

Climate-Related Risk Management Report

Prepared in accordance to the
recommendations of the TCFD

May 2022



IPRC public company limited

Table of Contents

INTRODUCTION	3
What is TCFD?	3
Who are we?	3
Our Climate Disclosure Overview	4
GOVERNANCE	5
Board-level Oversight	5
Management-level Oversight	5
STRATEGY	8
Foreseen Climate-related Risks and Opportunities	8
Climate Scenarios	10
Our Responses to Climate-related Risks and Opportunities	11
RISK MANAGEMENT	14
Our Approach in Identifying Climate-related Risks	14
How We Manage Risks	20
Integrating Climate-related Risks into our Risk Management	22
METRICS AND TARGETS	23
Our Environmental Performance and other Relevant Metrics	23
Our GHG-specific Performance	23
Our GHG Target and Tackling Approaches	26

INTRODUCTION

What is TCFD?

TCFD is the Task Force on Climate-related Financial Disclosures. It was formed by the Financial Stability Board, an international body that seeks to strengthen and protect global financial markets from systemic risks such as climate change. The TCFD recommendations provide guidance to all market participants on the disclosure of information on the financial implications of climate-related risks and opportunities so that they can be integrated into business and investment decisions.

The Task Force's recommendations are structured around four thematic areas that are core elements of how organizations operate—governance, strategy, risk management, and metrics and targets. The four overarching recommendations are supported by key climate-related financial disclosures—referred to as recommended disclosures—that build out the framework with information that will help investors and others understand how reporting organizations assess climate-related issues.



Figure 1: Core Elements of Recommended Climate-Related Financial Disclosures

While every industry could experience potential financial impacts from climate-related risks and opportunities, the Task Force developed supplemental guidance for non-financial industries (and their related supply and distribution chains) more likely to be financially impacted than others due to their exposure to certain transition and physical risks around greenhouse gas (GHG) emissions, energy, or water dependencies associated with their operations and products.¹⁰² These non-financial industries are grouped into four key areas (referred to as non-financial groups): Energy; Transportation; Materials and Buildings; and Agriculture, Food, and Forest Products.

Who are we?

IRPC Public Company Limited is Southeast Asia's integrated petrochemical pioneer. The Company operates a refinery and petrochemical complex in Rayong. Its main facilities are located within the IRPC Industrial Park, which features the infrastructure needed for its business, including a deep-sea port, an oil depot, and a power plant.

Petroleum Business

IRPC's refinery has a total capacity of 215,000 barrels per day (bpd), the 3rd largest refinery in Thailand in terms of production capacity. IRPC manufactures a range of petroleum products, namely liquefied petroleum gas (LPG), naphtha, gasoline, diesel, and fuel oil. Additionally, IRPC's Lube Base Oil Group I plant has a total capacity of 320 kilotons per annum (KTA), and the associated asphalt plant has a total capacity of 600 KTA, which are the highest domestic capacities. It is Thailand's first asphalt plant to sell TIS-certified 40/50 asphalt in the domestic market. IRPC is also a producer of the Terramaxx-branded rubber process oil, whose quality has attained international recognition.

Petrochemical Business

IRPC is a producer of upstream petrochemical products, namely olefins and aromatics. These upstream products are feedstocks for IRPC's downstream petrochemical plants: 931 KTA of polyolefins (HDPE and PP, UHMW-PE) and 383 KTA of styrenics (ABS, SAN, PS, and EPS). These downstream products are sold to producers of finished plastic products in Thailand and overseas under the brand POLIMAXX.

Focusing on the growth of its petrochemical business, IRPC endeavours to stay abreast of global environmental and technological changes through researching and developing new products that will increase its competitiveness. Recent innovations include paralene from natural ingredients, recycled compound resin, and acetylene black for Li-ion batteries (Pim-L and Pim-AL).

Furthermore, through the Eco Solution project, IRPC has pioneered a closed loop production for the plastics industry in which one plant's waste is efficiently used as another's feedstock. The model ensures that no waste would get out of the loop and become a burden to society

Asset Management Business

IRPC provides basic public utility services along with public utility systems. It generates and distributes power, industrial water, and air systems; provides wastewater treatment for industrial customers and EGAT (Electricity Generating Authority of Thailand); and provides other business services in support of full business operations. Like other industrial estates, utilities are of sufficient volumes with high quality standards. Above all, our businesses must stay sustainably alongside communities, society, and the surroundings. Below are our public utility systems:

Our Climate Disclosure Overview

We aim to develop our climate-related financial disclosures to be consistent with all of the TCFD Recommendations and Recommended Disclosures. Since this is our first year of disclosing in compliance with the Task Force Recommendations, our disclosures have been built upon the recent set of information reported in accordance with the requisites of Stock Exchange of Thailand (SET), as well as for the purpose of DJSI reporting requirements. We will continue to improve our approaches and alternatives to better align with TCFD disclosures in the coming years.

The following sections of this report present detailed information on respective core elements of recommended climate-related disclosure.

GOVERNANCE

To meet the needs of investors and other stakeholders in understanding the organization's governance around climate-related issues and opportunities, it is necessary to demonstrate any information supports evaluations of whether material climate-related issues receive appropriate board and management attention.

Board-level Oversight

The Company has structured risk management by appointing the **Risk Management Committee**, chaired by President and Chief Executive Officer with high level management as members. IRPC has appointed the Risk Management Committee with five members of the Board of Directors, in charge of formulating policies governing corporate risk management to ensure that important risks are at a manageable level, as well as assuring stakeholders of the Company's achievement of its projected objectives and goals. Members of the Committee shall have a term in office as per their term as members of the Board of Directors.

