



**PETRONAS**

# **TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES REPORT 2022**

**PETRONAS CHEMICALS GROUP BERHAD**

## OVERVIEW OF PCG

## TCFD RECOMMENDATIONS

## GOVERNANCE

## RISK MANAGEMENT

- 09** Our Risk Management Process
- 12** Inherent Climate-Related Risks
- 13** Climate-Related Opportunities

## STRATEGY

- 17** Scenario Analysis on Transition Risks
- 18** Climate Strategy on Transition Risks
- 21** Scenario Analysis on Physical Risks
- 21** Climate Strategy on Physical Risks

## CLIMATE RELATED METRICS & TARGETS

- 23** Energy and GHG Performance
- 24** Climate-Related Targets
- 24** Indirect Climate-Related Targets

## ADDITIONAL INFORMATION

- 25** Glossary of Terms, Abbreviations and Acronyms

# Inside This Report



# OVERVIEW OF PCG

PETRONAS Chemicals Group Berhad (herein referred to as "PCG", "the Group", or "the Company") is the chemical arm of PETRONAS and Malaysia's leading integrated chemicals producer. We manufacture, market, and sell a diversified range of chemical products. Established over 30 years ago, we were publicly listed on 26 November 2010.

Our Operational Excellence and Commercial Excellence have propelled us to become one of the largest integrated chemical producers in Southeast Asia. We currently operate from 11 manufacturing sites in Malaysia, the Netherlands, Singapore, Germany, and Canada, and two research and development (R&D) laboratories, in Malaysia and the Netherlands respectively.

The Group's Growth Delivery Excellence has been the driving force behind our expansions into segments with opportunities to future-proof the business. Our growth into speciality chemicals continues to strengthen with the commencement of the silicone blending facility in Gebeng, Pahang.

As we realise our vision of becoming The Preferred Chemical Company Providing Innovative Customer Solutions, we also remain focused on creating positive Economic, Environmental and Social (EES) impacts.

With sustainability at the core of all our decisions, we are on track to achieve net-zero carbon emissions by 2050 in alignment with the Paris Agreement.

Supported by the Task Force on Climate-Related Financial Disclosures (TCFD) and other related frameworks, we are making multiple transformational changes to our systems to tackle climate change. Our holistic approach ranges from assessing and mitigating our operations' impact on climate change to factoring in carbon pricing into our growth projects.



# TCFD RECOMMENDATIONS

In recent years, there has been a growing demand from investors, customers, and regulators for consistent and comparable climate-related disclosures. The recommendations were developed by the TCFD to solicit decision-useful, forward-looking information that can be reported alongside financial disclosures. These recommendations support a standardised reporting structure, providing enhanced comparability to stakeholders when assessing companies. Additionally, they guide companies in identifying and assessing risks and opportunities, which include transition risks, physical risks, and climate-related opportunities.

The TCFD Recommendations are structured according to four thematic pillars, representing the core elements of a business: governance, strategy, risk management, and metrics and targets.



## **Governance**

Disclose the organisation's governance around climate-related risks and opportunities.

## **Strategy**

Disclose the actual and potential impacts of climate-related risks and opportunities on the organisation's businesses, strategy, and financial planning where such information is material.

## **Risk Management**

Disclose how the organisation identifies, assesses, and manages climate-related risks.

## **Metrics and Targets**

Disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material.

# GOVERNANCE

At PCG we strive to always uphold the highest level of integrity and accountability while promoting a solid sustainability mindset across the Board and leadership team. In 2021 we introduced sustainability key performance indicators (KPIs) in top management performance appraisals. Additionally we also included PCG’s sustainability performance as a permanent agenda item in quarterly Board meetings. This includes deliberations on climate-related performance such as GHG emissions reductions and low carbon portfolio status.

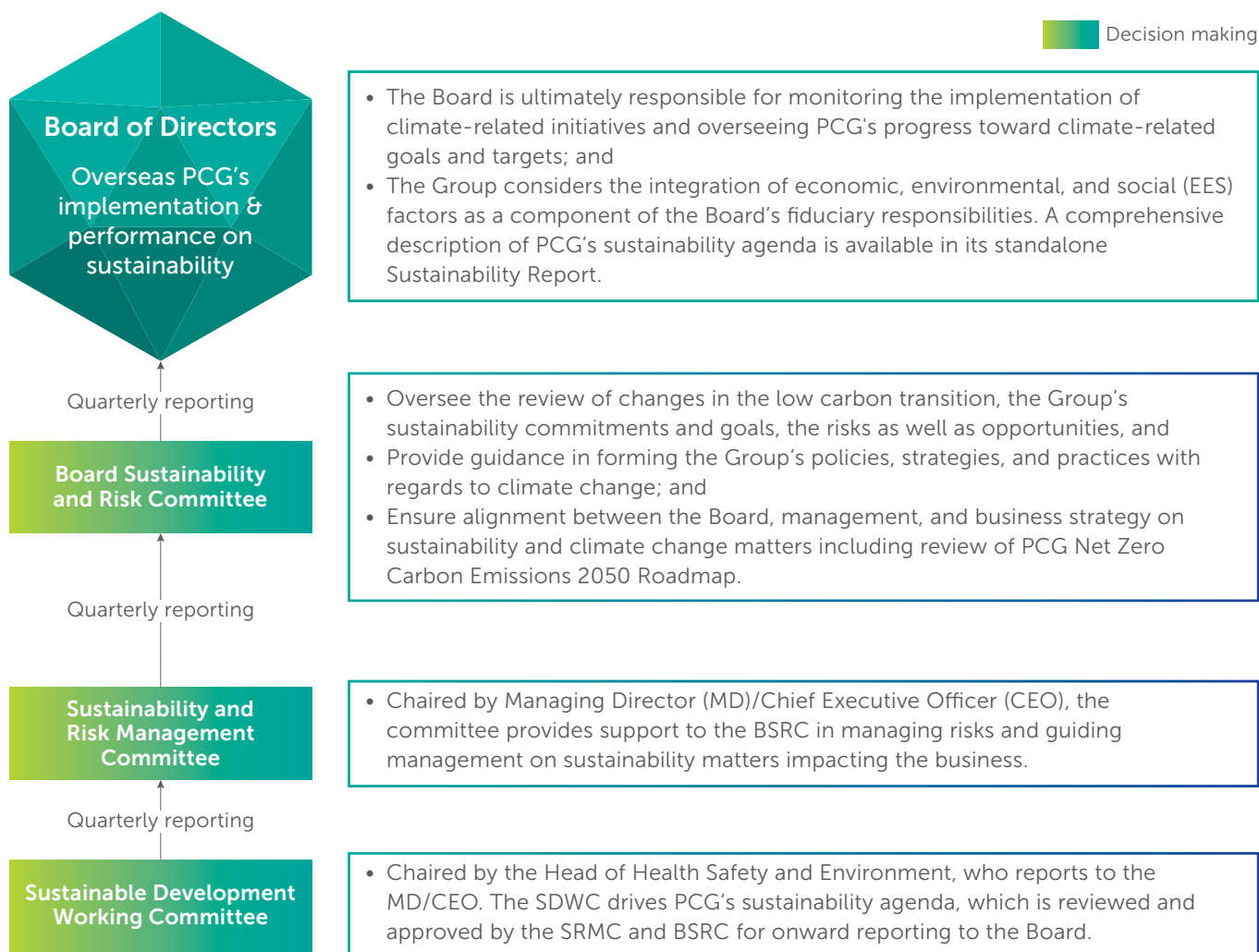
To ensure that the Board is equipped with the necessary knowledge and skills for sound climate governance, all Directors undergo external training on sustainability-related matters. During the year under review, the Directors attended and participated in programmes, conferences, and forums that

