



PETRONAS

PETRONAS' **Pathway to Net Zero** **Carbon Emissions 2050**

**Delivering Energy in a Responsible
and Sustainable Manner**



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Imbak Canyon

Message by PETRONAS President and Group CEO



The unstoppable push to transition to a lower carbon future is being driven by a global consensus on the science-based evidence of climate change. The world must cut 43 per cent of its total emissions by 2030 to mitigate the impact and secure a liveable future for humanity.

Achieving this target will require a complete but carefully planned transformation of the energy system to reduce emissions drastically during this decade. Clearly this poses a daunting challenge while also offering immense opportunities for the energy industry.

For PETRONAS, we intend to seize the opportunities and provide the world with the energy it needs today with consideration for the climate goals of the Paris Agreement. PETRONAS' priority is to be in step with the progress of the societies we serve. We recognise that each country has its own energy access, affordability and security concerns that would require a unique spectrum of solutions to address.

However, the reality is that no single pathway can be prescribed. We must acknowledge that any drastic, sudden and irresponsibly planned transition will risk

structural breakdowns in energy markets and broader society. Therefore, it is incredibly important for the energy transition to be responsibly orchestrated to ensure equitable outcomes where nobody is left behind.

With this in mind, PETRONAS has successfully balanced its unique position to fulfil its commitment to Malaysia while living up to the expectations of being an international energy player. With a strong integrated energy portfolio, we are focused on delivering our core responsibilities while transforming to meet the energy needs of the future – in line with our aspiration to achieve net zero carbon emissions by 2050.

Today, we aim to accelerate our efforts and have set out the details of how the organisation will take even more credible actions to fulfil our commitment. With the Board's support, I am pleased to share the PETRONAS Pathway to Net Zero Carbon Emissions 2050 and the capital expenditure that will see us progress towards our target.

The Pathway will address emissions from our operations and include growth targets for our cleaner energy solutions. PETRONAS has set a near-term target to cap operational emissions to 49.5 million tonnes of carbon dioxide equivalent by 2024 in Malaysia and achieve 25 per cent absolute emissions reduction Groupwide by 2030 based on 2019 emissions data. Delivery of these targets is anchored on our business context, national policies, international frameworks, and scientific consensus on climate change that supports the ambitious goals outlined in the Paris Agreement.

We are taking bold yet realistic and deliberate steps to create achievable and visible targets to manage emissions from our operations and strengthen the resilience of our business. PETRONAS will produce energy from its core portfolio and cleaner energy solutions as differentiated products that are aimed to be safe, reliable, cost-optimised and emissions abated.

We will focus on reducing our emissions by minimising flaring and venting from our operations. We will also continue investing in technology and innovation to ensure that we can scale up and accelerate the deployment of lower-carbon solutions for our

customers. PETRONAS will pursue carbon capture and storage technology projects while employing nature-based climate solutions to reduce and offset hardest-to-abate emissions and at the same time promoting the conservation of nature and biodiversity.

Beyond these efforts, PETRONAS has recently launched Gentari – a new, independent entity focused fully on cleaner energy solutions that will capture opportunities in the energy transition alongside our core portfolio. This entity will provide customers with lower-carbon solutions in three core offerings – Renewables, Hydrogen and Green Mobility.

These efforts undertaken by PETRONAS are just the beginning. They will evolve as we work with stakeholders and customers to decarbonise their energy systems and support their net zero aspirations.

On our part, PETRONAS has had the opportunity to collaborate with the Economic Planning Unit (EPU) to develop targets and policies for Malaysia to achieve optimal balance in energy security, affordability, and sustainability. PETRONAS will indeed support these national ambitions and Malaysia's Nationally Determined Contributions to the Paris Agreement for the long term. In the same stride, we will strengthen our targets and governance towards progressing our net zero carbon emissions by 2050 aspiration.

As we embark on this journey, PETRONAS welcomes increased partnerships and collaboration in the region and beyond to shape a pathway that will achieve our aspiration for a lower-carbon future – for this generation and the next.

This must be a future which will see us navigate the energy transition in a just and responsible manner, firmly anchored upon our Statement of Purpose which seeks to ensure PETRONAS becomes 'a progressive energy and solutions partner enriching lives for a sustainable future.'

Datuk Tengku Muhammad Taufik

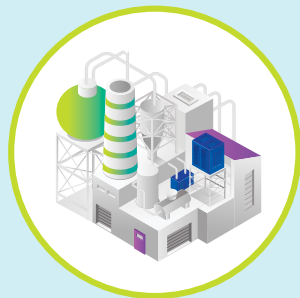
President and Group CEO
1 November 2022

Summary of PETRONAS' Pathway to Net Zero Carbon Emissions 2050

Our Aspiration

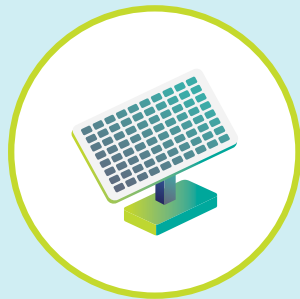
PETRONAS' aspiration is to achieve net zero carbon emissions by 2050 through an energy transition pathway that is in line with our Statement of Purpose:

"A progressive energy and solutions partner, enriching lives for a sustainable future."



Supported by
PETRONAS' Three-Pronged Growth Strategy

- Maximising Cash Generators
- Expanding Core Business
- Stepping Out into Specialty Chemicals, Customer-Centric Solutions and New Energy



By:

- Delivering net zero carbon emissions by 2050 with positive social impact



Informed by and anchored to:

- PETRONAS' business context
- National policies
- International frameworks
- Climate science

Our Greenhouse Gas Emissions Reduction Targets (Scope 1 and Scope 2) and Ambitions



49.5
MtCO₂e

Cap emissions at 49.5 million tonnes of carbon dioxide equivalent (MtCO₂e) from PETRONAS' Malaysia operations by 2024.

50%
reduction

in methane emissions from PETRONAS Groupwide natural gas value chain operations by 2025.

25%
reduction

in PETRONAS Groupwide emissions, including:

70%
reduction

in methane emissions from PETRONAS Groupwide natural gas value chain.

50%
reduction

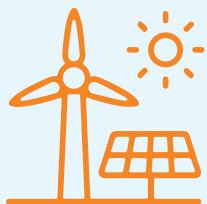
in methane emissions from Malaysia's natural gas value chain.

**NET
ZERO
2050**

Net zero carbon emissions.

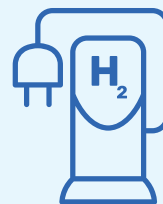
- We have set 2019 as the reference year for Scope 1 and Scope 2 emissions reduction.
- We recognise the importance of Scope 3 emissions and are taking a progressive approach to measure, report and understand our impact prior to establishing our position and strategy.