The Committee generally convene a meeting amongst its members, at least, every two months. Their responsibilities lie upon supervision corporate risk management to be in line with international standard, comprising context definition, risk identification, risk analysis and assessment, risk management measure formulation, including monitoring and reviewing risk management results on a quarterly basis to manage risks at an acceptable level and achieve specified targets.

The Committee review and recommend management measures for strategic risks, provide corporate risk management directions, monitor, evaluate various manage corporate risks, including climate-related issues, according to stated policy and directions. Then, recommendations and issues related to climate change, as well as other strategic risks potentially affecting business directions, shall be listed and tabled for the next Board meeting, which is held quarterly, for further discussion regarding corporate's operational and investment strategies from this point onwards.

Management-level Oversight

In order to strengthen the level of climate change impact and associated risks among the board members and senior management, IRPC has recently established the **Climate Change Management Working Group**, chaired by the Senior Executive Vice President of Petrochemical and Refinery Operation and under supervision of Management Committee (MC), who serves as an integrated management team for all IRPC plants in Rayong. The Working Group consists of key personnel from the following IRPC's functions and operations.

- Strategic Planning, Risk Management & Sustainability
- Corporate intelligence & Investment management
- Business Development
- Innovation and Operation Excellence
- Corporate Accounting and Finance
- Corporate Commercial and Marketing
- Procurement
- Petrochemical and Refinery Operation
- Office of Corporate Affairs

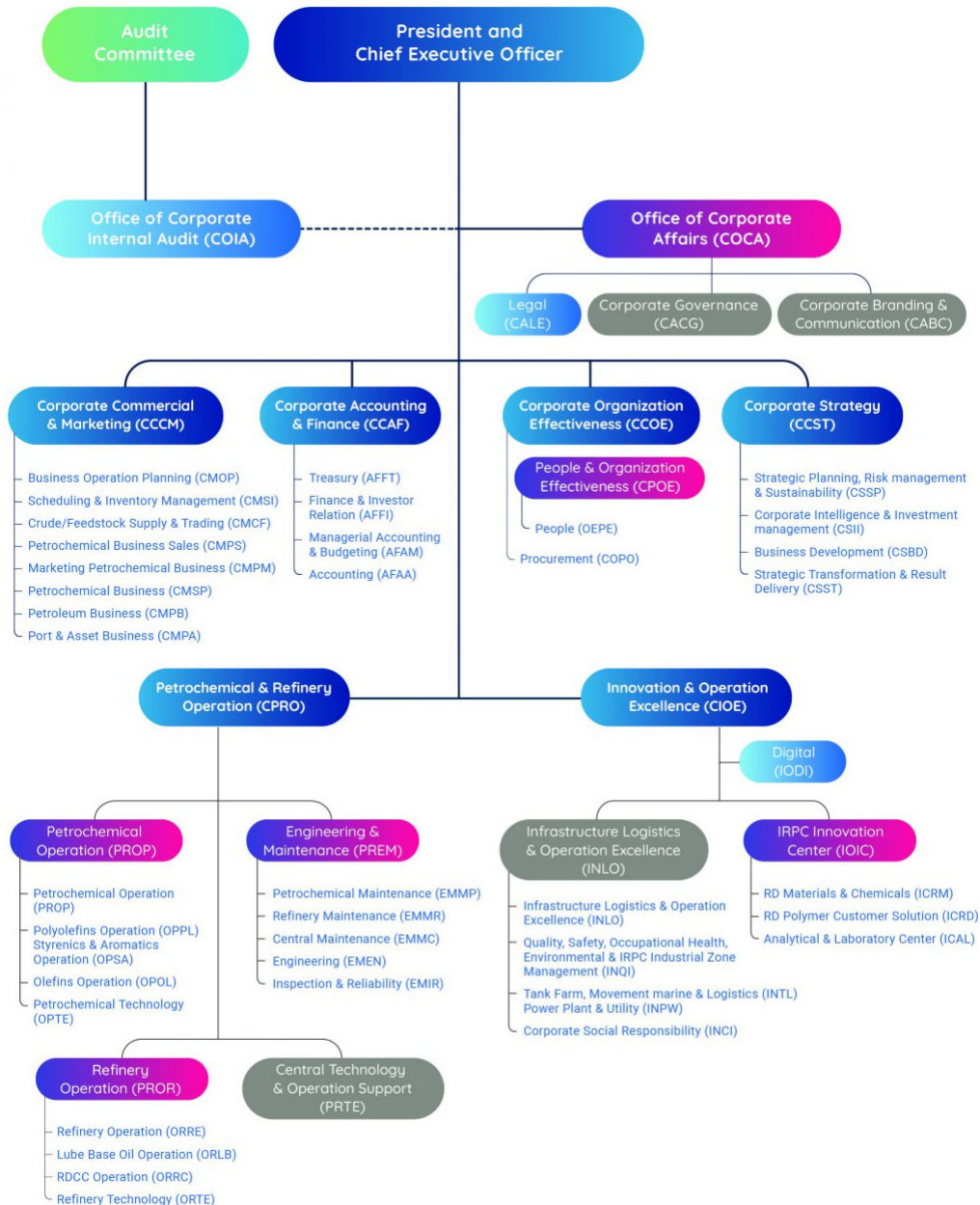


Figure 2: IRPC's Organisational Structure

Main responsibilities of the Working Group shall cover the development of net-zero strategy, identifying investment opportunities and subsequent innovative technologies, risk assessment and management, monitoring of GHG emissions, as well as awareness and capacity building of IRPC's management and relevant staff regarding to climate issues.

All corporate-level functions have specific responsibilities relating to climate change. Strategic Planning, Risk Management & Sustainability is responsible for observing, assessing and managing all corporate's strategic risks, with the integration of climate-related drivers. Corporate intelligence & Investment management, together with Business Development, are responsible for investing strategy, which includes a dedicated approach to climate change.