covered the areas of sustainability, corporate governance, financial, relevant industry updates and global business developments that are considered significant in contributing to the effective discharge of their duties as Directors.

PCG’s sustainability governance prioritises transparency and accountability when delivering our sustainability strategies. PCG’s Sustainable Development Working Committee drives our sustainability agenda, which is then reviewed and approved by the Sustainability and Risk Management Committee and the Board Sustainability and Risk Committee and subsequently reported to the Board. The clear delineation of roles and responsibilities enables us to uphold the highest level of integrity and efficiency in implementing our sustainability agenda.

## Roles & Responsibilities

Below are the key components of PCG’s climate governance structure and their respective responsibilities:



# Governance (Continued)

## Roles & Responsibilities (Continued)

Position	Responsibilities
<p><b>Board of Directors</b></p>	<p>The Board is ultimately responsible for monitoring the implementation of PCG’s climate change agenda and overseeing PCG’s progress against goals and targets for addressing climate-related issues. Climate-related issues are incorporated as a key consideration by the Board when reviewing and guiding the organisation’s strategy, major action plans, annual budgets, business plans, setting performance objectives, as well as when overseeing major capital expenditures, acquisitions, and divestitures. Additionally, the Board ensures that the Company’s strategies, priorities, and targets are communicated to internal and external stakeholders.</p> <p>PCG considers the integration of EES factors as a component of the Board’s fiduciary responsibility and convenes quarterly to discuss climate-related matters and performance. In 2021, the Board discussed, among others, the following matters:</p> <ul style="list-style-type: none"> <li>(i) Net Zero Carbon Emissions (NZCE) 2050 Roadmap;</li> <li>(ii) Sustainability KPIs including GHG, freshwater withdrawal, waste recycling rate, etc; and</li> <li>(iii) Governance related matters i.e., Dow Jones Sustainability Index (DJSI), FTSE4Good, Social Risk Assessment and TCFD recommendations.</li> </ul> <p>Five Board Strategic Conversations with PCG’s Management Committee were held in the year under review. During these sessions, the Board deliberated on long-term plans for PCG’s identified business portfolios based on market outlook and external environment analysis, as well as the Company’s sustainable development agenda, which includes plans to achieve net-zero carbon emissions by 2050.</p> <p>A comprehensive description of PCG’s sustainability agenda is available in its standalone Sustainability Report which can be found on PCG’s corporate website.</p>
<p><b>Board Sustainability and Risk Committee (BSRC)</b></p>	<p>The BSRC is chaired by a Board member and comprises Independent Directors who deliberate on risks and opportunities for high-impact business decisions. The duties of the BSRC include:</p> <ul style="list-style-type: none"> <li>(i) Overseeing the review of changes in the low carbon transition, sustainability megatrends, and social expectations that might impact the Group’s license to operate;</li> <li>(ii) Overseeing the review of the Group’s sustainability commitments and goals, the risks and opportunities. For example, risks associated with a potential carbon tax impacting business cost, technological options that support business decarbonisation as well as new products and services;</li> <li>(iii) Guidance in forming the Group’s policies, strategies, and practices with regard to climate change and sustainability; and</li> <li>(iv) Ensuring alignment between the Board, management, and business strategy on sustainability and climate change matters. Topics of discussion include the review of PCG’s NZCE 2050 Roadmap and progress towards achieving its targets.</li> </ul> <p>During the year, the BSRC (formerly known as Board Risk Committee) endorsed eleven risks to the Board. Six of these are critical risks that require continuous monitoring, which includes a new risk (i.e., Sustainability Risk) that encompasses environmental issues such as climate change, which has become significant due to increasingly stringent regulations and expectations from both external and internal stakeholders.</p>

Position	Responsibilities
<b>Sustainability and Risk Management Committee (SRMC)</b>	<p>The SRMC was established in May 2022 to deliberate sustainability matters, including climate change, at the groupwide level, especially those considered to have a high impact on the Group’s strategic objectives and business portfolios. The committee is chaired by the MD/CEO and supports the Board in managing risks and guiding management on sustainability matters impacting the business.</p>
<b>Sustainable Development Working Committee (SDWC)</b>	<p>The SDWC is chaired by the Head of Health, Safety and Environment, who reports to the MD/CEO. The SDWC strategises our sustainability agenda, which is then reviewed and approved by the Sustainability and Risk Management Committee and reported to the Board. The responsibilities of the committee include:</p> <ul style="list-style-type: none"> <li>(i) Reviewing quarterly information that will be reported to the Management Committee;</li> <li>(ii) Monitoring quarterly climate-related performance indicators against targets such as GHG performance on a quarterly basis;</li> <li>(iii) Coordinating cross-departmental enhancements and initiatives;</li> <li>(iv) Conducting an annual materiality review to determine PCG’s sustainability focus areas and formulate sustainability strategies;</li> <li>(v) Reviewing data related to each material matter that will be publicly reported; and</li> <li>(vi) Implementing initiatives that are required to support each material matter.</li> </ul>

## Evaluating The Effectiveness Of PCG’s Climate Governance

The annual Board’s effectiveness evaluation assesses the performance of the Board on sustainability. The Board also ensures that performance evaluations of Senior Management include a review of their performance in addressing the PCG’s material sustainability risks, including climate-related risks. The Board considers how well they have performed their respective EES roles, which may include progress against achieving sustainability targets set by the Board.

