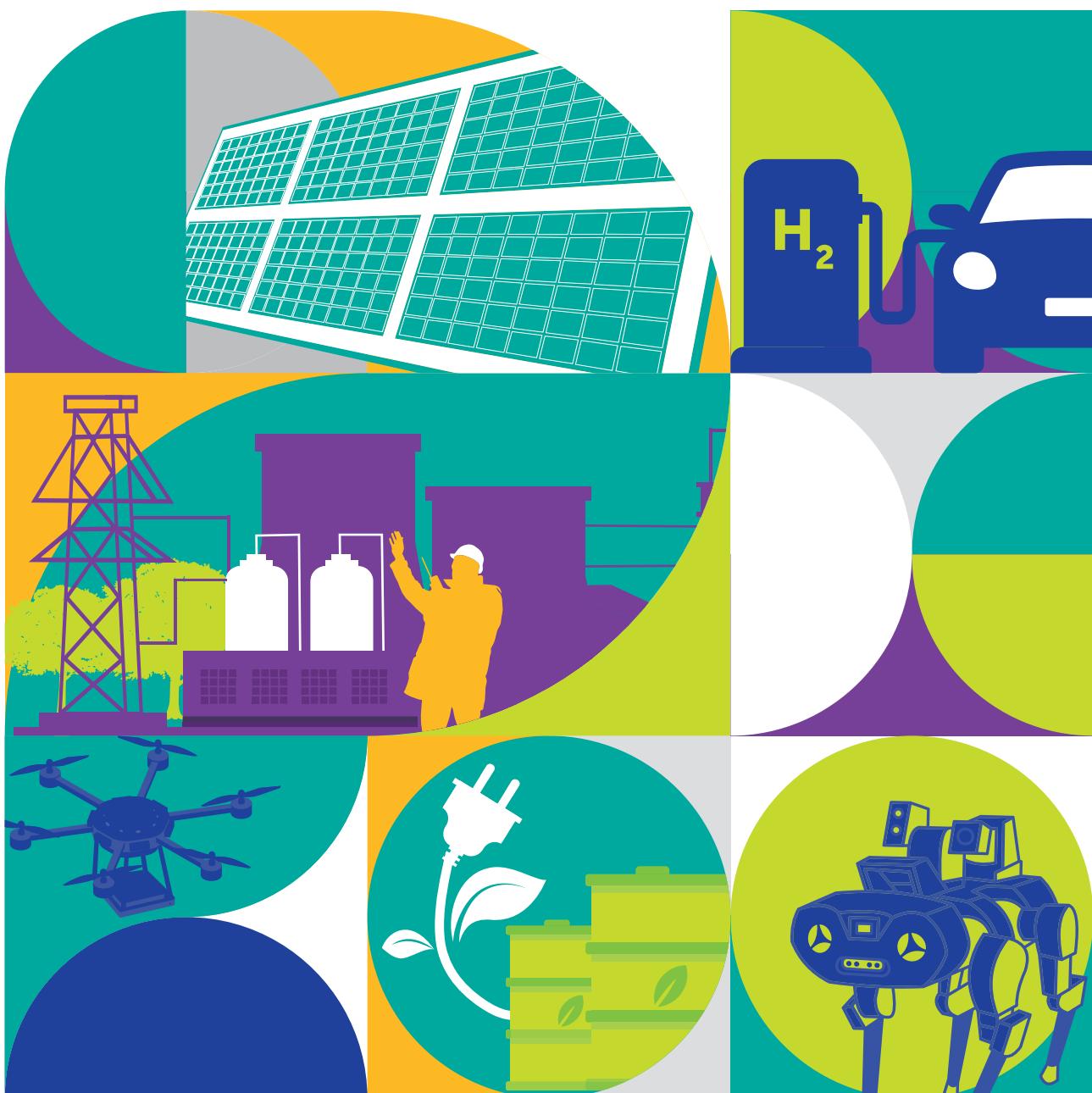


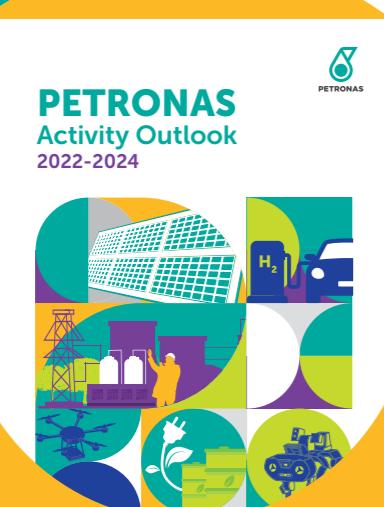


PETRONAS

Activity Outlook

2022-2024





Our Story

The oil and gas majors are starting to record improvements, with both profit and cash flow from operations surging upwards. Nevertheless, industry players remain vigilant and continue to take very cautious steps. Beyond the challenges, the future remains optimistic and the prospects for recovery are in sight, though it may be slow.

The global energy transition continues to gather pace, driven by technological advancements and supported by societal and regulatory push towards attaining net zero carbon emissions by 2050 (NZCE 2050).

In bringing everyone together and ensuring long-term value creation for the stakeholders, PETRONAS offers innovative, sustainable and customer-centric solutions. Our expanded portfolio is well-positioned to respond to the shifting needs of our customers from creating more access for natural gas and LNG to power a variety of industries.

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 2021.

Table of **Contents**





Reform Acceleration

Foreword by Vice President,
Group Procurement, PETRONAS

Dear Esteemed Partners,

We are pleased to present this year's edition of the PETRONAS Activity Outlook, covering insights on the industry and demand outlook from 2022 to 2024. As we enter the year 2022, the global economy is staging with multi-speed recovery across countries and sectors. At the same time, increased fields complexity and decarbonisation of operations require more extensive technology deployment and smarter solutions. Accelerated energy transition will also pose further challenges to the traditional oil and gas business. Thus, the industry must be innovative and remain competitive in the course of doing business, to ensure projects and production remain feasible in the uncertain economic climate.

Immediate reforms along the value chain have become increasingly important focusing on greater operational efficiencies and higher productivity. PETRONAS is collaborating with industry players in pursuit of maximising existing assets for better efficiency and cost optimisation. Oil and Gas Services and Equipment (OGSE) industry can capitalise on new opportunities which have emerged from changes introduced in the way we operate, whether it is rethinking how we do projects or leveraging on the rapid advancements of technology in the form of Artificial Intelligence (AI), machine learnings, robotics and Internet of Things (IOT). Globally, we have seen companies forming collaboration to accelerate technology uptake and create an array of new revenue streams while sharing the resources and investment.

It is our aspiration to achieve net zero carbon emissions by 2050 (NZCE 2050) and we have taken steps to realise the aspiration towards the energy transition and to embrace a low-carbon energy future by accelerating our Stepping Out strategy into renewables such as solar and hydrogen businesses.

As we approach sustainability from the Environmental, Social and Governance (ESG) perspective, PETRONAS is guided by four sustainability lenses - Continued Value Creation, Safeguard the Environment, Positive Social Impact and Responsible Governance. The oil and gas industry and its players must collaborate in moving forward together, embedding ESG as part of our industry's DNA.

There is also a need to intensify the adoption and capitalise on digital transformation and technology advancement. We must continue to remain focused in our efforts on technological advancements, digitalisation of processes, as well as harmonisation of standards for equipment and services. Leveraging technology and digital solutions to optimise cost while securing bottom line and performance are becoming more significant and vital.

PETRONAS has intensified efforts through partnerships to accelerate sustainable industry practices. At PETRONAS, we remain committed to upholding the highest standards of corporate governance and practices zero tolerance against bribery and corruption, in line with our Code of Conduct and Business Ethics (CoBE). We will continue to ensure individual and organisational integrity becomes a way of life in PETRONAS and we espouse the same for the industry. In navigating through the challenging conditions, **safety is not to be compromised**. While keeping the operations cost down and increasing pace, Health, Safety, Security and Environment (HSSE) practices must be upheld at all times.

On behalf of PETRONAS, we look forward to the continuous support and efforts from the entire ecosystem to shift the norm and foster stronger creative partnership to unlock opportunities in enabling a smooth journey towards a low-carbon economy. Together, we will move forward and thrive together in enriching lives for a sustainable future.

Freida Amat

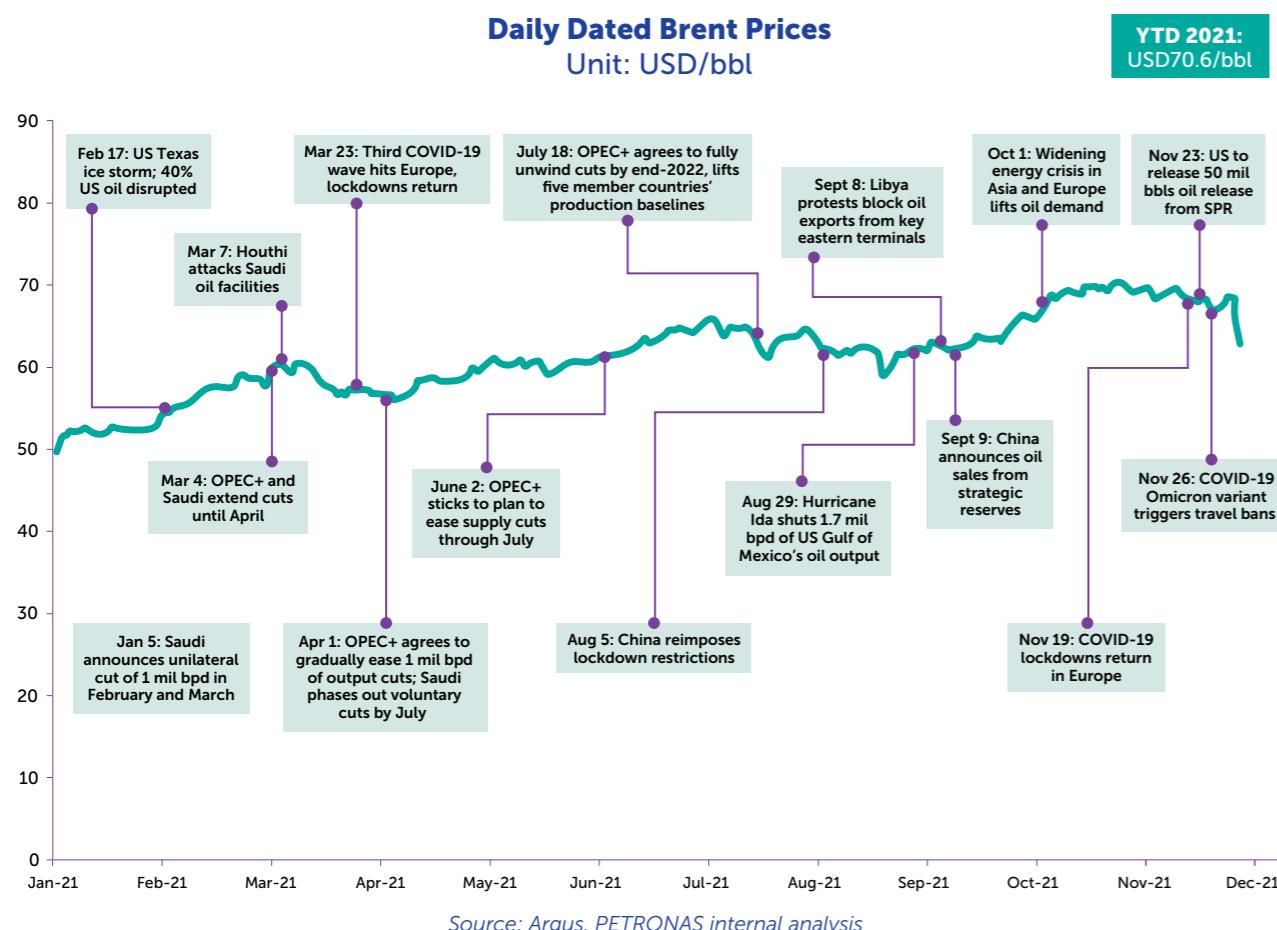
Industry Overview



Shifting Landscapes

As the world reopens and economic activities resuming, the global economy is staging its most robust post-recession rebound with speedy recovery seen across countries and sectors. A pervasive roll-out of vaccines in 2021 provided support to the recovery of road transport fuels amid pent-up traveling demand. However, the aviation sector is only expected to return to pre-pandemic level by 2024. The path towards sustained oil demand recovery remains fragile and uncertain due to the emergence of new COVID-19 variants that trigger fresh waves of lock-downs.

While most industry players are optimistic with the economic recovery, they still remain cautious. Thus, the smarter approach would be to strengthen efforts collectively and be ready to face the oil price volatility.



The energy crisis that unfolded in 2021 led to gas and Liquefied Natural Gas (LNG) prices surging to a record high. Asian spot LNG prices soared above US\$50/MMBtu, a historic high, due to factors including higher demand as economies re-open, rising competition for gas between Europe and Asia, a hotter summer and colder winter, as well as a coal crunch in China which led to a spike in demand for gas.

The LNG spot prices in the coming years are also expected to experience volatility due to the weather pattern and also potential change in policy, altering the supply-demand dynamics.

This underscores the need for continuous investments in the energy sector to ensure reliable and sustainable supply of energy in an equitable manner.

Average Northeast Asia LNG spot prices Unit: US\$/MMBtu							
2020: US\$4.20				2021: US\$15.50 (YTD)			
1H '20: US\$2.70		2H '20: US\$5.60		1H '21: US\$9.50		2H '21: US\$25.10	
Q1: US\$3.4	Q2: US\$2.1	Q3: US\$3.4	Q4: US\$7.9	Q1: US\$9.5	Q2: US\$9.4	Q3: US\$17.9	Q4: US\$32.3

Northeast Asia LNG spot price (Unit: US\$/MMBtu)



This year saw major carbon emitters pledging their net-zero aspirations by the middle of the century, setting the stage for a stronger commitment on the decarbonisation agenda. Post 26th UN Climate Change Conference of the Parties (COP26), the call for action has grown louder with greater scrutiny on governments and industries on top of a stronger demand for transparency and progress of pledged targets.

Amidst accelerating energy transition, gas and renewable will play a bigger role in meeting global energy needs. Gas is more resilient than oil as growing share of electric vehicles (EVs), rising demand for sustainable fuels and increasing efficiency of the transport sector would erode the consumption of oil. While gas is cleaner than oil, challenges come in the form of methane leakages from operations and pipeline targeted by policymakers, following more stringent emission goals set at COP26.

On the home front, the 12th Malaysia Plan (RMK-12) comes at an opportune time as the nation recovers from the COVID-19 pandemic. Setting a strategic direction for Malaysia's development for the period of 2021 to 2025, it aims to address current issues with strategic directions to achieve a sustainable economy focusing on rejuvenating economic growth; ensuring prosperity is distributed more fairly and equitably; and maintaining environmental sustainability.

With the objective of achieving a "Prosperous, Inclusive and Sustainable Malaysia", the third focus of RMK-12 accelerates the nation's progress in moving towards a low-carbon nation, safeguarding natural endowments, and increasing resilience against climate change. The green growth will be strengthened by a robust enabling environment and supported by a mindset change as well as behavioural shift.

In addition, energy sustainability will be further enhanced by ensuring adequate supply of energy resources and related infrastructure; while renewable energy as an alternative energy source will be augmented to complement energy efficiency measures.

In moving towards a low-carbon nation which will address the energy trilemma, the industry will need to brace and act towards supporting RMK-12. It is therefore imperative to relook the business model and mindset shift as energy transition is accelerating players to fast-track and step-out. PETRONAS will continue to focus on maximising value by leveraging the Group's integrated value chain to capture new opportunities and mitigate the impact of market uncertainties.



In the
Spotlight



PETRONAS will leverage its existing infrastructure and venture into strategic partnerships to grow its capabilities as a blue and green hydrogen producer and supplier.

Hydrogen: The Future of Energy



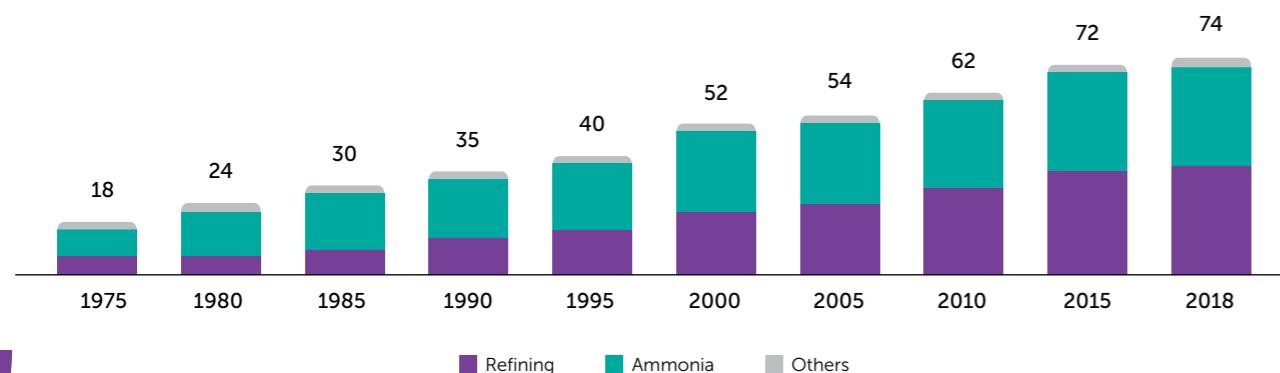
Hydrogen: The Future of Energy

Hydrogen, although a small molecule, has great potential. It can power up cities, vehicles and many other sectors. More importantly, it is clean as it emits zero CO₂ when used. This makes it a critical energy vector to decarbonise the world, complementing other clean energy sources.