At the operational level, Petrochemical and Refinery Operation, in association with Innovation and Operation Excellence, implement the corporate sustainability strategy, including the climate action

plan, continually conduct R&D and strive to identify more innovative and climate-friendly solutions. Other supporting functions provide necessary reinforcement to ensure the Company climate strategy is always intact, such as coordinating sustainability-related activities across the Company, ensuring greener procurement strategy, communicating on the firm’s net-zero strategy to wider external stakeholders, etc.

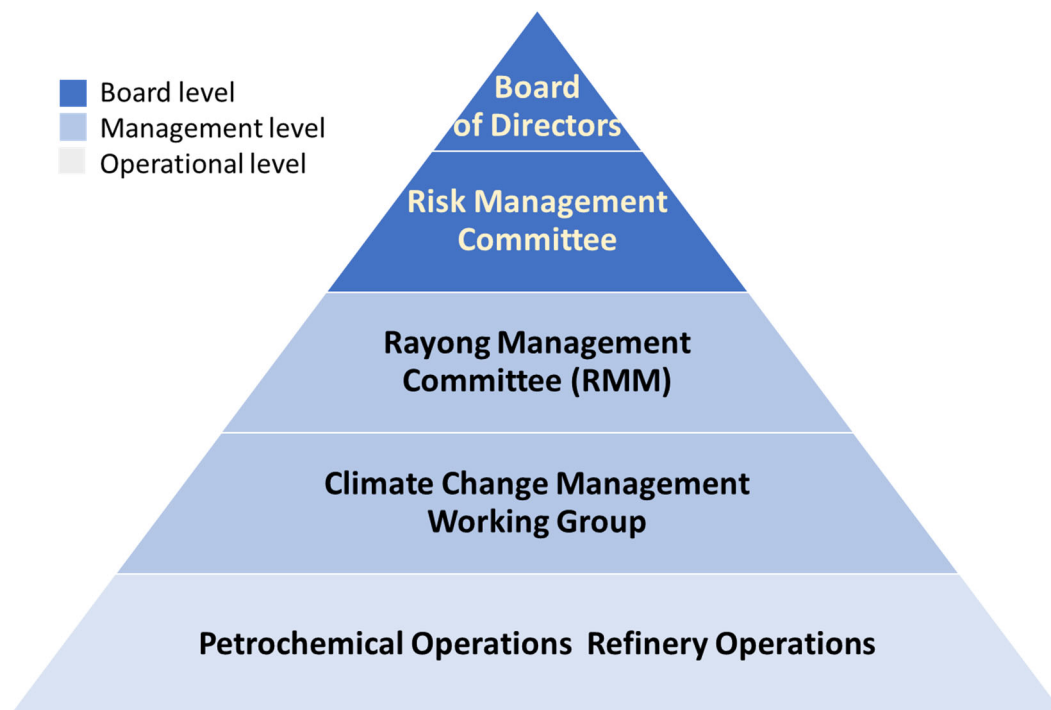


Figure 3: Sustainability and Climate-related Governance

Roles and responsibilities of each IRPC’s governing body are also summarised in the below *Table 1*.

Table 1: Governing Bodies and their responsibilities

GOVERNANCE	
BOARD OF DIRECTORS	Oversee all corporate operations. The board should be kept informed of the progress of the process to ensure it is in line with the Company’s other policies
RISK MANAGEMENT COMMITTEE	Manage and ensure the direction of the operations to be sustainable. Top leadership support and sponsorship are key pre-requisites contributing to the success of the whole process.
RAYONG MANAGEMENT COMMITTEE (RMM)	Serves as an integrated management team for all IRPC plants in Rayong. Review results from the climate change working group. Propose strategy, guidance, Investment and implementation.
CLIMATE CHANGE MANAGEMENT WORKING GROUP	Consists of key personnel from each department. Coordinate, analyse, and provide expertise and best practices, including driving implementation toward net-zero target.

STRATEGY

IRPC is in the process of refining its climate strategy to have a clear partway (short-, medium- and long-term) aligning with an effort to achieve the Net-Zero Emissions target. Investors and other stakeholders need to understand how climate-related issues may affect an organization’s businesses, strategy, and financial planning over the short, medium, and long term. Such information is used to inform expectations about the future performance of an organization.

Foreseen Climate-related Risks and Opportunities

We have studied climate-related impacts on our key businesses from various international and local sources to observe and prepare for the best approach suited with global climate change trends potentially exposed to the oil and gas sector. According to *The Global Risks Report 2021* (WEF, 2021)¹, the below trends are illustrated the risks perceived with highest likelihood in the next ten years are **extreme weather**, **climate action failure** and **human-led environmental damage**. Most impactful risks of the next decade are **Infectious diseases**, followed by **climate action failure** and **weapons of mass destruction**. This shows that the **climate action failure** is apparently falls into one of the top risks mankind is facing now and in the coming decade.

In addition, we have also study climate-induced **physical risks** more specific to Thailand and/or this region. The European Commission has assessed Country Risk Profile² and found that Thailand has confronted natural hazard and exposure at the level of 6.1 from the scale of 10. Other sources of information are depicted in *Table 2*.

