



Risk and Opportunity Assessment

A presentation materials for IRPC

25 July 2024

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Part 2

Strategy

Strategy

Developing Climate Strategy and Enhancing Resilience

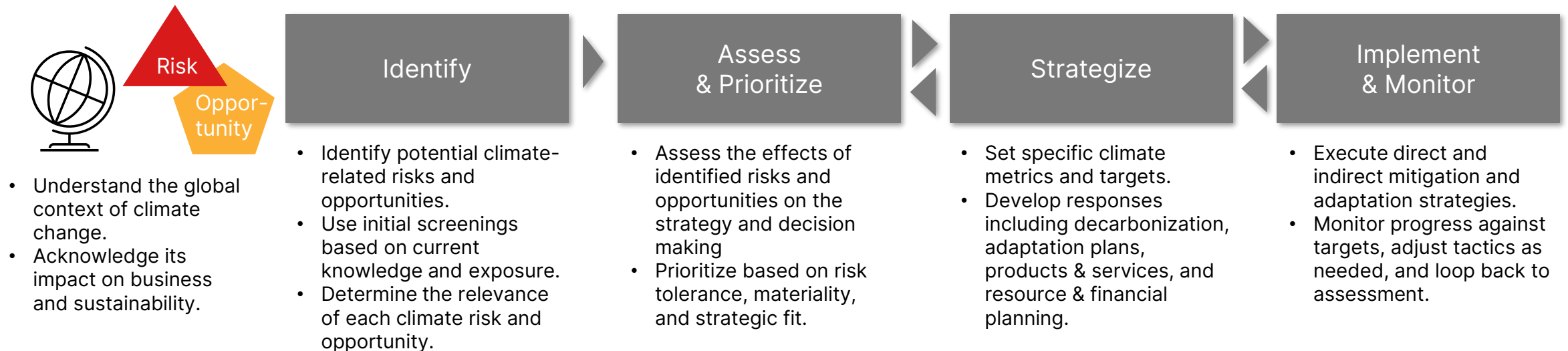
IRPC's strategic approach to climate-related risks and opportunities is guided by a systematic process to enhance resilience and sustainability. IRPC has integrated climate considerations into the core business strategies and operational plans. By integrating scenario analysis, internal engagement, and risk management processes, it ensures a comprehensive response to climate challenges, driving forward-looking business strategies.

 **Use of scenario analysis** Apply diverse future scenarios to inform all stages of the process, enhancing the robustness of strategies.

 **Internal engagement** Foster organization-wide collaboration and commitment to integrate climate considerations into all decision-making.

 **Integration** Fully incorporate climate risk and opportunity management processes into the existing risk management framework and culture.

IRPC identifies climate-related risks and opportunities through a structured process by revisiting the risk inventory to identify potential risks driven by climate-related factors. The identification process includes the impact analysis of those risks on IRPC's own operations and facilities level.



a) Describe the climate-related risks and opportunities the organization has identified over the short, medium, and long term.

In alignment with the Paris Agreement, which aims to limit global warming to well below 2°C above pre-industrial levels and pursue efforts to further limit warming to 1.5°C, IRPC is committed to a sustainable future. We have adopted the climate change strategy to achieve Carbon Neutrality by 2050 and Net Zero by 2060. Our risk management, strategy development, environmental management, and sustainability teams regularly assess climate-related risks and opportunities. These assessments are integrated into our business strategy to mitigate and adapt to climate change impacts, ensuring the resilience and long-term sustainability of our operations.

In 2023, IRPC identified risks and opportunities that could impact business and conducted both physical and transition climate scenario analyses using qualitative and quantitative methods. These analyses considered context-specific factors for each of IRPC's assets to assess the likelihood and severity of potential climate-related impacts.

IRPC has defined 3 timeframes for consistent use in our assessment, analyses, and response measures. These timeframes are:

- Short-term: 1-2 years
- Medium-term: 3-10 years
- Long-term: More than 10 years

The assessment and analysis focus on our own operations covering the majority of IRPC's assets across all business units, which operate in six provinces in Thailand.