Renewables and Clean Energy Ambitions by 2030



Leading Next Generation Utility-Scale **Renewable Energy** Developer

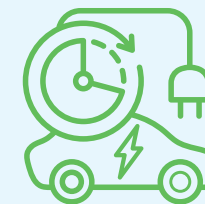
30 - 40 GW



Large-scale Clean **Hydrogen** Producer and Go-to Industry Partner

Up to 1,200,000

tonnes per annum of clean H₂



Preferred **Green Mobility** Solutions Provider

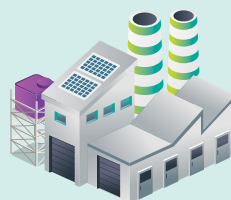
10% market share

(circa 25,000 charging points) across key markets in Asia Pacific

Our Approach to Achieve Our Targets

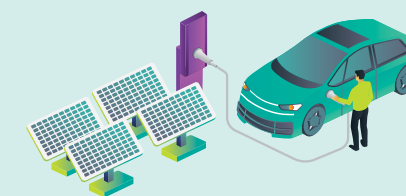
- We aim to allocate **20 per cent of total capital expenditure** to scale up decarbonisation and renewables from 2022 to 2026.
- We will focus on **technology, innovation** and **partnerships** to accelerate our progress to net zero carbon emissions.

Areas of Focus



Operational emissions reduction through:

- Zero routine flaring and venting
- Energy efficiency
- Electrification
- Carbon capture and storage



Business growth opportunities in the low carbon economy:

- Renewable energy
- Hydrogen
- Green mobility
- Biofuels
- Specialty chemicals
- Circular economy
- Nature-based climate solutions

The Context for a Sustainable Energy Transition

Rising scrutiny on organisations to deliver on their targets require urgent and tangible actions to be taken to address climate change with greater clarity on climate risks, while capitalising on business-building opportunities for a sustainable energy transition.

Globally, a growing number of organisations are incorporating an understanding of climate science into their strategies and long-term planning. Successful strategy implementation is dependent on technological advancements, supportive policies and regulation, incentives, research and development and fit-for-purpose financing frameworks.

The Paris Agreement sets long-term goals for reducing global greenhouse gas emissions to limit the average temperature increase to well below 2.0°C while pursuing efforts to limit the temperature increase to 1.5°C. According to the Intergovernmental Panel on Climate Change (IPCC), a 1.5°C average global warming above pre-industrial levels is the limit to avert the worst effects of climate change, such as extreme and more frequent weather-related natural disasters, including hurricanes, heatwaves, floods and droughts.

Consequently, the majority of the signatories to the Paris Agreement, including Malaysia, have made net zero carbon emissions pledges and committed to further refine emissions reduction targets.

At the heart of the energy transition is a shift away from fossil-based to clean and sustainable energy systems. 'Greenification' of key hard-to-abate sectors such as power, heavy duty transport, agriculture and heavy industries, cannot meet the target of capping the global temperature rise to well below 2.0°C. Growing population and economic expansion lead to rising energy consumption, where renewables alone will not be able to meet the demand.

Even in the most ambitious scenario, as per the International Energy Agency's Net Zero Emissions by 2050 Scenario (NZE), where energy demand flattens post-2030, oil and gas remain part of the global energy mix – though at a much reduced volume.

Despite the accelerating pace of the energy transition, most developing economies are moving at a different pace amid competing national economic and social agendas. The path and the pace taken by governments and companies depend on the current energy mix, state of the broader policy context, industrial ecosystem and the access and availability of resources.

Currently, while the focus is on energy diversification to ensure energy security, in the decades to come, decarbonisation of core oil and gas operations and accelerated investments in alternative energy sources are key to ensuring energy security and sustainability.

A wide range of technologies and approaches are required to reduce emissions, while investments and deployment of carbon-reduction technologies need to be intensified.

The oil and gas industry needs to transition itself to contribute towards the attainment of the global climate targets, while also requiring significant new investments in the coming decades - to produce the lowest cost and lowest emitting barrels of oil and units of gas.

At the same time, most oil and gas companies are upskilling and reskilling their workforce in specific areas to support business-building in low-carbon pathways. This is resulting in rising development and deployment of technologies and innovative solutions that include carbon capture utilisation and storage (CCUS), detection of fugitive methane emissions, low carbon and green hydrogen, advanced biofuels, offshore wind and other renewables.

Scaling up these technologies and bringing down their costs will rely on large-scale engineering and project management capabilities, qualities that are a good match to those of large oil and gas companies.

Deployment of digital solutions, process simplification and cost compression along the value chain are critical to achieve cost competitiveness and to remain resilient.

To achieve our net zero carbon emissions by 2050 aspiration, PETRONAS aims to drive its efforts to be within the range of Paris-aligned scenarios and Intergovernmental Panel on Climate Change 1.5°C and 2.0°C scenarios. To provide a holistic view on the low-carbon scenarios and pathways, reference is also made to the International Energy Agency's Net Zero Emissions by 2050 Scenario (NZE) and Announced Pledges Scenario (APS) to inform strategic decision-making.



40.0 Megawatt ground-mounted solar at PETRONAS Refinery and Petrochemical Corporation (PRPC), Johor



Universiti Teknologi PETRONAS solar rooftop

Malaysia's Vision for a Sustainable Energy and Shared Prosperity Future

Malaysia has pledged to become a net zero greenhouse gas emissions nation at the earliest, by 2050. As part of the journey towards net zero, the Government aims to reduce carbon intensity by 45 per cent by 2030, against Gross Domestic Product from 2005 levels.

PETRONAS is committed to support Malaysia's energy transition that is expected to transform the economy and open up new growth areas, especially in low-carbon businesses to be more inclusive and create opportunities for local players.

To capture new opportunities arising from the accelerated energy transition, in November 2020, PETRONAS became Southeast Asia's first oil and gas company to declare its aspiration of achieving net zero carbon emissions by 2050. This represents a fundamental shift in our long-term growth strategy, as we focus on new non-traditional businesses to complement our existing core of oil and gas.

The Malaysian Government is proactive and forward-looking in positioning itself to capture new opportunities from the global energy transition. Towards this end, the National Energy Policy 2022-2040 (DTN 2040) provides the avenues for both public

and private sectors to pursue new growth in low-carbon pathways, while meeting the Low-Carbon Nation Aspiration, as well as having a bigger share of energy from clean and sustainable sources in the country's primary energy mix.

The DTN 2040 recognises the critical role of energy in contributing to key sectors of the Malaysian economy to spur socio-economic development while the transition to net zero has the potential to create new areas of economic growth and employment, deliver reliable and affordable energy, and optimise the value of our indigenous oil and gas resources.

The DTN 2040 will also guide policymakers and industry players to strike the right balance in energy security, affordability and sustainability.

We aim to provide long-term value and contribute to the country's energy security by expanding our core portfolio to include renewables and lower carbon solutions, as well as specialty chemicals. We have also ventured into hydrogen as an alternative energy source to complement natural gas and renewables.

Our Pathway to Net Zero Carbon Emissions by 2050



Greenhouse Gas Emissions Accounting

Our achievements in emissions reduction began over one decade ago. In 2012, PETRONAS Carbon Commitments were introduced targeting reductions in flaring and venting and improving energy efficiency. This has resulted in cumulative greenhouse gas emissions reductions of about 17.5 million tonnes of carbon dioxide equivalent (MtCO₂e) up to 2021.

As a global energy company, PETRONAS takes the view that energy development and transition must balance between energy security, affordability and sustainability. We will continue to high-grade our asset portfolio to reduce carbon emission intensity. Efforts will focus on the development of oil and gas resources incorporating low emissions or emissions abatement technologies and pursue switching-out of high carbon intensity assets. As the resource custodian of Malaysia, PETRONAS aims to strive for economic development of oil and gas resources in Malaysia in a sustainable way, aligned with our net zero carbon emissions by 2050 aspiration.