Table 2: Potential Climate-induced Physical Risks in Thailand

Source	Specific Information
<i>IPCC, Climate change 2021: The physical science basis</i>	<p>Human-induced climate change is already affecting many weather and climate extremes in every region across the globe.</p> <ul style="list-style-type: none"> a) SEA - increase in hot extremes (High confidence) b) SEA - increase in heavy precipitation (Low confidence) c) SEA - Low agreement in the type of change in agricultural and ecological drought (Low confidence)
<i>Climate risk Country profile (Thailand), The World Bank Group (WBG) and the Asian Development Bank (ADB)</i>	<ul style="list-style-type: none"> • <u>As of 2010</u>, the population annually affected by river flooding in Thailand is estimated at <u>1.1 million people</u> and expected annual urban damage is estimated at <u>\$1.6 billion</u> • The climate change component can be isolated and <u>by 2030</u> is expected to increase the annually affected population by <u>500,000 people</u>, and urban damage by <u>\$6.9 billion</u> under the RCP8.5 emissions pathway
<i>The Projected Economic Impact of Extreme Sea-Level Rise in Seven Asian Cities in 2030, June 2021</i>	<p>extreme sea-level rise and any subsequent flooding in <u>2030</u> could put <u>US\$512.28 billion of GDP(PPP)</u> and <u>10.45 million people</u> at risk. The impacted GDP(PPP) accounts for 96% of Bangkok’s total GDP(PPP)</p>
<i>earthobservatory.nasa.gov, January 1 - February 7, 2020</i>	<p>Thailand is experiencing its <u>worst drought in possibly four decades</u>. About half of the major reservoirs in the country stand below 50% of capacity. River levels are so low that saltwater from the ocean is creeping upstream and affecting drinking water supplies. And in a country where 11 million people work in farming, crop production and the economy are expected to suffer.</p>

¹ Source: World economic forum: The Global risk report 2021, 16th edition

² <https://drmkc.jrc.ec.europa.eu/inform-index/INFORM-Risk/Country-Risk-Profile>

Another type of risks associated with climate change is so-called **transition risk**, which is coherent to changing strategies, policies or investments as the world works to tackle and mitigate the climate change and its consequences by reducing its reliance on carbon. TCFD research revealed that the transition risk is on a par with climate risk, threatening financial stability across the economy. Some of the shifts towards transition world era in oil and gas sector include, but not limited to, the followings:

- Changed fuel consumptions policies and/or financial barriers/incentives
- Increased costs in developing low-carbon technologies
- Reduction in the value of investments in carbon-heavy fuels or activities related to such fuels
- Additional requirements of additional regulation and reporting

Taking into consideration the fact that climate-related issues often manifest themselves over the medium and longer terms, we have realised the impacts of climate-related risks could arrive in various forms and many different magnitudes. In shorter time horizon, evidently weather-related events range from tropical cyclones to general floods, while the predicted impact of these changes on a wide range of environmental factors in a longer term, including sea level, agriculture and human health.

From our analysis, IRPC’s businesses may potentially have financial impacts from the risks as described in *Table 3*.

Table 3: Climate-related Risks and Potential Financial Impacts to IRPC

Type	Climate-related Risks	Potential Financial Impacts		
Physical Risks	Acute	Increased severity of extreme floods	<ul style="list-style-type: none"> • Increased capital costs (e.g., damage to facilities, Land lost due to coastal erosion) • Reduced revenue from decreased production capacity (e.g., transport difficulties, supply chain interruptions) • Reduced revenue and higher costs from negative impacts on workforce (e.g., health, safety, absenteeism) • Write-offs and early retirement of existing assets (e.g., damage to property and assets in “high-risk” locations) • Increased operating costs (e.g., inadequate water supply for operating plants) 	
		Increased severity of extreme droughts		
		Increased severity of coastal/bank erosion		
	Chronic	Risk of sea level rise		<ul style="list-style-type: none"> • Increased capital costs (e.g., damage to facilities, Land lost due to coastal erosion)
		Rising mean temperatures		<ul style="list-style-type: none"> • Reduced revenues from lower sales/output • Increased insurance premiums and potential for reduced availability of insurance on assets in “high-risk” location
Transition Risks	Policy and	Introduction of carbon pricing/ emission rights trading in country i.e., tax, ETS	Introduction of carbon pricing and emission rights trading will decrease net profit	
		Enhanced emissions-reporting obligations	Increased operating costs to disclose information and has been certified by the designated agencies	
	Technology	Increase in switching cost	The Company will have to consider selling assets or having a switching cost from fossil fuel to low-carbon intensive energy sources.	
		Required huge investment cost to install removal Technology i.e., CCUS	<ul style="list-style-type: none"> High capital investments in technology deployment e.g. installation of GHG removal technology Subsequent increased production costs due to the new and innovative technologies and skill set throughout the supply chain 	

Market	Changing customer behaviour	Decrease in oil consumption due to the shift in vehicle choice from oil-fuelled to electric vehicles (EV)
Reputation	Increased stakeholder concern or negative stakeholder feedback	More pressure from stakeholders regarding environmental management, such as emissions of volatile substances from factories, effects on health of workers and surrounding communities, GHG reduction policy towards the global agenda to limit temperature rise no more than 2°C, etc.

Climate Scenarios

From our risks and opportunities analysis, we have determined what would hypothetically happen to our businesses under three different scenarios as follows:

- **STEPS (2.3°C) Scenario** reflects current policy settings based on a sector-by-sector assessment of the specific policies that are in place, as well as those that have been announced by governments around the world. As a result of these collective actions, the global warming should be limited to around 2.8°C.
- **NZE (1.5°C) scenario** sets out a narrow but achievable pathway for the global energy sector to achieve net zero CO₂ emissions by 2050, by which limiting global temperature rise no more than 1.5°C is expected to achieve this net zero target.