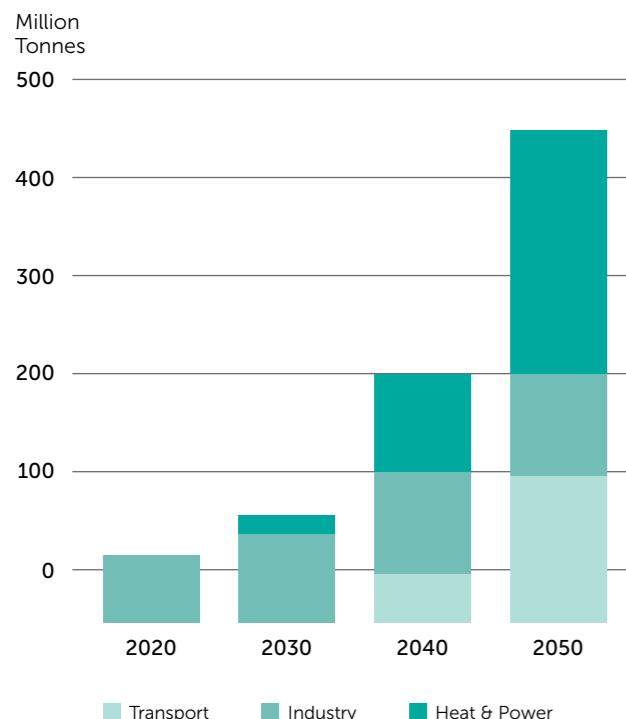
The world has been consuming hydrogen for many decades, primarily for industrial uses. But as the world moves towards cleaner energy, coupled with hydrogen's potential in many other sectors, it is projected that the demand for hydrogen will increase by almost eight-fold to 550 million tonnes per year compared to 70 million tonnes in 2020. As such, hydrogen is a key component in PETRONAS' commitment towards sustainability.

Demand for hydrogen has quadrupled since the 1970's

Global demand for pure hydrogen, 1975-2018 (million tonnes)



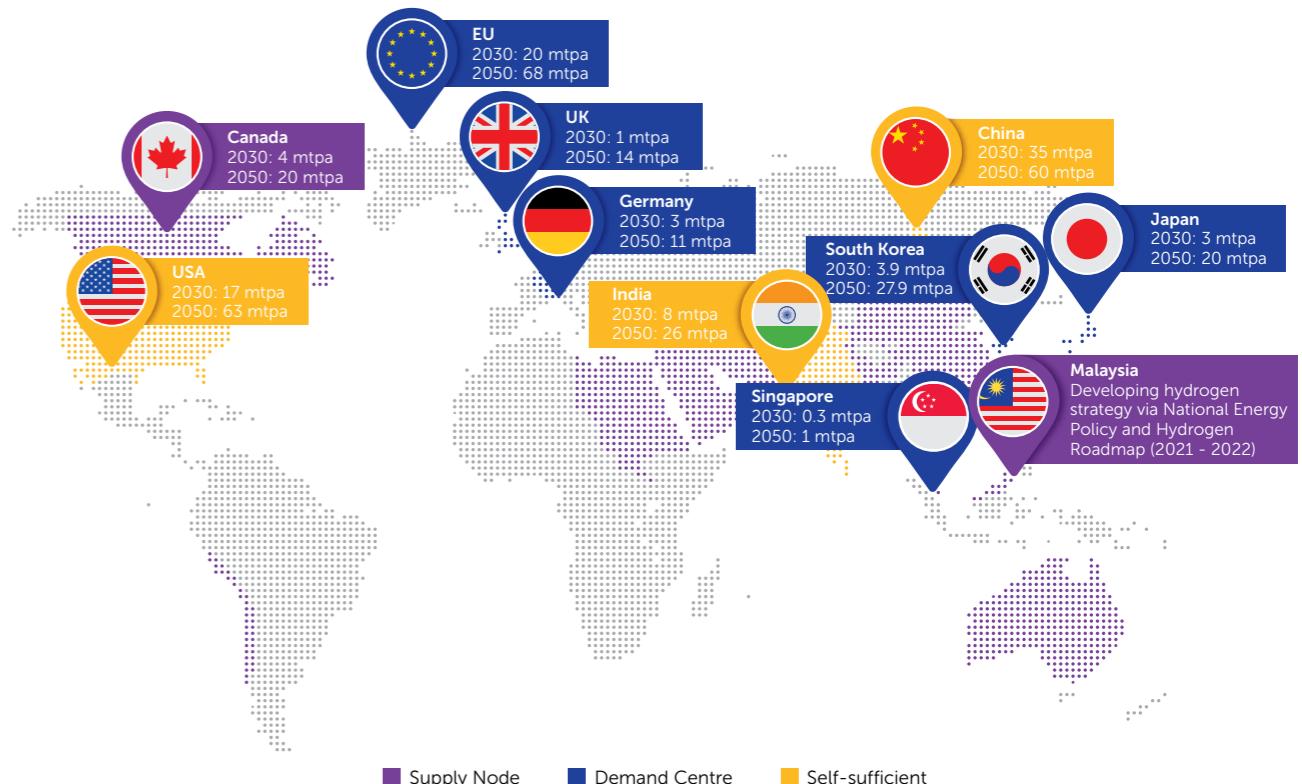
Global Hydrogen Demand Forecast



By 2050, hydrogen production is expected to account for 10 per cent of natural gas use and 25 per cent of renewable additions, with the most rapid adoption of low-carbon hydrogen taking place in developed economies like Europe, Japan and South Korea. According to industry experts, hydrogen is forecasted to contribute up to 18 per cent of the global energy mix by 2050, eliminating 6 giga tonnes of CO₂ annually and requiring a total investment of USD11 trillion.

With much emphasis on decarbonisation goals, global hydrogen demand is forecasted to accelerate around 2030 driven by policy, technology, market competitiveness and cost reduction. Prior to 2030, demand for clean hydrogen is expected to increase steadily as industries start to decarbonise their existing operations by switching to clean hydrogen. The versatility of hydrogen as fuel, heat source and feedstock allows for the demand to further grow and be used in many other sectors such as transport, industries and power generation.

Countries are implementing decarbonisation policies, spearheading the development of hydrogen supply chain and its demand.



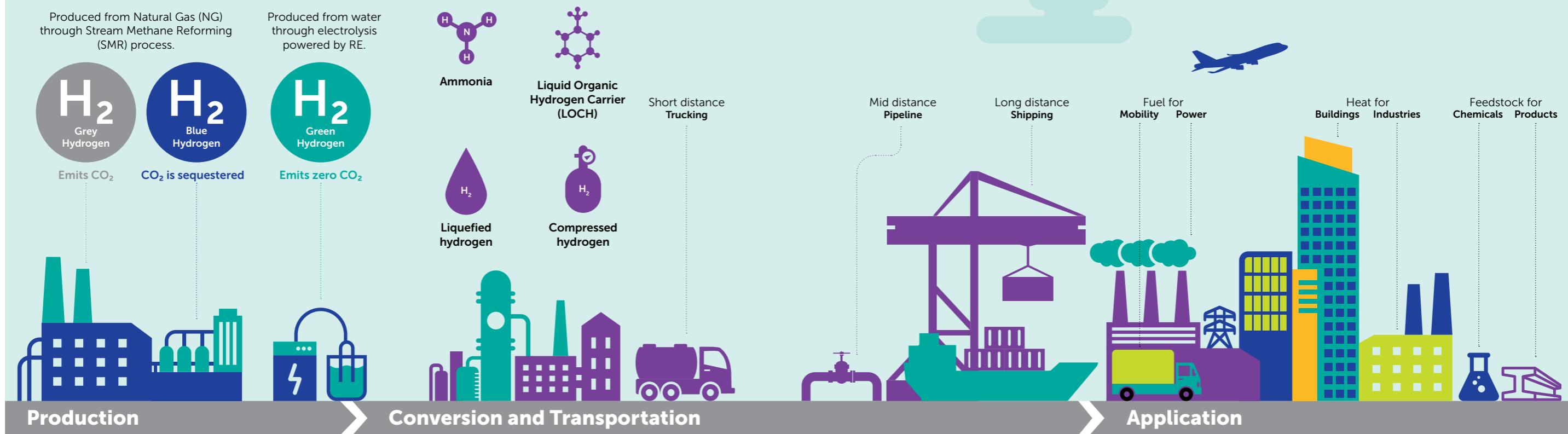
The figure above shows the trade flow between importing and exporting nations, where net importers include the likes of Japan, South Korea and Germany; while exporters include Australia, Middle East and Chile.

In this current nascent stage of the hydrogen industry, the demand for this molecule is mainly driven by country policies where decarbonisation agenda holds strong. Advanced countries are also seeking to diversify their energy source with alternative energy like hydrogen and seizing the potential growth in the green economy.

To create a competitive global hydrogen supply chain, it will require cost reduction along its value chain, particularly in hydrogen production. Additionally, industry players would also need to unlock the challenges to transport hydrogen. While technology advancement would enable this, another key factor in making this happen involves the government's support through policies and incentives, as well as development of global hydrogen standards.

Getting to Know Hydrogen

Hydrogen is the lightest and most abundant element in the universe, yet this tiny molecule has huge potential to connect energy generation, energy storage, transportation and industry, as an energy carrier. It is approximately 73 per cent of all the mass in the visible universe. The most common place to find hydrogen on earth is in water. It is also a clean-burning gas that contains more energy per unit of weight than fossil fuels.



KEY INSIGHTS

Production Cost

Current production cost of blue hydrogen is more than twice of the cost of grey hydrogen and current production cost of green hydrogen is also more than twice the cost of blue hydrogen.

Key Cost Elements

Seventy per cent of the price of green hydrogen comes from the cost of Renewable Energy (RE); 30 per cent of the price of blue hydrogen is from the cost of Carbon Capture and Storage (CCS).

Technology to Improve Production Cost

For blue hydrogen, further improvements in carbon capture and storage technology, and other new technology like methane pyrolysis can be the catalyst for cost reduction.

For green hydrogen, continuous improvements in terms of renewable and electrolyser efficiencies are needed to reduce green hydrogen cost below USD2/kg.

Hydrogen needs to be converted to other forms for it to be transportable, especially for long distance transportation.

- **Ammonia:** Most matured form of transportation, with existing facilities.
- **Liquid Organic Hydrogen Carrier (LOHC):** Chemically-bonded hydrogen with carriers such as toluene enables transportation in ambient conditions.
- **Compressed:** Hydrogen is compressed between 350 bar and 700 bar, may be limited to short-range transportation (such as land).
- **Liquefied:** Energy intensive nascent technology requiring supercool temperatures of -253°C to liquefy hydrogen.

For the power sector, Japan and South Korea have announced initiatives to co-combust ammonia in their coal-fired power plants, and using hydrogen in combine cycle gas turbine, to decarbonise the power sector.

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International Maritime Organisation (IMO) targets to reduce the total annual GHG emission by 50% when compared to 2008, reducing 500 million tonnes of CO₂ emissions per year. As such, industry players are collaborating to develop ammonia fuel bunkering supply chain, with ammonia-fueled vessels expected to be rolled out 2025 onwards.

Many countries are also looking to decarbonise their mobility segment and have set targets for the number of fuel cell vehicles on the road by 2030. Hydrogen fuel cell technology is expected to provide the solution for long-haul heavy road vehicles, complementing the battery electric vehicle (BEV) for short range and light vehicles.

Did You Know?

In
1950

NASA used liquid hydrogen as fuel for space missions

10

per cent of living things are hydrogen

H₂

emits zero GHG

75%

of the sun is made up of hydrogen

Produces 3x

energy as fossil fuel for the same amount of weight

1

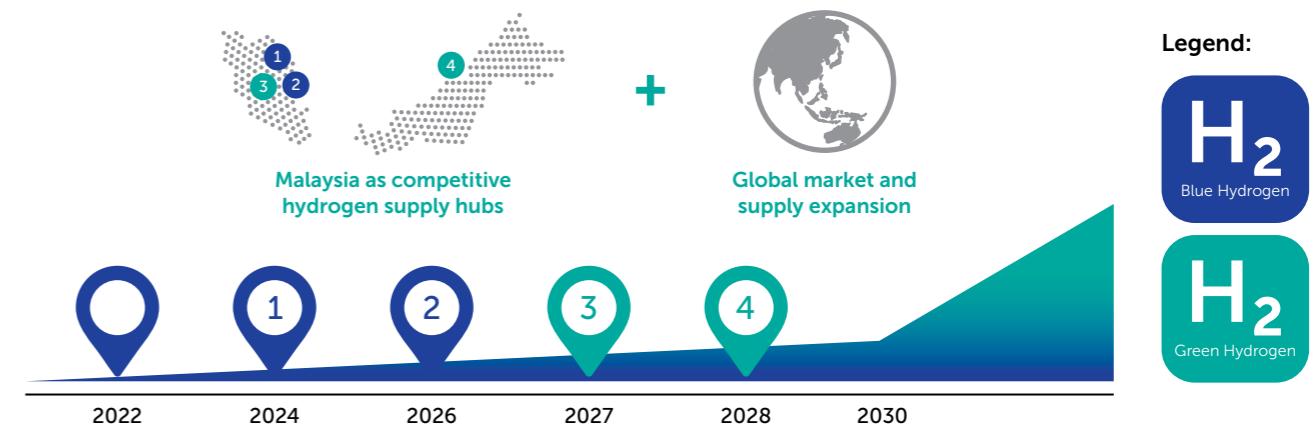
in a fuel cell, hydrogen releases a single product which is water

PETRONAS Hydrogen: Future-Ready Energy

PETRONAS venture into the hydrogen business is anchored on its passion to bring cleaner energy to the world to create a sustainable future. PETRONAS possesses ready capability and facilities to produce blue hydrogen. This builds upon our experience in petrochemical industry and as a world-renowned reliable LNG supplier. With our renewable portfolio expansion and strong partnerships, PETRONAS is also poised to be a competitive green hydrogen solutions provider. With ready capabilities and leveraging our proximity advantage to key hydrogen demand centres in Asia, PETRONAS is poised to grow our presence in the global hydrogen value chain.

With emerging clean energy sources like hydrogen, innovation and collaboration amongst industry players in projects and technology will be crucial towards achieving cost competitiveness and scalability for hydrogen. This is all in the pursuit to make hydrogen more affordable as an attractive clean fuel.

For PETRONAS, we are targeting for our domestic hydrogen projects to commence operation from 2024 onwards starting with blue hydrogen and subsequently green hydrogen production, while we continue to expand our supply capacity globally to serve our targeted markets.



PETRONAS Value Proposition



Geographic Advantage
Strategic location of supply nodes, proximity to H₂ demand centres.



Valued Relationship
Long history and trusting relationship as a reputable LNG and petrochemical supplier.



In-house Capacity
Availability of resources and logistic ability to supply competitively.



Alternative Offering
H₂ as an alternative product, complementing LNG, petrochemical and RE.



Strong Partnership
Access to partners in both supply and demand sides, creating a complete chain.



Capability and Technology
Leadership in project development and energy solutions.



Ready Assets
On-the-ground facilities, reducing costs to serve.

Seize the Chance to Accelerate the Business Advancement of Hydrogen

OGSE players are encouraged to collaborate in scaling up hydrogen in a coordinated way. An opportunity to diversify spurs new business growth while upskilling capabilities in line with charting our aspiration going into low-carbon economy. To reach out and consider opportunities/collaboration with PETRONAS Hydrogen, contact hydrogen@petronas.com.



The Power of Zero

M+ by PETRONAS unlocks the Power of Zero



Zero Techno-Financial Risks for a Seamless Switch

With zero CAPEX and up front investment, businesses can now embark on their sustainability journey with a peace of mind



Zero Interruptions for 24/7 Clean Energy

Businesses can now be energy independent with a reliable supply of clean energy day and night with our battery storage and hybrid solutions



Zero Wastage for Maximum Energy Efficiency

State-of-the art technology via Hawk Ai Energy & Monitoring Solution and real-time energy visibility for our customers to make informed, data-backed decisions to optimise and extend their clean energy usage



Zero Hassle for a Tailored Fit

Custom fitted solar solutions that achieves a perfect harmony with our customers' energy requirements and available space, be it for on-site or off-site solar solutions

We harness the power of the sun to power the nation sustainably

1. Largest rooftop solar installed in a single compound - Malaysia Marine & Heavy Engineering Holdings Bhd (MMHE)



18,720 solar panels installed across an area of 440,496 sqft



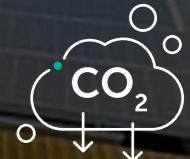
Clean energy generated equivalent to planting 2 million trees



Up to RM30 million cost savings over the next 2 decades



8.3 MWp solar capacity generating 10 GWh electricity per annum (197 GWh electricity over 21 years)



Reduced carbon emissions by 132,000 tonnes of carbon emissions

2. Powering one of the largest supermarket chain in Malaysia - Lotus's Malaysia (formerly known as Tesco Malaysia)



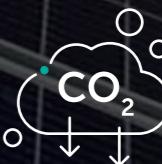
Largest commercial solar power purchase agreement signed in the nation



18 GWh of clean energy generated annually to power 15 Lotus's stores nationwide



A joint collaboration between PETRONAS New Energy and NEFIN Group



Reduce approximately 13,624 tonnes of carbon emissions into the atmosphere

PETRONAS Ventures

Innovation to Spur Growth



Driving technology innovation for growth

In the current increasingly agile market, trends may come and go. However, one industry that remains relevant and is gaining ever-increasing importance is the energy sector. The important role of energy has only been magnified by the unpredictable global events which see crucial responsibility from energy sectors in spearheading innovations in key areas, besides emboldening startups and companies from other relevant verticals to initiate growth and innovation in their own industries.

Towards this end, PETRONAS has set up a venture capital arm, PETRONAS Ventures, to drive technology innovation and maintain a competitive edge to support its core oil and gas business for further growth.

PETRONAS Ventures "tests what's out there, which could complement" potential investments anchored to three key pillars: Future of Facilities, Future of Energy, and New Chemicals/Advanced Materials, in alignment with PETRONAS' Technology Agenda.



