PTTEP

2023 TCFD Disclosure Report

Contents

INTRODUCTION TO TCFD

Task Force on Climate-Related Financial Disclosures (TCFD) has developed recommendations for businesses to adequately prepare for climate change, as well as for businesses to disclose financial information to investors and other stakeholders so that all parties can understand and avoid financial impacts from climate change. TCFD disclosure is structured around the four pillars of governance, strategy, risk management, and metrics and targets.

TCFD is endorsed by various international sustainability frameworks and indices such as, S&P Corporate Sustainability Assessment (CSA), The Dow Jones Sustainability Indices (DJSI, a subset of the CSA), Sustainability Accounting Standards Board (SASB), Carbon Disclosure Project (CDP), Climate Disclosure Standards Boards (CDSB), and Global Reporting Initiative (GRI). In addition, TCFD is utilized by multiple companies, banks, rating agencies and stock indices.

In October 2021, TCFD released an update of the recommendations and guidance, focusing on its strategy and metrics and target areas.

OVERVIEW OF PTTEP

PTT Exploration and Production Public Company Limited ("PTTEP"), a Thai national petroleum exploration and production organization, is a publicly listed company on the Thai stock exchange, and a subsidiary of PTT Public Company Limited, Thailand's national petroleum company. PTTEP's mission is to operate globally to provide reliable energy supply and sustainable value to all stakeholders. Therefore, we set our vision to be an Energy Partner of Choice through competitive performance and innovation for long-term value creations.

Operating under the philosophy and concept of sustainability, PTTEP strives to provide energy security through continuous growth and competitive returns with less impact on environment and society through responsible operations in response to the stakeholder expectations.

As such, PTTEP has fully integrated the Task Force on Climate-related Financial Disclosures (TCFD) framework into our climate change management. Furthermore, PTTEP takes climate-related risks into serious consideration, treating it as the Company's emerging risk. In 2021, PTTEP reassessed risks with context specific for timely improvement across all operational control assets, upstream & downstream activities (including our clients and suppliers) in Thailand, Myanmar and Malaysia (both onshore and offshore) for compliance with modified requirements, both at national and international levels.

ABOUT THIS REPORT

This is PTTEP's first full length TCFD report, which includes the performance of PTTEP. This report was published on 1 July 2023, covering the reporting period for calendar year of 2022, with aim to define PTTEP's implementation approach for each TCFD pillar according to TCFD's 2021 "Annex": Governance, Strategy, Risk Management and Metrics and Targets.

GOVERNANCE

Climate Change Governance

Strong governance structures and clear accountability enable PTTEP to deliver our commitments towards sustainability and climate change goals. Therefore, the Board of Directors (BoD) is responsible for approving of the company's sustainability strategy (including decarbonization strategy), sustainability framework and target under the advisory of the **Corporate Governance and Sustainability (CGS) Committee.** The CGS, selected board members (excluding the Chairman and CEO), monitors and reviews performance and effectiveness of sustainability roadmap, ensuring that the company is making progress towards achieving the sustainability goals.

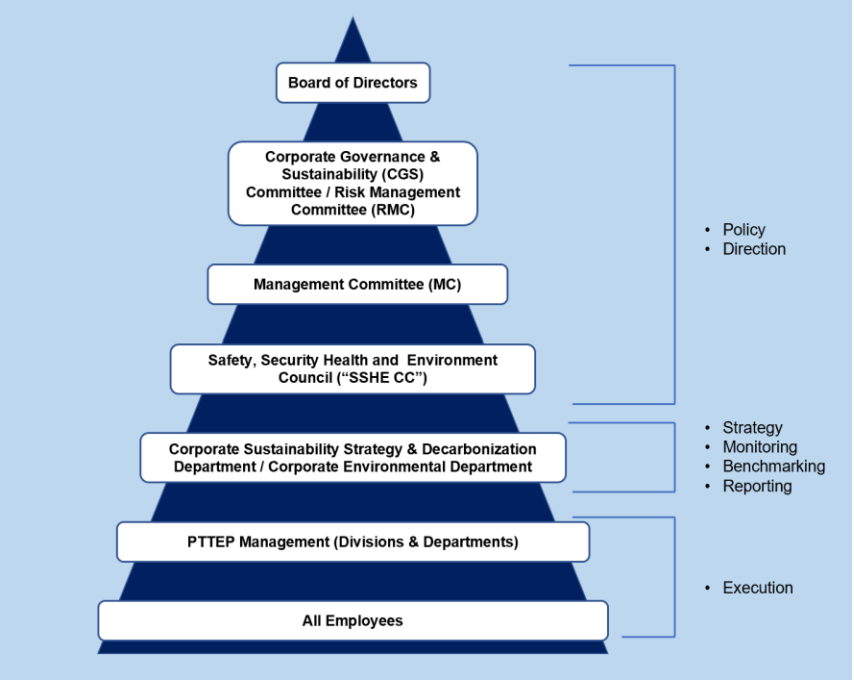


***Figure 1** presents PTTEP's climate change governance structure, roles and responsibilities related to climate change. For further details on Risk Management Committee, please visit our website.*

Figure 1 PTTEP Climate Change Governance Structure

Table 1: PTTEP's Climate Change Governance Roles & Responsibilities

Role	Responsibilities	Meeting Frequency
Board of Directors (BoD)	• Annually approve of the company's corporate policies and strategies, including frameworks and targets • Oversee the climate-related strategy, relevant policies, and action plans to be developed into PTTEP's decarbonization strategy • Conduct reviews of climate-related issues, including strategies, risks and opportunities, and emissions reduction targets, to monitor performance and effectiveness of sustainability roadmap.	Quarterly