Our focus now is to reduce our Scope 1 emissions which are emissions directly associated with our operations and Scope 2 emissions which include the energy we use to run them. We have revised our carbon emissions accounting method to adhere to international frameworks and sector specific guidance to give us a robust basis for Scope 1 and Scope 2, and a better understanding of Scope 3 greenhouse gas emissions. As a result of our enhanced emissions accounting practices, we have adjusted our 2019 baseline reference to 57.73 MtCO₂e equity share approach¹, from 53.80 MtCO₂e previously.

From 2023 onwards, PETRONAS aims to fully adhere to the Greenhouse Gas Protocol Corporate Accounting and Reporting Standard (2004), Ipieca Climate Change Reporting Framework (2011) and ISO 14064-1: 2018. To provide a total view of emissions across the Group, we will report emissions according to the operational control approach² and equity share approach, and include Scope 1, Scope 2 and Scope 3 (prioritising Category 11 'use of sold products') greenhouse gas emissions. Our strengthened reporting will improve external benchmarking and provide a better correlation between financial and greenhouse gas emissions accounting.

Meanwhile, Scope 3 emissions, which are the indirect emissions that occur across the value chain of our products and services, are not currently accounted for in the net zero carbon emissions by 2050 pathway. We are working on establishing a better understanding of our Scope 3 emissions and their impact. Notwithstanding this, PETRONAS is committed to grow our clean energy portfolio and emissions abatement solutions such as carbon capture and storage (CCS) to reduce our Scope 3 intensity.

PETRONAS headquarters in Kuala Lumpur, Malaysia

PETRONAS Net Zero Carbon Emissions 2050 Short-, Mid- and Long-term Targets

Our 2024 short-term greenhouse gas emissions target and methane emissions reduction targets are based on the operational control approach. This allows us to track performance of all assets under our control and to drive immediate climate actions for direct and effective change.

Our target is to cap our greenhouse gas emissions at 49.5 million tonnes of carbon dioxide equivalent (MtCO₂e) for Scope 1 and Scope 2 emissions for our Malaysia operations by 2024, and achieve a 50 per cent reduction in methane emissions from our Groupwide natural gas value chain operations by 2025.

In charting the pathway to net zero carbon emissions by 2050, PETRONAS adopted the equity share approach to reflect our economic interests in business activities by demonstrating our commitments not only on operational decarbonisation, but also responsible and sustainable investments. The equity share approach will guide our assets and investments to be in line with our net zero carbon emissions by 2050 aspiration and will be reflected in our annual integrated report. This methodology allows for business' long-term portfolio transition tracking.

Our 2030 target is to achieve greenhouse gas emissions reduction of 25 per cent from 2019 levels for Groupwide operations based on the equity share approach. This translates to a reduction from 57.73 MtCO₂e to around 43.30 MtCO₂e. To support this target, a specific methane emissions reduction target of 70 per cent is also outlined for Groupwide assets where PETRONAS has operational control as well as a 50 per cent methane emissions reduction target for Malaysia's natural gas value chain.

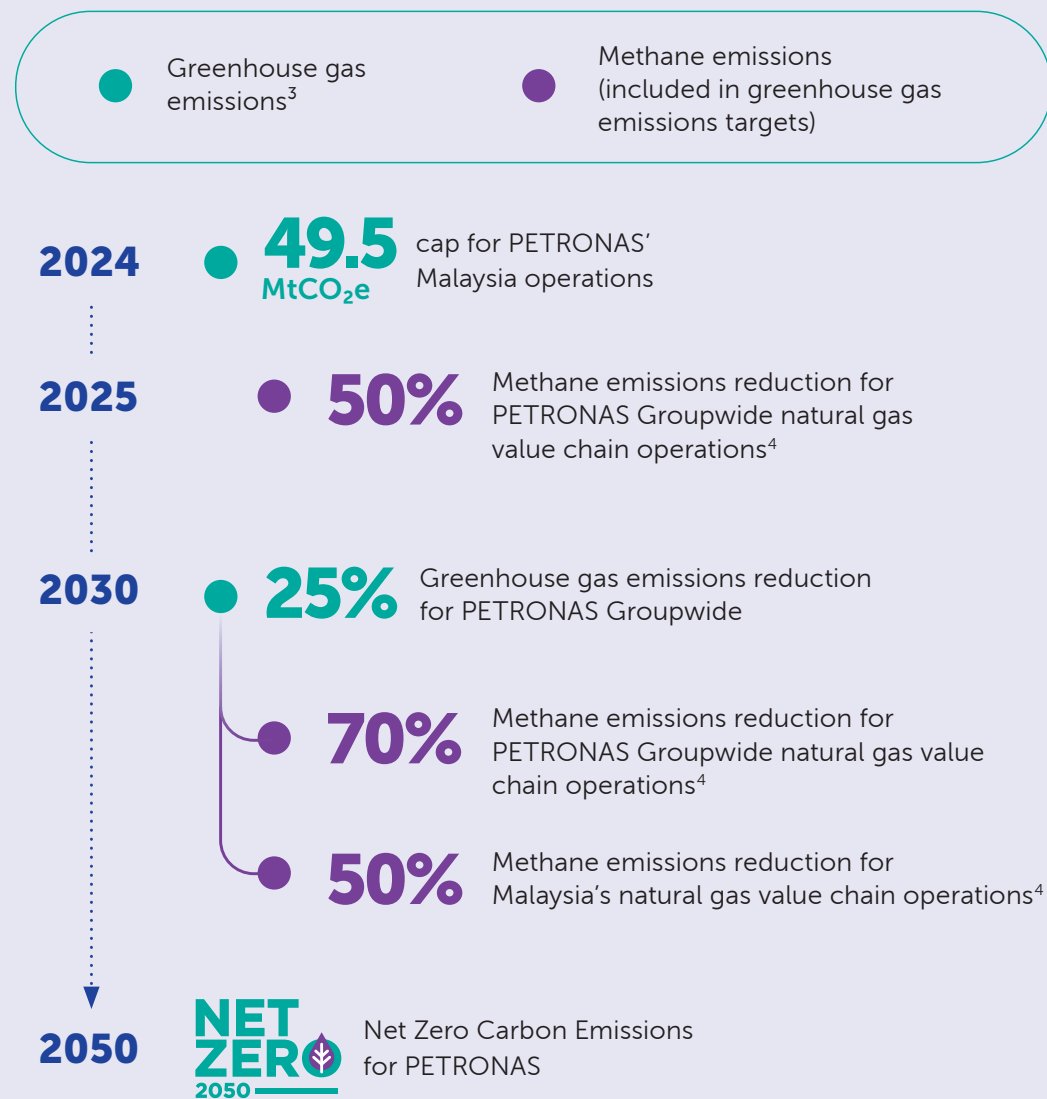
The methane emissions reduction targets will support Malaysia's commitment to the Global Methane Pledge, a collective effort by more than 100 countries to reduce global methane emissions by at least 30 percent from 2020 levels, by 2030.

PETRONAS will pursue our net zero carbon emissions by 2050 aspiration by leveraging on technologies and innovations, and offsetting our remaining hard-to-abate emissions with nature-based climate solutions. In tandem, we will provide our customers with a suite of clean energy solutions.