Facilities of the Future

- Robotics and Automation (AI/ML)
- Sensors and vision technology (surface/subsurface)
- Asset intelligence/connected factory
- Smart Maintenance and Inspection
- 3D printing and in-situ manufacturing



Future of Energy

- Novel energy generation
- Energy efficient/storage solutions
- Smart grid, electrification
- Renewables (solar/wind/bio)
- Vehicle automation
- Hydrogen



Specialty Chemicals and Advanced Materials

- Electronic Chemicals
- Surfactant
- Coatings
- Additives (food/feed)
- CO₂ to value products
- Lubricants

Realising the prospects of the startups space in Malaysia, PETRONAS kicked-off its PETRONAS FutureTech in October 2019, an accelerator programme to encourage local innovations and support Malaysian startups. Through FutureTech, PETRONAS is providing the opportunity to help the startups to realise the opportunity to grow even up to a global level.

The resounding success of the first edition of the programme has prompted PETRONAS to launch the second edition in 2021 called FutureTech 2.0 (FT2.0). In the edition, PETRONAS continues its partnership with 500 Global as well as teaming up with two local corporate giants, namely Telekom Malaysia (TM) and Sime Darby Plantation (SDP) to unlock synergies from cross-industries expertise and maximise value impact of the programme to local startups.



"We need to go beyond just oil and gas, which means we have to move towards a broader energy sector. Partnering with startups is the way to go because it provides PETRONAS with the insider intelligence and insights needed to accelerate in areas we may not currently see (from the perspective of) a traditional oil and gas company."

Arni Laily Anwarrudin, Head of PETRONAS Ventures.

Iron Sharpens Iron

The bigger value proposition of the programme is that, opportunities are largely open, paving ways for corporate tie-ups with PETRONAS and its partners, where they get to learn from 500 Global top-tier curriculum as well as access to corporate business experts and networks. In addition, mentors share relevant pain points within specific business segments during a 12-week programme.

This non-traditional partnership will create a synergy that will open possibilities and maximise benefits for the startups to accelerate their business and scale up to global standards. As for the corporates, access to business solutions is key. As technology and innovation are fast revolving, startups will play an important role. Through this effort, all participating parties gain value from each other's wealth of knowledge and experience, harnessing key contributors that help accelerate each other's journey towards a healthy market strategy. The partnership, clearly refreshes and changes the corporate innovation landscape and trend by encouraging the innovation culture using more agile approaches. By leveraging non-traditional thinking embedded in startup culture and the industry know-how of corporates, both stakeholders stand a better chance of fostering smarter, stronger and more resilient forms of innovation.

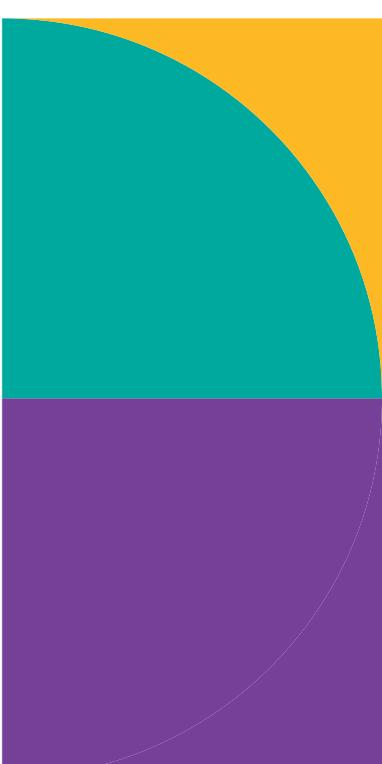
What is more, PETRONAS in playing its role in catalysing technology startup innovation in the energy sector, as well as internalising important processes in approaching how startups operate. Through FT2.0, participating startups are able to extend their services and commercial offerings with PETRONAS and its corporate partners, in ways that are lean and agile while still conforming with corporate governance standards. In a nutshell, this helps to fast-track their ability to commercialise within PETRONAS and the partners' ecosystem.

PETRONAS Ventures is continuously looking for more technology partners with new ideation to ride the wave together!

Start-ups enthusiasts can reach out for more info: petronasventures@petronas.com



Transformation: Delivering Project with Excellence



Project Management of the Future (PMoF)

Efficiency as Enabler

In the pursuit of maximising existing assets that provide strong and stable cash flow, continuous improvement to the way we operate is inevitable. Rethinking on how projects are being delivered with sustainability at the forefront and leveraging on the rapid advancements of technology in the form of Artificial Intelligence (AI); machine learnings, robotics and Internet of Things (IOT) supported by 5G data network, execution of projects is expected to be faster, cheaper, safer and of the highest quality. The highest degree of efficiency in our project delivery practices enables better project outlook, which will create value for the industry and maintains its competitive advantage and sustainability.

Transformation of Project Management – Delivering Project with Excellence

PMoF is established to drive and realise both transformative and progressive improvements in project delivery practices, via four Transformative Areas.

1. PDE (Project Delivery Digital Eco-system)

Project delivery Digital Backbone + AI-enabled to assist decision making

2. CBE (Construction-based Engineering)

Engineering interface and process improvements towards cost optimisation

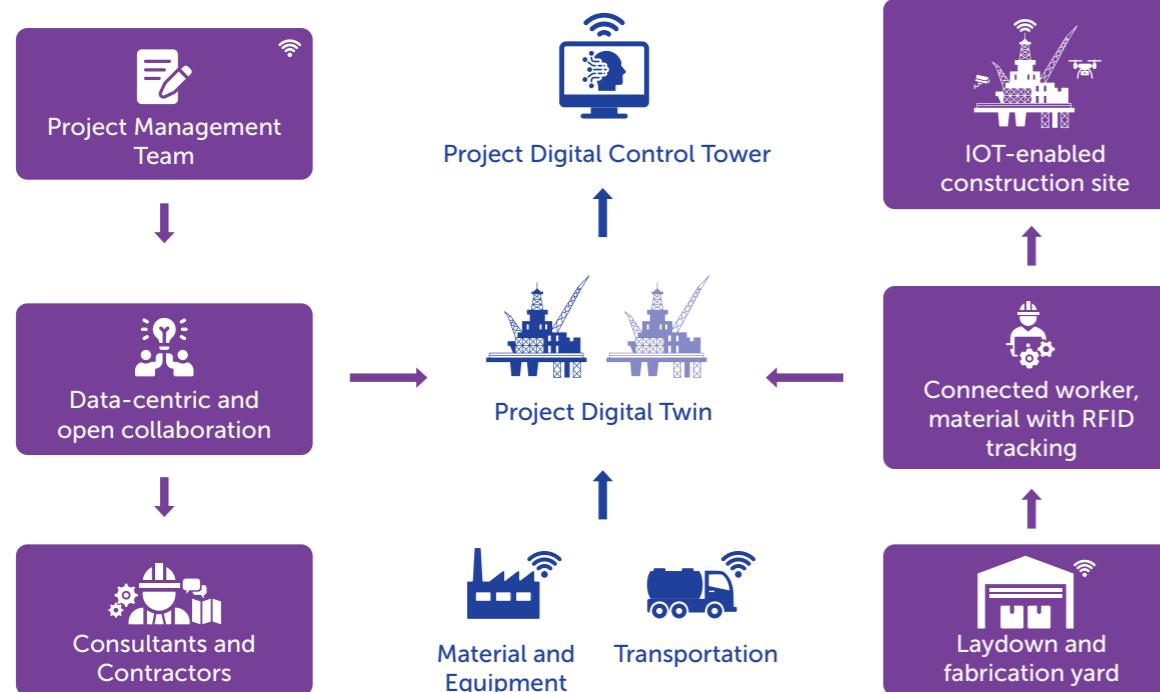
3. SPS (Smart Project Site)

Adoption of robotics and smart devices to deliver insights and optimisation at project site

4. DFG (Disruption for Growth)

Step change in project delivery ecosystem through R&D of project delivery practices

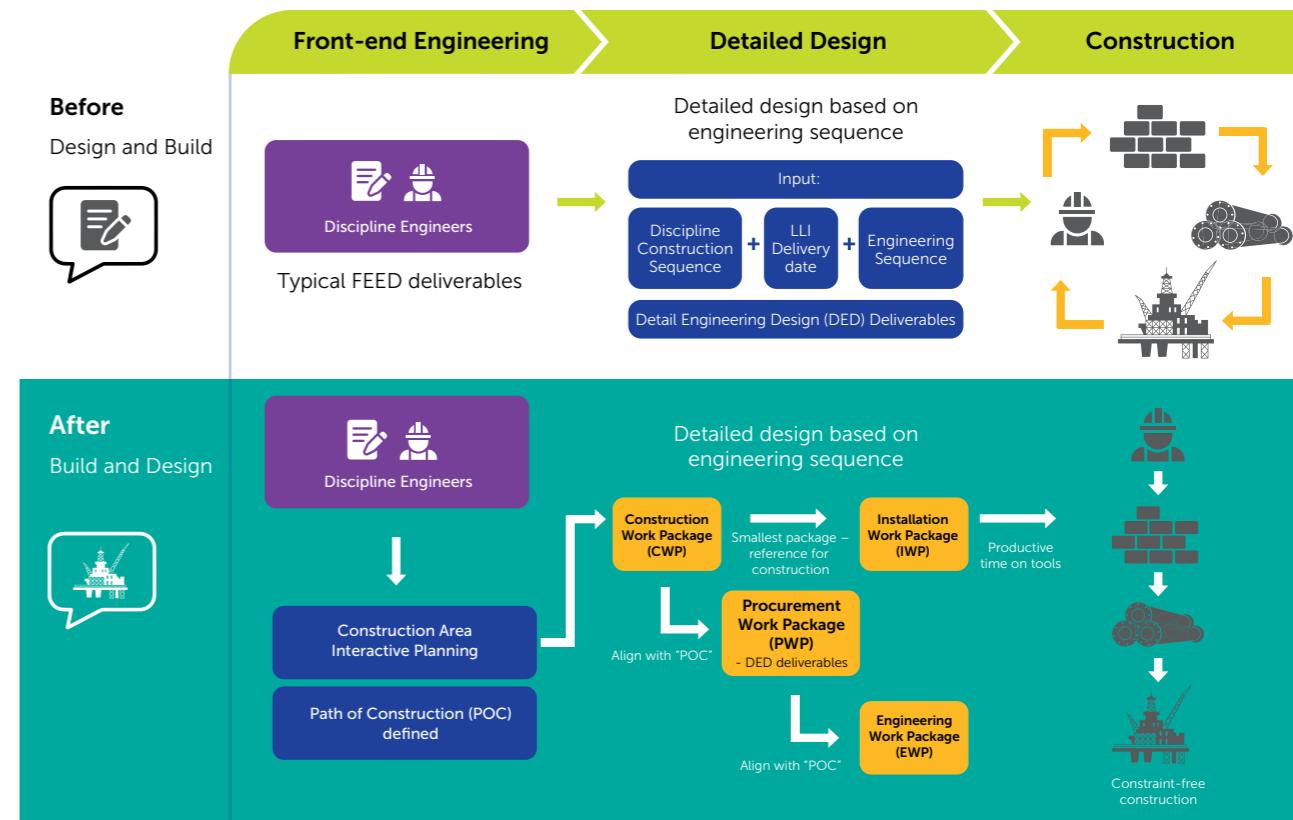
Highlights of the Transformation Areas



One of the four Transformative areas, which is the Construction-Based Engineering is optimising construction cost through process improvements. Aimed to optimise value delivery through improvement in efficiency, productivity and profitability, it is imperative for the industry to adopt Advanced Work Packaging (AWP) and Project Production Management (PPM) methodologies in delivering projects. A Joint Industry Collaboration (JIC) between industry players was established to accelerate maturity of the adoption.

Advanced Work Packaging (AWP): "Begin with the end in mind"

AWP is a construction-driven project delivery process that adopts the fundamental philosophy of "beginning with the end in mind." A key requirement of this process is the collaboration between construction and engineering during early project phase to create a constraint-free work environment in the field. With construction being part of consideration during project planning, reduction in overall labour cost is realised through minimised productivity losses.



It is important for industry players to be equipped with appropriate knowledge on AWP methodology and augment the principles in project delivery work processes. Closer collaboration between Project Owners and Contractors enables the achievement of common objective, improving productivity and overall project outcome.

Key benefits of AWP:



Reduced cost through improved labour productivity



Improved constructability input and installation quality



Improved overall project predictability



Improved safety awareness



Better alignment among stakeholders

Project Production Management (PPM): Understanding project behaviours for optimised execution

Project Production Management (PPM) utilises operation science in understanding project behaviours, ensuring projects achieve business objectives with minimal use of resources. This approach alleviates gaps in conventional project management by considering the impact of inventory and variability to project delivery outcome.

Comprehensive Approach for Project Optimisation

- Viewing "Project" as a "Production System" to deliver final product through a network of processes and inventories.
- Understanding projects as an interconnection between five levers of PPM.



- Utilising project planning and tracking data to generate critical insights through various analytics based on Operation Science.

New ways of working in Project Execution and Delivery

- Insights from Operation Science together with capitalisation of technology and digital tools enable proactive and effective mitigation of underlying project performance challenges.



Operation Science

"Study of transformation of resources to create and distribute goods and services with focus on interaction between demand, production and the associated variability"

- Project practitioners have clear understanding of inter-relating processes, align expectations and synchronise effort in the interest of the overall project objective.

Strategic Partnership Established to Facilitate CBE Adoption by the Industry

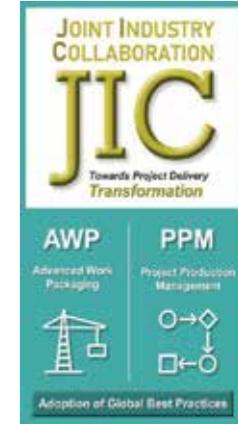
In progressing the JIC for CBE, a strategic partnership within the industry was established with the goals to:



Be a platform for collaboration and information sharing

Gather feedback on challenges and constraints in implementation and deliberate the best mitigation approach

Establish industry guideline and standardise implementation approach



"PETRONAS is transforming the way we deliver projects through digitalisation and adoption of industry best practices and new ways of working. This can only be achieved if the Malaysia's oil and gas industry players collaborate and move forward as the same direction with PETRONAS. We are in this together as one eco-system. ONE TEAM ONE GOAL"



Noor Ilias Mohd Idris
Vice President, Group Project Delivery,
PETRONAS

As PETRONAS and the industry continue to collaborate and move forward together, it is aspired that industry players are able to provide solutions which contribute to lesser greenhouse gas (GHG) emissions and demonstrate strong commitment towards sustainability. Innovation, creative partnerships and acceleration of technological development towards low carbon energy and solutions is paramount in realising PETRONAS' target of achieving the NZCE 2050 and support Malaysia's commitment of becoming a carbon-neutral nation by 2050.

Business Overview



Upstream

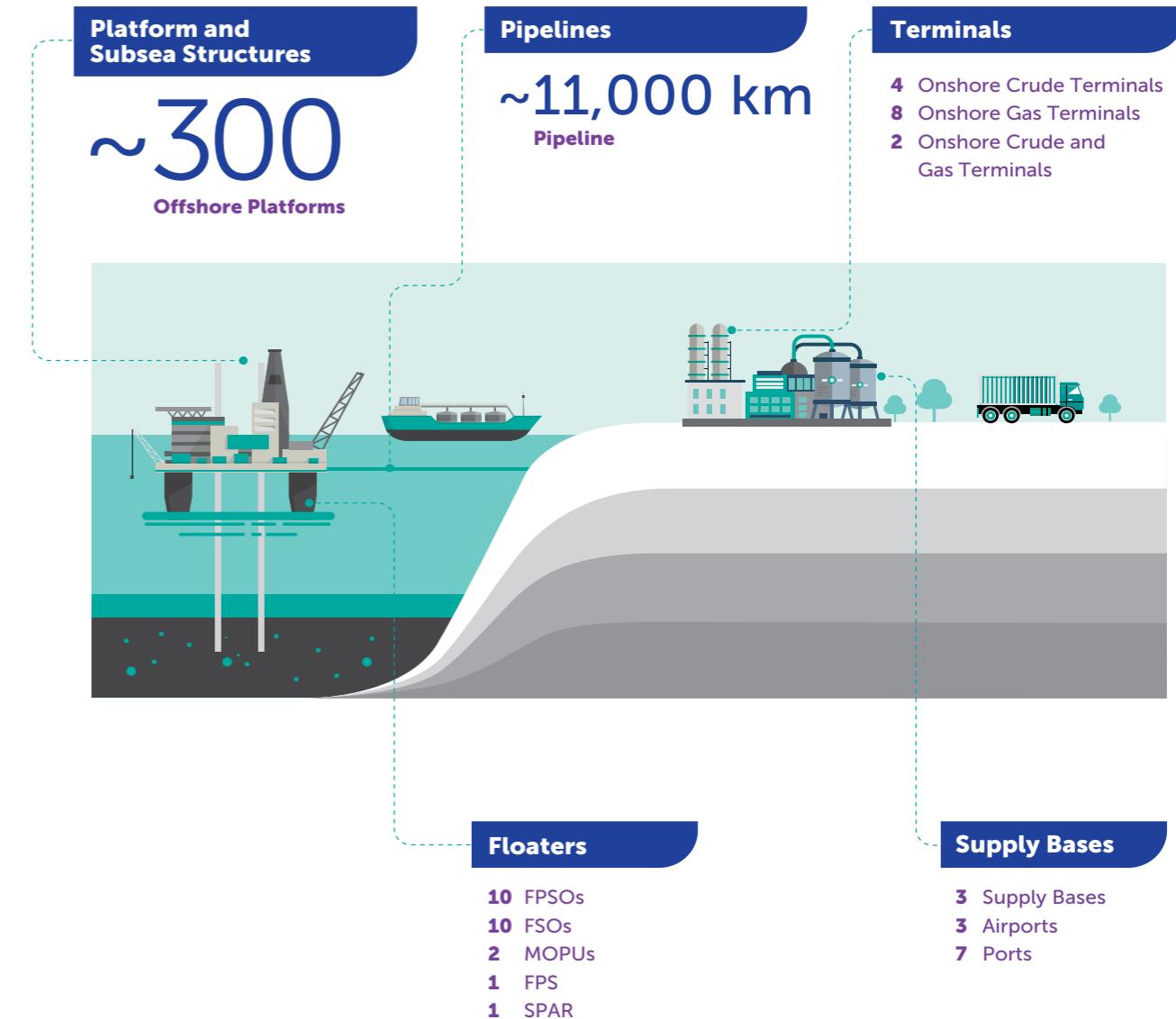


Gemusut Kakap, off the coast of Sabah

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.