Table 4: Scenario Descriptions and Implications to IRPC's Businesses

STEPS (2.3°C) Scenario	NZE (1.5°C) Scenario
reflects current policy settings based on a sector-by-sector assessment of the specific policies that are in place, as well as those that have been announced by governments around the world. <i>Global warming limited to 2.8°C</i>	sets out a narrow but achievable pathway for the global energy sector to achieve net zero CO ₂ emissions by 2050. <i>Global warming limited to 1.5°C</i>
Time Scale – We have considered, for the purpose of financial impact analysis to our businesses, the time period from now up to the year 2030 since the implications of climate change on oil and gas sector are considered very dynamic. The longer projection may not be beneficial as changes on business activities, markets, technologies, etc. are foreseen, awaiting only maturity.	
ASSOCIATED RISKS – Given the limitations on the prediction, understanding and timescale of physical risk at the stage of this report development, we have considered the financial implications from transition risks only.	
The only transition risk foreseen under BAU scenario is relevant to the Changing customer behaviour towards EV .	In order to achieve the net zero target, several efforts would have expected which, from our analysis, include: <ul style="list-style-type: none"> • Introduction of external carbon pricing (e.g., carbon tax, emission rights trading) in the country • Costs of transitions to lower emissions technology • Changes in customer behaviour towards EV
BUSINESS IMPACTS	
It is expected that the change of customer in the adoption of EV would reduce IRPC's gasoline sales as the government has set the target of 30% of EV to the automotive production in Thailand in 2030. The percentage of accumulated EV cars to total in 2030 is expected to be 4.88%.	<ul style="list-style-type: none"> • The introduction of carbon tax is foreseen at the rate of approx. USD5-15/tCO₂e and CBAM of USD35-50/tCO₂e • Potential investment in carbon capture utilization and storage (CCUS) at the cost of USD80/tCO₂e • Reduction in gasoline sales in response to the increase in EV as around 60% of new cars, which

	resulting in accumulated EV cars to total in 2030 at 9.76%.
POTENTIAL FINANCIAL IMPACTS – Reduction in Company EBITDA	
MTHB 322	MTHB 4,548
DATA USED	
<ul style="list-style-type: none"> - EBITDA 2018-2030 - Greenhouse gas emission 2018-2030 - Net sales 2018-2030 	

Our Responses to Climate-related Risks and Opportunities

IRPC recognizes the importance of combating climate change by starting various organizational initiatives, like the Floating Solar Power project, Internal Carbon Pricing, and Carbon-Neutral project. IRPC is committed to develop products and organize initiatives that reduce greenhouse gas emissions to combat climate change. Moreover, IRPC also applies the circular economy principle to our business operations by collaborating with partners to reuse the industrial plastic waste in our production process.

Not only investing in our operations, we also have committed on GHG reduction goals to achieve 20% reductions by 2030 and a longer-term commitment to become a Net Zero Emission Organization in 2060. Our initiatives to combat climate changes last year include:

- Certification on Carbon Emission Management
- Floating Solar Power Project
- Internal Carbon Pricing
- Carbon Neutral

Detailed information of each initiative is demonstrated in the following boxes.

Box 1: Certification on Carbon Emission Management

IRPC is committed to play its part in reducing greenhouse gas emissions in Thailand and meet the international targets set forth by the Conference of Parties (COP) under the United Nations Framework Convention on Climate Change. IRPC has requested to be certified by the Carbon Footprint Organization (CFO) and the Carbon Reduction Label to reduce the organization's carbon emissions, lower resource management costs, and develop new business opportunities.

IRPC has been certified by the Carbon Footprint Organization (CFO) for the past 6 years in a row from the Thailand Greenhouse Gas Management Organization (public organization). Specifically, the number of certifications expanded to cover an additional four wastewater treatment and water filtration plants, including wastewater treatment plants 1, 2, 3, and the IP water filtration plant. In addition, IRPC was certified to renew the Carbon Reduction Label from the Thai Environmental Institute for the following POLIMAXX products:

- Polypropylene (PP) plastics pellets for PP Homo Polymer products (69,787 tCO₂e per year), PP Random Copolymer products (20,043 tCO₂e per year, and PP Block Copolymer products (14,171 tCO₂e per year)
- Expandable Polystyrene (EPS) plastic pellets for STD Type (Standard Type) products (3,430 tCO₂e per year) and SE Type (Extinguishing Type) products (3,430 tCO₂e per year)
- Polystyrene (PS) plastic pellets for High Impact Polystyrene (HIPS) products (3,932 tCO₂e per year) and General Purpose Polystyrene (GPPS) products (3,844 ton CO₂ equivalent per year)

Box 2: Internal Carbon Pricing

In 2020, IRPC took part in a variety of knowledge programs about industrial carbon pricing and investing in greenhouse gas emission reduction campaigns organized by the TGO and World Bank. These programs discussed carbon pricing instruments, internal carbon pricing, and other financial tools for green financing. IRPC applied the internal carbon pricing principles to evaluate investment projects in 2020, which included the Floating Solar Power project, Ultra Clean Fuel project, and the ABS Expansion project.

Box 3: Carbon Neutral

In 2020, IRPC was certified for the first year as an organization with a Carbon Neutral Event. The certification was successful due to the carbon footprint results from our annual IRPC shareholder meeting on July 3rd, 2020. The carbon footprint calculation accounted for various activities from the meeting that emitted greenhouse gas emissions (12 tons of CO₂ equivalent) and included carbon offsets, which resulted in zero emissions generated.

Box 4: Floating Solar Power Project

IRPC established a 12.5 MW Floating Solar Power Project as an initial clean energy project to expand our businesses. With a budget of 550 million THB, the project was completed in 2020 to generate electricity for a polypropylene (PP) plant in the IRPC Industrial Zone. With a continuous 24 hours of operation, the project has an expected 25-30 year operational lifetime. The project is expected to decrease electricity consumption from coal power plants and natural gas, thus lowering GHG emissions by approx. 10,510 tCO₂e per year, which is equivalent to planting enough trees to cover the entire Ko Samet Island. In addition, IRPC improved the landscape surrounding the plant by expanding it into an exercise area.

