOAT is indeed a two-pronged strategy that will mutually benefit both parties; for DOSH it means optimising inspection activities and enforcement, as well as for PETRONAS commercial value via optimisation of operation run-length through self-managed planned shutdowns and maintenance schedules. In the long term, Asset Integrity and OSH Excellence are expected to extend the service life of PIC facilities, and in the future, PICOAT could potentially be emulated by other plants.



Pengerang Integrated Complex, Johor, Malaysia

PLANT TURNAROUND

Plant Turnaround is defined as a major engineering event during which an onshore facility is shut down for equipment inspection and overhaul, debottlenecking, revamps and catalyst regeneration projects.

Turnaround comprises main mechanical work, which constitutes the bulk of total activities (~60%). Other activities are disciplines' specific; e.g. electrical, instrument, inspection and rotating equipment maintenance. Turnaround is labour intensive, hence activity outlook is stated in man-hour units.



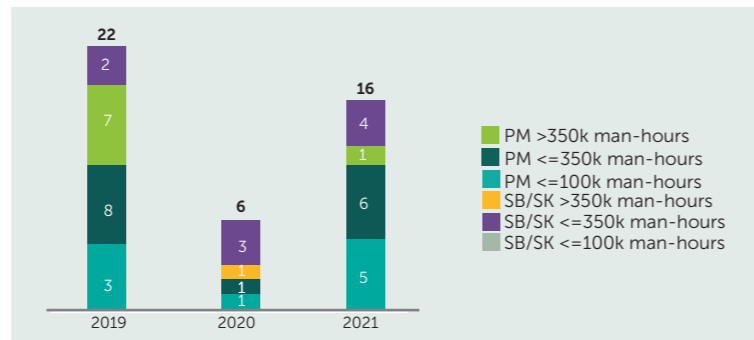
Plant Turnaround

Activity Phase: Operations

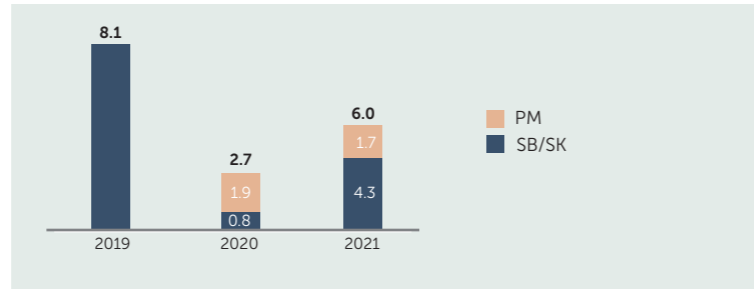
Application: Turnarounds are scheduled periodically, important to ensure timely renewal of Certificate of Fitness (CF) by authority and maximise plant efficiency and capacity.

Associated Services: Equipment services (e.g. mechanical, electrical, instruments, etc.), inspection services, manpower.

No. of TAs: Three-Year Outlook



No. of Man-hours (Millions): Three-Year Outlook



Notes:

- Outlook includes activities driven by PETRONAS Group of companies only.
- As of Oct 2018, approximately 3.3 million manhours is spent for TA activity.
- A new Frame Agreement is currently being established to cater for PETRONAS Groupwide Turnaround and Maintenance requirements.
- While Turnaround schedule is part of legislation compliance, activity deferment/rescheduling may take place depending on operational requirements.



Medium Term Outlook – Post 2021

- Positive outlook can be expected. Market should anticipate substantial increase in Turnaround activity beginning 2022 to cater for RAPID.
- Great opportunity for collaboration between industry players and foreign investments in building local capability.



Category Talent Insights

Industry players are urged to proactively plan talent requirements, in view of upcoming long-term integrated contracts. Thus, creating a steady base-load for a sustainable talent pool is encouraged.



Sabah Ammonia Urea (SAMUR) Plant, Sabah, Malaysia

FREQUENTLY ASKED QUESTION (FAQs)