Role	Responsibilities	Meeting Frequency
Corporate Governance and Sustainability Committee (CGS)	• Oversee the corporate sustainability strategy and framework including climate-related issues in terms of risks and opportunities to PTTEP • Provide directions and monitor climate-related implementation including PTTEP's decarbonization and its performance.	Quarterly
Risk Management Committee (RMC)	• Regularly review and provide directions on Enterprise Risk Management (ERM) including climate-related risks	Monthly
Management Committee (MC) (Chaired by CEO)	• Review sustainability materiality issues (including climate change) significant to the strategies, business directions, investment plans, budget, and human resources of PTTEP and subsidiaries • Monitor the achievement of sustainability performance and support underperforming gap closing with recommendations	Weekly
Safety, Security Health and Environment Council (SSHE CC) (Chaired by CEO)	• Oversee the management of safety, security, health and environment including climate-related issues of PTTEP under the umbrella of corporate strategy including sustainability strategy	Quarterly
Corporate Sustainability Strategy & Decarbonization Department / Corporate Environment Department	• Develop a strategic direction related to climate issues including PTTEP's decarbonization supervised by head of Sustainability and Decarbonization Department • Coordinate and deploy employees who have an important role in implementation and compliance to achieve sustainability and decarbonization targets • Regularly monitor result and effectiveness of the sustainability and decarbonization roadmap execution and benchmark internally and externally • Report the result to the Management Committee and the Corporate Governance and Sustainability Committee on a regular basis	Regularly
PTTEP Management (Divisions & Departments)	• Deploy sustainability and decarbonization strategies, assign clear roles and responsibilities and allocate adequate resources to ensure effective implementation within his/her area of responsibility	Regularly
All Employees	• Comply with PTTEP's sustainability and decarbonization requirements • Support sustainability and decarbonization strategy implementation related to his/her area of responsibility • Communicate with relevant stakeholders to ensure better understanding of PTTEP's sustainability and decarbonization strategies and targets	Regularly

PTTEP has implemented climate-related scenario analysis, physical and transition risks, and opportunity analysis and has fully integrated the Task Force on Climate-related Financial Disclosures (TCFD) framework into its climate change management, as governed by PTTEP's climate change governance. To ensure accountability for sustainability and climate-related actions, PTTEP has integrated environmental, social, and governance, climate change-related key performance indicators (KPIs) and monetary incentives into the functional group and the department level which will influence the bonus allocation, for example: The CEO has KPI linked to the Corporate KPI under decarbonization to achieve the GHG emission intensity reduction at 25% within 2030 compared to baseline 2012 and CCS project execution. This KPI is linked to at least 5% of the Chief Executive Officer's overall KPIs, and this is linked to salary increase and bonus considerations of the CEO.

In addition, PTTEP puts in place various campaigns within the company to promote the development of GHG reduction initiatives i.e. Operational Excellence Award, Performance Excellence Award, and Innovation Award. The campaigns not only help in the GHG emissions reduction, but also help in the significant improvement of operational efficiency and cost savings for the company.

STRATEGY

The process for identifying and assessing climate-related risks and opportunities is set out under "Climate Management Plan". This framework allows PTTEP to continually review and evaluate the risks, while also integrating the potential costs and management options into our business planning to determine any significant impact. The Climate Management Plan consists of three interlinked pillars which are: Mitigation, Adaptation and Resilience as defined in **Figure *2*** below:

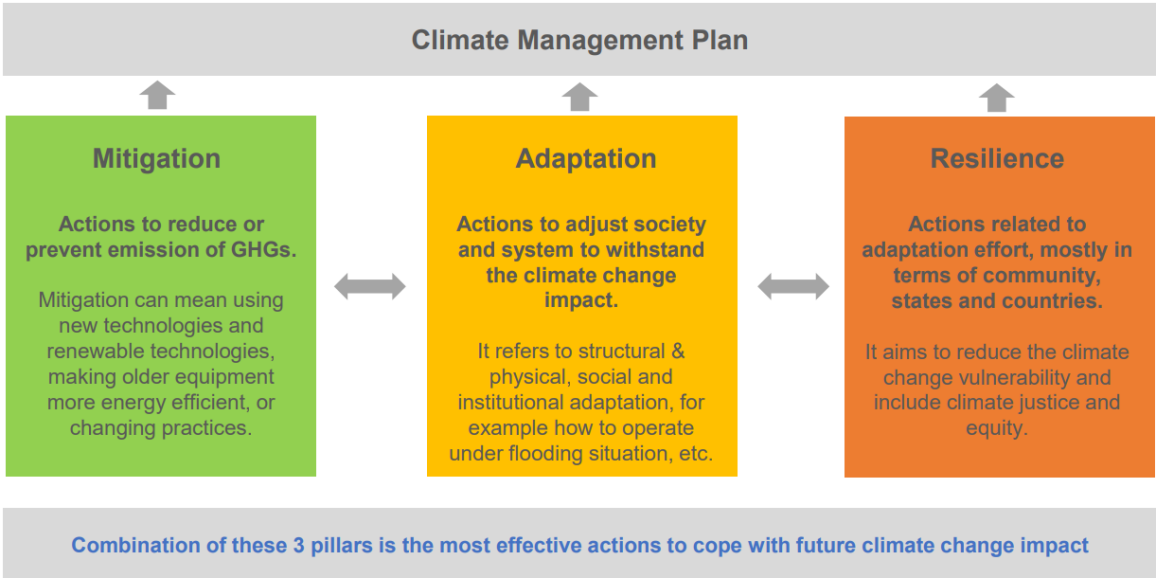


Figure 2: Climate Management Plan

PTTEP closely monitors climate-related risks and opportunities on a monthly basis. We plan to re-assess risk every five years or when we acquire new assets, using our own internal system with support from the corporate risk management team and the risk management committee.

Scenario Analysis of Climate-related Risk and Opportunity

Time Horizons

We use the following descriptions to explain the different time horizons and their significance in identifying risks in business planning:

Short-term (0–5 years: 2020 – 2025): This time frame enables us to use past data and probability studies to predict short-term climate risks and opportunities.

Medium-term (6–15 years: 2026 – 2035): Draws upon climate modelling data analysis and probabilistic modelling to anticipate climatic changes in this period.

Long-term (16–30 years: 2036 - 2050): Draws analysis that involves the use of climate scenario analysis in addition to the modelling data analysis and probabilistic study to understand the range of impacts that can occur over 15 years from now.

Physical Risks

Physical risks are risks arising from the impacts of a changing climate on corporations due to changes in the probability and intensity of changing climatic patterns, both those with chronic effects (e.g. gradual increase in average temperature and sea level) as well as those with acute effects (e.g. extreme weather events such as flooding, cyclones). Specifically, we looked at how events like tropical cyclones, heavy precipitation, droughts, and heatwaves might affect PTTEP's assets. We examined these changes for the years 2025, 2035, and 2050. Then, we analyzed how these changes could financially impact PTTEP across our value chain, including PTTEP operations, upstream activities, and downstream activities. An overview of our physical risk scenarios and assumptions summarized in Figure 3 below. Table 2 provides a summary of our most substantive physical risks. We measure the impacts in terms of severity (calculated by multiplying likelihood and impact) as this is how we define what a substantive impact is to our organization.