- Bangkok: Head office (Enco building)
- Rayong: Oil depot, Refinery, petrochemical plant, power plant, and port operations
- Samut Prakan: Oil depot
- Ayutthaya: Oil depot
- Chumphon: Oil depot
- Samut Songkhram: Oil depot



Identification of Climate-related Risks and Opportunities

IRPC collaborates with relevant stakeholders, utilizing established methodologies, in-house tools, and publicly available data to identify risks and opportunities. This also follows the TCFD classification of climate risks into physical, transition risk, and opportunities.


In the Enterprise Risk Management Manual (ERM), IRPC has defined criteria for assessing the likelihood of risks and opportunities, classifying them into four levels: rare (likelihood less than 5%), unlikely (likelihood 5% - 20%), possible (likelihood 20% - 50%), and likely (likelihood more than 50%).

The table below details the risks and opportunities expected to occur (possible and likely levels) at different timeframes: short-, medium-, and long-term.

		Potential risks and opportunities	Time Horizon		
			Short (1-2 years)	Medium (3-10 years)	Long (> 10 years)
Physical risk	Acute	• Severe and frequent flooding		✓	✓
		• Severe and frequent water scarcity		✓	✓
	Chronic	• Rising sea level			✓
		• Rising temperatures			✓
Transition risk	Policy & legal	• Governance introduce carbon pricing instruments such as carbon tax and emissions trading scheme (ETS)		✓	✓
		• Required are more detailed and comprehensive disclosures according to reporting standards	✓	✓	✓
	Technology	• Required huge investment cost to install removal Technology such as CCS			✓
	Market	• Market shift towards electric mobility		✓	✓
	Reputation	• Inaction leads to loss of public trust		✓	✓
• Lack of awareness and good practices among employees		✓	✓	✓	
Opportunity	Energy source	• Increasing renewable energy consumption	✓	✓	✓
		• Expand business to selling renewable energy sources such as solar PV and floating		✓	✓
	Products and services	• Circular economy for petrochemical products		✓	✓

b) Describe the Impact of Climate-Related Risks and Opportunities on the Organization’s Businesses, Strategy, and Financial Planning (1/3)

Annually, a workshop is conducted to assess climate-related risks that could impact the operation of IRPC. Various business units and external experts provide input to identify physical and transition risks, as well as opportunities that may affect IRPC's business.

		Scenario	Potential risks	Impact to IRPC’s business	
Physical risk	Acute	RCP 4.5 and 8.0	<ul style="list-style-type: none"> • Severe and frequent flooding 	Impact to IRPC’s assets: <ul style="list-style-type: none"> • Building and property damage • Operation disruption • Asset revaluation • Higher cooling requirements leading to increased energy consumption. • Increased heat-related health issues among employees 	
			<ul style="list-style-type: none"> • Severe and frequent water scarcity 		
	Chronic	RCP 4.5 and 8.0	<ul style="list-style-type: none"> • Rising sea level 		Financial Impacts: <ul style="list-style-type: none"> • Increased costs for repairs and recovery efforts • Increased expenses for alternative water sources or treatment • Decreased value of coastal properties and assets. • Increased energy cost • Higher premiums due to increased exposure to flooding
			<ul style="list-style-type: none"> • Rising temperatures 		

b) Describe the Impact of Climate-Related Risks and Opportunities on the Organization's Businesses, Strategy, and Financial Planning (2/3)