- 1** **How does this Report benefit the OGSE industry?**
This Report will improve visibility on PETRONAS' domestic activities, hoping to allow better planning of resources and investments by vendors.
- 2** **Is this a one-off exercise or a regular effort?**
This is part of PETRONAS' effort to increase engagement with the OGSE industry. Moving forward, we will endeavor to provide this Report on annual basis.
- 3** **What is the accuracy and reliability of the outlook data? Would this be in line with what has been previously disclosed to the public?**
This data is based on projection of activities with high/low scenarios evincing the project milestones, at the time of release. Changes are to be expected in response to market dynamics and operational requirements.
- 4** **Is this outlook referring to tenders to be issued or contracts to be awarded?**
The outlook provided is based on activity per year, not by tender issuance nor contract award. Therefore, it includes activity which may have been contracted at the time of reporting.
- 5** **Should I make my investment decisions/business planning based on this Report?**
The intent of this outlook is to provide a general direction for the industry and sufficient for players to make their high level planning. We recommend players to also make reference to other sources of data/information to complement your decision making.
- 6** **What is US\$60 to US\$70 per barrel expectation based on? Do these figures represent PETRONAS' view on the crude price?**
Most industry analysts e.g. research houses and banks, publicly share this expectation. Companies may take a conservative approach in their assumption. PETRONAS remains prudent and will continue to adopt lower for longer approach until we are confident that the current uptrend is sustainable.
- 7** **How will the OGSE industry be affected if oil price recovers?**
If oil price recovers for a sustainable period, we expect a higher number of greenfield and brownfield projects to become commercially viable; provided that we keep the cost at a competitive level. Thus activities for OGSE services may increase accordingly.
- 8** **WHP, CPP and Rigs information are primarily for larger players—are there any information targeted for smaller players?**
The outlook in this Report prioritises leading indicators for a broad spectrum of activities in the Oil and Gas industry, as indicated in the list of Associated Services. This Report also provides profiles of operating assets, giving a complete spectrum of the value chain.

List of Abbreviations

Abbreviations used in the Report

UNIT	DEFINITION	USED FOR
A	AHTS	Anchor Handling Tug Supply
C	CPP	Central Processing Platform
	CRA	Corrosion Resistant Alloy
D	DCS	Distributed Control System
	DD/MWD/LWD	Directional Drilling/Measurement-While-Drilling/ Logging-While-Drilling
E	EIA	Energy Information Administration
	EOS	Economies Of Scale
	EPCC	Engineering, Procurement, Construction & Commissioning
	EPCIC	Engineering, Procurement, Construction, Installation & Commissioning
	ETP	Economic Transformation Programme
F	FCB	Fast Crew Boat
	FPS	Floating Production Storage
	FPSO	Floating Production Storage & Offloading
	FSO	Floating Storage & Offloading
	FSU	Floating Storage Unit
H	HSE	Health, Safety and Environment
	HUC	Hook-Up & Commissioning
L	LTI	Loss Time Injury
M	MCM	Maintenance, Construction & Modification (MCM)
	MTJDA	Malaysia-Thailand Joint Development Area

List of Abbreviations

Abbreviations used in the Report (con't)

UNIT	DEFINITION	USED FOR
N	NDT	Non-destructive testing
O	O&M	Operations & Maintenance
	OCTG	Oil Country Tubular Goods
	OGSE	Oil & Gas Services and Equipment
	OPEC	Organisation of the Petroleum Exporting Countries
P	PFLNG	PETRONAS Floating LNG
	PM	Peninsular Malaysia
	PSV	Platform Supply Vessel
R	RMK-11	Rancangan Malaysia Kesebelas (Eleventh Malaysia Plan)
	ROV	Remotely Operated (underwater) Vehicle
S	SB	Sabah
	SK	Sarawak
	SME	Small & Medium-sized Enterprise
	SSV	Straight Supply Vessel
	STEO	Short-Term Energy Outlook
T	TADR	Tender Assisted Drilling Rig
V	VMI	Vendor Managed Inventory
W	WHP	Wellhead Platform

Glossary

Industry terms used in the Report

UNIT	TERMS	DEFINITION
B	Barrel	A standard unit of measurement for oil production. One barrel contains 159 litres of oil.
	Barrels of Oil Equivalent (boe)	A unit of measurement to quantify amount of crude oil, condensates and natural gas. Natural gas volumes are converted to barrels on the basis of energy content.
	Brent Price	The benchmark crude oil price in Europe, as traded on International Petroleum Exchange in London. Brent crude refers to a particular grade of crude oil, which is slightly heavier than WTI crude. See WTI price.
D	Deepwater	Projects in water depths exceeding 450ft. Unique methods are required to produce the oil and gas from ocean bed at such depths. See Floating Production Unit.
	Development	Drilling, construction and related activities following discovery that are necessary to begin production and transportation of crude oil and natural gas.
	Downstream	All segments of a value chain that add value to the crude oil and natural gas produced, for example, oil refining, gas processing, gas liquefaction, petrochemical manufacturing, marketing of petroleum and petrochemical products, storage and transportation.
E	Enhanced Oil Recovery (EOR)	Any method(s) applied to productive reservoirs in order to increase production rates and to improve the overall recovery factor.
	Exploration	The search for crude oil and/or natural gas by geological and topographical studies, geophysical and seismic surveys, and drilling of wells.
F	Feedstock	Raw material used in manufacturing a product. As example, crude oil is a feedstock in a refining process which produces gasoline (petroleum).
	Field	A geographical area overlying a hydrocarbon reservoir.
	Floating Production, Storage and Offloading (FPSO)	A converted or custom-built ship-like structure, with modular facilities to process oil and gas and for temporary storage of oil prior transfer to carriers/tankers.
	Floating, Storage and Offloading (FSO)	A converted or custom-built ship-like structure for temporary storage of the oil prior to transfer to tankers.
L	Liquefied Natural Gas (LNG)	Natural gas that is liquefied under extremely cold temperatures of about 260 degrees Fahrenheit to facilitate storage or transportation in specially designed vessels.