Hazard	Heavy precipitation	Droughts	Heatwaves	Tropical cyclones		Water risks
Methodology	Trend and scenario analysis			Hotspot – frequency analysis	Hotspot – intensity analysis	Scenario analysis
Scenarios	Intergovernmental Panel on Climate Change (IPCC) scenarios: RCP2.6, RCP 4.5, RCP8.5			RCP4.5	RCP8.5	RCP 4.5, RCP 8.5
Metrics	Rx5day [mm]	CDD [days]	WSDI [days]	Number of storms per year (#/year)	Potential relative damage based on 65 year event (%)	Difference between freshwater supply and demand
Input data	Reanalysis data (ERA-Interim), global climate model ensemble (CMIP5), facility locations			Historical cyclone tracks, scientific literature review, facility locations		Aqueduct, facility locations

Figure 3: Physical Risk Scenario Analysis

Table 2: PTTEP Substantive Physical Risks and Mitigation Plans

Physical Risk				
Risk driver	Time horizons	Severity (likelihood x impact)	Risk Implications	Mitigation Plans
Acute				
 Heatwave	 Medium-Term	Medium	• For PTTEP's Malaysia offshore asset (Sabah & Sarawak), changes in the frequency and intensity of heatwaves will reduce workers' ability to work. • At moderate intensity work and temperatures of 33-34°C, a worker's capacity can decrease by 50%. • Outdoor work in the oil and gas industry is physically demanding and requires protective clothing and gear. • During periods of excessive heat, the time required for outdoor operations and maintenance work may increase, resulting in higher maintenance costs. • Increased incidence of equipment failure or reduced performance due to high temperature.	• Reduced working hours, postponed maintenance, provided appropriate clothing, mandatory drinking breaks, and smartwatches for heat stroke detection through body temperature monitoring. • Identified critical equipment, monitor their performance, assess remaining lifespan and any system upgrades. • Consider revising specifications for improved resilience in high temperatures.
 Cyclone, hurricane, typhoon	 Medium-Term	Medium	• PTTEP's Malaysia, Myanmar, and Thailand offshore assets are in areas prone to tropical cyclones. • Tropical cyclones have caused production interruptions for these assets in the past. • During production interruptions, the flow rate of oil and gas production decreases by an average of 50%. • The average length of a production interruption is 5 days. • Using scenario analysis with the IPCC RCP 4.5, it is projected that the frequency of tropical cyclones will increase for the Malaysia and Thailand offshore assets. This poses a growing financial risk for PTTEP.	• Implement monitoring for early detection and identify vulnerable infrastructure areas • Explore measures to prevent process upset that may lead to explosion and major GHG leak and minimize spill magnitude. • Develop a strategy and protocol for managing equipment in response to process upset and storage tank capacity; and update the spill prevention, control, and countermeasure plan.

Transition Risk and Opportunities

Transition risks are those risks resulting from a transition to a 2°C economy. According to the Task Force on Climate-related Financial Disclosures (TCFD): “transitioning to a lower-carbon economy may entail extensive policy, legal, technology, and market changes”.

For the oil and gas sector, the main impacts are related to the carbon emissions related to our operations and of our fuel product, and the change in demand for our products due to low carbon economy transition. As our business mainly focuses on sales of product to customer, our scenario analysis therefore also considers impacts of reduced sales from our customers (or downstream impacts). We do not have material impacts from our suppliers (or upstream impacts), we consider that transition risk impacts from suppliers is minimal. For transition risk assessment, we looked at risks related to policies, laws, markets, technology, and reputation. We followed a structured approach to examine potential changes at the asset level for market and carbon pricing risks. For other transition risks, we assessed them at the country level. An overview of the transition scenarios and assumptions used are summarized in the Table 3 below, which include only the most material climate-related transition risks to PTTEP’s business. As mentioned under physical risks, we use severity as the measure of the impact of risks and opportunities.

Hazard	Policy risks	Legal risks	Technology risks	Market risks	Reputation risks
Methodology	Scenario analysis and literature review	Literature review and data analysis	Scenario analysis	Scenario analysis	Data analysis
Scenarios	IEA Sustainable Development Scenario (SDS) and IPCC 1.5°C scenarios	Not scenario specific	IEA SDS and Stated Policies Scenario (SPS)	IEA SDS	Not scenario specific
Metrics	Carbon cost (USD), compliance cost	# of cases, % of total greenhouse gas (GHG) emissions	Change in demand of O&G products	Stranded assets	Share price loss from reputational damage
Assumptions	• Carbon price based on IEA SDS • O&G prices based on US EIA projections	Attribution science (i.e. total of GHG emissions from the fossil fuel industry) is used to determine the “fair share” of PTTEP	• Change in O&G demand is computed by the difference between SDS and SPS scenarios • O&G prices based on US EIA projections	• Assets are considered stranded when their continued production is inconsistent with IEA SDS • O&G prices based on US EIA projections	Estimated based on the impact of reputational incidents on peer O&G companies’ share prices

Figure 4: Transition Scenarios and Assumptions

Table 3: PTTEP Material Transition Risk and Mitigation Plans

Transition Risk				
Risk driver	Time horizons	Severity (likelihood x impact)	Risk Implications	Mitigation Plans
 Carbon pricing mechanism	 Long-Term	Medium	• Carbon taxes and/or cap and trade mechanisms have a significant impact on PTTEP's operations globally. • They affect PTTEP's future requirements for reducing internal emissions and may influence the company's strategy to adopt low carbon energy technologies. • Potential to use carbon credit mechanism (with estimated high price) to meet GHG requirement & expectation • PTTEP expects that carbon pricing will become stricter in the long-term as new policies and regulations evolve, regulated by the Thailand office of Natural Resources and Environmental Policy and Planning (ONEP), Thailand Greenhouse Gas Management Organization (TGO) and other agencies.	• Established the GHG criteria (apply abatement cost, carbon tax and offset cost) for investment decision of new M&A project to align with the PTTEP net zero pathway by 2050. • Integrate Net Zero strategy and GHG management for existing and new project development e.g. GHG criteria into engineering policy, engineering manual and PREP process and extend the use of internal carbon price throughout PTTEP value chain. • Acquired carbon credit from the Thailand Voluntary Emission Reduction Program (T-VER) for support all PTTEP's events to align with Carbon Neutral Event campaign.
 Transitioning to lower emissions technology	 Medium-Term	Medium	• According to the SDS Scenario, oil consumption is expected to decrease by 61% by 2040. • Renewable energy consumption is forecasted to increase by 215%. • Natural gas consumption is projected to decline by 4%. • Since natural gas and liquid make up 71% and 29% of PTTEP's value respectively, this poses a significant risk.	• Explore power business opportunity for Gas/LNG and renewables to support electricity usage demand in future. • Explore business opportunities in CCUS, H2 and investments in future energy to move forward to lower carbon business. • Expand E&P growth to gas-weight portfolio, which is lower emissions, in the strategic countries with strategic partners. • Dedicated 0.24% of PTTEP's capital expenditures to invest in technology opportunities.