To further drive effective climate governance, monetary rewards are provided to the MD/CEO and key leaderships based on performance against a set of sustainability KPIs that encompass climate-related indicators. The sustainability KPIs contribute to a percentage of the overall performance evaluation and is reflected in their performance bonuses. One of the climate-related indicators that is incorporated into the overall performance evaluation is the absolute emissions reduction against the set target. In addition to the emissions reduction target, the CEO is also evaluated for governance alignment with the TCFD recommendations.

# RISK MANAGEMENT

We have embedded effective risk management processes across our business and throughout the value chain by including risks and opportunities related to sustainability, as these are fundamental to business resilience and stakeholder trust. We identify, assess, manage, and monitor all risks that could impact our business, including inherent risks.

As climate change has a significant impact, we have adopted a holistic approach to manage

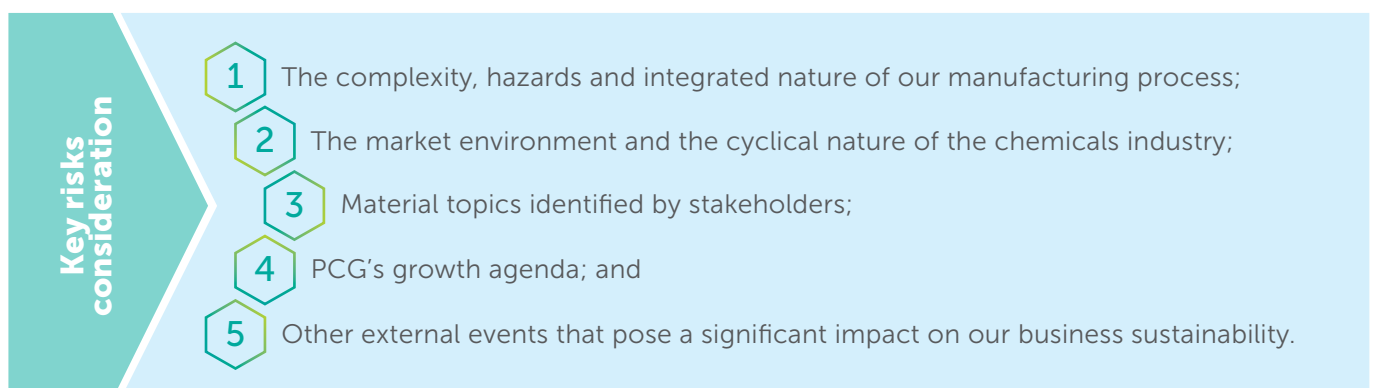
climate-related risks and their interrelations with our strategy. Physical and transition risks are proactively assessed using qualitative and quantitative climate-related scenario analysis with the below approach.

We have included climate change and circular economy under Sustainability Risks, both of which are rated as high in our Corporate Risk Profile (CRP).



## Our risk management process

Key risks are identified and prioritised based on the following considerations:





The relevant climate-related key risks identified are as below:



### Current regulation

PCG has applied internal carbon prices in the economic evaluation of all new projects to ensure economic viability if carbon tax is imposed during its operation phase. The internal carbon price also guides the development of PCG's NZCE aspiration by 2050.



### Acute physical

Through Hazard and Effect Management Processes, we conduct facilities risk assessments which encompass extreme weather events such as flooding, lightning, increased sea level and others. Mitigation efforts are identified to ensure impacts are maintained at the lowest levels.



### Legal

Compliance is becoming increasingly challenging as we expand our footprint globally, with more stringent laws and regulations. PCG is monitoring its applicability to laws and regulations pertaining to sustainability as well as changes to the laws and regulations in the host countries. SRMC will deliberate on any changes in regulations, to assess their impact and develop necessary compliance and mitigation strategies.



### Market

Customers demand for products manufactured from recycled raw materials instead of linear used crude oil-based materials. As more customers are looking into the circular economy and redesign their businesses to minimise negative environmental impacts, there is a need for products with a lower environmental footprint. PCG has set up teams to delve into circular economy initiatives, which are currently at various stages of study and implementation.



### Reputation

Diminishing interest from investors and other financiers leads to reputational damage and loss of stakeholder trust. Reputation-related issues could negatively impact a company's image and earnings, causing funding costs to increase as the perceived risk associated with the company escalates. Extreme levels of reputational risk could also result in difficulty recruiting contractors, a reduction in revenue, and increased expenditure. This could increase the cost of equity and cost of debt, hence increasing the weighted average cost of capital (WACC) and resulting in an overall decline in valuation.



### Technology

Products from lower emission technologies will have higher demand in the future. Some technologies at early stages of development may not have a big impact. However, they will indeed have a role to play. The International Energy Agency (IEA) predicts that biomass-based feedstock will increase from currently at less than 1% to account for 4% of primary chemical production by 2070. PCG has initiated steps towards exploring bio-based feedstock and chemical plastic.



### Emerging regulation

To meet Paris Agreement requirements, the World Bank requires carbon prices to be in the range of the following:

- USD 40-80 per tonne by 2020;
- USD 50 and USD 100 per tonne by 2030; and
- USD 140-80 per tonne under the SDS scenario for some developing countries by 2040.

Consequently, PCG will see an increase in cost. The European Union (EU) plans to propose a bill for an EU Carbon Border Adjustment Mechanism (CBAM), targeted to be introduced in early 2023. CBAM supports climate protection by pricing GHG emissions that are not priced by the Emission Trading Scheme (ETS), which is only imposed on domestic emissions. By doing so, CBAM compensates for carbon leakage risks that are not covered by the ETS.

This mechanism may impact PCG's products (through the imposition of carbon costs) exported to EU countries and potentially to other countries are not significant. However, other countries could take similar steps, especially countries with net zero ambitions like Japan, Korea, and China, exports to these countries could also face CBAM over the long term.



### Chronic physical

Due to a rapidly evolving climate landscape, there have been changes in freshwater availability and the expected quality in future. To understand the potential impact of these changes, PCG conducted assessments of future freshwater availability against project demand from 2021 to 2050. Detailed water availability projection modelling was conducted to identify future risks associated with freshwater availability and to develop appropriate mitigation plans.