1 Equity Share Approach – Equity share reflects economic interest, which is the extent of rights a company has to the risks and rewards flowing from an operation.

2 Operational Control Approach - Operational control means that a company has authority to implement its operational policies.

Net Zero Carbon Emission 2050 Targets



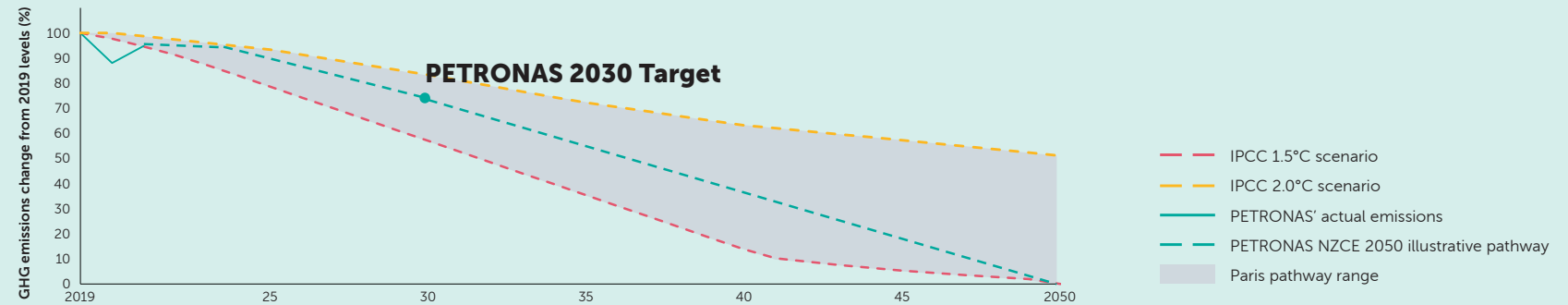
Note: From 2019 levels.

3 Greenhouse gas emissions inclusive of Carbon Dioxide (CO₂), Methane (CH₄) and Nitrous Oxide (N₂O) measured in CO₂e.

4 Natural gas value chain definition is aligned with the Oil and Gas Climate Initiative's (OGCI) reporting parameters, which includes production processing and storage, transportation, distribution and end-use of natural gas.

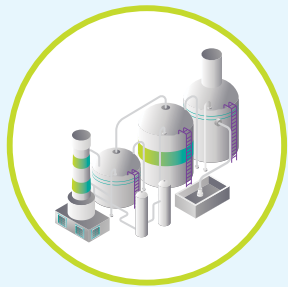
PETRONAS Net Zero Carbon Emissions 2050 Illustrative Pathway

PETRONAS Net Zero Carbon Emissions 2050 illustrative pathway shows a steady decline of greenhouse gas emissions to reach net zero by 2050.



In our role as a global energy company which operates in both developed and developing countries, our decisions require consideration of national circumstances, balancing requirements of local laws, economic needs of the countries we serve, addressing climate change and maintaining a reliable and secure energy supply.

To reduce our operational greenhouse gas emissions, we will implement activities through four main decarbonisation levers:



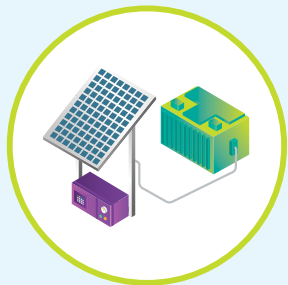
Zero Routine Flaring and Venting

Implementing flare gas recovery projects, improvements in compressor capacity, vent-to-flare conversion and vent recovery projects. To this aim, we have endorsed the World Bank's Zero Routine Flaring by 2030 Initiative. PETRONAS has pledged to avoid routine flaring in new oil field developments and end routine flaring at existing oil production sites by 2030.



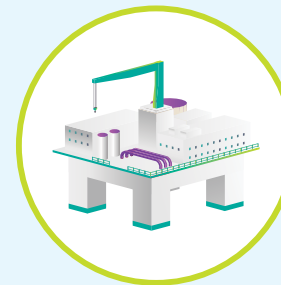
Electrification

Investing in and developing renewable energy infrastructure to power PETRONAS' operations and processes, which include, among other things, fuel gas replacement with electricity where feasible.



Energy Efficiency

Building on existing operational excellence with technology and innovation, such as implementation of digital solutions and process equipment advancement, to uplift process optimisation initiatives such as optimising gas turbine operations, superior heat transfer, furnace, and boilers efficiency, etc.



Carbon Capture and Storage (CCS)

Develop carbon capture and storage solutions in partnership with technology providers, focusing on efforts to capture carbon dioxide and injecting it into deep geological formations for permanent secure storage. With the applied technologies and innovation, the joint partnerships will drive PETRONAS' efforts towards net zero carbon emissions by 2050 aspiration.

➤ Further examples on electrification and CCS can be found in pages 11 and 12.

Electrifying Operations to Reduce Emissions

Traditionally, a Liquefied Natural Gas (LNG) plant uses imported electricity as a back-up connection to power the plant. Through a strategic collaboration with Sarawak Energy Berhad (SEB), we initiated an electrification project at the PETRONAS LNG Complex (PLC) in Bintulu, Sarawak, to reduce the utilisation of natural gas in Gas Turbine Generators (GTG) that generate electricity to power the plants. For this electrification project, a new substation and transmission line tower will be constructed to connect the Sarawak main grid to PLC.

“Upon completion by 2024, PLC will be able to receive a continuous supply of 90.0 Megawatts electricity generated from renewable hydropower, via the Sarawak main grid. We expect to substitute around 40 per cent of PLC’s total power requirements to enable the reduction of greenhouse gas emissions by 0.5 million tonnes of carbon dioxide equivalent per year.”



Rose Sapinah Hashim

Head, LNG Technology and Project Commercial Lead,
Malaysia LNG

Reducing Methane Emissions

Methane emissions are a significant contributor to global warming. According to the Intergovernmental Panel on Climate Change (IPCC) 6th Assessment Report, methane is a short-lived climate pollutant with a global warming potential that is 82.5 times greater than carbon dioxide over a 20-year period, and more than 29.8 times greater over a 100-year period. As extraction of hydrocarbons can be a source of methane emissions, this is a critical priority for the oil and gas sector and thus, a component of the PETRONAS Net Zero Carbon Emissions 2050 Pathway.



PETRONAS has been reducing its methane emissions since 2013. During 2021, we reduced 0.38 million tonnes of methane through flaring and venting reduction initiatives.

We are committed to reduce 50 per cent of methane emissions from our Groupwide natural gas value chain by 2025, from 2019 levels, and achieve a 2030 target of 70 per cent methane emissions reduction for PETRONAS Groupwide natural gas value chain.

Meanwhile, to support Malaysia's pledge of 30 per cent methane emissions reduction by 2030, PETRONAS will play an active role through Malaysia Petroleum Management as the oil and gas regulator, in committing to 50 per cent methane emissions reduction for Malaysia's natural gas value chain.

We aim to continue to reduce our methane emissions and improve our quantification methods and reporting.

Note: PETRONAS' Groupwide natural gas value chain includes upstream and gas business assets under PETRONAS operational control, Malaysia and international.