Transition Risk				
Risk driver	Time horizons	Severity (likelihood x impact)	Risk Implications	Mitigation Plans
 Increased stakeholder concern or negative stakeholder feedback	 Short-Term	Medium	• Investors and stakeholders increase their focus on environmental, social, and governance (ESG) factors when making investment decisions. There is growing pressure on E&P company to align their strategies, e.g., climate targets, decarbonization pathway, and disclose climate-related risks. Failure to do so can lead to reputation damage and diminished brand value, divestment, and limited access to capital.	• Maintain a high ESG performance and continuously monitors media sentiment as it will continue to evolve under the framework of the Paris Agreement and domestic policies, which in turn co-determine financial impact. • Raise public awareness of PTTEP and its contribution towards creating the right balance of business operation and conserving the environment. The company is committed to striving towards Net Zero Greenhouse Gas Emissions target, as well as supporting the nation's goal in reducing GHG emissions. • Developed the Communication Plans for Net Zero, CCS and Beyond E&P business, to publicize the company's direction and execution through various media outlets (TV, newspaper, radio, online media, event and exhibition etc), including the company's channels (Website, Facebook, LinkedIn, Youtube). • Implemented the Issue and Stakeholder Management System (ISMS) as a tool to analyze social risks (including the risk of reputational damage) and mitigate issues by considering the good relationships with all stakeholders in every operating area.

Table 4: PTTEP Substantive Transition Opportunities

Transition Opportunities				
Risk driver	Time horizons	Severity (likelihood x impact)	Opportunity	Implementation Plans
Participation in the carbon market	 Long-Term	Medium	• Increasing demand and price of carbon credits in the market is an opportunity for PTTEP to participate in the markets through carbon credit development and sales.	• Engaged in the Thailand Voluntary Emission Reduction Program (T-VER) a dedicated carbon credit platform of Thailand. • Involved in carbon markets and identified GHG reduction initiatives that can be certified as carbon credits. • Ongoing study of blue carbon project & methodology development for carbon credits • Develop potential emission reductions opportunities identified into carbon credit projects to realize monetary value and finance of reduction projects.
Shift in consumer preference	 Long-Term	High	• According to the IEA SDS, the demand for natural gas is projected to remain substantial, while the demand for oil is expected to decline more rapidly. • This increased demand for natural gas is expected to positively affect PTTEP's revenue. • Customer preferences towards cleaner energy sources, sustainable products, and environmentally concerns can impact demand for oil & gas products. Increased awareness and concerns about climate change can potentially lead to reduce demand for fossil fuels.	• Maintain natural gas weighted portfolio and diversifying energy storage & renewable. • Continue to focus on natural gas exploration & production by maintaining a natural gas biased portfolio 56% by revenue as well as improve operational efficiency to maximize natural gas sales.

A Deep Dive into Climate-related Scenario Analysis

Scenario analysis is a process for looking at potential future impacts (both positive and negative) to companies. Climate-related scenario analysis then looks specifically at climate-related impacts. 2050 is an important milestone as we need to achieve Net Zero by 2050 in order to limit temperature increase, therefore 2050 is used as the longest timeframe for scenario analysis for both transition and physical risks. Since it is impossible to precisely predict the conditions in 2050, the purpose of scenario analysis is not to determine specific impacts, but the possible range of impacts to companies and the strategic implications for companies.

Physical risks are informed by the Representative Concentration Pathways (RCPs) developed as part of the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC). Scenario analysis based on RCPs helps in understanding the range of outcomes regarding the physical impacts to the environment over a range of global temperature increases compared to pre-industrial levels. This then helps informing businesses such as PTTEP on the potential physical impacts (such as drought and flooding) that may occur if global average temperatures are increased to above 2°C. It supports informed decision-making by providing insights into the potential risks, opportunities, and trade-offs under different scenarios.

Transition risks for energy companies are mainly informed by scenarios from International Energy Agency (IEA). The IEA primarily looks at future trends of energy production, demand and consumption, and from these any related impacts to global GHG emissions. In lower carbon scenarios, such as Sustainable Development Scenario or Net Zero Emissions by 2050 Scenario, renewable energy transition occurs faster, and use of higher polluting fuels such as coal are phased out more quickly. The Stated Policies Scenario looks at a scenario where the world continues as per national and international policies in place as of now. In this scenario, the majority of energy consumption still remains fossil based, with less actions towards renewable energy.

By looking at both physical scenarios and transition scenarios PTTEP can understand the full range of risks to business, for example decreased product demand in transition scenario, and increased drought in physical scenario. PTTEP can then be prepared for both physical and transition risks that may occur in the future and adjust its business plan accordingly.

The scenarios and assumptions used by PTTEP to conduct climate-related scenario analysis are summarized below:

Physical Risk Scenarios Selected	Transition Risk Scenarios Selected
RCP 2.6: an 'aggressive' mitigation that may lead to temperature increase of approximately 1°C in 2100 **RCP 4.5:** a strong mitigation and that may lead to temperature increase of approximately 2°C in 2100 **RCP 8.5:** a business-as-usual (BAU) scenario with a continuation of the current path of increasing GHG concentrations that may lead to temperature increase of approximately 4°C in 2100	**Intergovernmental Panel on Climate Change (IPCC)** • Database of hundreds of scenarios on how keeping global temperature below a 1.5°C increase • Shows a wide range of possible carbon prices based on policy measures, available technologies, and model methodologies **International Energy Agency Sustainable Development Scenario (IEA SDS)** • Major transformation of the global energy system from O&G to renewable energy • Fully aligned with the Paris agreement Scenario **IEA Stated Policies Scenario (IEA STEPS)** • Reflects the impact of existing policy frameworks and today's announced policy intentions • Shifts from oil to natural gas and (to a lesser extent) renewable energy

The scenario analysis evaluates physical risks at specific sites, while transition risks are assessed at the country level, encompassing Thailand, Malaysia, and Myanmar. The qualitative results indicate that for the 2026-2050 time horizon, several physical risks, including heatwaves, heavy precipitation, tropical cyclones, drought, and water risk, were classified as Medium according to PTTEP's Risk Management Guideline. The exception was tropical cyclones in the 2036-2050 period, which could not be assessed due to insufficient data. This Medium risk level signifies the potential high level of risk that PTTEP's operations might face during this period.