# Risk Management (Continued)

## Roles & Responsibilities (Continued)

To evaluate if a risk poses a substantive financial or strategic impact on the business, it is assessed based on:

### 1 Likelihood of occurrence.

The impact of risk is measured against qualitative and quantitative measurements. Risk is considered substantive when there is a reduction of more than 8% of Profit Before Tax (PBT) and requires intervention from the MD/CEO and/or Board of Directors.

### 2 Impact of the risk.

From the evaluation of likelihood and impact, the risk is categorised into four ratings as follows:

The identified risks are then evaluated and rated based on their probability of occurrence and the impact they will have. These are then mapped into our Corporate Risk Profile (CRP). The CRP is presented to the Board of Directors, who will deliberate and provide their views to ensure the Company’s risks are comprehensively evaluated.

To support our risk assessments, we have established a risk appetite, which is the level of risk that PCG is willing to accept in pursuit of our strategy and objectives. We consider how many resources we are willing and able to devote to each risk, such as financial resources, people, processes, systems, and controls.

The impact and likelihood assessment, combined with risk appetite, determines the type of risk response, such as controls and assurance activities, that may be required to manage each risk. Possible response strategies include:

- Mitigating or reducing the risk with appropriate controls and mitigation plans, supported by assurance activities;
- Accepting the risk without any further action;
- Transferring the risk, for example, to insurance providers where appropriate; and
- Avoiding or forgoing the activity that gives rise to the risk.

Risks are presented to the Board on a quarterly basis for deliberation to ensure the Company’s risks are comprehensively evaluated. The risks rated **High** and **Very High** are deliberated in detail at the Board meetings. Discussions cover the key risk indicators, mitigation updates, and the progress of their implementation. Climate change and the circular economy are two of the sustainability risks associated with PCG. Both of which are rated **High**.



Likelihood	
Possible	
Impact	
Quantitative	Severe
Qualitative	Major

The SDWC is responsible for providing input on risks related to climate change. The SDWC consists of representatives from different functions, i.e., Health, Safety & Environment, Strategic Planning, Finance, Manufacturing, Commercial, Human Resource, Project Management, and Strategic Communications, which provide strategic information and facilitate the execution of initiatives and programs. In giving input to our risk process, the SDWC assesses material physical and transition climate risks for the company using a combination of qualitative and quantitative climate-related scenario analysis as well as the TCFD recommendations.

Various climate change scenario analyses are performed to quantify potential financial impacts. Climate-related scenario analysis leads to more strategic decision-making to improve business resiliency and capitalise on climate change and circular economy opportunities.

Assessment on the scope of physical and transition risks is also included in the overall risk identification process.



## Risk Management (Continued)

### Inherent climate-related risks with the potential to have substantive financial or strategic impact on PCG

Risk Type	 Emerging regulation on Carbon pricing mechanisms	 Chronic physical - Water scarcity
Risk Assessment	Likelihood: Very likely Magnitude: High	Likelihood: Likely Magnitude: High
Time Horizon	>3 years	>3 years
Financial Impact	RM 541 million/year	RM 100 million/month
Our Analysis	<p>Various climate scenario analyses were performed to quantify the potential financial impacts. To understand the potential business impact of transition risks, the IEA World Energy Outlook 2020 Scenarios, including STEPS (Stated Policies Scenario), SDS (Sustainable Development Scenario), and the IEA Net Zero Emissions by 2050 Scenario (NZE), were used. The figure presented is a potential EBITDA loss, calculated based on the NZE scenario by 2030.</p>	<p>The financial impact is calculated from the total shutdown of a single plant, located in a water-stressed area. The shutdown arising from utility disruption (water) could result in an EBITDA loss from the product value chain.</p>
Cost of response to risk	RM 124 million	RM 18 million
Our Action	<p>The cost of the response to risk includes the decarbonisation plan for our existing assets by implementing energy efficiency initiatives for the first milestone (up to 2030) of our Net Zero Carbon Emissions Roadmap. At least 15 energy-efficient projects have been planned. PCG aims to reduce 20% of our baseline emissions (2020 - 7.1 million tonnes of CO<sub>2</sub>e) by 2030.</p>	<p>In order to reduce dependency on freshwater withdrawals from local water suppliers, PCG embarked on a pilot study using mobile reverse osmosis technology. Our facility in Labuan has installed a reverse osmosis system, enabling the recovery of 140m<sup>3</sup>/hr of process condensate to produce demineralised water. This helped the facility reduce raw water consumption by 20%, reducing water stress on the island. Several initiatives have been planned with the aim of further reducing more than 50% of freshwater consumption through further recycling of water.</p>

<b>Opportunity Type</b>	Resource efficiency	Development of new products or services through R&D and innovation	Use of lower-emission sources of energy
<b>Opportunity Assessment</b>	Likelihood: Very likely Magnitude: High	Likelihood: Likely Magnitude: High	Likelihood: Likely Magnitude: Medium-low
<b>Time Horizon</b>	Medium-term	Medium-term	Short-term
<b>Cost of response to risk</b>	RM 36 million	RM 40 million	Not applicable
<b>Our Action</b>	Through process optimisation, our Energy and Loss Management System (ELMS) initiatives contribute significantly to our identified emissions reduction projects. At least 15 energy-efficient projects have been planned and are expected to reduce an estimated 120,000 tonnes of GHG emissions by 2025. For example, we have implemented waste gas recovery to reduce flaring; replaced better efficiency catalysts and equipment; reduced venting; improved the recovery rate of condensate; and utilisation of cleaner energy.	The cost is derived from the investment in a Bio-Monoethylene Glycols (Bio-MEG) pilot plant within our research facility in Malaysia. The plant is the world's first direct conversion technology that converts palm biomass into renewable products. This innovative technology uses palm oil's empty fruit bunches, a sustainable material that does not interfere with the food chain supply, to create Bio-MEG.	Usage of solar panels for four of our facilities in Malaysia via third-party arrangement.
<b>Savings</b>	RM 48 million	Currently assessing	RM 1 million
<b>Our Analysis</b>	The chemical process is an energy-intensive process. To ensure we operate efficiently, we remain alert to technological changes that may result in greater emissions reduction, energy efficiency, and improved productivity. We also seek opportunities to optimise the plant processes and eliminate wastage by improving fuel recovery. In order to increase the efficiency of our energy consumption, we have in place an ELMS which monitors and seeks to reduce the amount of energy consumed in different areas of our operations. In 2021, PCG conducted a Site Energy Review (SER) for several facilities with the aim of identifying and capturing opportunities for energy efficiency projects with potential carbon reduction. The value is derived from potential cost savings due to the reduction of 20 MW of power, 56 tonne/hr of steam and 478,000 GJ/hr of fuel usage in our facilities.	Our growth strategy involves creating optionality for growth through research and technology (R&T). A key research focus is to convert biomass into differentiated value-added chemicals. In this domain, we continue to mature the conversion process for second-generation palm biomass into sustainable and cost-competitive Bio-MEG. Our first drop of Bio-MEG product from the pilot plant was achieved in December 2021, and we are currently evaluating the technology for commercial-scale production.	The financial impact was calculated from the savings of electricity procured via solar panel generation within a specified period of time and averaged into annual savings.