Glossary

Industry terms used in the Report (con't)

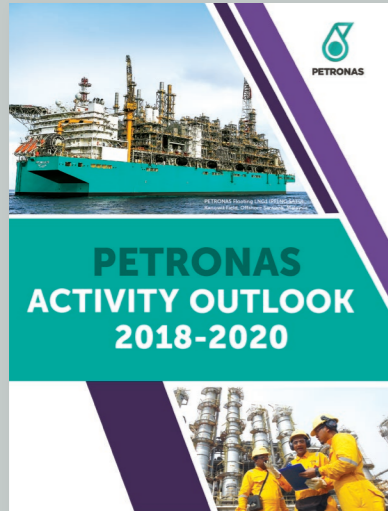
UNIT	TERMS	DEFINITION
M	Mobile Offshore Production Unit (MOPU)	A self-installing and re-usable production jack-up.
N	Naphtha	Usually an intermediate product between gasoline and benzene, naphtha is colourless and volatile petroleum distillate used as a solvent or fuel.
P	Petrochemicals	Organic and inorganic compounds and mixtures derived from petroleum, used principally to manufacture chemicals, plastics and resins, synthetic fibres, detergents, adhesives and synthetic motor oils.
	Pan Malaysia Contract	A contract that combined the requirement for more than one PACs to get Economies of Scale (EOS)
R	Refining	A purification process for natural resources which includes hydrocarbons, using distillation, cooling and/or compression.
	Regasification	Process of converting LNG temperature back to natural gas at atmospheric temperature.
	Resources	The total estimated quantities of petroleum at a specific date to be contained in, or that have been produced from known accumulations of hydrocarbon.
S	Sour Crude/Gas	Sour crude oil is crude oil containing a high amount of the impurity sulfur. Sour gas is natural gas or any other gas containing significant amounts of hydrogen sulfide H ₂ S.
	Steam Cracker	Steam cracker plant are facilities in which a feedstock is thermally cracked to produce lighter hydrocarbons.
T	Tight Oil	Also known as shale oil, tight oil is a type of oil found in impermeable shale and limestone rock deposits that are broken up by advanced drilling techniques such as horizontal drilling or hydraulic fracturing. The process is needed to produce oil in commercial quantities as shale has low matrix permeability.
U	Upstream	The segment of value chain pertaining to finding, developing and producing crude oil and natural gas. These include oil and gas exploration, development and production operations; also known as Exploration & Production (E&P).
W	WTI Price	Stands for West Texas Intermediate, the benchmark crude oil price in the US, measured in USD per barrel, which refers to a type of high quality light crude oil.

Glossary

Units used in the Report:

UNIT	DEFINITION	USED FOR
kbd	Kilobarrels per day	Production Rate
mmscfd	Million metric standard cubic feet per day	Production Rate
mmstb	Million stock tank barrels	Volume
bscf	Billion standard cubic feet	Volume
tscf	Trillion standard cubic feet	Volume
sqkm	Square kilometers	Area
bce	Big cargo equivalent	Capacity
mtpa	Million Tonnes per Anum	Capacity
mmBtu	Million British Thermal Unit	Heating Value
tbtu	Trillion British Thermal Unit	Heating Value

More on PETRONAS



PETRONAS Activity Outlook 2018-2020



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Email us:
lrs_enquiries@petronas.com



Malaysia Tax Incentives Compilation and Guide for Oil and Gas Services and Equipment (OGSE) Sector



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Petroleum Nasional Berhad (PETRONAS) (20076-K)

Tower 1, PETRONAS Twin Towers, Kuala Lumpur City Centre
50088 Kuala Lumpur, Malaysia