	Scenario	Potential risks and opportunities	Impact to IRPC's business
Transition risk	<p>NGFS:</p> <p>1. National Determined Contribution (NDC):</p> <ul style="list-style-type: none"> Carbon pricing will be implemented in 2025 at USD 4/tCO₂. It will reach USD 74/tCO₂ in 2050. <p>2. Delayed Transition:</p> <ul style="list-style-type: none"> Carbon pricing will commence in 2035 at USD 75/tCO₂. It will continually increase to reach USD 325/tCO₂. <p>3. Net Zero 2050:</p> <ul style="list-style-type: none"> Carbon pricing will commence in 2025 at USD 19/tCO₂. It will continually increase to reach USD 938/tCO₂. 	<ul style="list-style-type: none"> Governance introduce carbon pricing instruments such as carbon tax and emissions trading scheme (ETS) 	<ul style="list-style-type: none"> Implementation of carbon pricing could lead to increased operational costs due to carbon taxes or costs associated with purchasing emissions allowances under an ETS.
		<ul style="list-style-type: none"> Required are more detailed and comprehensive disclosures according to reporting standards 	<ul style="list-style-type: none"> Improved reporting standards may result in additional expenses. These could include hiring specialized staff, investing in new data collection and reporting technologies, and conducting external audits or assessments to ensure compliance. They may also necessitate restructuring internal processes and systems.
		<ul style="list-style-type: none"> Required huge investment cost to install removal Technology such as CCS 	<ul style="list-style-type: none"> The upfront capital expenditure for CCS implementation will be considerable, potentially affecting IRPC's financial liquidity and requiring strategic financial planning. Integrating CCS into existing operations may require modifications to infrastructure and processes, potentially causing disruptions and necessitating operational adjustments.
		<ul style="list-style-type: none"> Market shift towards electric mobility 	<ul style="list-style-type: none"> Consumers and governments are increasingly favoring electric vehicles (EVs) due to environmental concerns and technological advancements. IRPC's revenue from traditional oil products could decline as sales volumes decrease due to lower demand.
Reputation		<ul style="list-style-type: none"> Inaction leads to loss of public trust 	<ul style="list-style-type: none"> IRPC faces reputational risks because of increased scrutiny from the public and investors regarding their actions to combat climate change. The public is demanding greater transparency from these companies about their greenhouse gas emissions, sustainability strategies, and transition plans to a low-carbon economy. Reduced investor confidence has affected IRPC's ability to raise capital or access green finance options.
		<ul style="list-style-type: none"> Lack of awareness and good practices among employees 	<ul style="list-style-type: none"> Poor practices can erode corporate culture and employee morale. Disengaged employees may be less motivated to contribute to IRPC's sustainability goals or adhere to ethical standards, impacting overall productivity and organizational cohesion.

b) Describe the Impact of Climate-Related Risks and Opportunities on the Organization's Businesses, Strategy, and Financial Planning (3/3)



	Scenario	Potential risks and opportunities	Impact to IRPC's business
Opportunity	Resource efficiency	<ul style="list-style-type: none"> Increasing renewable energy consumption 	<ul style="list-style-type: none"> Investing in renewable energy technologies, such as solar panels or wind turbines, can lead to long-term cost savings through reduced energy costs and operational efficiencies. IRPC can proactively mitigate regulatory risks and ensure compliance with reduce their carbon footprint. IRPC can capitalize on this trend by expanding its portfolio to include renewable energy products and services, such as solar, wind, or bioenergy solutions.
		<ul style="list-style-type: none"> Expand business to selling renewable energy sources such as solar PV and floating 	<ul style="list-style-type: none"> IRPC can diversify its revenue streams beyond traditional petrochemicals IRPC can capitalize on this trend by tapping into new markets and expanding its customer base. Renewable energy sources typically have lower operating costs and can provide long-term cost savings compared to traditional energy sources. This can improve IRPC's cost competitiveness and profitability over time
	Products and services	<ul style="list-style-type: none"> Circular economy for petrochemical products 	<ul style="list-style-type: none"> Introducing circular economy practices can open new markets and revenue streams. For example, by offering recycled or upcycled petrochemical products, IRPC can cater to environmentally conscious consumers and industries that prioritize sustainable sourcing. Fosters R&D and innovation within IRPC, leading to competitive advantages and differentiation of petrochemical products and services in the market. IRPC can strengthen market position, drive sustainable growth, and mitigate risks associated with resource scarcity and environmental impact.

Physical Scenario Analysis



Describe scenario overview: Flood

Climate change presents both acute and chronic risks, affecting companies financially through asset damage, operational disruptions, and issues with water availability, quality, and security. Extreme weather events also impact corporate operations and employee safety, underscoring the need for thorough physical scenario analysis and adaptation strategies. Considering the potential for acute risks to affect IRPC's assets in the medium to long term, IRPC has decided to focus on flood risk for this year's scenario analysis.

IRPC uses Representative Concentration Pathways (RCPs) to project GHG emissions throughout the 21st century, forecast global temperature changes, and evaluate risks of riverine and coastal flooding.