## Risk Management (Continued)

### Inherent climate-related risks with the potential to have substantive financial or strategic impact on PCG (Continued)

<b>Opportunity Type</b>	Development and/or expansion of low emission goods and services	
<b>Opportunity Assessment</b>	Likelihood: Implemented Magnitude: High	Likelihood: Likely Magnitude: High
<b>Time Horizon</b>	Medium-term	Long-term
<b>Cost of response to risk</b>	RM 1 million	RM 758 million
<b>Our Action</b>	<p>The cost is derived from the construction of the Ultra-High Purity Methanol (UHPM) filling station. In September 2021, we successfully delivered our first product shipment to one of the leading providers of fuel cell technology for stationary and mobile hybrid power solutions. Through this initiative, they are able to supply more efficiently to their customers in the Asia-Pacific region.</p>	<p>PCG is exploring a circular economy project to construct a plastic waste to crude naphtha facility in Malaysia. We collaborated with Plastic Energy Ltd. to develop a solution to turn non-recyclable plastic waste into crude naphtha. This can be further processed into polymer resin, a feedstock for plastic production. PCG has performed a feasibility study with the objective of bringing the technology of turning low-quality, mixed plastic waste from landfills into naphtha quality pyrolysis oil to Malaysia. In addition, PCG also developed and distributed 'Plastic, Sustainability &amp; You' Education (PSYE) modules to all schools in Malaysia, in collaboration with the Ministry of Education (MOE).</p>
<b>Savings</b>	RM 4 million	Currently assessing
<b>Our Analysis</b>	<p>As the demand for clean energy is increasing and gaining market traction in Asia Pacific, PCG captured, developed and commercialised clean energy innovation projects that are aligned with the global renewable energy direction. We had invested in lowering pollutant emissions for energy supply through our UHPM fuel cell applications, in line with the market demand for clean energy as the use of methanol fuel cells has increased. The cost is derived from the opportunity gain of the new product (product margin (RM) x production capacity per annum).</p>	<p>Products from lower emission technologies will have higher demand in the future. The demand for circular products is expected to grow. This will support the demand for circular products in the PCG portfolio that have a lower carbon footprint due to fewer use of virgin materials. For instance, demand for materials derived from recycled plastic is increasing in the textile industry, and a similar trend has been forecasted for the automobile industry.</p>

# STRATEGY

PCG's two-pronged strategy is designed to support future financial resilience and the overall sustainability of our company in an effort to remain robust and resilient in weathering external challenges. This includes maximising cash generation and revenue growth for business sustenance, within the past two years and their uncertainties have put our strategy to the test. This extends to the sustainable development of the business, which encapsulates the Group's sustainability agenda covering EES and governance.

PCG established the NZCE 2050 Roadmap in alignment with PETRONAS' net-zero carbon target by 2050. The long-term strategy is to reduce the business's climate impact while also improving its resilience and capitalising on opportunities from the circular economy.

In addition, PCG commits to embedding the sustainability element as part of our day-to-day business decisions and growth initiatives. This also includes reaching out to key stakeholders to address risks and regulations.

PCG's sustainability strategy for financial resilience:

- Pursue sustainability-related growth projects as part of sustainable development initiatives to achieve net-zero carbon emissions by 2050;
- Optimise current assets for greater efficiency, resulting in lower GHG emissions and cost reductions from manufacturing assets;
- Diversify product offerings with bio-based and circular economy portfolios, such as the Bio-MEG; and
- Initiate flagship projects to spearhead the circular plastic economy initiatives in Malaysia through the New Plastics Economy (NPE).

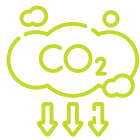


# Strategy (Continued)

## PCG Net Zero Carbon Emissions 2050 Roadmap



## PCG Net-zero Carbon Emissions Pathways



<p><b>Increase Scope 1 and Scope 2 emissions eduction efforts</b></p>	<p><b>Carbon capture &amp; storage</b></p>	<p><b>Scale up renewables and low carbon solutions</b></p>	<p><b>Optimise the use of forest-based carbon offset</b></p>
<p>Improve energy efficiency and increase reduction from operational GHG emissions</p>	<p>Collaborate with key stakeholders on carbon capture from gas combustion and transport to storage</p>	<p>Invest in renewables and embrace the circular economy</p>	<p>Remove carbon using nature-based solutions like afforestation and avoid deforestation</p>



## The Impact of Climate Risks and Opportunities on PCG's Financial Planning

As we progress towards a low-carbon economy, PCG has incorporated key climate risks and opportunities into its strategy and financial planning. This will enable PCG to identify key hotspot risk areas for a deeper assessment, prepare for timely responses to such risks and opportunities, and respond to the increasing stakeholder need for greater transparency in climate identification and management. The focus of climate-related risk is on potential carbon taxes. If emissions remain at a business-as-usual level, the potential impact on EBITDA from carbon taxes under the SDS scenario is expected to be >20% by 2040.

### Capital Allocation

With growing demands for greener products, PCG must adapt to the evolving market landscape fueled by a low-carbon economy. For all growth projects, PCG conducted a feasibility assessment that considers all sustainability elements. We work with cutting-edge technology providers to develop a portfolio of certified circular polymers and other products. As a result, PCG has increased its investments in the development of innovative and disruptive technologies to capitalise the growing (current and future) demand for sustainable products.

### Acquisition

PCG is transitioning from energy-intensive commodity chemicals to a specialised chemical platform by pursuing sustainability-driven and strategic acquisition targets that are aligned with PCG's strategic objective of transitioning to a low-carbon economy.