Below is a snapshot of Upstream Malaysia's facilities dimension, operated by ~30 Petroleum Arrangement Contractors (PACs) as at October 2021.



Gas + New Energy

Gas Processing Plant in Kerteh, Terengganu

Gas + New Energy Overview

The Gas + New Energy portfolio reflects our intent in PETRONAS' Statement of Purpose that places an emphasis on sustainability. The illustration below depicts the spectrum of domestic value chain for the Gas + New Energy business.



Downstream



Pengerang Integrated Complex (PIC)

Downstream Overview

Downstream business plays a strategic role in enhancing the value of molecules through its multiple integrated operations, transforming it into high-quality and value-added products. The diverse activities include refining, trading, and marketing of crude oil and petroleum products, the manufacturing and marketing of petrochemical and specialty chemical products, as well as the supply of lower carbon and sustainable solutions such as sustainable aviation fuel and LNG bunkering to customers.



Refining and Trading

- **3 Refineries**
Malaysian Refining Company Sdn Bhd
PETRONAS Penapisan (Terengganu) Sdn Bhd
Pengerang Integrated Complex
- **Trading Office**
Headquarters in Kuala Lumpur



Petrochemical

- **21 Petrochemical Processing Plants***
*Including the one at Pengerang Integrated Complex



Marketing

- **>1,000 Retail Stations**
- **1 Lube Oil Blending Facility**
- **11 LNG Bunkering Facilities**
1 LNG Bunkering Vessel
2 LNG Bunker Distribution Hubs
4 LNG Bunkering Sites
4 LNG Trucks
- **12 Conventional Fuel Bunkering Facilities**
1 Conventional Fuel Distribution Hub
11 Diesel Bunkering Facilities
- **38 Terminals**
17 Fuel Terminals
13 Aviation Terminals
8 LPG Terminals and Bottling Facilities

Activity Outlook

PETRONAS Floating LNG DUA

Methodology

Scope of Coverage

This section provides the activity outlook for core categories, serving as leading indicators to many other supporting services. The interdependencies create 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 and Gas + New Energy-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 2022 to 2024. Information is accounted for when a specific activity begins and not by contract award. Using the 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. Another example is Plant Turnaround that begins in December 2022 and ends in January 2023, is only accounted for once, which is in 2022.

Directional narratives are provided for the medium-term (which is post-2024), to support outlook analysis using the following signposts:

-  **Positive**
Medium Term Outlook
-  **Steady**
Medium Term Outlook
-  **Modest**
Medium Term Outlook

Actual vs Plan 2021

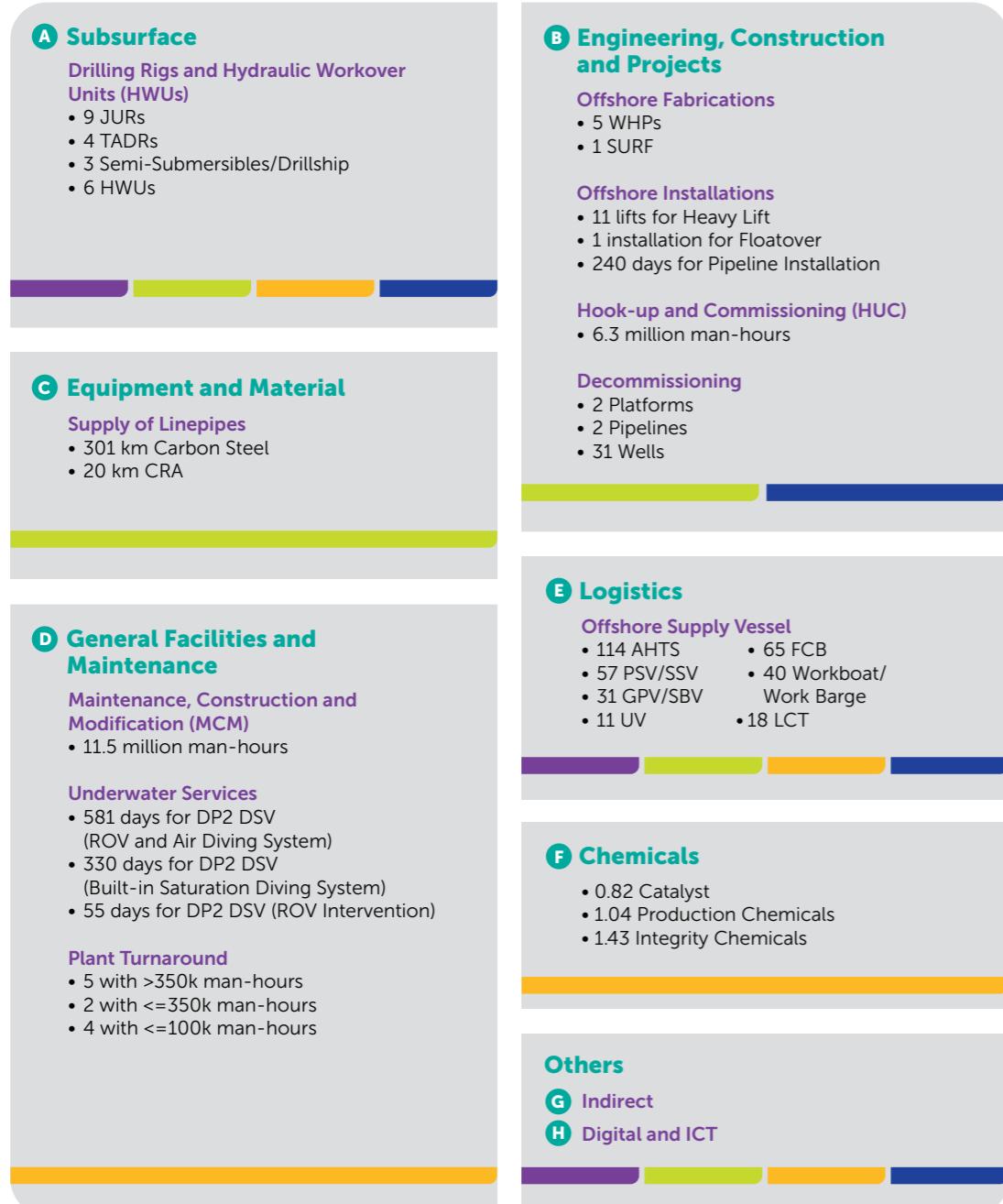
Actual numbers are based on data as at October 2021.

Base and High Case Scenarios for 2022–2024

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

- **Base 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

Quick Reference for 2022



Activity Phase (Upstream, Downstream and Gas + New Energy):



Subsurface

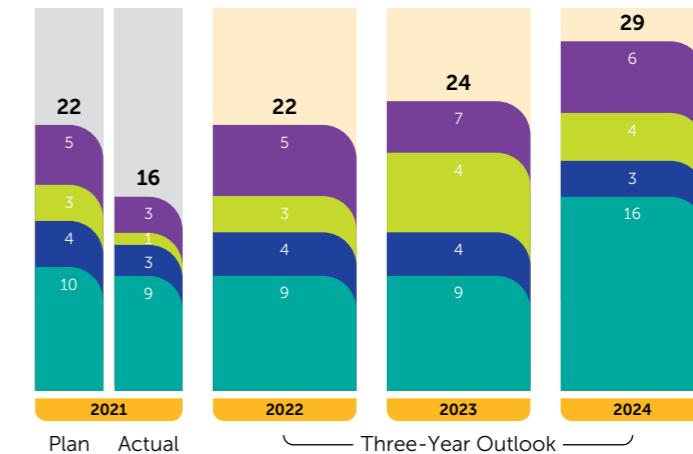
Drilling Rigs and Hydraulic Workover Units

Drilling Rigs are used to drill wellbores. Activity outlook will be provided for all types of rigs operating in Malaysia, i.e. Jack-up Rigs (JURs), Tender Assisted Drilling Rigs (TADRs), Semi-Submersible Rigs and Drillship.

The Hydraulic Workover Units (HWU) are utilised to perform workover for recompletion and plugged abandonment work and could function as an alternative to the rigs mentioned above.

Type of Rigs	Jackup	TADR	Semi-Submersible	Drillship	HWU
Activity Phase	• Exploration • Development • Abandonment	• Development • Abandonment	• Exploration • Development • Abandonment	• Exploration • Development • Abandonment	• Production • Abandonment
Application	The most common type of offshore rig due to its flexibility. Typically used for drilling in shallow water.	Typically used in deepwater with space/load/approachability limitations, e.g. deepwater spars, tension leg platform (TLP), etc.	The most stable type of rig, typically used for drilling in deepwater and/or harsh environment.	Typically used for drilling in deepwater/ultra deepwater. Can also be used for well maintenance, completion and capping works.	Typically used for workover operations, e.g. recompletion, well repair and barrier placement.
Associated Services	Supporting vessels, Oil Country Tubular Goods (OCTG), third party drilling services, e.g. drilling fluids, Directional Drilling (DD)/Measurement While Drilling (MWD)/Logging While Drilling (LWD), wellheads, drill bits, cementing, fishing, slickline, etc.	OCTG and third party drilling services.	Supporting vessels, production logging, slickline, wellhead, fishing cementing, etc.		

Number of Rigs:



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

- In 2021, the rig count declined from 2020 due to reprioritisation of investments.
- Positive outlook is expected for the next three years given the oil price recovery with relaxation of pandemic SOP/directives and increase of plug and abandonment (P&A).
- Outlook for 2022 to 2024 is based on full year utilisation. Actual numbers may vary based on campaign duration and/or optimisation, project deferment, cancellation, etc.

Medium Term Outlook – Post 2024

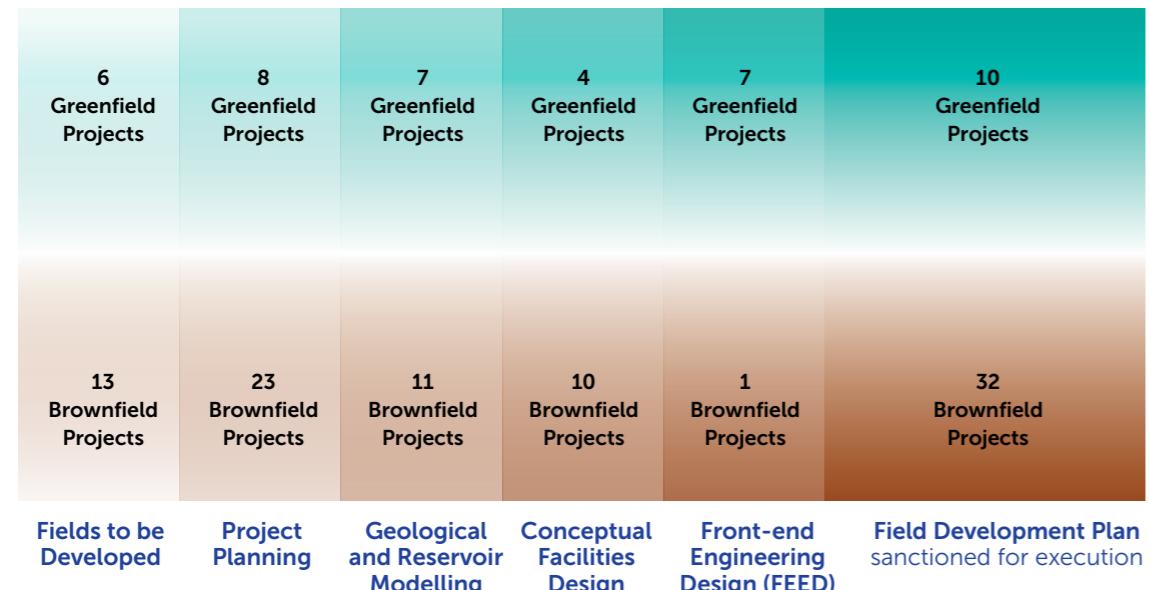
Positive outlook is expected for drilling rigs activity while continue focusing to enhance and upgrade the rig capability and mature the integrated operations scope via integrated rig, drilling and completions services (i-RDC) to deliver operational excellence and cost effective solutions.

Engineering, Construction and Projects

The outlook for **Engineering, Construction and Projects** is best represented by activities related to **development projects**, i.e. offshore fabrication, supply of linepipes, offshore installation, hook-up and commissioning as well as decommissioning.

Typical upstream project development comprises Engineering, Procurement, Construction, Installation, Hook-up and Commissioning (EPCIC) stages.

The following portfolio of projects showcase abundant investment opportunities in the Malaysian waters over a longer period. Large pool of projects are continuously and rigorously reviewed to materialise a steady pipeline of feasible and economically viable projects for production sustainability.



Number of projects are as at November 2021, and inclusive of infill drilling projects.

The fields to be developed include marginal fields, late life assets, fields with high contaminants, high complexity reservoirs and distant fields that offer opportunities for investors to turn the projects viable through innovative, disruptive and cost-effective solutions. This is a niche play that can create a marketspace for a profitable and sustainable business.

i Did you know?

- PETRONAS has announced its endorsement of the World Bank's Zero Routine Flaring by 2030 Initiative and the recommendations of the Task Force on Climate-related Financial Disclosures, as part of its broader effort for greater transparency around its action on climate change, in line with the Group's aspiration to achieve Net Zero Carbon Emissions by 2050.
- The Zero Routine Flaring Initiative aims to end routine flaring of associated gas from oil production. Under this Initiative, PETRONAS pledges to avoid routine flaring in new oil field developments and end routine flaring at existing oil production sites by 2030. This is applicable to PETRONAS' Upstream operations within operational control and excludes flaring sources due to safety and non-routine flaring.



Engineering, Construction and Projects

For the purpose of this report, the timeline for each project is segregated into three stages, i.e. (i) Engineering and (ii) Fabrication, (iii) Installation, Hook-up and Commissioning. There may be overlap of activities between the two stages, as depicted by the gradient. Also illustrated are indicators for facility type and; installation requirements.

The list below depicts upstream **greenfield development projects**:

Greenfield Projects¹

Project	2022	2023	2024	Facilities Type	Installation Requirement
Kasawari CPP				C	
Kasawari (E11R-AA)				L	
NMB Phase 4A (Kangsar)				M	
Project 1	Engineering	Fabrication,	Installation and Hook-up Commissioning	M	
Project 2	Engineering	Fabrication,	Installation and Hook-up Commissioning	C	
Project 3	Engineering	Fabrication,	Installation and Hook-up Commissioning	M	
Project 4	Engineering	Fabrication,	Installation and Hook-up Commissioning	M	
Project 5	Engineering	Fabrication,	Installation and Hook-up Commissioning	F	S
Project 6	Engineering	Fabrication,	Installation and Hook-up Commissioning	S	
Project 7	Engineering	Fabrication,	Installation and Hook-up Commissioning	S	
Project 8	Engineering	Fabrication,	Installation and Hook-up Commissioning	H	
Project 9	Engineering	Fabrication,	Installation and Hook-up Commissioning	L	
Project 10	Engineering	Fabrication,	Installation and Hook-up Commissioning	L	
Project 11	Engineering	Fabrication,	Installation and Hook-up Commissioning	L	
Project 12	Engineering	Fabrication,	Installation and Hook-up Commissioning	M	
Project 13	Engineering	Fabrication,	Installation and Hook-up Commissioning	H	
Project 14	Engineering	Fabrication,	Installation and Hook-up Commissioning	H	C
Project 15	Engineering	Fabrication,	Installation and Hook-up Commissioning	M	
Project 16	Engineering	Fabrication,	Installation and Hook-up Commissioning	M	

¹At the time of reporting, high number of projects are still under review

- Engineering
- Fabrication,
- Installation and Hook-up Commissioning
- In Execution

Legend for Facilities Type:

Fixed structure	L WHP Lightweight – total tonnage ≤ 1,000 tonnes	H WHP Heavy Weight – total tonnage > 7,500 tonnes
	M WHP Medium Weight – total tonnage ≤ 7,500 tonnes	C CPP Heavy Weight – total tonnage > 7,500 tonnes
Floating structure	F Floaters – Floating Production Storage and Offloading (FPSO) / Floating Storage and Offloading (FSO) / Mobile Operating Production Unit (MOPU)	
Subsea structure	S Subsea – Subsea Production System and Subsea Umbilical, Riser Flowline (SURF)	

Engineering, Construction and Projects

For the purpose of this report, **brownfield projects** are segregated by:

- Brownfield Projects (with new structural installation)**
- Brownfield Projects (without new structural installation)**

Brownfield Projects² (with new structural installation)

Project	2022	2023	2024	Facilities Type	Installation Requirement
GK Ph3				S	PETRONAS is open to any cost effective and innovative method of installation. Proposals are welcome.
Bayan Gas Phase 2				F	
Project 1				M F	

²At the time of reporting, high number of projects are still under review

█ Engineering
█ Fabrication,
█ Installation and Hook-up Commissioning
█ In Execution

Legend for Facilities Type:

Fixed structure	L WHP Lightweight – total tonnage ≤ 1,000 tonnes	H WHP Heavy Weight – total tonnage > 7,500 tonnes
	M WHP Medium Weight – total tonnage ≤ 7,500 tonnes	C CPP Heavy Weight – total tonnage > 7,500 tonnes
<hr/>		
Floating structure	F Floater – Floating Production Storage and Offloading (FPSO) / Floating Storage and Offloading (FSO) / Mobile Operating Production Unit (MOPU)	
<hr/>		
Subsea structure	S Subsea – Subsea Production System and Subsea Umbilical, Riser Flowline (SURF)	

Engineering, Construction and Projects

For **brownfield projects (without new structural installation)**, the activity types are indicated as:

- Infill Drilling** → Drilling of new wells in an existing field within the original well patterns to accelerate production.
- Platform Modification** → Modifying existing structures to enable rig move-in (for infill drilling) or to serve new/additional operational objectives. May involve minor fabrication works.
- Host Tie-in** → Connecting two or more structures to complete the chain of production facilities, allowing production to commence.