From the establishment of the Floating Solar Power Project, IRPC applied to take part in various development programs in 2020, such as the Validation program and the Thailand Voluntary Emission Reduction Program (T-VER) for the 2021 fiscal year. The T-VER program was developed by the Thailand Greenhouse Gas Management Organization (TGO) with an objective for organizations to reduce GHGs voluntarily and sell accredited and registered carbon credits in the country's voluntary carbon market.

In coming years, we plan to grow cleaner and greener through our climate strategy including new initiatives, R&D and adoption of new technology. Existing and committed future activities such as investments, restructuring or damage of assets will certainly be incorporated into our risk assumption son planning process. One of our flagship initiatives is the Ultra Clean Fuel (UCF) project which aims to achieve higher refinery efficiency and diesel quality in compliance with Euro V standards, also in response to government policy to promote environment-friendly business. The Company has confirmed commercial production in 2024.

In addition to cleaner and more climate-friendly initiative we have been implementing and strive to explore more in the future, IRPC has considered the climate change and how the trend may twist the world economy and change our business model. The corporate has embraced the opportunity we foresee from the downward trend in petroleum product consumption. Petrochemical products have fallen into the picture.

IRPC has dedicated to research and develop in order to cope up with the rapid change of market needs. Among diversity and exclusivity of the products, the corporate has introduced a new business line to specifically handle all polymer and petrochemical products, strategically planned and managed to initiate hybrid marketing, focusing on quality products and modernized one-stop service to offer our customers. The products range from houseware, packaging, electric & home appliances, automotive components to medical supplies.

RISK MANAGEMENT

In this section, how IRPC's climate-related risks are identified, assessed, and managed and whether those processes are integrated in existing risk management processes for the purpose of financial disclosures in evaluating the organization's overall risk profile and risk management activities.

Our Approach in Identifying Climate-related Risks

The climate-related risks have been identified by our risk management and sustainability teams, in close consultation with the team of external climate consultants. In order to construct our comprehensive risk assessment and identification, our special unit responsible for area-based operations at the EEC area has been engaged in the analysis of climate-related physical risks, while marketing, petroleum and petrochemical operations were more active on the determination process of transition risks. Then the risk report has been handled and managed by the Climate Change management Working Group, prior to being considered at the Board level as described in Chapter 2.

The risk analysis covers the following dimensions:

- Operational and regulatory risk
- Safety, occupational health and environmental risk
- Reputational risk
- Stakeholder risk

IRPC has considered both physical and transition risks, based on the definitions provided by the Task Force, but with slightly different approaches since we encounter the complications of financial determination of the potential consequences from unreliable proxies; thus, we deny it at this first TCFD reporting. However, we are committed to improve our work on the matter in the future reporting.

Physical Risks

The Global Risks Report 2021 (WEF, 2021), among various types of global risks ranging from debt crisis to weapons of mass destruction, climate action failure is the most extreme with highest likelihood and highest impact levels. Those among the top impactful and most likely global risks are also relevant.

- The highest likelihood risks of the next ten years are **extreme weather, climate action failure** and **human-led environmental damage**.
- The highest impact risks of the next decade, **infectious** diseases are in the top spot, followed by **climate action failure**.

As a steppingstone and leaning purpose, IRPC applied a three-step assessment approach based mainly on a desk review, for our first climate-related risk outlook, in identifying, assessing and planning its adaptive responses to the identified physical risks are delineated below (see *Figure 4*):

- Step 1: Review and Identification of regional and country level climate related physical risks
- Step 2: Review and evaluation of asset locations specific climate indices and trends
- Step 3: Identify physical climate risk responses in various forms of actions



Figure 4: Physical Risks Assessment Methodology

Having considered the risk levels in Thailand and this region from various secondary sources (summarised in Table 5), we have found that the major physical risks are around three forms: increased severity of extreme flood, increased severity of extreme drought and rising sea levels.

Table 5 Regional and Country-levelled Assessment of Physical Risks

Type		Climate-related risks	Global Risk assessment					
			S&P Global		IPCC		World Bank	
			2030	2050	2030	2050	2030	2050
Physical Risks	Acute	Increased severity of extreme flood	Low	Low	Low	Medium	Medium	Medium
		Increased severity of extreme drought	Low	Low	Low	Low	Medium	Medium
		Increased severity of coastal erosion/ bank erosion	Low	Low	Low	Low	Low	Low
Physical Risks	Chronic	Rising sea levels	N/A	N/A	Low	Low	Medium	Medium
		Rising mean temperatures	N/A	N/A	Medium	Medium	Medium	Medium

Risk Level Low Medium High Extreme

Notes:

- Risk level assessment base on data from S&P Global insight on low, medium and high impact climate change scenarios across time intervals. www.spglobal.com/esg/education/essential-sustainability/climate/physical-risks
- IPCC : https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM_final.pdf

World bank: https://climateknowledgeportal.worldbank.org/sites/default/files/2021-08/15853-WB_Thailand%20Country%20Profile-WEB_0.pdf

The next step is considering potential risk at site-specific area. Based on our own experiences and given that IRPC complex is located in the country's Eastern Economic Corridor, the ground level has been readjusted in order to quarter heavy industrial activities and preventive measures have been well set in place to avoid any potential disruptions in the area. **Flood and drought** preventions are among those mechanisms. Besides, the historical records show that the provinces where IRPC facilities situate including Rayong (the main production complex in EEC area), Bangkok, Chumporn and Samut Songkram which are not categorised as flooded areas in the past 11 years.

There are two locations, Samut Songkram and Phra Pradaeng, of our properties where might be threaten by the **sea level rise**. However, from the observation of coastal risk³ in 2030, both areas are subject to the potential rises of 0.1 and 0.3 metre (see Figure 5), respectively.