### Asset

As part of the pathways of PCG's NZCE 2050 Roadmap, the decarbonisation of current assets through Scope 1 and Scope 2 emissions reduction efforts are critical in achieving the net zero carbon emissions goal by 2050. To date, more than five major projects have been implemented to lower 80% of our initial 100,000 tonne CO<sub>2</sub>e emissions by 2024. Our next target will be to further reduce our NZCE baseline emissions by 20% to approximately 1.9 million tonnes of CO<sub>2</sub>e by 2030. More initiatives have been identified through renewables and low carbon products as well as carbon capture and storage pathways to attain this target with a mid-term time horizon. As of 2019, we identified up to 7.1 million tCO<sub>2</sub>e emitted from our assets. With the inclusion of our growth projects expected to come onstream in 2023 and 2024, we expect an additional 1.8 million tCO<sub>2</sub>e. This means we need to address a total reduction requirement of 8.9 million tCO<sub>2</sub>e.

# Strategy (Continued)

## Scenario Analysis on Transition Risks

PCG uses climate-related scenario analysis to inform its strategy. A climate scenario analysis is performed to quantify the potential financial impacts. The financial impact analysis focuses on carbon prices applicable to PCG's business activities.

The following scenarios were adopted for the climate-related scenario analysis.

Transition scenarios IEA	Coverage	Financial impact analysis focuses on	Carbon tax impact
<p><b>Stated Policies (STEPS) (previously IEA NPS)</b></p>	<p>Company-wide</p>	<p>Carbon prices are applicable to PCG's business activities.</p>	<p>&gt;10% of PCG EBITDA by 2030.</p>
<p><b>Sustainable Development Scenario (SDS)</b></p>		<p>Carbon prices applicable to PCG's business activities. The IEA World Energy Outlook 2020 Scenarios, including SDS, are adopted to understand the potential business impact from transition risks.</p>	<p>&gt;20% of PCG EBITDA by 2040.</p>
<p><b>Net Zero Emissions by 2050 Scenario (NZE)</b></p>		<p>Carbon prices are applicable to PCG's business activities. The IEA World Energy Outlook 2020 Scenarios, including NZE, are adopted to understand the potential business impact of transition risks.</p>	<p>&gt;20% of PCG operating profits by 2040.</p>

# Climate Strategy on Transition Risks

PCG has taken proactive steps to ensure our business remains resilient during the transition to a lower carbon economy:



**Case study:**  
In 2021, we launched UHPM, a low-carbon solution which is suitable for stationary and mobile energy solutions for fuel cell applications, intending to fulfil the demand for clean energy in the Asia-Pacific Region.

## Product and Services

In pursuing our growth agenda, we have set clear growth plans by making long-term investments in emerging technologies that align with the strategic direction to meet fast evolving market demands and trends. Adopting a lifecycle approach and employing sustainable product design criteria prioritises the development of innovative product solutions that are low carbon and sustainable. These customised product solutions carry significant commercial opportunities in enabling our customers to penetrate new markets, grow their business, and derive optimal value from our products.

## Research & Development

Our approach to innovation is spearheaded by PCG's Product Research and Development (R&D) team, which collaborates with customers to meet their needs and aspirations. PCG's R&D focuses on creating solutions that are resilient to market risks and trends. PCG uses a lifecycle approach in designing innovative product solutions with a focus to deliver superior product solutions while minimising the use of hazardous substances. PCG has several Sustainable Product Development areas:

- Develop chemicals to support a circular economy;
- Continued R&T investments in the development and commercialisation of bio-based specialty surfactants;
- Explore chemical markets and commercially ready biotechnologies to further mature the process technology to develop natural and environmentally-friendly specialty chemicals.



**Case study:**  
We invested more than RM 40 million in a Bio-MEG pilot plant and are currently evaluating the technology for commercial-scale production. The bio-MEG development is the world's first Bio-MEG pilot plant via direct conversion from palm biomass utilising in-house technology.

# Strategy (Continued)

## Climate Strategy on Transition Risks

### Supply and Value chain

The irresponsible use and disposal of plastic is a growing environmental concern if it is not effectively managed. The existing linear economy for plastic is not only unsustainable but also detrimental to the health of society and the environment. A transformation from a linear to a circular economy will minimise this issue. Plastic is prevented from ending up as garbage or pollution with the implementation of the NPE. The production and consumption of plastic can be made sustainable by turning it into a new resource. This addresses the two fundamental issues with the current plastics system: the use of limited resources to make plastics and the impact of plastics on the environment and marine life.



#### Case study:

PCG is actively participating in establishing the Malaysia Plastics Sustainability Roadmap 2021-2030 with the Ministry of Environment and Water. As one of the founding members of the Malaysia Sustainable Plastic Alliance, we continuously maintain good rapport with government agencies, including the Ministry of Housing and Local Government, brand owners, industry leaders, and non-government organisations (NGOs), to collectively tackle plastic waste issues in Malaysia. Recently, PCG signed a Memorandum of Understanding with waste collectors for the supply of plastic waste from landfills and the evaluation of potential collaboration to build waste segregation facilities in Malaysia. PCG also explored technological solutions and performed a feasibility study with Plastic Energy Ltd. to convert plastic waste to crude naphtha in Malaysia. The pyrolysis oil will then be used as a feedstock for polymer production, enabling PCG to offer certified circular polymers.

### Operations

We have established PCG's NZCE 2050 Roadmap, which is aligned with PETRONAS' aspiration to achieve net-zero carbon emissions by 2050. The following factors will drive the decarbonisation of our emissions:

- Improve energy efficiency and reduce GHG from operations;
- Collaborate with key stakeholders on carbon capture from gas combustion and transport to storage or utilisation/conversion to valuable products;
- Invest in renewables and embrace the circular economy; and
- Remove carbon using nature-based solutions like afforestation and avoid deforestation.



# Scenario Analysis on Physical Risks

Following the high-level physical climate risk assessment, PCG selected and conducted a more detailed, asset-level physical climate risk assessment. One site in Labuan Island, Malaysia i.e., PC Methanol was selected for a detailed study on water stress.

For high-level key physical climate risks, we have assessed the potential business implications based on two Representative Concentration Pathway (RCP) scenarios adopted by the United Nations Intergovernmental Panel on Climate Change (IPCC). The two scenarios assessed were based on RCP 8.5 and RCP 4.5.