Brownfield Projects (without new structural installation)

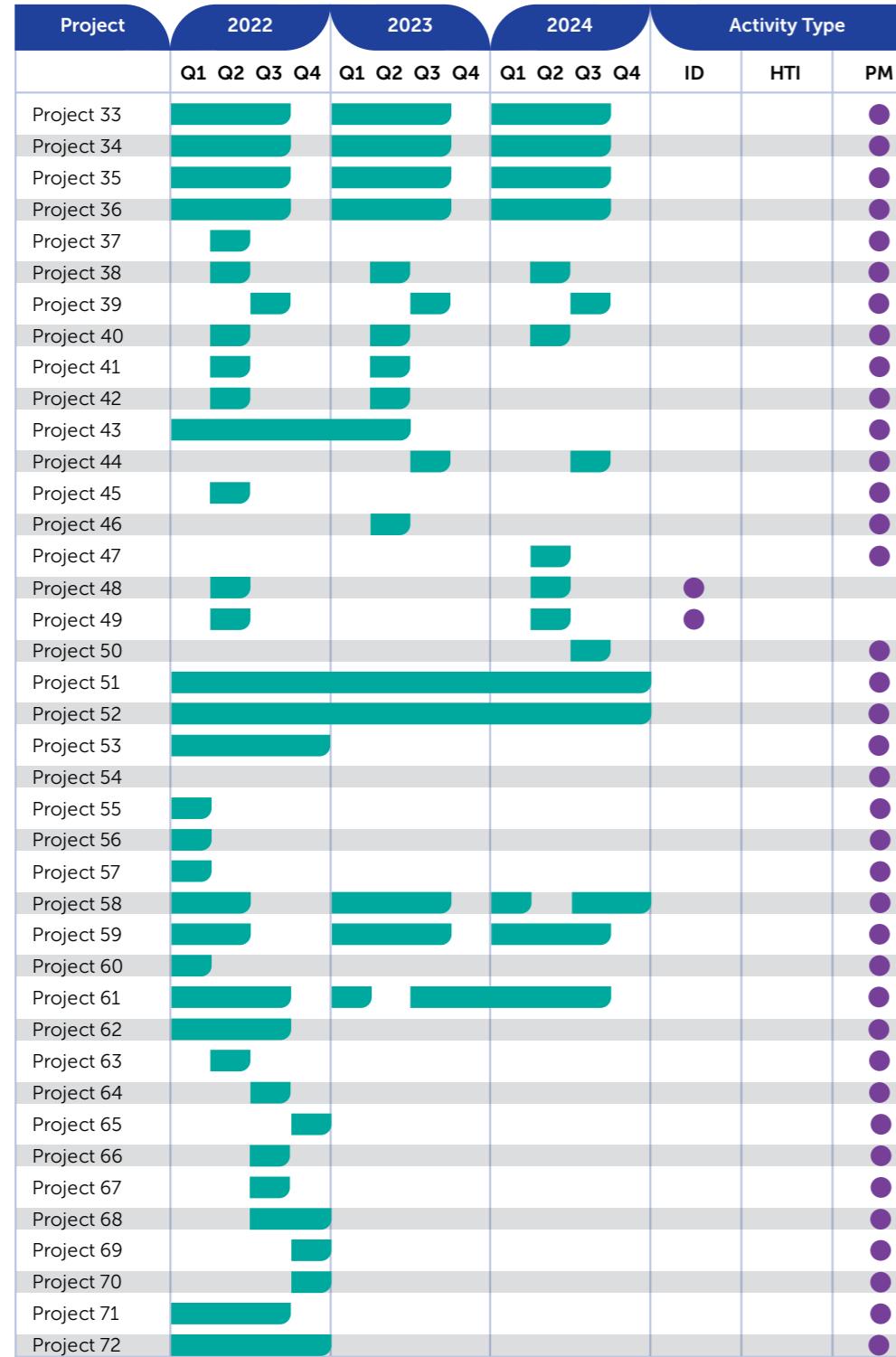
Project	2022				2023				2024				Activity Type		
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	ID	HTI	PM
Project 1													●		
Project 2													●		
Project 3													●		
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Project 32															●

Legend:

█ ID Infill Drilling █ HTI Host Tie-in █ PM Platform Modification

Engineering, Construction and Projects

Brownfield Projects (without new structural installation)



Legend:

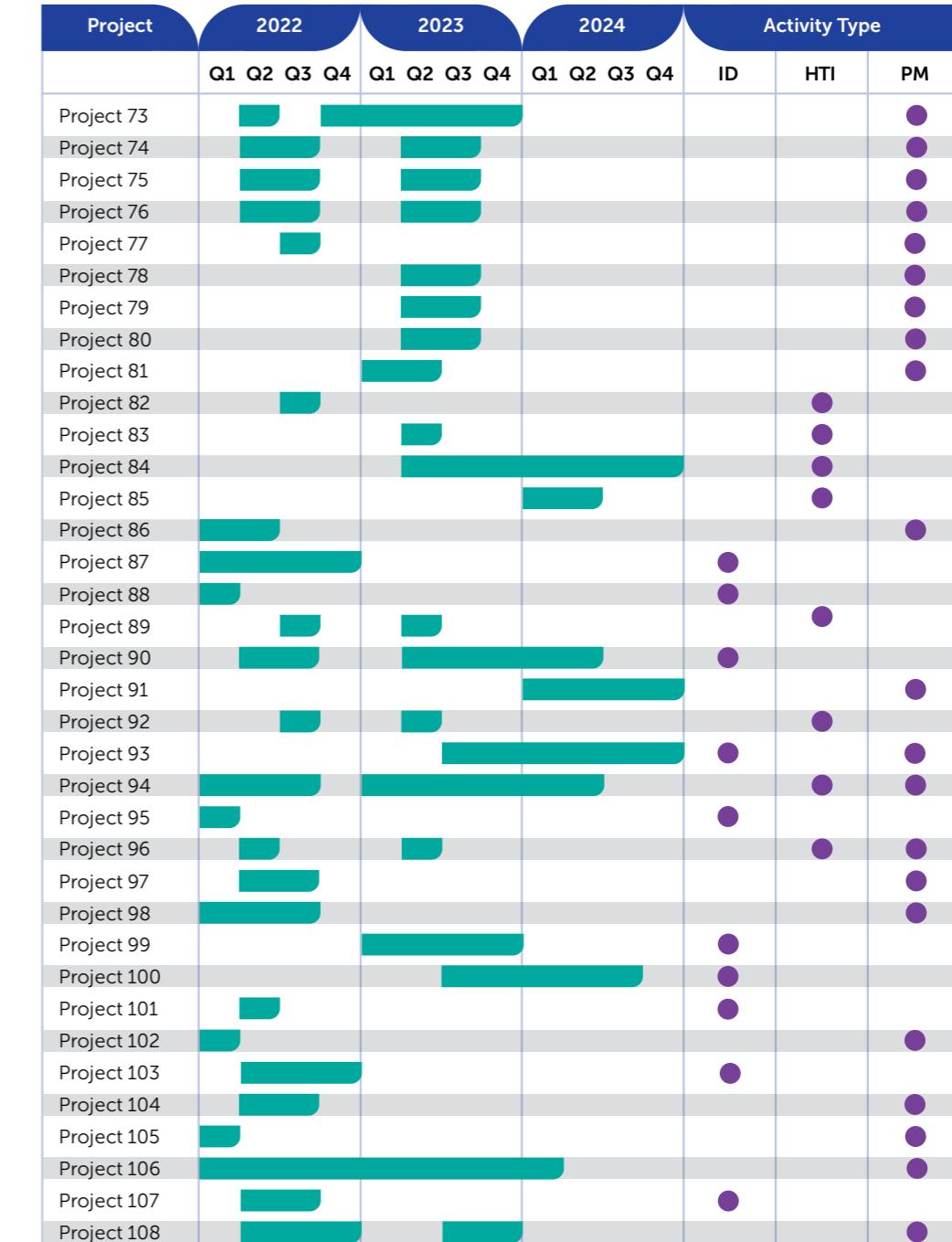
ID Infill Drilling

HTI Host Tie-in

PM Platform Modification

Engineering, Construction and Projects

Brownfield Projects (without new structural installation)



Legend:

ID Infill Drilling

HTI Host Tie-in

PM Platform Modification

Engineering, Construction and Projects

Offshore Fabrication

Offshore fabrication outlook is provided for fixed and floating structures, with first steel-cut as the indicator of commencement of fabrication activity.

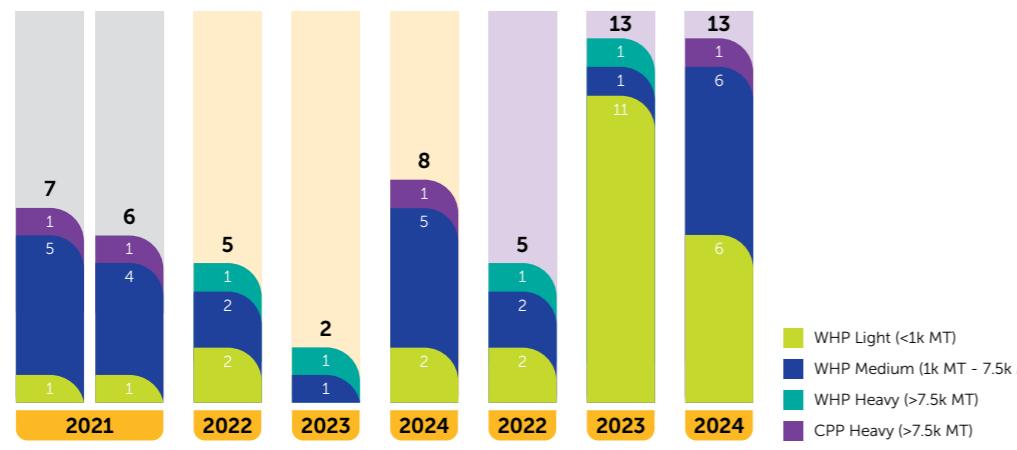
Fixed Structures: Wellhead Platform/Central Processing Platform

Wellhead Platform (WHP) Application: Used to house wellheads and equipment that extract oil/gas from the seabed and serve as a platform for drilling activities. Typically, it is linked to other fixed or floating structures for oil/gas processing.

Central Processing Platform (CPP) Application: Used to house wellheads and equipment that extract and process oil/gas from WHPs and piped to point of export. CPP typically acts as the central hub for the entire field complex.

Associated Services: Engineering, structural steel, bulk material (such as piping, cables, etc.), equipment supplies (like mechanical, electrical, instruments, etc.)

Number of Fixed Structures Fabrication:



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

- For 2021, one Medium WHP was deferred to 2022 due to realignment of strategy.
- In 2023 and 2024, most projects are at the preconception selection stage, which are still subjected to projects' economic feasibility. Therefore, there is a disparity in the high and base case.

Did you know?

- PETRONAS focuses on the development and monetisation of high contaminant fields which include high CO₂ gas fields. The development of these fields will help meet PETRONAS' commitment in reducing GHGs which will be commenced through Sarawak Integrated Sour Gas Evacuation System (SISGES) Plant.
 - SISGES Phase 1 (2022): Development of onshore plant and projects engineering for offshore.
 - SISGES Phase 2 (2023): Projects engineering for offshore.

Engineering, Construction and Projects

Floating Structures: Floaters

For the purpose of this report, floaters refer to non-fixed structures involved in processing and/or storage of hydrocarbons, like the Floating Production Storage and Offloading (FPSO), Floating Storage and Offloading (FSO) and Mobile Offshore Production Units (MOPU).

Application: Used as relocatable production facilities, generally to enable monetisation of marginal or isolated oil and gas fields without existing export facilities (pipeline) in the vicinity.

Associated Services: Engineering, structural steel, equipment supplies (e.g. mechanical, electrical, instruments, etc.), fabrication yards, shipyards, transportation and installation, hook-up and commissioning and Marine Warranty Surveyor.



Floating Production, Storage and Offloading

Vessel used for the processing of hydrocarbons, as well as for storage of crude oil before export via tanker lifting.



Floating Storage and Offloading

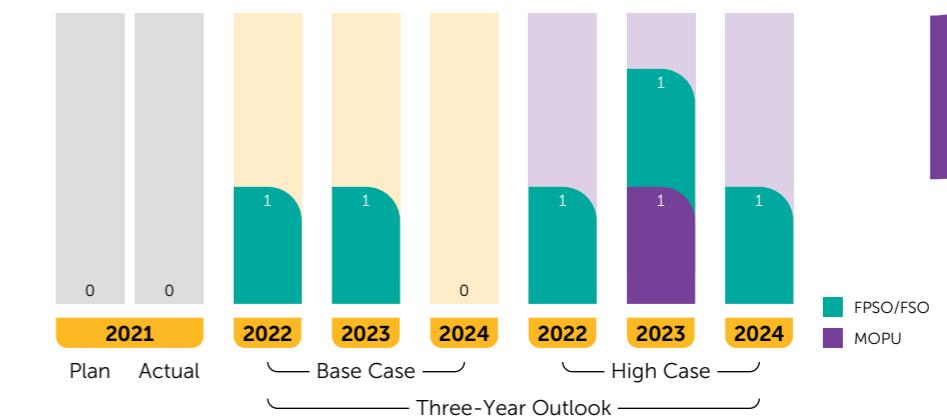
A simplified FPSO without the capability for oil or gas processing.



Mobile Offshore Production Unit

Portable structure that can be reused in offshore well production. In this report, MOPU refers to the portable wellhead platform.

Number of Floating Structures Fabrication:



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

- Globally, the FPSO market is picking up from 2021 amidst the energy transition and lowering of carbon emissions. FPSO industry players also need to adapt and move towards achieving the common aspiration of net zero carbon emissions.

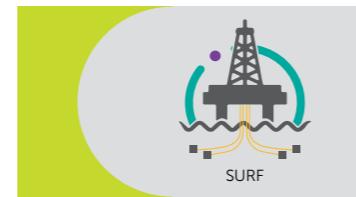
Engineering, Construction and Projects

Subsea Structures

Subsea structures are facilities located on the sea floor, as opposed to on the surface. The petroleum is extracted on the sea floor, and then "tied-back" to an existing production platform using Subsea Umbilical, Riser and Flowline (SURF) facilities.

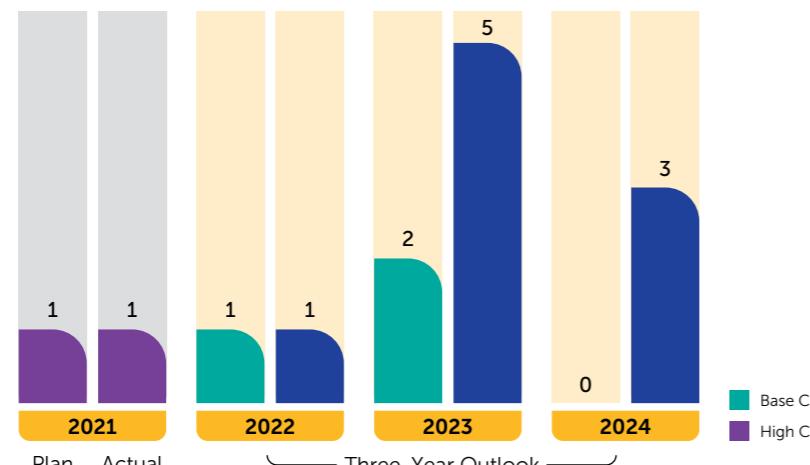
Application: Used to provide safe and efficient interconnection from the topside platforms and vessels to the wellheads and pumps on the sea floor, and vice versa for a reliable oil and gas extraction from subsea wells.

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



Subsea Umbilical, Riser and Flowline (SURF) comprises subsea completed wells, subsea Christmas trees and wellhead systems, subsea tie-in to flowline system, jumpers, umbilical and riser system, and subsea equipment to operate the well.

Number of Projects for SURF:



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

- Subsea tie-backs are gaining traction as they present economic viability for monetisation of previously untapped and less economically viable discoveries, i.e. deepwater and marginal fields.
- Demand for SURF in 2023 could be higher as more deepwater projects are maturing.
- Deepwater projects in Malaysia are maturing and having a long-term arrangements for SURF is one of the options to support the project requirement.



Medium Term Outlook – Post 2024

- Steady outlook is expected for fabrication of fixed structures (especially Lightweight) and subsea facilities as PETRONAS continues monetising its oil and gas resources for cash generation while meeting gas customers' demand.
- Modest outlook is expected for heavier structures as cost competitiveness drives development projects to opt for WHP tie-ins to existing nearby facilities.
- Modest outlook is also expected for floaters, as technology advancements present favourable options for monetisation of remote fields.

Engineering, Construction and Projects

Offshore Installation

Offshore installation outlook for each project is provided by the type of installation barge required for facility installation, i.e. heavy lift, floatover or pipelaying barge.