Methodology

- Key factors like "Average flood depth " and "Adaptive Capacity" were pivotal in assessing risk across asset locations such as the head office, refinery, petrochemical plant, power plants, oil depot, and port operations.
- Multiple climate models, including WRI flood data, were utilized to generate mean flood maps for each scenario within specified timeframes. Within a 2-km radius circle around each asset location, flood depth pixels were analyzed to compute the average flood depth.
- The analysis encompassed both riverine and coastal floods, culminating in the derivation of damage functions specifically for riverine floods.

Scenario	Indicators	Timeframe	Description	Global Mean Temperature Change in 2100	Possibility	Tools
RCP4.5	<ul style="list-style-type: none"> • Flood Dept • Adaptive capacity 	2030 - 2050	<ul style="list-style-type: none"> • Medium effort on the implementation of decarbonization • Medium intensity & medium frequency in extreme weather • Strong mitigation: CO₂ emissions stabilize at half today's levels by 2080 	3.5 °C	Possible, with high uncertainty	 
RCP8.5		2030 - 2050	<ul style="list-style-type: none"> • Low effort on the implementation of decarbonization • High intensity & high frequency in extreme weather • Very high GHG emissions: CO₂ emissions triple by 2075 	5.7 °C	Not Possible	

Physical Scenario Analysis

Quantitative assessment: Flood

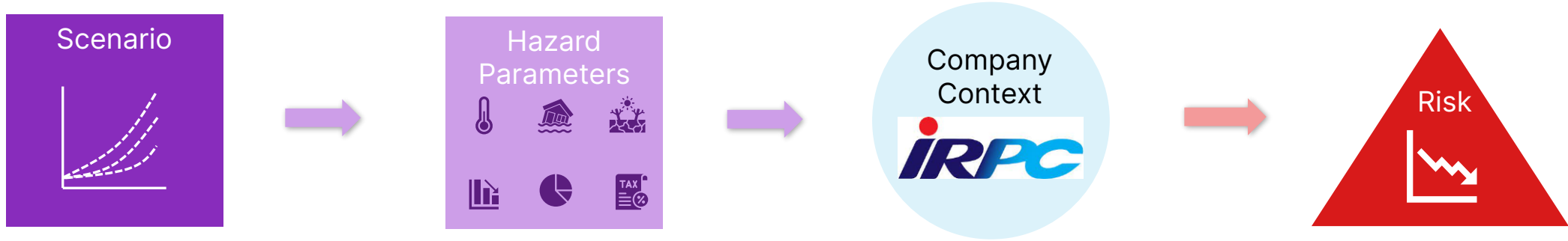
Assumption:

- Consider data of the majority IRPC's property location
- Adaptive capacity (depth threshold) of 1-meter is assumed. Water depth below this threshold is assumed not to cause direct impact on building structure and inventory

IRPC's Assets	Province	Flood Dept (meter) 2030		Flood Dept (meter) 2050		Adaptive capacity	Flood Exposure	Financial impacts (MTHB)
		RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.0			
Enco Building	Bangkok	-	-	-	-	Raise from the road level by approximately 1 meter	Not effect	-
Refinery and Petrochemical	Rayong	-	-	-	-			
Oil depot Phra Pradaeng	Samut Prakan	-	-	-	-			
Oil depot	Ayutthaya	0.47	0.53	0.57	0.62			
Oil depot	Chumphon	-	-	-	-			
Oil depot	Samut Songkhram	-	-	-	-			
IRPC Power Plant	Rayong	-	-	-	-			
IRPC Rayong Port	Rayong	-	-	-	-			