Kasawari CCS will be one of the largest offshore CCS projects in the world

Kasawari Carbon Capture and Storage Project

To ensure the viability of the Kasawari Carbon Capture and Storage (CCS) Project, PETRONAS has undertaken several benchmarking exercises and technical validations with external experts.

In addition, focus has been given to achieve robustness in the evaluations and workplan in reservoir containment and well integrity, monitoring, measurement and verification, capability development and operating philosophy.

“Kasawari CCS is a demonstration of PETRONAS’ commitment to sustainability that we hope will serve as a catalyst and reference for other offshore CCS projects in Malaysia and the world.”



Khairul Nizam Mohd Zaini
Head, Petroleum Engineering,
Bintulu, PETRONAS

Delivering New Energy Solutions

PETRONAS is committed to playing our part in the energy transition. Between 2022 and 2026, we aim to allocate 20 per cent of PETRONAS’ capital expenditure for operational decarbonisation, renewables projects and other clean energy solutions, to reduce emissions and to grow new energy offerings for our customers in support of their respective net zero ambitions. In 2021, close to RM1.0 billion of capital expenditure was spent on stepping out beyond our core business strategy, mainly on renewables.

In 2022, PETRONAS established a centralised Carbon Management Division (CMD) within Upstream operations to drive carbon capture and storage and decarbonisation at pace.

Carbon Capture and Storage to Reduce Emissions

Carbon capture and storage (CCS) will be an important component of PETRONAS’, as well as Malaysia’s and the region’s response to the energy transition.

Implementing CCS requires seamless integration of subsurface and surface technologies from the reservoir to the topside of offshore oil and gas facilities. PETRONAS will continue to invest in maturing technologies for offshore facilities and onshore processing plants to further decarbonise and reduce our carbon emissions by capturing and storing carbon dioxide safely.

PETRONAS is planning to adopt CCS for our high carbon dioxide fields, starting with the Kasawari Gas Field project, off the coast of Sarawak. The first injection of carbon dioxide is planned for commencement by 2026. Once in operation, the project is expected to reduce carbon dioxide volumes emitted via flaring by 3.3 MtCO₂e annually, making it one of the largest CCS projects in the world.

Wide deployment of CCS is essential for delivering substantive emissions reduction in oil and gas production and hard-to-abate industrial sectors. New value chains need to be defined and deployed. Therefore, greater collaboration between corporations and nations is required to fully realise the benefits of CCS. PETRONAS is exploring the development of CCS value chains and laying the foundation for such practice in Malaysia to serve both domestic and international industrial customers, with the potential as a new source of growth for PETRONAS.



Solar Projects at PETRONAS Refinery and Petrochemical Corporation (PRPC), Johor

Renewables

The International Energy Agency's Net Zero Emissions by 2050 Scenario (NZE) illustrates the possibility of almost 70 per cent of electricity generation globally coming from solar photovoltaics and wind by 2050.

We are scaling up our efforts in offering clean energy solutions to customers. In September 2022, PETRONAS established Gentari Sdn Bhd (Gentari) to deliver integrated sustainable energy solutions which include renewable energy, hydrogen and green mobility.

Our aspiration is for Gentari to be a leading utility-scale renewable energy developer with a goal to achieve 30.0 to 40.0 Gigawatt of renewable energy capacity by 2030, serving commercial, industrial, and retail customers. The strategic plans include:

- Growing commercial and industrial projects in Asia Pacific
- Growing utility-scale solar and wind in Malaysia and Asia Pacific to support our green hydrogen aspiration
- Embarking on offshore wind projects within Asia Pacific and the European Union
- Developing round-the-clock energy storage capability

As of September 2022, Gentari already had 1.1 Gigawatt peak of renewable energy capacity in operations and under development globally.

Solar Solutions

As part of Gentari's portfolio of projects to support PETRONAS' decarbonisation efforts and to grow the renewable energy business, we have embarked on two new solar projects in 2022:

- 1. Universiti Teknologi PETRONAS (UTP) Rooftop Solar in Tronoh, Perak:** a **7.4 Megawatt peak capacity rooftop solar** was installed at the main chancellery building. Operational in April 2022, this is the largest single rooftop solar installation in Malaysia.
- 2. Solar Projects at PETRONAS Refinery and Petrochemical Corporation (PRPC), Johor:**
 - a. 4.0 Megawatt rooftop solar** located in the non-process area of the power plant, consisting of five buildings.
 - b. 40.0 Megawatt ground-mounted solar**, which is the largest self-generating solar installation in Malaysia.
 - c. 374.0 Kilowatt rooftop solar at Pusat Air Mentah RAPID (PAMER)** situated at Empangan Seluyut, Kota Tinggi, Johor, on three buildings which will be completed by March 2023.



"Our solar projects in Malaysia will help to provide a cheaper alternative to electricity resulting in cost savings for the customer, as well as providing cleaner energy."

Syed Malek Faisal Syed Mohamad

Head, Renewable Energy Malaysia and SEA,
Gentari



Hydrogen production facility in PETRONAS Ammonia, Kertih, Terengganu

Hydrogen

Our aim is for Gentari to be a scale producer of clean hydrogen with the ambition to supply the world with up to 1.2 million tonnes per year by 2030, serving industrial, power and transportation customers. Our strategic plans include:

- Developing clean hydrogen projects in Malaysia, Canada and other geographies
- Providing solutions for customers in Asia Pacific and other key markets
- Expanding global footprint through partnerships
- Venturing across the hydrogen value chain through technology
- Advocating for policy and regulations that support the hydrogen industry

To develop low carbon hydrogen projects in Malaysia, India, the Middle East, and East Asia, 12 Memoranda of Understanding (MoU) have been signed with foreign partners and customers. These cover initiatives to explore the development of green hydrogen projects and their transportation, advocacy on policy and regulations to support the hydrogen industry, and studies on a low-carbon ammonia supply chain, among other things.

Green Mobility

The transportation sector significantly contributes to climate change, accounting for about 15 per cent of total greenhouse gases and 22 per cent of carbon dioxide emissions globally. Therefore, reducing this footprint is essential to achieving net zero carbon emissions by 2050. Some estimates predict that by 2030, as much as 60 per cent of cars sold globally will be electrically powered.

Our aim is to position Gentari as Asia Pacific's preferred green mobility solutions provider with an ambition to capture 10 per cent market share, circa 25,000 charging points based on current estimates, across key markets by 2030, serving business customers such as logistics companies and fleet operators. The measures include:

- Expanding charging points across Asia Pacific, starting with 9,000 public charging points by 2026 in Malaysia and India before scaling to the adjacent markets of Thailand and Indonesia
- Establishing Vehicle-as-a-Service fleet in Malaysia, India and Asia Pacific
- Growing value-added services for customers

As of 2022, more than 225 Gentari charging points have been installed, and a mix of over 350 electric two-, three- and four-wheelers have been delivered as part of Gentari's green mobility fleet in India and Malaysia. Through the Vehicle-as-a-Service offering in India, we have achieved 1,000,000 clean kilometres, equivalent to avoiding 83.4 tonnes of carbon dioxide emissions.

Gentari already provides integrated services to customers. This includes supporting decarbonisation of the Pengerang Integrated Complex (PIC) with Gentari's renewable and green mobility solutions. The PIC is one of the biggest integrated petrochemical facilities in the Southeast Asia region.