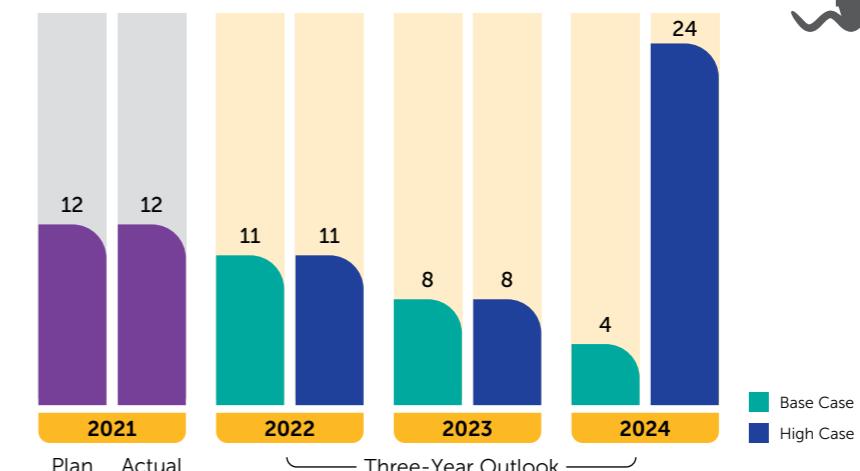
Structural Installation – Heavy Lift

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

Associated Services: Supporting vessels, diving and remotely operated vehicles (ROVs), welding and non-destructive testing (NDT).



Number of Lifts Using Heavy Lift Barges:



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

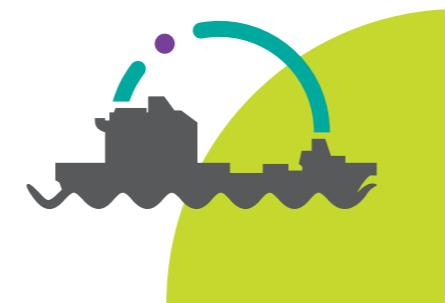
- In 2021, all planned activities for structural installation were materialised despite pandemic challenges and Movement Control Order (MCO) restrictions.
- Outlook number is measured in terms of number of lifts, counted separately for each jacket and topside, and excludes heavy lift barges utilisation for facilities decommissioning.
- This outlook may be read together with the outlook for offshore fabrication.
- In 2024, most projects are at preconception selection stage, which are still subjected to projects' economic feasibility. Therefore, there is a disparity in the high and base case.

Engineering, Construction and Projects

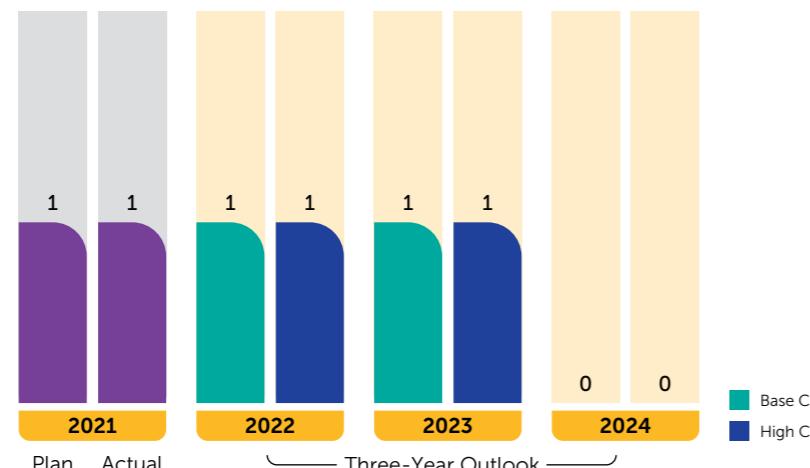
Structural Installation – Floatover

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

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



Number of Structural Installation Using Floatover Barges:



- Numbers indicated are base case and are measured in terms of number of projects. Duration may vary.
- Modest outlook is expected for floatover barges with lower number of projects requiring CPPs.



Medium Term Outlook – Post 2024

- Steady outlook is anticipated for heavy lift barges given the steady amount of projects requiring WHPs.
- Modest outlook is expected for floatover barges with lower number of projects requiring CPPs.

Engineering, Construction and Projects

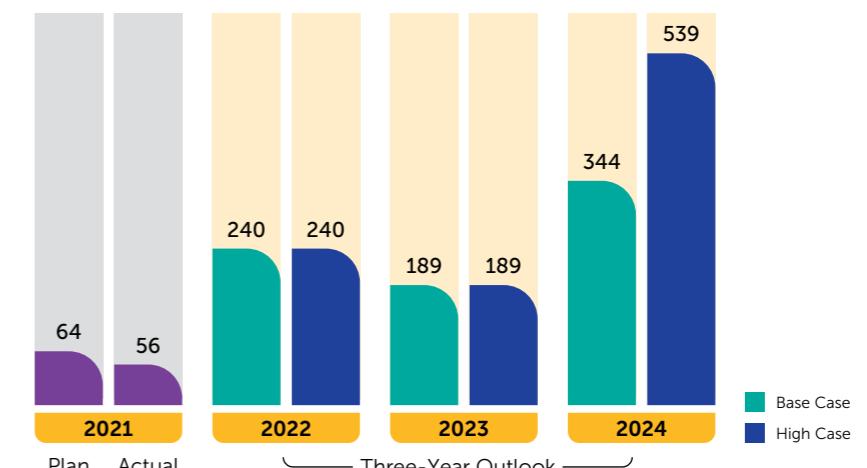
Pipeline Installation – Pipelay

Application: Used to install rigid linepipes (e.g. carbon steel, corrosion resistant alloy (CRA), etc.) for offshore projects.

Associated Services: Supporting vessels, diving and ROVs, fill joint coating services, welding and NDT.



Number of Installation Days:



- Outlook number is measured by number of installation days, based on estimated number of pipe joints and length, and covers carbon steel and Corrosion Resistant Alloy (CRA) pipeline only.
- This outlook exclude requirement for pipeline replacement.
- In addition, there are potential installation requirements for flexible pipes as follows:
 - 10 km in 2022
 - 44 km in 2024
- This outlook may be read together with the outlook for supply of linepipes.



Medium Term Outlook – Post 2024

- Steady outlook can be expected for pipelay barges as more development projects opt for tie-ins to existing WHP or processing facilities.

Engineering, Construction and Projects

Hook-up and Commissioning

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

Outlook is stated in man-hour units as the activities are labour intensive.

Activity Phase: Development and Production

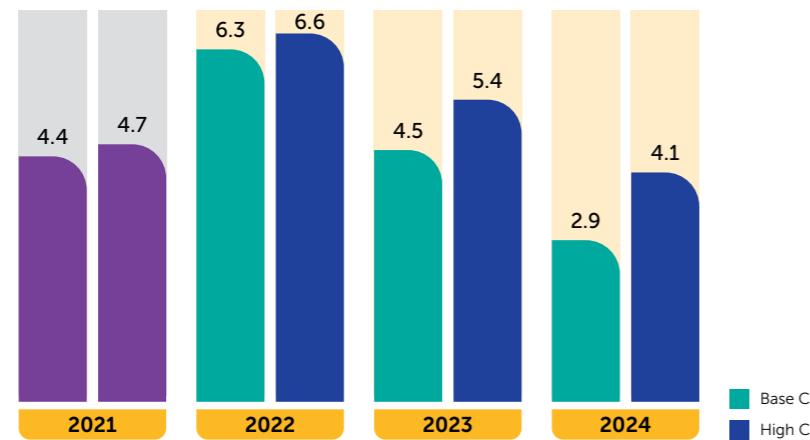
Application: **Greenfield** HUC involves works on newly-installed platforms during development stage. Typically bundled as part of EPCC/EPCIC contracts.

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, Fast Crew Boat), logistics services, pre-commissioning services, inspection services, etc.



Number of Man-Hours (Millions):



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

- In 2021, actual numbers are higher than planned due to acceleration of project execution after CAPEX deferment in 2020.
- By 2023 and 2024, there are many current projects which are expected to be completed.
- Many of the initially planned projects for 2022, 2023 and 2024 had to be deferred and rationalised due to the COVID-19 pandemic. The projects which survived are expected to resume and peak only in 2025.
- Outlook excludes manhours from EPCC and/or EPCIC projects.



Medium Term Outlook – Post 2024

- Steady outlook for Brownfield HUC to maximise hydrocarbon recovery from existing fields.

Engineering, Construction and Projects

Decommissioning

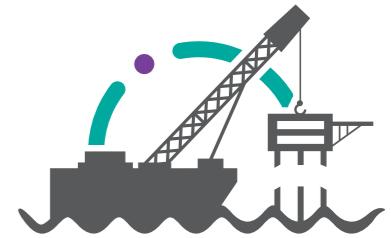
Decommissioning refers to activities to restore previously producing sites to safe and environmentally stable conditions.

Activity Phase: Abandonment

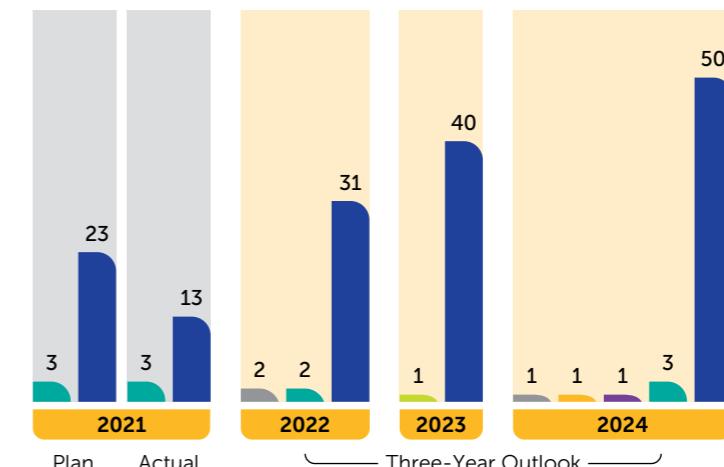
Application: Decommissioning comprises two activities:

- Well Abandonment: prepare wells to be closed permanently.
- Upstream Facilities Decommissioning: permanently make safe the facilities, e.g. WHP, CPP, Subsea Tree, etc.

Associated Services: Drilling rigs and HWU, offshore support vessels, lifting and third-party drilling services, engineering services, yard facility, transport, cutting services, conductor removal, pipeline flushing, etc.



Decommissioning of Facilities and Wells:



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

- Lower number of wells abandonment executed against planned due to COVID-19 restriction. However, for Pipeline decommissioning activity was executed as planned in 2021.
- PETRONAS currently is focusing on Wells P&A for the next three years as preparation for future facilities removal campaign.
- PETRONAS is currently exploring innovative decommissioning solutions focusing on technologies, re-use/purpose options, integrated approach as well as identifying potential alternatives that can introduce cost compression. Thus, participation and collaboration are encouraged from all parties.



Medium Term Outlook – Post 2024

- Steady outlook is expected for decommissioning activities as more fields have come to the end of life and PETRONAS as the host Authority in Malaysia and as a responsible operator will execute the abandonment's obligation, respectively.

C Equipment and Material

Supply of Linepipes

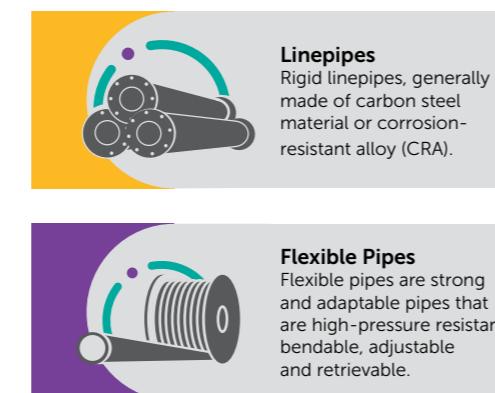
Linepipes and flexible pipes are used to transport oil or gas between two or more facilities. In this report, pipeline requirement is indicated by its type, i.e. rigid linepipe, flexible pipe, or both.

In this report, outlook is provided in relation to development projects' requirement and pipeline replacement projects, reflecting the year's activities which have started to meet the required-on-site date.

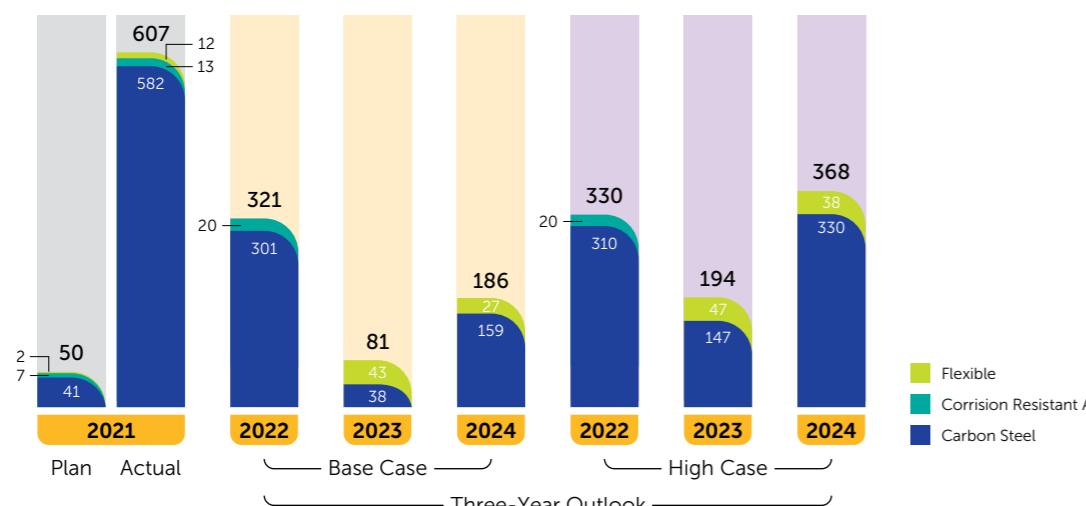
Application (Linepipes): Generally used for longer distances, typically for platforms to onshore plants.

Application (Flexible Pipes): Generally for shorter distances, typically for floating production systems with high-pressure production risers, export risers, chemical/water/injection lines, and gas lift lines.

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



Length of Linepipes (km):



- In 2021, the length of linepipes being procured was more than what was planned due to realignment of strategy.
- The outlook is for carbon steel, CRA and Flexible pipes only.
- This outlook may be read together with the outlook for installation of linepipes.



Medium Term Outlook – Post 2024

- Steady outlook is expected for supply of linepipes as steel price will stabilise starting Q3 2022 and onwards.

D General Facilities Maintenance

Offshore Maintenance, Construction and Modification

Offshore Maintenance, Construction and Modification (MCM) covers activities related to the repair and maintenance of existing topside facilities.

Outlook is stated in man-hour units as the activities are labour intensive.

Activity Phase: Production

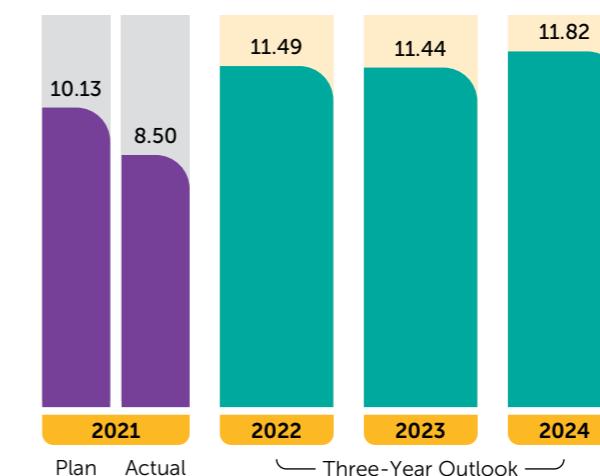
Application: MCM involves two types of activities:

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

Associated Services: Supply vessel, inspection services, blasting, painting services, etc.



Number of Man-Hours (Millions):



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

- In 2021, the actual man-hours were slightly lower than planned due to directives and restriction of the COVID-19.
- Activity is expected to remain stable over the next three years, given the oil price recovery with relaxation of COVID-19 SOP and contractors are fully adapted to the new norm and improve their overall manpower planning.



Medium Term Outlook – Post 2024

- Steady outlook can be expected for MCM activities for the next three years due to its cyclical nature. Potential growth due to activities for newly producing PACs.

D General Facilities Maintenance

Underwater Services

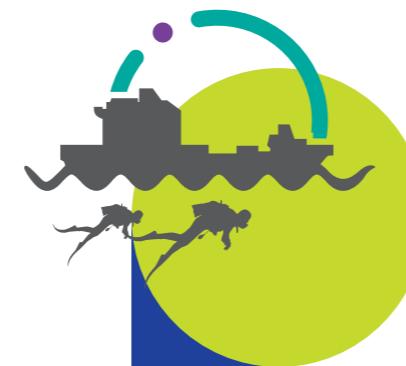
Underwater Services cover inspection, maintenance and repair activities performed for underwater structures such as platform jacket inspection, offshore pipeline inspection, debris survey and removal, etc.

For the purpose of resource planning and optimisation, the outlook is represented by the number of days for activities execution.

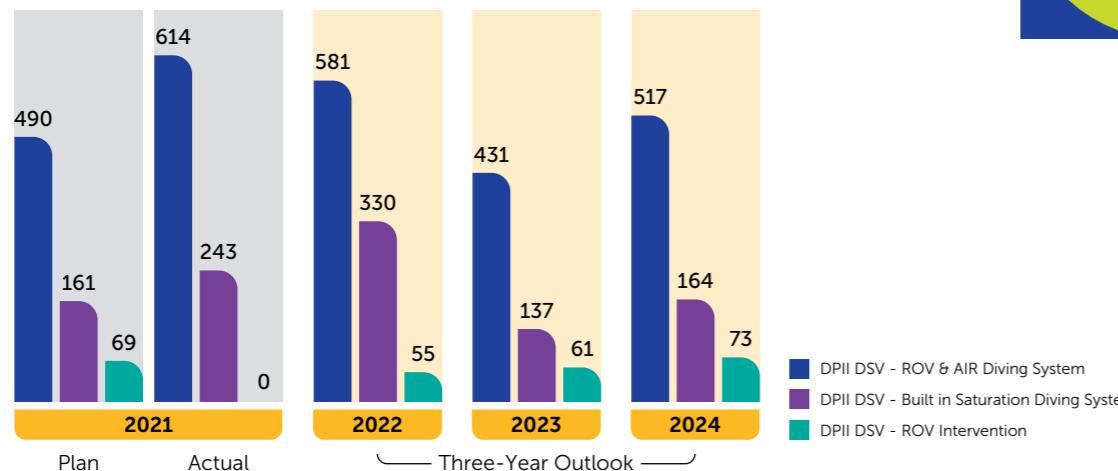
Activity Phase: Development and Production

Application: Inspection, maintenance and repair activities for continuity of services, safety and integrity of underwater structures, e.g. platform jackets, pipelines, subsea equipment, etc.