Physical Scenario Analysis

Quantitative assessment result: Flood



Select Scenarios	Select Hazard Parameters	Company Context	Risk
<p>Select physical scenarios from the Representative Concentration Pathway (RCP) scenario groups that cover varying future physical conditions; from best case to worst case.</p> <p>1. RCP 4.5: Leads to a global warming of 3.5C</p> <p>2. RCP 8.5: Lead to a global warming of 5.7C.</p>	<ul style="list-style-type: none"> Select the return period that reflects the organization's definition of extreme events. Flood depth is the main variable for determining damage on assets and operations. <p>Assumption:</p> <ol style="list-style-type: none"> Time horizon: 2030, 2050 Location of Assets : <ul style="list-style-type: none"> Headquarters Office Building Refinery and Petrochemical plant Oil depot Power Plant Port 	<ul style="list-style-type: none"> Overlay asset and operation locations on the flood map to determine exposure of the company's portfolio. Outline the vulnerability of each type of asset and operation. Past flooding events could be used. Otherwise, ask the facility and operation supervisors to determine flood vulnerability points <p>Assumption: Adaptive capacity (depth threshold) of 1-meter is assumed</p>	<ul style="list-style-type: none"> Assess the potential damage that would occur to all assets and operations in the event of flood. Assess the risk level across different scenarios to determine the likelihood of flooding impacts. <p>Assessment Result: No impact on IRPC's assets</p>

Transition Scenario Analysis

Describe scenario overview: Carbon Price

Climate transition risk refers to the financial and operational risks that organizations face because of the transition to a low-carbon economy. These risks arise from changes in policies, regulations, technologies, market dynamics, and consumer behaviors aimed at mitigating climate change

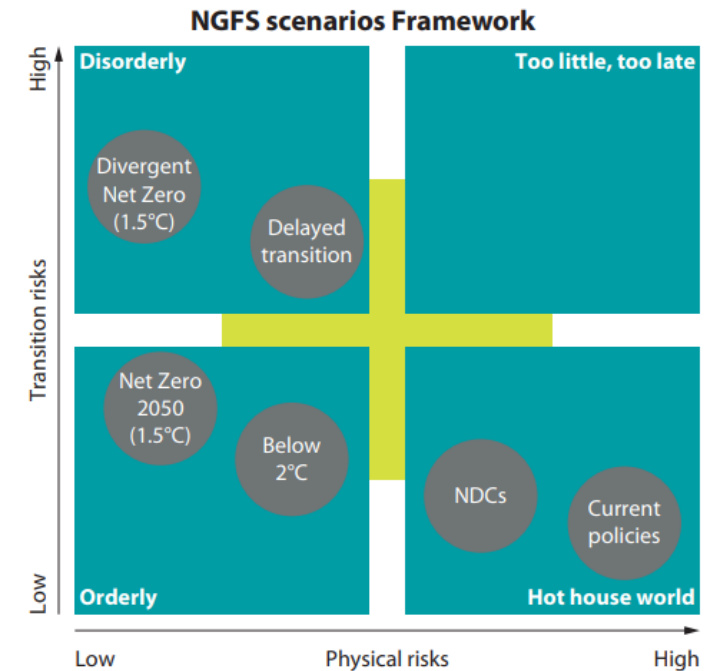
IRPC uses The Network for Greening the Financial System (NGFS) framework to assess impact from carbon price. NGFS is a global coalition of central banks and financial supervisors that aims to enhance the financial sector's role in managing climate and environmental risks and to mobilize capital for green and low-carbon investments. Established in December 2017, the NGFS focuses on sharing best practices, conducting research, and advocating for policies that promote a sustainable financial system.

The NGFS scenarios explore a set of six scenarios which are consistent with the NGFS framework (see figure) published in the First NGFS Comprehensive Report covering the following dimensions:

- Orderly scenarios assume climate policies are introduced early and become gradually more stringent. Both physical and transition risks are relatively subdued.
- Disorderly scenarios explore higher transition risk due to policies being delayed or divergent across countries and sectors. For example, carbon prices would have to increase abruptly after a period of delay.
- Hot house world scenarios assume that some climate policies are implemented in some jurisdictions, but globally efforts are insufficient to halt significant global warming. The scenarios result in severe physical risk including irreversible impacts like sea-level rise.

IRPC uses three scenarios from NGFS as follows:

- Orderly scenarios: Net Zero 2050
- Disorderly scenarios: Delayed transition
- Hot house: NDCs




Positioning of scenarios is approximate, based on an assessment of physical and transition risks out to 2100.

Transition Scenario Analysis

Describe scenario overview: Carbon Price

Methodology

- Assessing carbon pricing entails calculating the expense linked to emitting one metric ton of GHG emissions.
- IRPC projects business-as-usual (BAU) emissions and EBITDA growth up to 2050.
- Utilizing data from the NGFS database, outline carbon pricing in Nationally Determined Contributions (NDCs), Delayed Transition, and Net Zero 2050 scenarios, which provides insights into various carbon pricing.