Gentari aims to secure 10 per cent green mobility market share across Asia Pacific



First Malaysia Airlines flight fuelled with Sustainable Aviation Fuel (SAF)

Co-processing of Biofuels

This project involves studying the viability of co-processing bio-feedstocks to produce Sustainable Aviation Fuel (SAF), and Hydrogenated Vegetable Oil (HVO) diesel at PETRONAS' existing assets.

“Biofuels play an important role in the energy transition in bridging the transition from conventional fossil fuels to complete electrification. Our biofuel projects will contribute towards PETRONAS' net zero carbon emissions by 2050 aspiration.”



Ahmad Izuddin Ismail

Head, Strategic Planning & Business Development, Refining, Marketing & Trading, PETRONAS

Biofuels as Cleaner Energy Source

In addition to the offerings under Gentari, PETRONAS is making inroads into the biofuels market through the proposed construction of a greenfield biorefinery as well as co-processing at existing PETRONAS facilities. This biorefinery will be positioned to provide Sustainable Aviation Fuel (SAF) with operational flexibility and to also generate Hydrogenated Vegetable Oil (HVO) or renewable diesel when it is expected to commence operations in 2025.

In June 2022, PETRONAS Dagangan Bhd, the domestic marketing arm of PETRONAS, in partnership with Neste, fuelled the first Malaysia Airlines flight using SAF, a blend of 38% of neat SAF and conventional jet fuel, travelling from Amsterdam to Kuala Lumpur International Airport. SAF is a cleaner, direct replacement for fossil jet fuel and reduces greenhouse gas emissions by up to 80 percent over the life cycle compared to fossil jet fuel.

Our collaboration with Malaysia Airlines includes a joint communication and advocacy approach to raise awareness of sustainability in aviation and the viability of SAF as a feasible fuel source for the industry.

PETRONAS' focus on providing solutions to address carbon emissions extend into our motorsports sponsorships. In supporting Formula One's net zero carbon emissions target by 2030, PETRONAS will research and supply Mercedes-AMG PETRONAS F1 team with 100 per cent advanced sustainable fuels starting from 2026.

Currently, PETRONAS is providing the Mercedes-AMG PETRONAS F1 team and its customer teams with advanced sustainable E10 fuel, which contains 10 per cent second-generation non-food based ethanol E10 that lowers carbon dioxide emissions overall.

We will extend the same services and supply sustainable fuel to our two-wheel sponsorship portfolio, namely the Moto2™ and Moto3™ World Championship that runs concurrently with MotoGP™.



PETRONAS and Samsung C&T Corporation to jointly develop a clean hydrogen supply chain in South Korea

Clean Energy Collaborations

To further bolster our delivery in support of the energy transition, we are working closely with partners, suppliers and contractors throughout the supply chain. The demand for renewables is set to rise, as customers, major corporate interests, and nations set ambitious targets to achieve net zero carbon emissions by 2050.

To fully realise the potential of these alternative energy solutions, we have embarked on several notable ventures with industry partners, among others:

Some of Our Notable Ventures

JERA Co., Inc. to collaborate on ammonia and hydrogen supply chains.

Masdar of Abu Dhabi to seek collaborative opportunities for solar and wind projects in Asia.

ENEOS Corporation to deliver a joint technical-commercial study of hydrogen supply chains.

Samsung C&T Corporation to jointly develop a clean hydrogen supply chain in South Korea.

Circular Economy

Circular economy solutions are expected to address 45 per cent of global emissions, complementing renewables and carbon reduction efforts¹. For PETRONAS, circular economy is integral to our sustainability efforts, and we are in the process of embedding the mindset of circular economy into our activities to enable a low waste future, steward natural resources, and minimise our carbon footprint while creating value.

We are embarking on various circular economy projects focusing on five key approaches:

- **Waste to products:** converting waste to base materials or other products, for example plastic recycling
- **Circular carbon:** closed-loop system by reducing, reusing, recycling, removing to manage emissions, for example, Condensate Recovery System (CRS)
- **Sharing module:** optimising resources via shared platforms, for example, Liquid8 (a decentralised peer-to-peer multi-functional platform, which enables the global tokenisation of assets for exchange and loan among community members)
- **Repurpose and reuse:** to extend the life of materials and resources or repurpose them, for example, Rig-to-Reef (transforming decommissioned offshore structures into flourishing reefs projects)
- **Bio solutions:** bio-based inputs or products that are regenerated, for example, Sustainable Aviation Fuel (SAF)

Our aim is to contribute to a circular future with solutions that can create improved economic and environmental outcomes for our stakeholders and society through technologies, capability building, business models and collaborations.

¹ Ellen MacArthur Foundation, *Completing The Picture*, 2021.

PETRONAS' Position on Nature and Biodiversity

As we aim to position PETRONAS as a progressive energy and solutions company, the emphasis is on integrating sustainability considerations into our strategy and delivery. Our commitment is to conduct and grow our business in ways that deliver sustainable value and contribute positively to society and the environment.

In support of our net zero carbon emissions by 2050 aspiration, PETRONAS strives to demonstrate visible leadership on the nature and biodiversity agenda in Malaysia and in countries where we operate. Wherever possible, we aim to conserve, protect and restore nature as we recognise that climate and nature considerations are intertwined and need to be addressed in parallel.

Our Five Areas of Actions

1 Establishing voluntary exclusion zones

We recognise the Universal Values* of UNESCO World Heritage Sites. Commencing 2024, we commit to not conduct any new operations or projects in UNESCO World Heritage Sites.

2 Managing nature and biodiversity risk

We recognise the importance of conserving nature and biodiversity and aim to ensure no or minimal impact to biodiversity caused by our operations and projects.

We aim to achieve net positive impact (NPI) on nature and biodiversity for new projects in Protected Areas and Key Biodiversity Areas starting from 2024. We will establish site-specific inventory of important biodiversity features for our existing sites and consider additional conservation measures using a risk-based approach.

We will develop a Biodiversity Action Plan for new projects in Protected Areas and Key Biodiversity Areas, starting from 2024. For existing operations, a Biodiversity Action Plan will be developed for "Very High" and "High Risk" sites**, which is identified through Biodiversity and Ecosystem risk profiling.

* Outstanding Universal Values, which means cultural and/or natural significance which is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity. [Source: UNESCO World Heritage Centre - Compendium]

** Will be determined using Biodiversity and Ecosystem Services (BES) risk profiling and analysis using the Integrated Biodiversity Assessment Tool (IBAT)

3 Promoting nature and biodiversity through partnerships and collaborations

We support local nature and biodiversity conservation, restoration and enhancement to safeguard and protect ecosystems, habitats and endangered species in Malaysia and countries where we operate. We continue to participate in relevant initiatives that promote nature and biodiversity conservation. We partner with credible international organisations to leverage on global best practices, international frameworks and standards.

4 Supporting public policy that aims to protect nature and biodiversity

We support the intent of the United Nations Post-2020 Global Biodiversity Framework, Malaysia's National Policy on Biological Diversity and recognise the policies and ambitions on nature and biodiversity of the countries where we operate.

5 Promoting high-quality nature-based solutions

As part of our aspiration to achieve net zero carbon emissions by 2050, protecting nature and biodiversity is an integral part to supporting nature-based carbon offsets. We actively explore opportunities to invest in high-quality nature-based solutions that are credible and apply internationally recognised certification standards.