Associated Services: Diving and support vessel, air and saturation diving system, ROV and Project Management Team (PMT), etc.



Number of Days:



- Outlook is based on estimated number of days for execution of underwater activities utilising Diving Support Vessel (DSV). Vessel specification may vary depending on scope requirement.
- While activity prioritisation continues for the next three years, requirement for DSV is anticipated to be consistent. Where possible, optimisation will be exercised through activity consolidation across PACs.
- Prioritisation of local vessels will continue to be exercised.



Medium Term Outlook – Post 2024

- Steady outlook is expected for Underwater Services as activities are periodically scheduled. However, constant cost pressure will continue to drive further scope optimisation/prioritisation.

D General Facilities Maintenance

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 per cent). Other activities are discipline-specific, e.g., electrical, instrument, inspection and rotating equipment maintenance. Since turnaround is labour intensive, the activity outlook is stated in man-hour units.

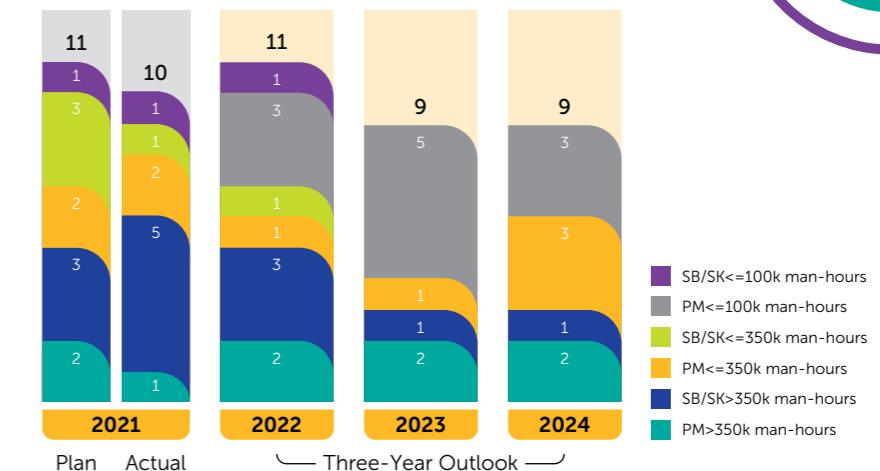
Activity Phase: Operations

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

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



Number of Turnarounds:



- In 2021, one turnaround was deferred to 2022.
- Plant Turnaround activities for the next three years outlook remain steady and shall provide sustainable demand.
- The outlook represents the number of PETRONAS Operating Units (OPUs) to perform turnaround and excludes PETRONAS upstream onshore facilities and plants not operated by PETRONAS. Activities under Pengerang Refining and Petrochemical (PRefChem) are also excluded from the outlook.



Medium Term Outlook – Post 2024

- Steady outlook is expected, given the cyclical requirement of maintenance for downstream plants.

Logistics

The Logistics category covers transportation, logistics, warehouse, workshop, storage and Offshore Support Vessel (OSV).

Offshore Support Vessel (OSV)

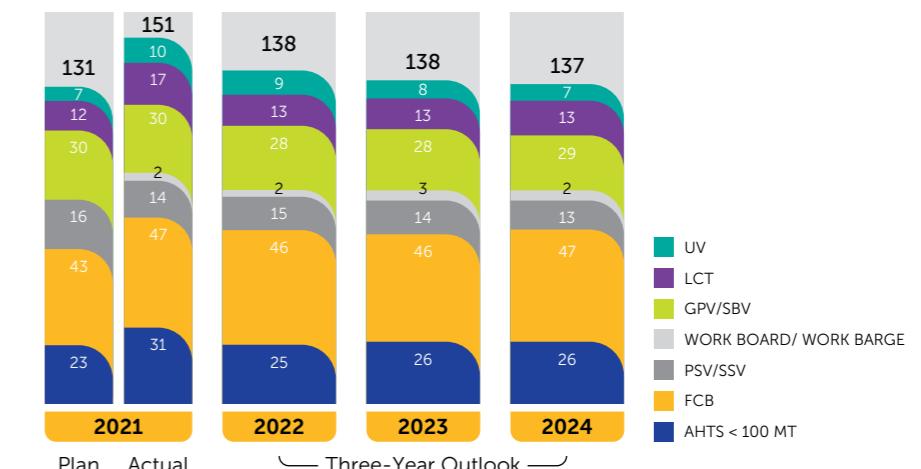
Type of Vessel	Anchor Handling Tug Supply (AHTS)	Platform Supply Vessels (PSVs)/ Straight Supply Vessels (SSVs)	Fast Crew Boat (FCB)
Activity Phase	<ul style="list-style-type: none"> Exploration Development Production Abandonment 		<ul style="list-style-type: none"> Development Production Abandonment
Application	Used to assist in anchor handling operation, towing and transport supplies to and from offshore platforms/drilling rigs	Transport equipment and supplies to offshore platforms/drilling rigs	High-speed vessel for the transportation of crew to offshore facilities and inter rigs
Associated Services	Vessel inspection services, bunkering services, port services, tank cleaning services		

Type of Vessel	Workboat/ Work Barge	General Purpose Vessel (GPV)/Standby Vessel (SBV)	Utility Vessel (UV)	Landing Craft Tank (LCT)
Activity Phase	<ul style="list-style-type: none"> Development Production Abandonment 	<ul style="list-style-type: none"> Development Production 		<ul style="list-style-type: none"> Production
Application	Accommodation for personnel	Standby support, rescue and emergency duties		Transport equipment and supplies to offshore platforms/drilling rigs
Associated Services	Vessel inspection services, bunkering services, port services			

For the purpose of activity outlook, the number represent OSVs requirements for Production Operations, Drilling and Projects (Wells).

Logistics

Number of Vessels Supporting Production Operations:



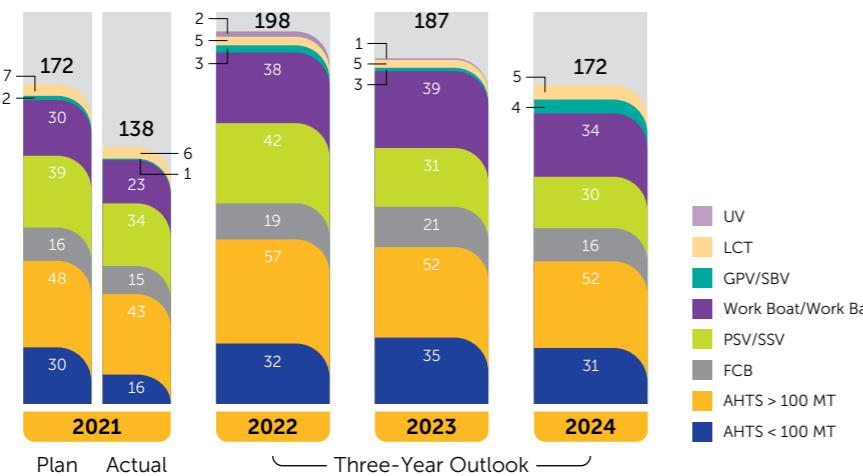
- In 2021, the actual numbers were higher due to additional vessels required in view of compliance to COVID-19 quarantine requirement for vessels and marine crews, particularly in Sabah and Sarawak.
- Outlook depicts consistent demand for vessels supporting production operation from year-to-year.
- This is an opportunity for local players and financiers to re-evaluate its position for investment as there is consistent demand for vessels supporting production operation.

Medium Term Outlook – Post 2024

- Steady outlook is expected for OSV due to the consistent activity of production operations throughout Malaysian waters.

Logistics

Number of Vessels Supporting Drilling and Projects:



- In 2021, lower actual number of vessel as activities were slowly recovering from the pandemic during the first half of the year. Majority of the drilling campaigns/projects were deferred to the following year.
- Slight decrease in requirement for 2023 and 2024 in view of potential vessel optimisation across drilling campaigns/project (Wells).
- This outlook excludes the requirement of vessels for HUC, MCM and Underwater Services activities, EPCC and EPCIC which will be sourced separately.



Medium Term Outlook – Post 2024

- Modest outlook can be expected for OSV supporting drilling and projects (Wells) through PETRONAS' effort of optimising its resource requirement.

Chemicals

Chemicals are utilised in both Upstream and Downstream businesses, mainly during maintenance and operation activities.

For the purpose of this report, only the **primary categories** (excluding chemicals used as feedstocks) are highlighted as below:

Main composition	Process	Commodity	Chemical Services
Main composition	Catalysts, production chemicals, corrosion inhibitors and biocides, boiler and cooling water chemical, sulfiding agent and additives	Base oil, lubricants, API Class G cement, glycols, amines, resins, chloralkali, solvents	Catalysts and internal media change out
Utilisation	Chemicals that are used to accelerate plant processes, maximise asset reliability and improve productivity.	Chemicals that are commonly used in process and operations.	Periodical services during unit shutdown or turnaround based on catalyst/internal media life and/or operation requirements
Outlook	<ul style="list-style-type: none"> Catalysts, production chemicals, corrosion inhibitors and biocides, oil and lubricants, glycols and base oil amount to 80 per cent of spending in chemicals. Continuous requirement for purchases and services related to catalyst and internal media across PETRONAS' OPUs in view of multiple change out or top up requirements for the period 2022 to 2025. 		

Selected major categories outlook highlighted in this report for Process Chemicals, i.e. Catalyst, Production Chemicals and Integrity Chemicals (Corrosion Inhibitors and Biocide) for reference.

Catalyst



Production Chemicals



Integrity Chemical (Corrosion Inhibitors and Biocide)



Chemicals

Catalyst

Catalyst is a substance that increases the rate of a reaction without being consumed in the reaction.

Application:

Petroleum refining, chemical synthesis, petrochemical production, polymer processing, environment protection reactions.

Associated Services:

Supply of catalyst, supply of internal media, logistics services, catalyst change-out services.

In PETRONAS, purchase of new catalyst is for top-up requirements and catalyst-changeout activities, depending on the catalyst lifespan (ranging from 2-10 years) and/or plant turnaround/shutdown activities.

Production Chemicals

The usage of production chemicals is crucial to prevent flow assurance and process integrity threat in the production system. It is essential to ensure optimum and uninterrupted flow for higher productivity.

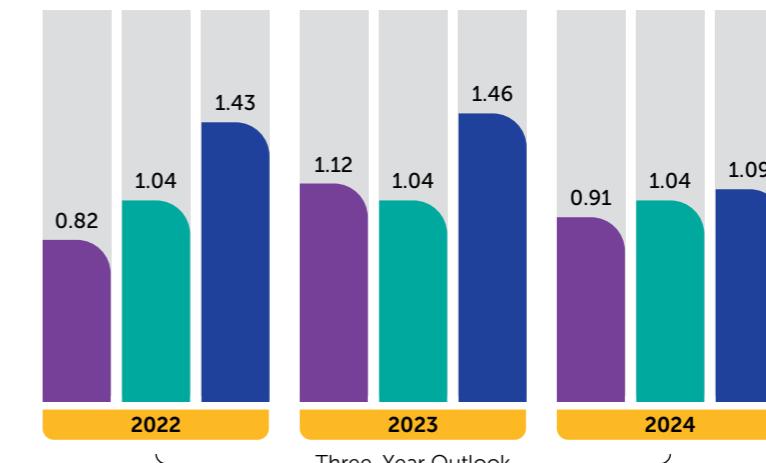
Examples of these chemicals are Demulsifier and Pour Point Depressant.

Integrity Chemicals (Corrosion Inhibitors and Biocide)

Type	Description	Function	Application	Criticality
Corrosion Inhibitor	Any chemical used to mitigate the corrosion at recommended concentration and dosage	To protect the pipeline, equipment and piping from internal corrosion threat related to Carbon Dioxide (CO ₂) corrosion	Upstream: Crude Pipeline, Wet Gas Pipeline and Dehydrated Gas Pipeline Downstream: Cooling Water System, Boiler and Heat Exchanger	Pipeline, equipment and piping integrity
Biocide	Any chemical used to control and reduce microbial growth that can lead to microbiological induced corrosion issues	To protect the pipeline, equipment and piping from internal corrosion threat related to Microbial Influenced Corrosion (MIC)	Upstream: Crude Pipeline Downstream: Cooling Water System, Boiler and Heat Exchanger	

Chemicals

Number of Chemicals' Purchase Ratio:



Note: Chemicals' Purchase Ratio is based on the forecasted purchase in comparison to actual purchased in base year 2020.

- Catalyst:** Continuous requirement for purchases and services related to catalyst across PETRONAS' OPUs in view of multiple periodical change-out and/or top-up requirements.
- Production Chemicals:** Outlook will depend on the projection of crude oil production and alignment towards low-carbon world.
- Integrity Chemicals (Corrosion Inhibitors and Biocide):** Continuous requirement in ensuring the asset integrity/reliability especially to the pipeline, equipment and piping from corrosion/leak. Also, additional demand for Cooling Water System to remove heat from process or equipment.

Medium Term Outlook – Post 2024

- Steady outlook is expected given the continuous requirement for upstream and downstream (for maintenance and operation activities).

Indirect

The Indirect category covers diverse products and services such as Human Resource Services; Health, Safety, Security and Environment (HSSE); Marketing, Advertising and Public Relations; Office Administration and Professional Services; as well as Corporate Services; mainly supporting internal usage to maintain the company's daily operations.

Primary highlights are tabulated below:

	Human Resource Services	HSSE	Marketing, Advertising and Public Relations	Office, Administration and Professional Services
Main composition	<ul style="list-style-type: none"> • Manpower supply • Capability development 	<ul style="list-style-type: none"> • Waste management • Medical services and supply • Protection equipment • HSSE consultancy • Safety and firefighting equipment and services 	<ul style="list-style-type: none"> • Creative advertising • Media advertising • Brand management 	<ul style="list-style-type: none"> • Business travel management • Onshore and offshore catering • General consultancy services • Laboratory services

The key approach for sourcing within the Indirect category will be via:

- Integrated contracts across corporate and business units through volume consolidation to achieve Economies of Scale (EoS).
- Established efficient and cost-effective procurement method by providing online buying experience for low value transactions through external Business-to-Business (B2B) marketplaces, i.e. Lapasar and Droepe, expanding opportunity for suppliers to access wider clientele not limited to oil and gas industry.
- New ways of working through technology driven initiatives, such as, Scheduled Waste (SW) transition from disposal to 3R (Reduce, Reuse and Recycle) in line with PETRONAS' net zero carbon emissions by 2050 (NZCE 2050) aspiration.



Digital and ICT

Digital and ICT cover all digital and ICT-related products and services such as application software, Information Technology (IT) consultancy and professional services, as well as telecommunications and network hardware and software. The key approach for sourcing of digital and ICT is through integrated consolidated contracts across PETRONAS' corporate and business units.

PETRONAS is taking a fit-for-purpose procurement approach for Digital and ICT to adapt and respond to the rapidly changing digital landscape:

- Drive flexible contracting to co-innovate and capture "unknown" future requirements.
- Foster long-term strategic partnership to co-create and incentivise partners to 'scale fast or fail fast' outcomes.
- Allow pace in procurement to match with the shorter innovation cycle.
- Optimise value for PETRONAS through governance based on outcome/value and Total Cost of Ownership (TCO) throughout the lifecycle of the asset.

i Did you know?

PETRONAS has accelerated the digital transformation through execute-and-adopt digital strategy by being outcome-led and user-centric; leveraging digital technologies, expertise and infrastructure to achieve the desired business outcomes supported by the right culture and mindset.

This is achieved through the following:

Award Winning Solutions





Digital and ICT

In addition, Digital and ICT is constantly focusing for business continuation.

Primary highlights are tabulated below:

	Archetype 1 Run and Maintain	Archetype 2 Essential Building Block	Archetype 3 Sandbox and Scale
Description	Focuses on everyday digital and ICT operations of the business such as software maintenance and license renewal , application support , etc.	Foundational infrastructure , application and security requirements for enterprise.	Explore or experiment and develop "among first of its kind" concepts , use cases or products which need to be proven in PETRONAS' context at pace, at scale.
Outlook	Positive outlook for digital and ICT services, in line with active digitalisation efforts in PETRONAS		



PETRONAS desires fit-for-purpose technologies to support cost competitiveness and encourage innovative solutions to enable PETRONAS to be a progressive energy and solutions partner, enriching lives for a sustainable future.

Contracts Outlook





Contracts Outlook

The outlook comprises the following contracts:

Pan-Malaysia contracts Joint contracts among Petroleum Arrangement Contractors (PACs) in Malaysia for similar scopes of services and material.	Integrated Downstream contracts Joint contracts among PETRONAS' Downstream Operating Units (OPUs) for similar scopes of services and material.
Integrated Upstream and Downstream contracts Joint contracts among PETRONAS' OPUs for similar scopes of services and material in Upstream and Downstream.	Upstream and Downstream Individual contracts

As many of these contracts are due for re-tendering in the period 2022-2024, this would be an opportune time for players to strategise on resources, new technology offerings and strategic partnerships, while maintaining the highest degree of efficiency in performing jobs. With that, industry players will have sufficient time to offer proposals to PETRONAS.

Details of the contracts are based on data as at October 2021.