Scenario	Indicators	Timeframe	Description	Global Mean Temperature Change in 2100	Tools
National Determined Contribution (NDCs)	<ul style="list-style-type: none"> • BAU emissions • EBITDA growth • Carbon price 	2025 – 2050	<ul style="list-style-type: none"> • Climate policies are introduced in 2025 • Carbon pricing will be implemented in 2025 at USD 4/tCO₂. It will reach USD 74/tCO₂ in 2050. 	2.0 °C	
Delayed Transition		2025 - 2050	<ul style="list-style-type: none"> • New climate policies are not introduced until 2030 • Requires accelerated and disruptive policies • Transition risks are considered very high • Carbon pricing will commence in 2035 at USD 75/tCO₂. It will continually increase to reach USD 325/tCO₂. 	Below 2.0 °C	
Net Zero 2050		2025 - 2050	<ul style="list-style-type: none"> • Ambitious climate policies introduced immediately, resulting in steady increases in carbon prices from 2025-2050 • Carbon pricing will commence in 2025 at USD 19/tCO₂. It will continually increase to reach USD 938/tCO₂. 	1.5 °C	

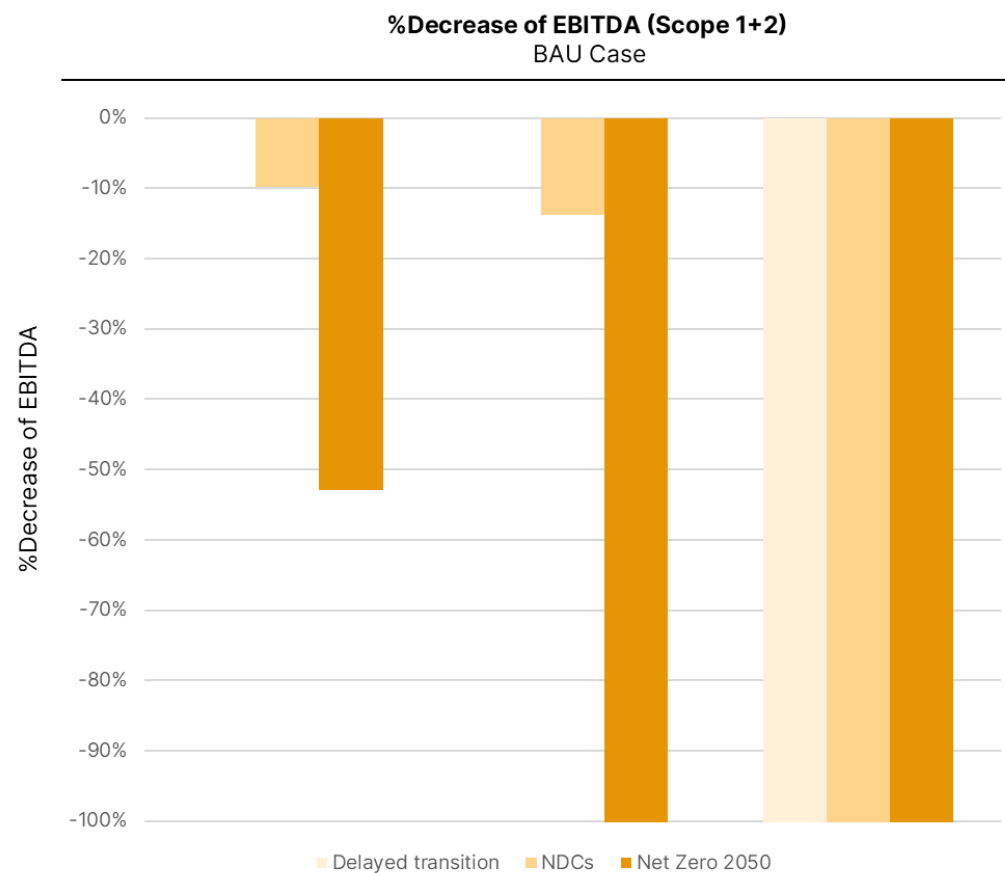
Transition Scenario Analysis

Quantitative assessment: Carbon Price

IRPC has incorporated climate change regulations as a corporate risk factor in the risk assessment process conducted by the Corporate Governance and Sustainability Committee. The implementation of a carbon pricing instrument, such as a carbon tax, by the government will raise IRPC's operational costs. If these costs cannot be transferred to customers, IRPC's EBITDA will decrease.