Mangrove rehabilitation at the EcoCare Centre in Kertih, Terengganu

Our Efforts in Nature and Biodiversity

PETRONAS has adopted a two-pronged approach towards nature and biodiversity conservation. The first and well-established approach comprises activities aimed at conserving and rehabilitating ecosystems and habitats ranging from tropical rainforest, mangroves and corals. This has contributed to the conservation of ecosystems in places such as Imbak Canyon, Setiu Wetlands and Similajau National Park.

The second approach is to manage the potential impact of our operations on surrounding biodiversity and ecosystem services through the adoption of the PETRONAS Technical Guideline on Biodiversity and Ecosystem Services (BES) Management which outlines the steps to be taken to identify and mitigate the impact of PETRONAS' operations on nature and biodiversity.

Recognition of PETRONAS' efforts on biodiversity conservation and risk management are evident when PETRONAS is among the key stakeholders engaged by the Ministry of Energy and Natural Resources, Malaysia, on the revision of the National Policy on Biological Diversity. PETRONAS is also an appointed member of the National Biodiversity Roundtable, which is a platform for stakeholders to interact with the Government of Malaysia on enhancing biodiversity management in the country.

Internationally, PETRONAS holds the position of vice-chair of the Biodiversity and Ecosystem Services Peer-to-Peer taskforce for Ipieca, an oil and gas association focused on advancing the industry's environmental and social performance.

Moving forward, our Board-approved position on nature and biodiversity provides the opportunity for PETRONAS to step up our nature and biodiversity management to meet stakeholder demands and support the attainment of our net zero carbon emissions by 2050 aspiration.

Progressing Nature-Based Solutions

Nature-Based Solutions (NBS) describe actions that protect, manage and restore natural ecosystems, while addressing societal challenges. NBS are an essential component of addressing climate change. For PETRONAS, NBS are an important lever to promote the health of natural ecosystems, as well as offset residual and hard-to-abate emissions, as a complement to decarbonisation.

Investing in NBS will help PETRONAS explore potential new business areas including participation in the voluntary carbon market space.

Areas of interest for investment are high-quality NBS, anchoring on credible and internationally recognised certification standards. Our active position in this space is aligned to Malaysia's decarbonisation objectives, leveraging the nation's rich natural resources capital.



"To date, we have completed biodiversity risk profiling for our operations. Moving forward, we will intensify efforts in line with PETRONAS' position on nature and biodiversity."

Mohd Nizam Basiron

Head, Natural Resource Management,
PETRONAS

On-going Efforts in Environmental Conservation in Malaysia

Over the years, PETRONAS has collaborated with the Malaysian government and State governments, as well as non-profit organisations to support and fund environmental and biodiversity projects.



Rainforest conservation in Imbak Canyon, Sabah

Since 2010, PETRONAS has contributed a total of RM83 million towards the conservation of Imbak Canyon. This includes setting up of the Imbak Canyon Studies Centre and introduction of environment research grants to spur research in biodiversity, carbon sinks in relation to reforestation and carbon sequestration, as well as renewables including ethno-forestry and applicable new energy solutions for the community.



Marine biodiversity restoration in Biodiversity, Environment and Conservation (BEACON)

This project began in 2013, where thousands of reef balls were embedded in the seabed for corals to amalgamate in offshore areas in Bintulu, Sarawak, Malaysia. As a result, at Similajau Beach, Sarawak, sea turtles are returning, and dolphins have also been sighted.



Setiu Wetland PETRONAS Ecosystem Conservation and Tourism programme in Terengganu

PETRONAS has contributed a total of RM8 million to upgrade the facilities and implement programmes to help eradicate poverty among the local communities that depend on the biodiversity of the surrounding areas.



Mangrove rehabilitation and the establishment of the EcoCare Centre in Kertih, Terengganu

The Centre has been in operation for more than a decade. Planting mangrove trees is one of the communal activities conducted at the EcoCare Centre. About 12,000 mangrove trees have been planted in a 14,000 square meter area along the Keroh River.



Walk4Trees Challenge

In September 2020, PETRONAS committed to planting 50,000 trees at 14 sites across 11 states in Malaysia, with a carbon emissions benefit of more than 200 tonnes during the project period. PETRONAS pledged to plant one tree for every million steps taken by participants of the company's Walk4Trees Challenge. We have since exceeded our initial commitment and have pledged a total of 60,131 trees.

Enabling the Energy Transition

Sustainability Governance

Our net zero carbon emissions by 2050 aspiration is inspired by our purpose and grounded in governance. Robust and responsible oversight is essential to ensure we achieve our net zero carbon emissions aspiration without compromising our key business activities. This includes shaping a conducive ecosystem across our value chain to ensure we manage risks and capitalise on commercial opportunities to deliver long-term performance and value creation.

Our Board and Executive Leadership Team are spearheading a top-down approach to sustainability, with clear roles and responsibilities. The Board plays an active role in our sustainability governance, while the Executive Leadership Team undertakes continuous efforts to strengthen decision-making, embed sustainability into strategy and execute related activities.

In 2021, PETRONAS appointed our first Vice President and Chief Sustainability Officer (CSO) to provide executive-level strategic focus to our sustainability agenda and drive the pathway towards net zero carbon emissions by 2050. We also strengthened the role and function of the Sustainability Council to implement decisions from the Board and Executive Leadership Team into our day-to-day operations, while deliberating insights from across the organisation.

The Executive Leadership Team receives periodic sustainability performance updates from across the business, ensuring accountability for our targets. The implementation of our sustainability decisions is supported by other internal bodies, such as the Risk Management Committee, Health Safety and Environment (HSE) Council and Security Risk and Oversight Committee.

Board members participate in sustainability-related training opportunities to stay abreast of evolving topics, such as carbon markets, emissions strategies and human rights imperatives.



PETRONAS headquarters in Kuala Lumpur, Malaysia

Embedding Sustainability at the Executive Level

To ensure that sustainability values are driven from the very top of our business, we have embedded Top Management Performance Management and supporting Short-Term and Long-Term incentive plans at the executive level to encourage desired leadership behaviours to deliver our net zero carbon emissions by 2050 aspiration successfully. This includes the incorporation of environmental, social, and governance (ESG) factors weightage of 20 per cent into the Top Management Long-Term Incentive Plan.