It is important to note that the analysis also includes other countries, but the following countries with medium impact are shown below as they represent the highest level of impact for transition risks. For a detailed summary of transition risks, please refer to the table provided below.

Table 5: Summary of all transition impacts from scenario analysis with medium impact

Impact	2020-2025	2026-2035	2036-2050
Policy	-	Malaysia	Myanmar
Legal/litigation	Thailand, Malaysia	Malaysia	Myanmar
Technology	-	-	Myanmar
Market	Malaysia	Malaysia	-
Reputation	Thailand, Malaysia, Myanmar	Malaysia, Myanmar	Myanmar

In addition to the qualitative results above, we have summarized the quantitative impacts below (Table 6&7), Currently, we are disclosing our preliminary findings, with additional results scheduled for future publication. For more details on the scenario impacts please refer to our latest CDP response, questions C2.3a, C2.4a, C3.2, C3.2a and C3.2b.

Table 6: Summary of assessed impacts and cost of mitigation measures of risk from scenario analysis

Risk Driver	Scenario Used	Year of Expected Impacts	Financial Impact Areas	Impact (USD Million)	Mitigation Cost (USD Million)
Physical (Acute)					
Heatwave	RCP 8.5	 Medium-term (2026 – 2035)	Increased operating Cost	7	2
Tropical cyclone	RCP 4.5	 Medium-term (2026 – 2035)	Decreased revenue	18	10
Transition (Legal and Policy)					
Carbon pricing mechanism	IEA SDS	 Long-term (2036 – 2050)	Increased operating cost	60	90
Transition (Market)					
Transitioning to lower emissions technology	IEA SDS	 Medium-term (2026 – 2035)	Decreased revenue	10,265	1,009
Increased stakeholder concern or negative stakeholder feedback	NDC (impact based on past events)	 Short-term (2020 – 2025)	Decrease share price	5,100	21

Table 7: Summary of assessed impacts and cost of mitigation measures of opportunities from scenario analysis

Opportunity Area	Opportunity Driver	Scenario Used	Year of Expected Impacts	Financial Impact Area	Impact (USD Million)	Cost to implement (USD million)
Energy source	Participation in carbon market	NDC	Medium-term (2026–2035)	Additional revenue from carbon credit	9	14
Products and services	Shift in consumer preferences	NDC	Long-term (2036–2050)	Increased revenues resulting from increased demand for products	4,096	2,706

Climate Management Plan

PTTEP has disclosed our full adaptation plan for physical risks at the link provided here. Our adaptation plan covers 100% of our operations and new operations. Our overall adaptation covers heatwaves, tropical cyclones, heavy precipitation and drought and other water related risks. We have developed site specific actions with three time periods: 2020, 2026 and 2036 which includes monitoring of the weather, retrofitting equipment, site inspections and investment in flood protection.

PTTEP has been taking steps to reduce and minimize transition risks. We are investing more in natural gas, which is the cleanest fossil fuel source, and conducting studies to find ways to decrease greenhouse gas emissions. Furthermore, we are supporting Thailand's goals to achieve Carbon Neutrality and Net Zero Greenhouse Gas Emissions. PTTEP aims to achieve Net Zero GHG Emissions for our E&P business by 2050, focusing on scope 1 and scope 2 emissions that is under our operational control. PTTEP has also set targets to reduce greenhouse gas emissions intensity by 30% by 2030 and 50% by 2040, compared to the emissions in 2020.

RISK MANAGEMENT

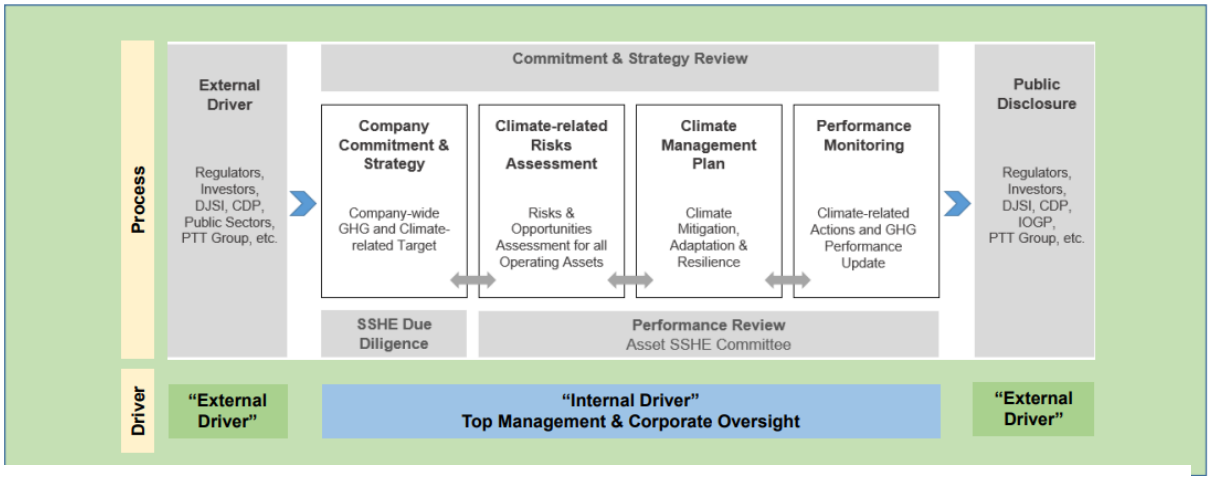
Climate-related Risks and Opportunities Management Process

PTTEP has identified Climate Change Risks as an emerging risk and aims to integrate risk management into its business activities and decision-making, which cover core business activities in PTTEP such as strategic planning management, investment and divestment plans, capital project management, and operations and business process management. The group has established a risk management process to identify, assess, and manage climate-related risks and opportunities in line with the 2017 The Committee of Sponsoring Organizations of the Treadway Commission (COSO) Enterprise Risk Management framework. Risk management is implemented at both the corporate and operational levels via a consolidated Corporate Risk Profile (CRP) to ensure that key emerging climate-related risks and opportunities are managed in accordance with PTTEP's Risk Management Guideline which are informed by Key Risk Indicators (KRIs) to enable PTTEP to set up effective mitigation, adaptation, and resilience measures. Climate change is integrated into this process as there are multiple types of risks that we consider in our CRP and KRIs. Our supply chain physical risks assessment covers all our major tier 1 suppliers where we evaluated impacts from heavy precipitation, heatwaves, and drought. Our transition risks include our operational and customer related risks and opportunities. We have not yet focused on physical risks of customers and end users, as our customers and end users are diverse therefore it would be difficult to identify their locations for physical risk. Regarding transition risk of our suppliers, we have screened the risks from suppliers and since their impacts are much less than our operational and customer risks we have deemed supply chain transition risks as immaterial.