³ <https://coastal.climatecentral.org/> | scenario SSP5-8.5)

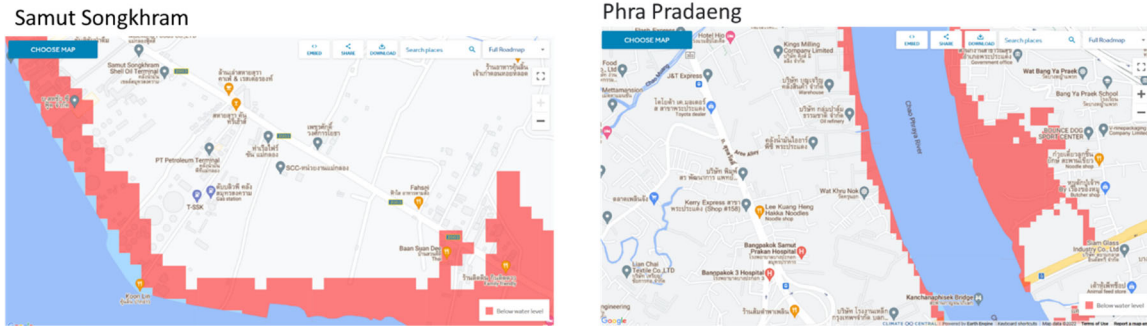


Figure 5: Physical Risks Assessment Methodology

As per the assessment above, we have come to conclusions that:

- In Rayong, as a result of temperature rise, more frequent and more severe natural disasters (i.e., floods and drought) occur. However, since IRPC's factory site has been adjusted to prevent flooding; thus, this risk considered *low*. While more frequent and severe droughts may cause the company to stop production. Therefore, it is expected that the impact will be *moderate*.
- Based on IPCC report, sea level is expected that an average of 0.5-metre around the world in 2050. Therefore, it may cause damage to the oil depot in Phra Pradaeng and Samut Songkhram, as well as delays in oil transportation.

Table 6: IRPC's Physical Risk Assessment

Type	Climate-related risks	IRPC Risk assessment												
		Rayong		Bangkok		Ayuttaya		Chumphon		Samut Songkhram		IRPC		
		2030	2050	2030	2050	2030	2050	2030	2050	2030	2050	2030	2050	
Physical Risks Acute	Increased severity of extreme flood	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
	Increased severity of extreme drought	Low	Medium	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Medium
	Increased severity of coastal/bank erosions	Low	Low	Low	Medium	Low	Low	Low	Low	Low	Medium	Low	Medium	Medium
Physical Risks Chronic	Rising sea levels	Low	Low	Low	Medium	Low	Low	Low	Low	Low	Medium	Low	Medium	Medium
	Rising mean temperatures	Low	Medium	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Medium

Transition Risks

The other type of risks, transition risk (i.e., the financial risk arising from the changes in asset valuations caused by the structural shift toward a low-carbon energy system), has been assessed to observe potential impacts of financial statement of the Company. Figure 6 illustrates the three-step approach in transition risk method for IRPC assessment.



Figure 6: Transition Risks and Financial Impact Assessment Methodology

By following transition risk categories suggested by the Task Force, the first step we have taken is to identify relevant risks, assessment scope and time horizons, as delineated earlier in *Table 3*. The transition risks we have seen threatening possibilities, and could be new opportunities in return, include:

- Introduction of carbon pricing in country i.e., carbon tax, ETS
- Enhanced emissions-reporting obligations
- Increase in switching cost
- Required huge investment cost to install removal Technology, i.e., CCUS
- Changing customer behaviour
- Increased stakeholder concern or negative stakeholder feedback

Then, s each of the identified risks relevant to our business has been assess and discussed below.

Policy and legal risks

Apparently, the growing number of jurisdictions that applying prices on carbon emissions have been increasing. Globally, there are 65 carbon pricing initiatives, both in the forms of carbon taxes and emission trading schemes, are in place or scheduled to be endorsed in the near future. Even in private sector, it is observed that over 2,000 companies have announced that they are already using or plan to introduce internal carbon pricing.

From the policy perspective aligning with the world agenda⁴, Thailand and its neighbours are moving the same way towards low-carbon emission economy.

- Thailand intends to reduce its GHG by 20% from the projected business-as-usual (BAU) level by 2030. The level of contribution could increase up to 40%, subject to adequate and enhanced access to technology development and transfer, financial resources and capacity building support.
- Myanmar's total emissions reductions contributions as a part of its NDC are 244.52 million tCO₂e unconditionally, and a total of 414.75 million tCO₂e, subject to conditions of international finance and technical support by 2030.
- Malaysia intends to reduce its GHG emissions intensity of GDP by 45% by 2030 relative to the emissions intensity of GDP in 2005.
- Singapore is the first country in ASEAN to implement a "carbon tax" to reduce GHG emissions and decrease environmental impact and air pollution in the country.