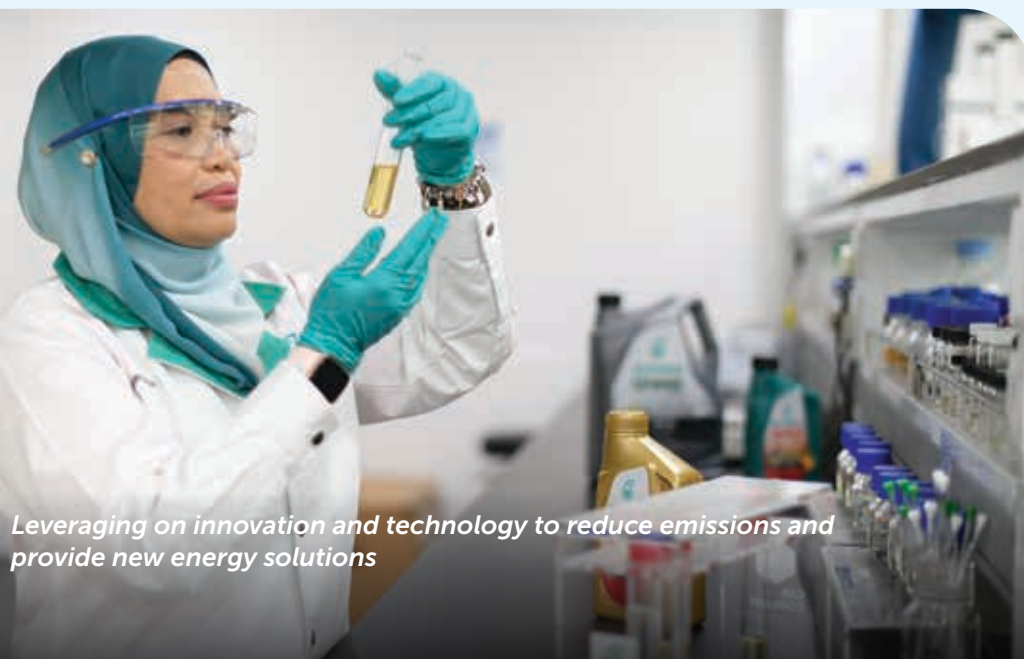
Promoting Net Zero through our People

At PETRONAS, our people are our greatest asset. Our long-term growth and sustainability is contingent on our ability to innovate, be agile, and adapt to changing business environments. To successfully achieve net zero carbon emissions, we are continuously upskilling our leadership and workforce with the capabilities and tools to drive positive change, harness new technologies, and deliver the Group's business objectives for a low-carbon future.

We have dedicated activities in place to upskill and reskill our existing workforce in critical areas that are core to our forward-looking strategy. Our ongoing Human Capital transformation effort aims to redefine our talent experience towards an empowered, agile, and enabled workforce, with a strong emphasis on performance management aligned with our overall business objectives. Our innovation culture of 'think big, test small' enables our people to approach innovation through the customer lens, explore non-traditional business areas, and de-risk premature investments.

We actively crowdsource solutions from across the organisation and externally to enlarge our innovation funnel, diversify expertise, and pool the best minds to address new and existing challenges related to the energy transition. We are promoting "Agile" awareness methodology and practice among senior leadership teams to better respond to dynamic industry developments. We also emphasise creating a diverse and inclusive environment to support the organisational culture required to achieve our goals.

We have introduced several educational trainings and programmes on sustainability for all levels of employees. Additionally, selected trainings are made mandatory across the organisation to ensure awareness and understanding of climate change and its importance to the business and society at large.



Leveraging on innovation and technology to reduce emissions and provide new energy solutions

Building Trust in our Delivery through Transparency

We believe transparency of our strategy, performance, emissions profile and how we engage in policy and standards development is critical in earning trust with stakeholders, as we are delivering towards our net zero carbon emissions by 2050 aspiration and positioning ourselves as a contributor to the energy transition.

PETRONAS supports the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD) to ensure greater transparency around how we approach climate risk, with the aim to adopt the TCFD disclosure framework from 2023 onwards. TCFD provides guidance to assess the financial risk of climate change, and promote more informed decision-making by investors, lenders, and other stakeholders.

PETRONAS' integrated annual report incorporates sustainability-related disclosures with financial reporting, thus portraying how value is created both through financial and non-financial elements. From 2023 onwards, we will report our Scope 1, Scope 2 and Scope 3 emissions in our annual integrated report in accordance with recognised international frameworks (see page 8).

We endorse the World Bank's Zero Routine Flaring by 2030 Initiative. 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. With this pledge, we are joining a growing global coalition of stakeholders who demonstrate strong environmental leadership by publicly reporting flaring data annually. Our first disclosure is slated for 2023.

PETRONAS is a signatory member to United Nations Environment Programme (UNEP) Oil and Gas Methane Partnership 2.0 (OGMP 2.0) and Methane Guiding Principles initiative. Through these memberships, we will systematically enhance our approach to methane emissions measurement, quantification, reduction and reporting. Additionally, PETRONAS will undertake proactive advocacy for sound policy and regulations while benefiting from knowledge-transfer on effective methane management.

We also proactively promote and advocate better management of methane emissions among our peers and regulators in Southeast Asia through the ASEAN Methane Energy Roundtable that we initiated in 2021. We plan to convene a series of roundtables over the next five years.

Our intent is for our external engagement to be fully aligned with our net zero carbon emissions 2050 aspiration and to be in support of our Statement of Purpose: 'A progressive energy and solutions partner enriching lives for a sustainable future'.

To help ensure consistency in our engagement we continue to strengthen our overall sustainability governance, raise awareness, deliver education programmes and define our positions on various climate and sustainability-related aspects, such as our Position on Nature and Biodiversity (see page 17) and advocating for carbon pricing as an effective policy tool.

The Imbak Canyon Studies Centre adds to the capability in biodiversity and environmental research



Given the pace and urgency to reduce emissions and the high degree of interconnectedness of the energy sector and other energy-related stakeholders, it is essential that policies, strategies and action plans are carefully orchestrated.

We see it as our role to act as a catalyst to speed up the transition to net zero specifically in Malaysia and the Southeast Asian region, drawing on our experience and the reach of a global energy company.

Through our network of international and national organisations and industry partners we can collectively enhance and generate knowledge, share best practices, and support decarbonisation initiatives that simultaneously create value for the company and our stakeholders.

Internationally, we are members of the World Economic Forum, World Business Council for Sustainable Development, Ipieca, International Emissions Trading Association, and supporting members of the Hydrogen Council, to name a few. In Malaysia, we engage proactively and broadly on issues related to energy and climate change both at national and state levels. Such engagements also take place in other jurisdictions where we operate.

PETRONAS also engages directly with government, the investor community, technology partners, suppliers, customers, academia and communities. The main objectives are to accelerate the energy transition, demonstrate sustainability leadership and collectively pursue efforts to establish a conducive operating environment, in making the shift as orderly as possible, keeping responsible and equitable green growth at the top of the agenda.

PETRONAS will continue to nurture a robust Malaysian Oil and Gas Services and Equipment (OGSE) ecosystem and remain committed in working together with our partners in this energy transition journey. This collaboration will become even more important as the oil and gas industry collectively accelerates its efforts to decarbonise operations as part of a far-reaching sustainable future. Such a transition must be executed responsibly and sustainably, where we would need to deploy lower-carbon technologies strategically and systematically.

By joining forces, we aim to create new synergies and increase opportunities by developing innovative solutions for zero emissions energy; and support a fair and sustainable energy transition that creates social value and enables progress for society as a whole.



Imbak Canyon



Cautionary Statement

Forward-looking statements in this document or in subsequent discussions with regards to this document involve inherent risks and uncertainties. These forward-looking statements are identified by their use of terms and phrases such as “aim”, “ambition”, “anticipate”, “believe”, “could”, “estimate”, “expect”, “goals”, “intend”, “may”, “objectives”, “outlook”, “plan”, “probably”, “project”, “risks”, “schedule”, “seek”, “should”, “target”, “will” and similar terms and phrases. Should one or more of these or other uncertainties or risks materialise, actual results may vary materially from those estimated, anticipated or projected.

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