Additionally, PTTEP has considered the emissions reduction requirements determined by existing Nationally-Determined Contributions (NDCs) under the Paris Agreement for countries in which PTTEP operates and/or invests in such as Thailand, Myanmar, and Malaysia. Other risk types include current regulation, emerging regulation, technology, legal, market, reputation, acute physical and chronic physical risks, which are integrated into enterprise risk management process.

As mentioned in the Strategy section, the identified risks are also included into our Strategy and planning processes after they are identified by the process shown below.

Figure 5: PTTEP's Climate-related Risks and Opportunities Process

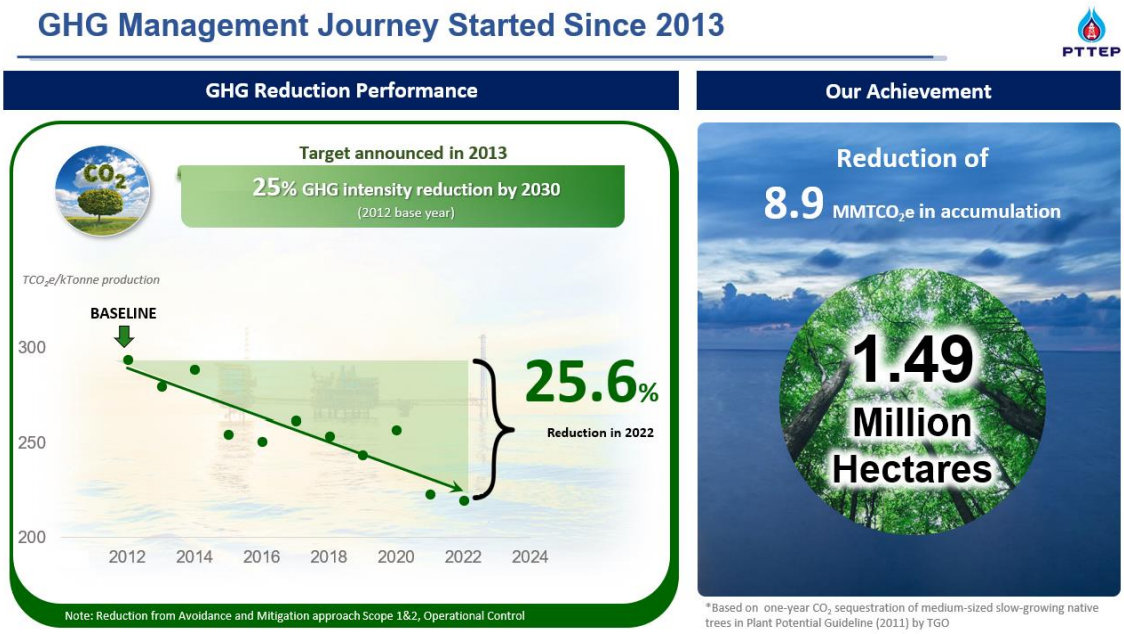


METRICS AND TARGETS

Introduction to PTTEP's Climate-related Metrics and Targets

PTTEP aims to play a role in addressing climate change as an urgent national and global issue, striving to create a better world for future generations by reducing greenhouse gas emissions from our operational activities. Previously, PTTEP has set our target to reduce greenhouse gas intensity by at least 25% by 2030 compared to the base year of 2012. Over the past decade, PTTEP has been dedicated to implementing projects in domestic and international assets to consistently reduce emissions.

Figure 6: GHG Emissions Intensity Performance as of 2022

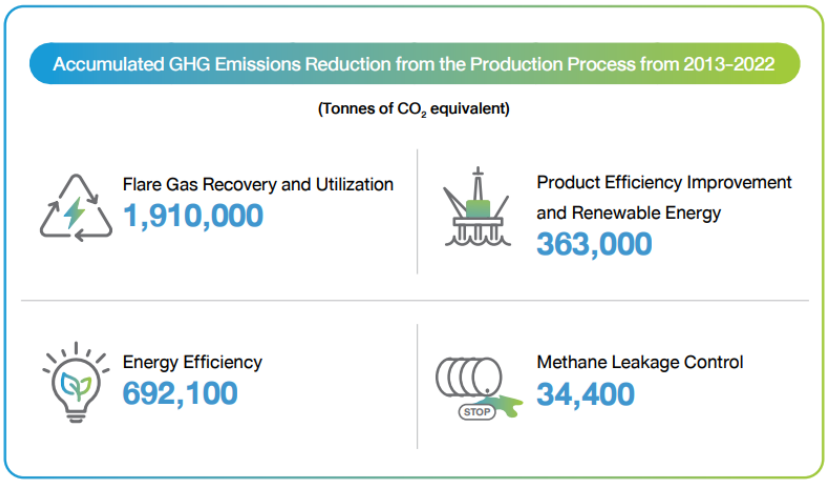


In 2022, PTTEP was able to reduce GHG emissions intensity at 25.6% which is about 8 years ahead of plan. From this achievement, the accumulated GHG emissions reduction is approximately 8.9 million tonnes of CO_2 equivalent since 2013. This target was achieved through:

- E&P portfolio and well management (contributing approximately 5.9 million tonnes of CO_2 equivalent of reduction)
- Approximately 3 million tonnes of CO_2 equivalent are contributed from flare gas recovery and utilization, energy efficiency improvement, production efficiency improvement, renewable energy adoption in operations, methane leak reduction, and logistic fleet management.