**Table 1: High-level Physical Climate Risk to PCG Operations**

Risk Rank	Hazard	Drought				Cyclone				Extreme Heat				Extreme Cold				Flooding				Sea Level Rise					
		RCP 4.5		RCP 8.5		RCP 4.5		RCP 8.5		RCP 4.5		RCP 8.5		RCP 4.5		RCP 8.5		RCP 4.5		RCP 8.5		RCP 4.5		RCP 8.5			
		2030	2050	2030	2050	2030	2050	2030	2050	2030	2050	2030	2050	2030	2050	2030	2050	2030	2050	2030	2050	2030	2050	2030	2050		
1	Thailand	1	1	1	1	2	2	2	3	2	2	2	2	-1	-2	-2	-2	3	3	3	3	3	3	3	3	3	3
2	China	2	2	2	3	2	2	2	3	2	3	2	3	-2	-3	-2	-3	2	3	2	3	1	2	2	2	2	2
3	Indonesia	2	1	1	1	2	3	3	3	1	2	1	2	-1	-2	-1	-2	3	3	3	3	1	2	1	2	2	2
4	Malaysia	1	1	1	1	2	2	2	3	1	2	1	2	-1	-2	-1	-2	3	3	2	3	1	2	1	2	2	2
5	India	1	1	1	1	1	2	2	2	2	2	2	3	-2	-2	-2	-3	3	3	3	3	1	2	1	2	2	2
6	Netherland	1	1	1	1	N/A	N/A	N/A	N/A	2	3	2	3	-2	-2	-2	-2	2	2	2	2	1	1	1	1	2	2

China indicates comparatively higher risk due to drought as compared to other countries of interest

Cyclones indicate intensification under RCP 8.5 scenario by 2050. Particularly higher risk due to cyclone

Flood could be a major concern throughout the Asia. Particularly Thailand, Indonesia, and India indicate comparatively higher risk in the region

Thailand indicates the highest risk due to sea level rise among the countries of interest

Risk of sea level rise increases towards mid century under both the RCPs

## Criteria for Climate Risk (Qualitative) Classification

Category		Drought (Change in likelihood of extreme drought)	Cyclone (Change in maximum sustained wind speed)	Extreme Heat (Change in monthly maximum temperature)	Extreme Cold (Change in monthly minimum temperature)	Flooding (Change in rainfall of very wet day)	Sea Level Rise
-3	Significant Increase	> +0.2	> 5%	> 2°C	< -2°C	> 10%	> 50cm
-2	Moderate Increase	> +0.1	> 2.5%	> 1°C	< -1°C	> 5%	> 25cm
-1	Increase	> 0	> 0%	> 0°C	< 0°C	> 0	> 0
0	No Change	0	0	0°C	0°C	0	0
1	Decrease	< 0	< 0%	< 0°C	> 0°C	< 0	< 0
2	Moderate Decrease	< -0.1	< -2.5%	< -1°C	> 1°C	< -5%	< 25cm
3	Significant Decrease	< -0.2	< -5%	< -2°C	> 2°C	< -10%	< 50cm

Reference: IPCC, 2014: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change

Note: Country ranks are based on the cumulative hazard score across all climate change scenarios

## Table 2: High-level Physical Climate Risk to PCG Operations

### Climate related scenario

Physical climate scenarios RCP 8.5 and RCP 4.5

### Scenario analysis coverage

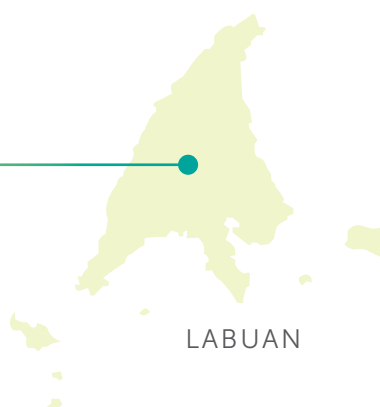
Facility

### Summary of results

A water risk screening exercise was conducted in 2019 for locations where PETRONAS operates (focusing on major freshwater users), using the World Resources Institute's Aqueduct Water Stress Atlas.

Labuan was identified as a projected high water-stressed location, particularly due to its dependency on water from mainland Sabah. Hence, a detailed water availability study was conducted. The climate indices were evaluated based on the multi-model mean of climate models from Coupled Model Intercomparison Project (CIMP-5) datasets for RCP 8.5 over the timeframes of 2030, 2050, and 2080.

The purpose of this analysis was to get a closer look at selected meteorological stations with respect to climate change. The site location, i.e., Labuan Island and the neighbouring Padas River watershed, is likely to experience 'high' water stress by 2040 due to an increase in water demand.



### PCG's Response

Developed a water risk adaptation plan for PC Methanol to be "Zero Water Discharge" by 2040.

As an initial action, PC Methanol invested RM 3.1 million in mobile reverse osmosis (RO) technology to enable recovery of 140m<sup>3</sup>/hr of process condensate to produce demineralise water for plant consumption.

This resulted in a 20% decrease in PC Methanol's raw water consumption, significantly reducing the high raw water stress of Labuan Island.

# CLIMATE-RELATED METRICS & TARGETS

PCG's climate-related metrics and targets are an integral component of our annual sustainability reporting suite. They allow our stakeholders to track our progress in managing our climate-related risks and opportunities.

PCG's carbon footprint was calculated using all three scopes of GHG emissions:

- Scope 1: Direct GHG emissions that occur from sources that are owned or controlled by PCG;
- Scope 2: GHG emissions from the generation of purchased electricity consumed by PCG; and
- Scope 3: GHG emissions deriving from assets not owned or controlled by PCG.

## Energy and GHG Performance<sup>1</sup>

GRI	Require Data	Unit	Data Collection Period			
			2018	2019	2020	2021
<b>302-1</b>	<b>Energy Consumption</b>					
	Total direct non-renewable energy consumption	GWh	29,722	28,188	27,913	27,481
	Electricity (non-renewable) purchased	GWh	667	620	656	622
	Steam/heating/cooling and other energy (non-renewable) purchased	GWh	293	325	337	306
	Total energy consumption within the organisation from non-renewable sources	GWh	30,682	29,133	28,906	28,409
	Total renewable energy consumption	GWh	0	0	0	0
	Percentage of data coverage	% of Operation	100	100	100	100
	Total non-renewable energy consumption target at fiscal year	GWh			28,937	28,698
<b>302-3</b>	Total energy intensity <sup>2</sup>	GJ/ tonne production	16.36	15.37	15.73	15.76
<b>305-1</b>	<b>Greenhouse Gases (GHG) Emissions<sup>3</sup></b>					
	Total direct GHGs emissions (scope 1) <sup>4</sup>	Million tonne CO <sub>2</sub> equivalent	5.77	5.73	5.77	5.67
	Percentage of data coverage	% of coverage	100	100	100	100
<b>305-2</b>	Indirect GHGs emissions from energy purchased and consumes (scope 2) <sup>2</sup>	Million tonne CO <sub>2</sub> equivalent	1.31	1.29	1.33	1.33
	Percentage of data coverage	% of coverage	100	100	100	100
<b>305-4</b>	GHGs emissions intensity (scope 1 & 2) <sup>5</sup>	Tonne CO <sub>2</sub> equivalent/ tonne production	0.68	0.68	0.66	0.67
<b>305-3</b>	GHGs emissions (scope 3) <sup>6</sup>	Million tonne CO <sub>2</sub> equivalent			3.06	3.27