No.	Contract	Start	2021	2022	2023	2024	2025
Individual - Upstream							
11	Wellhead Maintenance Services	2017					
12	Surface Controlled Subsurface Safety Valve System Installation and Services	2018					
13	Geophysical, Geomatics, HSE and Technical Auditor Consultancy Services	2018					
14	Remotely Operated Vehicle (ROV)	2018					
15	Drilling Tools, Well Test Tubular and Accessories Rental	2018					
16	Surface Sand Management	2019					
17	Gas Lift Valves (GLV) and Insert Strings Equipment, Accessories and Services	2019					
18	Real Time Metocean Observation System and Services	2019					
19	Drilling Rigs – Offshore Rig – Integrated Rig, Drilling and Completion (i-RDC) Services	2021					
20	Marine Site Investigation Survey	2020					
21	Offshore Surveying and Positioning Services	2020					
22	Metal Expandable Packer (MEP) for Annular Barrier Equipment	2019					

A Subsurface

No.	Contract	Start	2021	2022	2023	2024	2025
Pan-Malaysia							
01	Slickline	2018					
02	Tubular Handling, Conductor Installation and Slot Recovery	2018					
03	Well Testing and Tubing Conveyed Perforations (TCP)	2017					
04	Drill Bits (Rock/PDC) and Hole Enlargement Tools	2017					
05	Mudlogging	2017					
06	Cementing and Downhole Tools	2018					
07	Drilling Fluids	2018					
08	Deepwater Subsea Wellhead Equipment, Tools and Services	2019					
09	Directional Drilling (DD)/Measurement While Drilling (MWD)/Logging While Drilling (LWD)	2020					
10	Fishing Equipment and Services	2020					

Notes:

- In contract
- The final procurement approach may change to fit PETRONAS' overall strategy.
- This list includes contracts for Gas + New Energy.
- The list excludes OEM supplied item contracts.

B Engineering, Construction and Projects

No.	Contract	Start	2021	2022	2023	2024	2025
Pan-Malaysia							
01	Engineering, Procurement and Construction (EPC) of Fixed Offshore Structure	2018					
Integrated Upstream and Downstream							
02	Engineering Services (Major)	2019					
Individual - Upstream							
03	Marine Warranty Survey and Technical Services for Offshore Facilities	2020					
04	Integrated Hook-up and Commissioning (HUC)	2020					

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C Equipment and Material

D General Facilities Maintenance

No.	Contract	Start	2021	2022	2023	2024	2025
Pan-Malaysia							
01	Mechanical Rotating Equipment Services and Part	2019					
Integrated Upstream and Downstream							
02	Maintenance and Services of HV/LV Motor and Alternator	2018					
03	Instrument Maintenance and Services	2019					
04	Heat Exchanger, Pressure Vessel and Utility Tank Maintenance	2019					
05	Centrifugal and Reciprocating Type Gas Compressors	2019					
06	General Electrical Equipment Services/Tank Maintenance	2020					
Integrated - Downstream							
07	Water Treatment Solution Programme for Boiler and Cooling Water System	2017					
08	Repair and Refurbishment of Mechanical Seal	2020					
09	Critical Flange Management Services	2019					
10	Supply of Gaskets	2019					
11	Maintenance for Switchgear and Transformer	2021					
Individual - Upstream							
12	Operational Pigging Services	2018					
13	Pressure Relief Device Maintenance Services	2019					
14	Reciprocating Engine and Compressor Maintenance	2019					
15	Material Disposal Services	2019					
16	Valve Maintenance Services	2020					
Individual - Downstream							
17	Supply of Gas Turbine Filters	2018					

No.	Contract	Start	2021	2022	2023	2024	2025
Pan-Malaysia							
01	Inspection and Corrosion Monitoring Services (ICMS)	2018					
02	Underwater Services	2018					
03	Maintenance, Construction and Modification (MCM) - Offshore and Onshore	2018					
Integrated Upstream and Downstream							
04	Mercury and Pyrophoric Decontamination Services	2019					
05	Pump Maintenance Services (Region 1)	2020					
06	Water Treatment Solution Programme	2017					
07	Pump Maintenance Services (Region 2)	2020					
08	Maintenance for Single Point Mooring and Supply of Marine Hoses	2020					
Integrated - Downstream							
09	Atmospheric Storage Tank Maintenance Services	2021					
10	Civil Maintenance Work for Process and Non-Process Area	2020					
11	Fire and Gas Maintenance Services	2020					
12	Integrated Turnaround Main Mechanical and Maintenance Mechanical Static	2019					
13	Support Services for TA, Shutdown, Catalyst Change	2021					
14	Mechanical Pipelines Maintenance	2019					
Individual - Upstream							
15	Production Optimisation with CO ₂ Tracer Pumping Services	2018					
16	Maintenance, Construction and Modification (MCM) - Onshore	2018					
17	Marine Operations and Maintenance for Floating LNG	2019					
18	Operation and Maintenance for Kerteh Airport	2019					
19	Integrity and Fitness for Service (FFS) Assessment of Pipelines	2019					
20	Pipeline Isolation Services	2019					
21	Maintenance, Construction and Modification (MCM) - Offshore	2017					

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No.	Contract	Start	2021	2022	2023	2024	2025
Individual - Downstream							
22	General Maintenance Work at PETRONAS stations	2019					
23	Fabricate and Reconditioning of LPG Cylinder and Supply of LPG Compact Valves	2019					
24	Requalification and Shot-Blast Repainting of LPG Cylinder	2019					
25	Civil Works Maintenance for Gas Pipeline	2022					
26	UnderMain Cryogenic Heat Exchanger (MCHE) Repairvices	2019					
27	Refractory Inspection and Repair	2019					
28	Supply and Maintenance of LPG Cylinder Steel Pallets	2019					
29	Maintenance for Actuated Valve	2019					
30	Repainting of LPG Cylinders	2018					
31	Terminal Operations and Maintenance Services	2018					
32	Overall Commissioning and Maintenance for Chillers and Freezers	2019					
33	Inspection and Servicing Electrical Works at PETRONAS stations	2020					
34	Facilities Maintenance, Associated Works and Bush Control	2020					
35	Maintenance of Fuel Dispenser, Accessories and Equipment for PETRONAS stations	2020					
36	Overall Upgrading, Renovation and Decommissioning of PETRONAS stations	2020					
37	Online Leak Sealing Services	2021					

No.	Contract	Start	2021	2022	2023	2024	2025
Individual - Upstream							
07	Chemical Treatment and Chemical Cleaning Services	2019					
08	Supply of Production Chemicals	2017					
Individual - Downstream							
09	Supply of New Empty High Density Polyethylene (HDPE) Drums	2019					
10	Catalyst & Adsorbent Change Out	2020					
11	Precious Metal Silver Leasing for Ethylene Oxide Catalyst Production	2017					
12	Supply of Di-Iso Propanol Amine (DIPA) and Sulfolane	2020					
13	Laboratory Analysis for Petroleum Products	2020					



Chemicals

No.	Contract	Start	2021	2022	2023	2024	2025
Pan-Malaysia							
01	Chloroalkali Chemicals	2018					
02	Sulphuric Acid Chemicals	2018					
03	Base Oil	2018					
Integrated - Downstream							
04	Supply of Caustic Soda	2019					
05	Sample Management Programme	2019					
06	Integrated Flushing and Passivation Services for Boiler Feedwater and Cooling Water Systems	2018					

No.	Contract	Start	2021	2022	2023	2024	2025
Pan-Malaysia							
01	Comprehensive Integrated Medical Services	2020					
Integrated Upstream and Downstream							
02	Flame Resistant Coverall and Headscarf	2019					
03	Supply and Delivery of Safety Footwear	2020					
04	Environmental Monitoring and Analysis	2017					
05	Manpower Supply Services	2019					
06	Environmental Impact Assessment	2019					
07	Media Advertising Services	2020					
08	Talent Acquisition Services	2020					
09	Travel Management Company	2020					
10	Global Mobility Services	2018					
Integrated - Downstream							
11	Pest Control Management	2020					
Individual - Upstream							
12	H2S Safety Equipment and Services	2019					
13	Quality Assurance/Quality Control and Inspection Services	2019					

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Digital and ICT

No.	Contract	Start	2021	2022	2023	2024	2025
Individual - Downstream							
14	Associated Services for Solid Product Warehouse	2021					
15	Associated Services for Bagged Urea	2018					
16	Digital Agency Services	2018					
17	Above-The-Line (ATL) Creative Advertising Services	2018					
18	Janitorial Services for Malaysia LNG	2019					
19	Above-the-Line (ATL) Creative Advertising Services	2020					
20	Supply of New Empty Steel Drum	2019					
21	Geohazard Assessment for Onshore Gas Pipeline	2019					
22	Printing and Delivery of Promotional Materials	2020					
23	Vehicle Leasing for Onshore Plants	2020					

No.	Contract	Start	2021	2022	2023	2024	2025
Integrated Upstream and Downstream							
01	Supply of Digital Microwave Radio and Auxiliary Services	2020					
Integrated Downstream							
02	Supply and Services of Desktop, Notebook and High-end Workstations	2018					
03	Supply and Commissioning of Public Address and General Alarm (PAGA) System	2019					
04	Maintenance and Support of Public Address General Alarm (PAGA) System	2020					
05	Intrinsically Safe Smart Devices	2018					
06	Access Control System (ACS)	2020					
07	Data Engineering Professional Services	2020					
08	Software Engineering Works	2020					
09	Supply and Maintenance of Video Surveillance Management System	2020					
10	Structured ICT Cabling and Electrical Works	2020					
11	Supply and Maintenance for Private Long-Term Evolution (LTE)	2021					
Individual - Upstream							
12	Wells Real Time Centre Services	2019					
Individual - Downstream							
13	Supply and Maintenance of Payment Terminal and Other Peripherals for PETRONAS stations	2019					
14	Software Support and Maintenance Services of Cloudbased Point-of-Sale (POS) for PETRONAS stations	2019					
15	Supply of Hardware for Cloud-based Point-of-Sale (POS) for PETRONAS stations	2020					
16	Supply and Maintenance of Visual Element for PETRONAS stations	2020					

No.	Contract	Start	2021	2022	2023	2024	2025
Pan-Malaysia							
01	Offshore Support Vessels for PACs' Production Operations	2018					
02	Offshore Support Vessel (OSV) Services for PETRONAS PACs' Drilling Project Activities	2019					
Integrated Downstream Contract							
03	Intra-Plant Transportation and Related Services	2017					
Individual - Upstream							
04	Material Coordination Services	2018					
05	Vessel Tracking System (VTS)	2019					
Individual - Downstream							
06	Transportation Services for Bulk Petroleum Products	2019					

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List of Abbreviations

Abbreviations used in the report

Unit	Definition	Used for
A	AHTS	Anchor Handling Tug Supply
	AI	Artificial Intelligence
C	CCS	Carbon Capture and Storage
	COVID-19	2019 novel coronavirus (or 2019-nCoV)
	COP26	26 th UN Climate Change Conference of the Parties
	CPP	Central Processing Platform
	CRA	Corrosion Resistant Alloy
D	DD	Directional Drilling
	DP	Dynamic Positioning
	DSV	Diving Support Vessel
E	EPCC	Engineering, Procurement, Construction and Commissioning
	EPCIC	Engineering, Procurement, Construction, Installation and Commissioning
F	FCB	Fast Crew Boat
	FPSO	Floating Production Storage and Offloading
	FSO	Floating Storage and Offloading
G	GPV	General Purpose Vessel
H	HR	Human Resource
	HSSE	Health, Safety, Security and Environment
	HTI	Host Tie-in
	HUC	Hook-up and Commissioning
	HWU	Hydraulic Workover Unit
I	ICT	Information and Communications Technology
	ID	Infill Drilling
	IMO	International Maritime Organisation
J	JUR	Jack-up Rig
	JIP35	Joint Industry Programme 35
L	LCT	Landing Craft Tank
	LOHC	Liquid Organic Hydrogen Carriers

List of Abbreviations

Abbreviations used in the report (continued)

Unit	Definition	Used for
M	MCM	Maintenance, Construction and Modification
	MCO	Movement Control Order
	MCH	Methylcyclohexane
	MOPU	Mobile Offshore Production Unit
	MTJDA	Malaysia-Thailand Joint Development Area
N	NDT	Non-Destructive Testing
	NZCE	Net zero carbon emissions
O	OCTG	Oil Country Tubular Goods
	OEM	Original Equipment Manufacturer
	OGSE	Oil and Gas Services and Equipment
	OPEC	Organization of the Petroleum Exporting Countries
P	PAC	Petroleum Arrangement Contractors
	PIC	Pengerang Integrated Complex
	PM	Peninsular Malaysia
	PSV	Platform Supply Vessel
R	RMK-12	The 12 th Malaysia Plan
	ROV	Remotely Operated Vehicle
S	SB	Sabah
	SBV	Standby Vessel
	SDG	Sustainability Development Goals
	SK	Sarawak
	SSV	Straight Supply Vessel
	SURF	Subsea Umbilical, Riser and Flowline
T	TADR	Tender Assisted Drilling Rigs
	TLP	Tension Leg Platform
U	USD	United States Dollar
	UV	Utility Vessel
W	WHP	Wellhead Platform
	WTI	West Texas Intermediate
	WTE	Waste to Energy

Glossary

Industry terms used in the report

Unit	Definition	Used for
A	Aframax	Mid-sized tanker with a dead weight tonnage (DWT) between 80,000 MT-120,000 MT and oil storage capacity of approximately 600 kbls–750 kbls
	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.
B	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.
	Brownfield	Field that has been previously developed and has reached its peak oil/ gas production level.
	Brownfield Development Project	Projects to improve oil and/or gas recovery from an existing producing field, inclusive of infill drilling, Improved Oil Recovery (IOR) and Enhanced Oil Recovery (EOR) projects.
C	COVID-19	The name of the disease caused by the novel coronavirus, SARSCoV- 2, and is short for "2019 novel coronavirus (or 2019-nCoV)"
D	Deepwater	Projects in water depths exceeding 450 feet. Unique methods are required to produce the oil and gas from ocean bed at such depths. See Floating Production Unit.
	Development	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.
	Decarbonisation	Decarbonisation is the term used for removal or reduction of carbon dioxide (CO ₂) output into the atmosphere.
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	Field	A geographical area overlying a hydrocarbon reservoir.
G	Greenfield	Field that has proven oil/gas reserves but has never been developed.
	Greenfield Development Project	Projects to start the production of oil and/or gas from new, undeveloped reserves.
H	Hydrocarbon	A compound of hydrogen and carbon, such as any of those which are the chief components of petroleum and natural gas.
	Hydrogen	Hydrogen is a clean alternative to methane, also known as natural gas. It is the most abundant chemical element, estimated to contribute 75 per cent of the mass of the universe.

Glossary

Industry terms used in the report (continued)

Unit	Definition	Used for
I	Infill Drilling	Drilling of new wells in an existing field within the original well patterns to accelerate production.
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.
	Linepipes	A high strength carbon steel pipe used for transporting crude oil, petroleum products, natural gas and water.
N	Net Zero Carbon Emissions	Achieved by balancing carbon dioxide (CO ₂) emissions with removal (for example, through carbon capture and sequestration) or simply eliminating CO ₂ emissions altogether (for example, decarbonisation of energy systems through solar and wind energy).
	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).
P	Panamax	Smaller-sized tanker with a dead weight tonnage (DWT) between 65,000 MT-80,000 MT and oil storage capacity of approximately 350 kbls.
	Platform Modification	Modifying existing structures to enable rig move-in (for infill drilling) or to serve new/additional operational objectives. May involve minor fabrication works.
	Refining	A purification process for natural resources which includes hydrocarbons, using distillation, cooling and/or compression.
R	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.
	Sustainable Development Goals	17 interlinked goals adopted by all United Nations Member States in 2015 as a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030. Also known as the Global Goals.
S	Spars platform	An offshore floating product unit with relatively large aspect ratio (draft over diameter).
	Subsurface	Relating to, or being something located beneath a surface and especially underground.
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 and Production (E&P).
W	WTI Price	Stands for West Texas Intermediate (WTI), which refers to a type of high quality crude oil, as the benchmark crude oil price in the US, measured in USD per barrel.
	Wellheads	Component at the surface of an oil or gas well that provides the structural and pressure-containing interface for the drilling and production equipment.

Glossary

Units used in the report

Unit	Definition	Used for
GW	Gigawatt	Power
kbd	Kilobarrels per day	Production Rate
km	Kilometre	Distance
MMscfd	Million metric standard cubic feet per day	Production Rate
MMstb	Million stock tank barrels	Volume
mtpa	Million tonnes per annum	Capacity
MMBtu	Million British thermal unit	Heating Value
MT	Metric tonne	Weight
MWp	Megawatt peak	Power
km²	Square kilometres	Area

Frequently Asked Questions (FAQs)

1

How does this report benefit the local Oil and Gas Services and Equipment (OGSE) sector?

This report will improve visibility on PETRONAS' domestic activities, enabling better planning of resources and investments by vendors.

2

What is the USD50s to USD60s per barrel expectation based on? Do these figures represent PETRONAS' view on the crude price?

Most industry analysts like 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 a lower-for-longer approach until we are confident that the current uptrend is sustainable.

3

How will the OGSE sector 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 sector may increase accordingly.

4

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 the projection of activities with high/base scenarios indicating the project milestones at the time of release. Changes are to be expected in response to market dynamics and operational requirements.

5

Is this outlook referring to tenders to be issued or contracts to be awarded?

The outlook provided is based on activities per year, not on tender issuance nor contract award. Therefore, it includes activities which may have been contracted at the time of reporting. An overview of contracts with its current duration is provided in this document. Companies may use them as an indicator for opportunities that may arise in the future.

6

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 be sufficient for players to make their high-level planning. We recommend players to also make reference to other sources of data/information to complement their decision making.

7

WHP, CPP and rigs information are primarily for larger players. How will smaller players benefit from the information?

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, which may benefit smaller players.

8

Is this a one-off exercise or a regular effort?

This is the fourth edition of the report and is part of PETRONAS' effort to increase engagement with the OGSE sector. We endeavour to provide this report on an annual basis.

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Thank you for showing your interest in **PETRONAS Activity Outlook 2022-2024**



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