Please see the highlights of our actions summarized in **Figure *7*** below:

Figure 7: Cumulative GHG Emissions Reduced from 2013 – 2022



**Calculated from local slow-growing plants as appeared in TGO's plant capacity manual (June 2011)*

From increasing of driving forces, to demonstrate our commitment to mitigate climate change, and supporting global and national goals for carbon neutrality, we have set a target to achieve Net Zero greenhouse gas emissions by 2050 in our exploration and production activities including emissions scope 1 and 2 for our operations where we are the operator for both Thailand and oversea assets. To reach this target, we have set interim targets to reduce emissions intensity by at least 30% by 2030 and 50% by 2040 compared to the base year of 2020 where the emissions were at 6,026,933 tonne CO_2e. We have outlined the "EP Net Zero 2050" strategic approaches to achieve Net Zero greenhouse gas emissions targets. Those include "E - Exploring for Lower Carbon E&P Portfolio", focusing on the E&P portfolio management to be a lower-carbon organization, "P - Production and Planet in Balance" focusing on the mitigation and offsetting. We will move forward for zero routine flare for new asset, energy efficiency improvement and apply Carbon Capture, Utilization and Storage (CCUS) technologies and digitalization to mitigate GHG emissions. CCUS are currently being explored, including converting CO_2 into Carbon Nanotube and Cyclic Carbonate. These initiatives reflect our commitment to address climate change and find innovative ways to reduce emissions. We also focus on emissions offsetting through the planting of trees in forests and mangroves (Carbon Removal Project) which will increase the natural carbon sink in our offsetting portfolio. Ocean for Life projects focusing on blue carbon will be continuously conducted to improve the biodiversity abundance and marine ecosystems as healthy oceans and coastal ecosystems are the efficient sources of carbon sink.

Figure 8: PTTEP Net Zero Targets

As the Science Based Targets initiative (SBTi) is currently in the process of developing the formal science-based target setting guidance for the Oil & Gas sector, we cannot seek validation of its targets by SBTi.

As the process evolves, we will continually monitor and evaluate the principles intended for inclusion in the guidance and we will consider revisiting our target once we attain a more comprehensive understanding of SBTi's guidance.

Integration of Metrics and Targets into Strategy and Risk Management Process

From the 2022 materiality issues and preparation for the energy transition trend, PTTEP have outlined our strategy to set position to move forward with the 3 key strategies are: Drive Value (strengthen E&P and ensure Thailand energy security), Decarbonize (manage E&P for lower carbon portfolio), and Diversify (focus on new business opportunities beyond E&P).

In 2022, we have incorporated GHG emissions intensity reduction into the Corporate Key Performance Indicator (KPI), comprising of 10% of our Corporate KPI under the “Decarbonize” theme. We are also expanding our business activities under the “Diversify” theme by exploring opportunities in AI & Robotics Ventures (ARV), the power sector and exploring the implementation of carbon capture and storage (CCS) as a service as a mean for investing in permanent carbon removal, which makes up 30% of their KPI. These efforts demonstrate PTTEP's commitment to sustainability and addressing climate change. The remaining 60% of Corporate KPI focusses on financial metrics, and which are key for the sustainability of the company.

Figure 9: PTTEP 2022 Corporate KPI

GHG Emissions

Overall, our absolute emissions have increased since 2019, this is due to increased production. However, we have been able to maintain the GHG emissions intensity of our operations at a stable level.

PTTEP Absolute GHG emissions Scope 1, 2 and 3

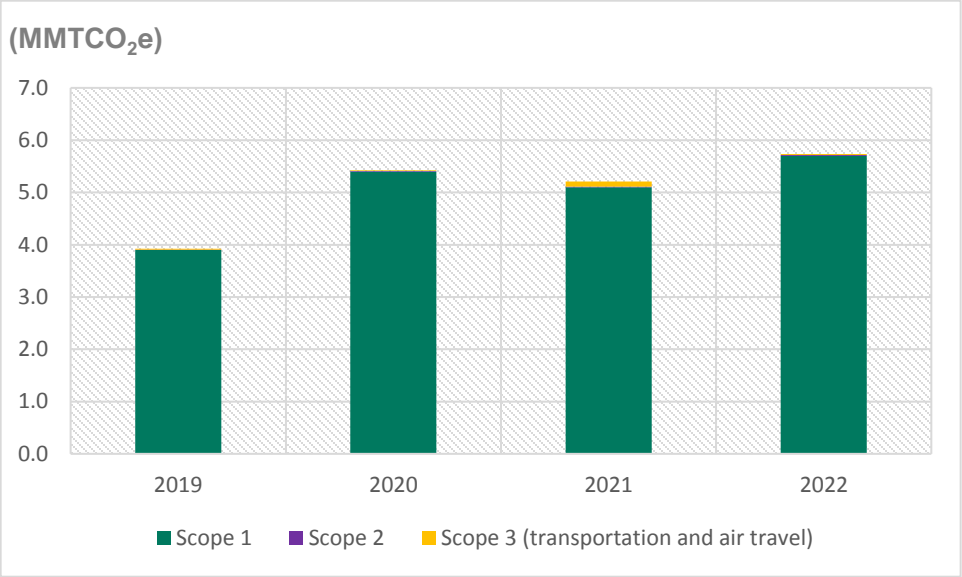
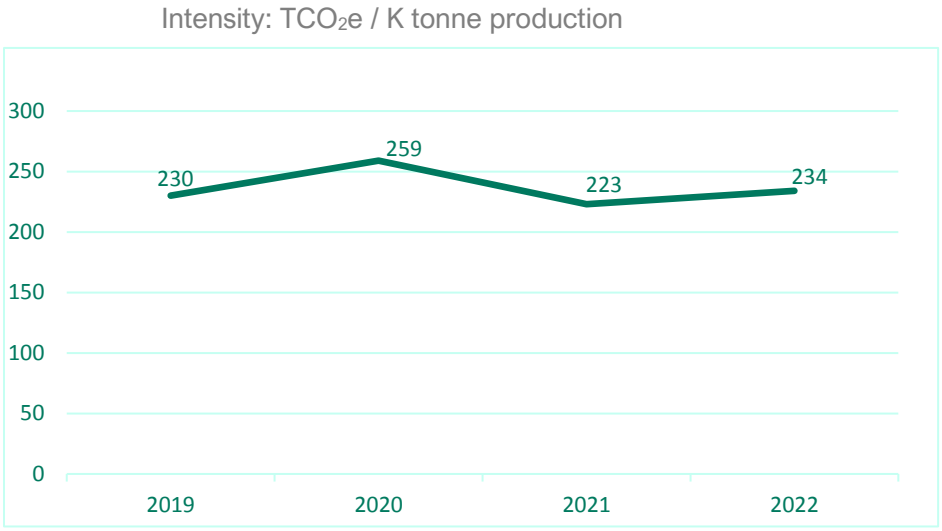


Table 8: PTTEP GHG Emissions Breakdown by Year

Scopes	GHG Emissions ($MMTCO_2$ e)			
	2019	2020	2021	2022
Direct GHG emission (Scope 1)	3.9	5.4	5.1	5.7
Energy indirect GHG emission (Scope 2)	0.006	0.014	0.014	0.015
Other relevant indirect GHG emission (Scope 3)	0.02	0.012	0.095	0.018

PTTEP GHG emissions Intensity



In addition to the data provided above, more details are available at the link below.
https://www.pttep.com/en/Sustainability/Disclosure/Sustainability-Performance-Data/download.aspx?Content=4803

Low Carbon and Avoided Emissions Products

In addition to our emissions Scope 1 and 2 targets of our operating assets, we are also exploring ways to reduce the emissions of our customers through low carbon products and avoided emissions targets.