<sup>1</sup> Energy consumption (total non-renewable energy consumption) and GHG emissions (Scope 1 and 2) data have been verified in accordance with the International Standard on Assurance Engagements ("ISAE") 3000 (Revised), Assurance Engagements other than Audits or Reviews of Historical Financial Information and ISAE 3410, Assurance Engagement on Greenhouse Gas Statements, as adopted by the Malaysian Institute of Accountants ("MIA"). Kindly refer to the Independent Limited Assurance Report found in PCG's Integrated Report 2021 (p. 226 to 227).

<sup>2</sup> All types of energy included in the intensity ratio and consumed within the organisation.

<sup>3</sup> GHGs emissions based on report of 1) GHGs calculation standard, methodology, emission factors and Global Warming Potentials referred to IPCC 2006, World Resources Institute GHG protocol and ISO 14064. 2) The operational control approach for emissions.

<sup>4</sup> All greenhouse gases included in the report.

<sup>5</sup> Types of GHGs emissions, which are direct (scope 1) and energy indirect (scope 2), included in the intensity ratio.

<sup>6</sup> Scope 3 GHG emissions disclosed include Category 1 (Purchase of Goods & Services) and Category 11 (Use of Sold Products).

## Climate-related Metrics & Targets (Continued)

PCG has set absolute short- and long-term reduction targets for Scope 1 and 2 emissions that will contribute towards the achievement of the Company's net zero ambitions. To achieve these targets, the following initiatives have been or are in the process of being implemented by PCG:

- Optimised current assets for greater efficiency, resulting in lower GHG emissions and cost reductions from manufacturing assets through our Energy and Loss Management Systems (ELMS) projects;
- Diversified product offerings with bio-based and circular economy portfolios, such as Bio-MEG;
- Initiated flagship projects to spearhead the circular plastic economy initiatives in Malaysia through the NPE;
- Collaborate with key stakeholders on carbon capture from gas combustion and transport to storage. We have currently initiated a carbon capture and storage study in collaboration with PETRONAS at our integrated facility in Terengganu, Malaysia. The first phase (data collection) of the study is expected in 2023;
- Initiated an alternative energy study, which includes solar panels and the potential conversion of all Malaysian assets to cleaner energy, as well as carbon offset from Scope 2 emissions; and
- Remove carbon using nature-based solutions such as afforestation and avoid deforestation. In collaboration with PETRONAS, our Sustainable Development Working Committee is looking into nature-based solutions and is currently identifying suitable sites for afforestation projects.



# Targets

## Short Term

Reduce GHG emissions (Scope 1 & Scope 2) by 100,000 tCO<sub>2</sub>e from 2017 baseline by 2024

## Long Term

Achieve Net Zero Carbon Emissions by 2050

- Reduce GHG emissions (Scope 1 & Scope 2) by 20% from 2020 baseline by 2030;
- Reduce GHG emissions (Scope 1 & Scope 2) by 80% from 2020 baseline by 2040;
- Net Zero Carbon Emissions (Scope 1 & Scope 2) by 2050.

## Indirect Climate-related Targets

In addition to the absolute reduction targets established, PCG has also included an indirect target focused on increasing revenue contribution deriving from the Company's low carbon technology, circular economy, and sustainable products:

By 2030, non-traditional business activities such as low-carbon technology, circular economy, and sustainable products will account for 30% of total PCG revenue.



# GLOSSARY OF TERMS, ABBREVIATION AND ACRONYMS

Abbreviation	Full Terms/Definitions
<b>Bio-MEG</b>	Bio-Monoethylene Glycols
<b>CBAM</b>	Carbon Border Adjustment Management
<b>CIMP</b>	Coupled Model Intercomparison Project
<b>CO<sub>2</sub></b>	Carbon Dioxide
<b>CO<sub>2</sub>e</b>	Carbon Dioxide equivalent
<b>CRP</b>	Corporate Risk Profile
<b>DJSI</b>	Dow Jones Sustainability Index
<b>EES</b>	Economic, Environmental and Social
<b>ELMS</b>	Energy and Loss Management Systems
<b>ETS</b>	Emission Trading Scheme
<b>EU</b>	European Union
<b>FTSE4Good</b>	Index Series designed to ensure the performance of companies demonstrating strong ESG practices
<b>GHG</b>	Greenhouse Gas
<b>GJ</b>	Giga Joule
<b>GWh</b>	Gigawatt Hours
<b>IEA</b>	International Energy Agency
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>ISAE</b>	International Standard on Assurance Engagements
<b>KPIs</b>	Key Performance Indicators
<b>MIA</b>	Malaysian Institute Accountants

Abbreviation	Full Terms/Definitions
<b>NGO</b>	Non-governmental Organisation
<b>NPE</b>	New Plastics Economy
<b>NZCE</b>	Net Zero Carbon Emissions
<b>NZE</b>	IEA Net Zero Emissions by 2050 Scenario
<b>PBT</b>	Profit Before Tax
<b>PCG or the Group</b>	PETRONAS Chemicals Group Berhad
<b>PC Methanol</b>	PETRONAS Chemicals Methanol Sdn Bhd
<b>PSYE</b>	Plastic, Sustainability & You Education
<b>RCP</b>	Representative Concentration Pathway
<b>RM</b>	Ringgit Malaysia
<b>R&amp;D</b>	Research & Development
<b>R&amp;T</b>	Research & Technology
<b>RO</b>	Reverse Osmosis
<b>SDS</b>	Sustainable Development Scenario
<b>SER</b>	Site Energy Review
<b>STEPS</b>	Stated Policies Scenario
<b>UHPM</b>	Ultra-High Purity Methanol
<b>TCFD</b>	Task Force on Climate-related Financial Disclosures
<b>WACC</b>	Weighted Average Cost of Capital

**PETRONAS Chemicals Group Berhad**  
199801003704 (459830-K)

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

Tel: +603 2051 5000  
Fax: +603 2051 3888

[www.petronaschemicals.com](http://www.petronaschemicals.com)