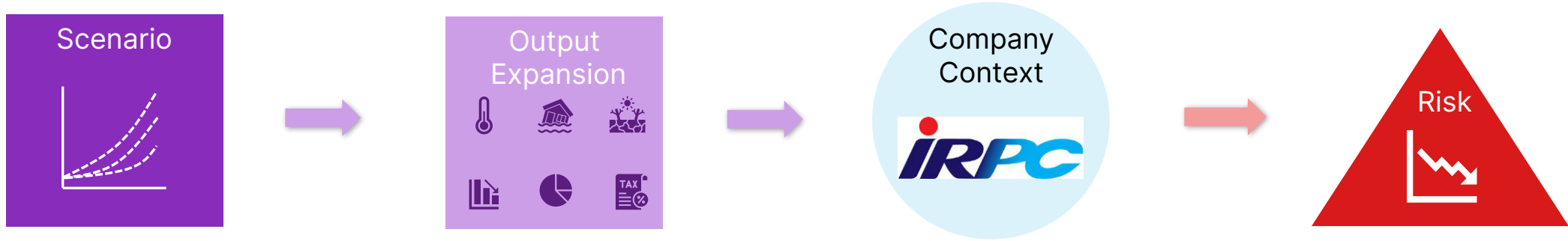
We have quantified the potential financial impacts on IRPC as follows:

	NDCs	Delayed transition	Net Zero
2025 (Short-term)			
Carbon Cost (MTHB)	595	-	3,204
%Decrease of EBITDA	10%	-	53%
2030 (Medium-term)			
Carbon Cost (MTHB)	949	-	26,819
%Decrease of EBITDA	14%	-	100%
2050 (Long-term)			
Carbon Cost (MTHB)	23,249	> 23,249	> 23,249
%Decrease of EBITDA	100%	100%	100%



Transition Scenario Analysis

Quantitative assessment result: Carbon Price



Select Scenarios	Select Relevant Outputs	Company Context	Risk
<p>Two NGFS scenarios capture certain aspects of the Thailand LT-LEDS:</p> <ol style="list-style-type: none"> 1. National Determined Contribution (NDC): Lead to a global warming of 2C. 2. Delayed Transition: Leads to a global warming of 1.6C 3. Net Zero 2050: Leads to a global warming of 1.5C 	<p>NGFS also models the carbon prices in Thailand towards each pathway as followed</p> <ol style="list-style-type: none"> 1. National Determined Contribution (NDC): Carbon pricing will be implemented in 2025 at USD 4/tCO₂. It will reach USD 74/tCO₂ in 2050. 2. Delayed Transition: Carbon pricing will commence in 2035 at USD 75/tCO₂. It will continually increase to reach USD 325/tCO₂. 3. Net Zero 2050: Carbon pricing will commence in 2025 at USD 19/tCO₂. It will continually increase to reach USD 938/tCO₂. 	<p>In 2022, IRPC's total Scope 1 and 2 carbon emissions amounted to about 4.05 MtCO₂e while generating a revenue of THB 152 billion.</p> <p>Assumption</p> <ul style="list-style-type: none"> • BAU emissions grow at 2.6% p.a., from BOT (GDP Growth 2024) • Revenue grows at 2.6% p.a. from BOT (GDP Growth 2024) • Exchange rate 1 USD = THB 36 	<p>IRPC projects its carbon emissions to reach 9.68 MtCO₂ in 2050. Key carbon cost analysis (BAU base)</p> <ol style="list-style-type: none"> 1. National Determined Contribution (NDC): between 595 - 23,249 million baht, 10-100% of EBITDA 2. Delayed Transition: more than 23,249 million baht, 100% of EBITDA 3. Net Zero 2050: more than 23,249 million baht, 100% of EBITDA

C) Describe the Resilience of the Organization's Strategy, Taking into Consideration Different Climate-related Scenarios, including a 2°C or Lower Scenario.