- **Low Carbon Products**: We consider low carbon products as those where the energy consumption intensity for operational control assessed under Scope 1 and 2 are lower than the IOGP average. These kinds of products account for approximately 13% of our total revenues.
- **Avoided Emissions Products:** According to the WRI white paper on "comparative emissions impacts of products" avoided emissions products are products that allow customers to reduce their lifecycle emissions when compared to a baseline. Although there is not yet an oil and gas industry standard for avoided emissions, we have referred to WRI and the "Addressing the Avoided Emissions Challenge" report by WBCSD Chemicals to identify products that would be considered as avoided emissions by the customer. On the customer side, around 11% of our product revenue comes from products that instead of being sold as fuel are being sold as petrochemical feedstock. Petrochemicals have a lower lifecycle emissions profile per tonne of product when compared to fuels because the carbon is stored in the product rather than released to the atmosphere.

Methodologies used to Calculate GHG Emissions

Our GHG calculations are performed in the line with the PTT GHG Standard as well as external standards listed below.

- American Petroleum Institute Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Natural Gas Industry, 2009
- IPCC Guidelines for National Greenhouse Gas Inventories, 2006
- IPIECA's Petroleum Industry Guidelines for reporting GHG emissions, 2nd edition, 2011
- ISO 14064-1
- The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (Revised Edition)

Internal Carbon Pricing

Our internal carbon pricing aligns business operations with climate goals, manages risks, encourages innovation, and meets stakeholder expectations. By putting a price on carbon, we can have a proactive business strategy that supports transition towards a low-carbon economy and contribute to addressing the challenges of climate change by guiding our business decisions towards lower carbon investment decisions.

PTTEP has introduced an internal carbon pricing scheme aimed to create a right balance between GHG emissions management towards net zero aspiration and business growth opportunities, PTTEP implements an internal carbon pricing of USD 20 per tonne of CO_2 equivalent for existing projects while new M&A projects adhere to pricing levels of USD 35 and USD 60 per tonne of CO_2 equivalent. The pricing undergoes a biennial review or as required for effectiveness.

Other Climate Related Metrics

Our other climate related metrics related to water are disclosed in our Environmental Management Performance Data disclosure on our website here. Other ESG indicators are available here.

TCFD CONTENT INDEX

In addition to the disclosures in this report, you may find additional content below.

TCFD Recommendation	PTTEP's Annual Report, Sustainability Report and Website
Governance - Disclose the organization's governance of climate-related risks and opportunities.	
a) Describe the board's oversight of climate-related risks and opportunities	Corporate Governance and Sustainable Development Committee https://www.pttep.com/en/Aboutpttep/Corporategovernance/Thecommittee.aspx?Group=122 Risk Management committee: https://www.pttep.com/en/Aboutpttep/Corporategovernance/Thecommittee.aspx?Group=126 Sustainability Governance Structure: https://www.pttep.com/en/Sustainability/Sustainability-At-Pttep/Sustainability-Governance-Structure.aspx Roles and Responsibilities CDP Climate Change C1.2a Incentives CDP Climate Change C1.3a
b) Describe management's role in assessing and managing climate-related risks and opportunities	
Strategy - Disclose the actual and potential impacts of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning where such information is material.	
a) Describe the climate-related risks and opportunities the organization has identified over the short, medium and long term	Climate Management Plan: https://www.pttep.com/en/Sustainability/Environmental-Stewardship/Climate-Change-Management/download.aspx?Content=5167 Risk Management Process: CDP Climate Change C2.1a, C2.2
b) Describe the impact of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning	Climate Management Plan: https://www.pttep.com/en/Sustainability/Environmental-Stewardship/Climate-Change-Management/download.aspx?Content=5167 Risk disclosure: CDP Climate Change C2.3a Opportunity disclosure: CDP Climate Change C2.4a
c) Describe the resilience of the organization's strategy, taking into consideration different climate related scenarios, including a 2°C or Lower scenario.	Climate Management Plan: https://www.pttep.com/en/Sustainability/Environmental-Stewardship/Climate-Change-Management/download.aspx?Content=5167 Opportunity disclosure: CDP Climate Change C3.2, C3.4
Risk Management - Disclose how the organization identifies, assesses, and manages climate-related risks	
a) Describe the organization's processes for identifying and assessing climate-related risks	Risk and Crisis Management https://www.pttep.com/en/Sustainability/Governance-For-Sustainable-Business/Risk-And-Crisis-Management.aspx
b) Describe the organization's processes for managing climate-related risks	

TCFD Recommendation	PTTEP's Annual Report, Sustainability Report and Website
c) Describe how processes for identifying, assessing and managing climate-related risks are integrated into the organization's overall risk management	Annual Report 2022 Risk Management Policy and Plan, p.83 https://www.pttep.com/en/Investorrelations/Regulatorfilings/Annualfiling.aspx Climate Management Plan pg.3: https://www.pttep.com/en/Sustainability/Environmental-Stewardship/Climate-Change-Management/download.aspx?Content=5167 Risk Management: CDP Climate Change C2.2a
Metrics & Targets - Disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material	
a) Disclose the metrics used by the organization to assess climate-related risks and opportunities in line with its strategy and risk management process	Internal Carbon Pricing https://www.pttep.com/en/Sustainability/Environmental-Stewardship/Climate-Change-Management.aspx
b) Disclose Scope 1, Scope 2, and, if appropriate, Scope 3 GHG emissions, and the related risks	Sustainability Performance Data: https://www.pttep.com/en/Sustainability/Disclosure/Sustainability-Performance-Data/download.aspx?Content=4803
c) Describe the targets used by the organization to manage climate-related risks and opportunities and performance against targets	Net Zero Targets, Sustainability Report pg. 26-27: https://www.pttep.com/en/Sustainability/Disclosure/Sustainability-Report/download.aspx?Content=5406 PTTEP Sustainability Framework and Strategy: https://www.pttep.com/en/Sustainability/Sustainability-At-Pttep/Sustainability-Framework-And-Strategy.aspx PTTEP 2022 Corporate KPI: https://www.pttep.com/en/Sustainability/Sustainability-At-Pttep/Sustainability-Framework-And-Strategy/download.aspx?Content=5419