Discerning of the risks related to regulations, the climate change severity which is likely to increase in the near future, IRPC takes into account the Paris Agreement which Thailand has expressed its intention to lower the greenhouse emission to control the rising of the global temperature in 2016, the changes of market demand toward low-carbon products and the advance of low-carbon technology, for instance, batteries and electrified vehicles including physical risk i.e., severe weather, flood and the draught which could get worse.

Our scenario analysis study helps us understand the potential impacts of flood risk and carbon costs on our strategy, ensuring our operations remain resilient.

In other point of view, IRPC visions the opportunity of business growth through a variety of low-carbon products and the use of alternative energy of which IRPC has invested continuously in terms of product development and project implementation to manage such risks and to seek for an opportunity to become a leader of climate change management in a concrete plan.

IRPC aims for Net Zero Emissions by 2060

TO SHAPE
MATERIAL
AND **ENERGY**
SOLUTIONS
IN HARMONY
WITH



สร้างสรรค์นวัตกรรมการใช้วัสดุและพลังงานเพื่อชีวิตที่ลงตัว

Deliver with *Innovations* the Better Attributes and Solutions of **Sustainable Material and Energy** for the Future with Low Carbon Products to our Customers

Opportunity: Capturing opportunity along our value chains to shape *Material and Energy Solutions* for the carbon-free economy.



Risk management: Translating the net-zero targets into a *Clear pathway & Actionable roadmap* to manage IRPC's own carbon emissions scope 1 & 2.

Leadership: Demonstrating IRPC's leadership through *climate actions and disclosures*. We've been listed under the Dow Jones Sustainability Indices for 8 consecutive years.

Physical Responses and Adaptation Plan

Physical Risk

Building Design for Prevention

- Implement flood mitigation measures such as raised platforms, flood barriers, and improved drainage systems to protect infrastructure from flood damage.
- Raise the ground floor level approximately 1 meter above the level of the road.

Business Continuity Planning

Develop and regularly review business continuity plans that address potential flood-driven disruptions. This includes backup power systems, alternative communication channels, and arrangements for repairs and maintenance.

Emergency Response Plan

Develop and implement robust emergency response plans that outline procedures for managing flood events, others violence, ensuring employee safety, and minimizing operational disruptions.

- Install the water pump and drainage systems for draining rainwater
- Install the additional water pump as the backup pump
- Organize a team to monitor the northern water situation and discharge volume from the dams
- Survey the risk area from flooding to prepare the map of particular area for installing the protection system/lines
- Arrange the team to monitor and inspect the areas both day and night-time.

Transition Responses and Adaptation Plan



Transition Risk

Eco-operation
& Technology
(Net Zero Lab)

Absorption
and offsets

Major levers	GHG reduction potential	Potential Solutions
Energy Efficiency	~ 10%	<ul style="list-style-type: none"> Advanced analytics (AA) to further optimize set points and APC Extensive capability development and change management program to reach EII top quartile and zero routine flaring target
Blue / Green H2	~ 20%	<ul style="list-style-type: none"> Liaise with government to support low-carbon initiatives Partnership with PTTEP for CCU Partnership with GPSC/ EGAT for RES
CCUS	~ 30%	<ul style="list-style-type: none"> Partner with PTTEP to secure CCS capacity and gain economies for scale in capture technology acquisition
Renewables	~ 20%	<ul style="list-style-type: none"> Switching operations to renewable energy and alternative fuels: divest coal to NG, solar power, biofuels Seek out opportunity in solar / wind business Partnership with GPSC / EGAT
Forestation	~ 10%	<ul style="list-style-type: none"> The creation of stakeholder engagement and social impact through community forest development

Reshape Portfolio to
Green Business

~ 10%

New stream product
& Circular economy



Portfolio Adjustment

Increase new streams 70% by 2030
including Hygiene & Life Science



Green Product

- Advanced Material
- New sustainable products



Circular economy Target

The implementation of circular
economy principles

WHAT IGNITES CREATIVE ENERGY?



COMMITMENT



COMPETENCE



COLLABORATION



COMMUNICATION



COMPASSION



CREATIVITY



CLARITY



CONTENTIOUSNESS



COFFEE

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