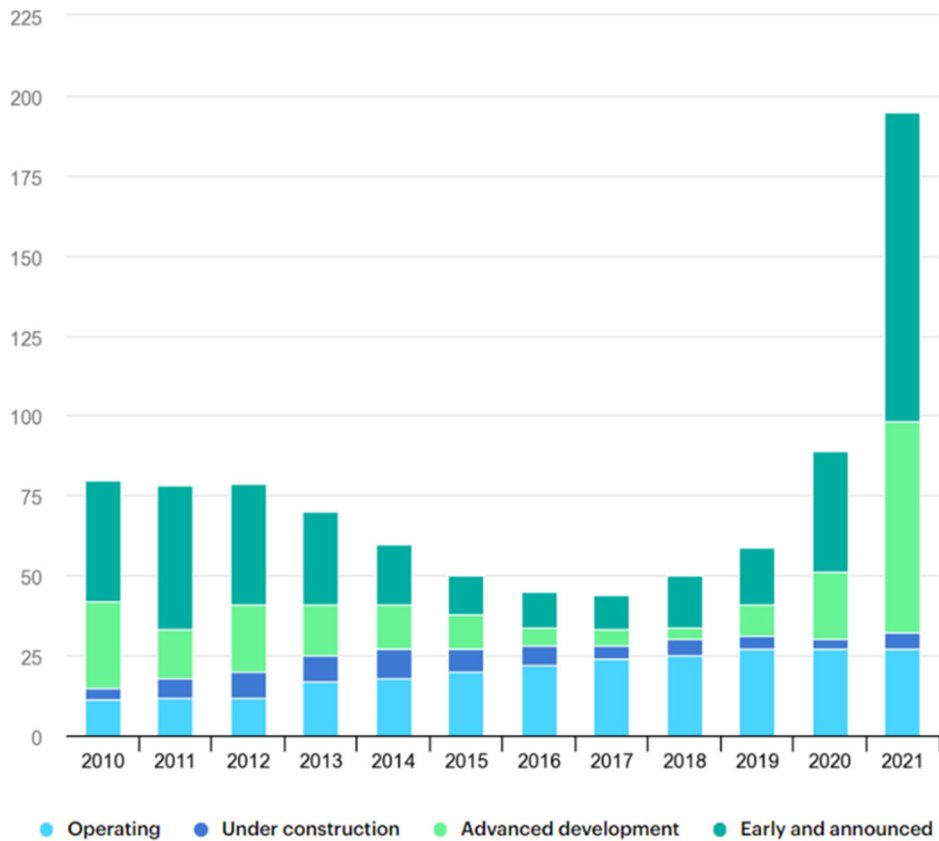
In Thailand, the GHG emission issue has been at one among the top concerns in every economic sector, not only manufacturing, but also the financial sector. Recently, the Securities and Exchange Commission (SEC) requires businesses to disclose their environmental policy, environmental performance, Greenhouse Gas (GHG) emissions and the policy direction reflecting their business intentions towards reducing negative impact on the environment and management of GHG emissions in 56-1 One report. Following that initiative, SEC has become a TCFD supporter and encouraging companies in stock exchange market in the country to follow TCFD recommendations.

Technology risks

It is undefendable that the oil and gas business is the top polluter in the world. By nature, to become net-zero syndicate is practically impossible. Carbon capture, utilisation and storage (CCUS) is considered as a critical technology to reduce GHG emission to achieve global climate goals. The

⁴ Source: <https://www4.unfccc.int/sites/ndcstaging/Pages/Home.aspx>

Intergovernmental Panel on Climate Change (IPCC) shows that most of the 1.5°C pathways assume significant CCS. Although the technology requires tremendous upfront investment and a certain operating skill, CCUS has become the most promising potentials in the business. As of November 2021, global pipeline of commercial facilities operating and in development has been growing fast during 2010 and 2021, especially those at early and announced stage increased more than double in 2021 from 2020 (see *Figure 7*).



Source: <https://www.iea.org/data-and-statistics/charts/global-pipeline-of-commercial-ccus-facilities-operating-and-in-development-2010-2021>

Figure 7: Global pipeline of commercial CCUS facilities operating and in development, 2010-2021

Market risks

In order to decarbonize transportation sector, the growth of the electric vehicle (EV) market is being supported by Thailand EV Roadmap. Most recently, the Government of Thailand has announced a “Smart Mobility 30@30” target where the production of (EVs) shall account for 30% of all auto production by 2030. This is supported by the new 2022 EV Package that focuses on domestic manufacturing of EVs and lowering of investment costs for installing charging stations. Based on our observation of the accumulated number of cars and market trend, the accumulated EV cars running on the Thai road system could be around 5% in 2030.

Table 7: Projected Adoption of EV Cars from 2025 to 2030

Year	Accumulated no. of cars	Accumulated no. of EV cars	%EV to total
2025	15,846,167	283,327	1.79%
2026	16,846,721	384,769	2.28%
2027	17,844,496	510,874	2.86%
2028	18,815,150	657,818	3.50%
2029	19,760,232	824,517	4.17%
2030	20,673,002	1,008,336	4.88%

Finally, after the relevant transition risks have been identified, we analyzed the impacts of these risks under the two scenarios which we have foreseen true future paths. One is the *Stated Policies Scenario (STEPS)* as the scenario is deemed accounting not only for existing policies and measures but also of those that are under development. Thus, it somehow reflects a conservative benchmark where the world should be walking along and expectedly not any other worsen than this way. And Thailand first NDC pledges align with this STEP scenario.

The other scenario is more ambitious, but as IRPC itself is aiming at the net zero pathway and highly committed to global contributions on the climate change agenda. The *Net Zero Emissions by 2050 Scenario (NZE)* has been selected. This NZE scenario shows a narrow but achievable pathway for the global energy sector to achieve net zero CO₂ emissions by 2050, and is consistent with limiting the global temperature rise to 1.5 °C in line with reductions assessed in the IPCC in its Special Report on Global Warming of 1.5 °C.

We have applied a four-by-four risk matrix to determine risk level, a product of likelihood and impact, of the two scenarios. Both scenarios would lead to HIGH risk level, indicating that the climate change issue could be the Company’s serious threat; thus, GHG mitigation measures, preventive and adaptive plans should be in place. To diversify these climate-related risks, new business opportunities should also be further explored.

Table 8 shows our considered likelihood and impact levels, while Figure 8 illustrates the risk level of each scenario.

Table 8: Likelihood and Impact Levels in determination of Risk

Likelihood level		Impact level to EBITDA	
Low	< 5%	Low	< 1.25%
Medium	5%-20%	Medium	1.25%-2.5%
High	20-50%	High	2.5% - 5%
Extreme	> 50%	Extreme	> 5%

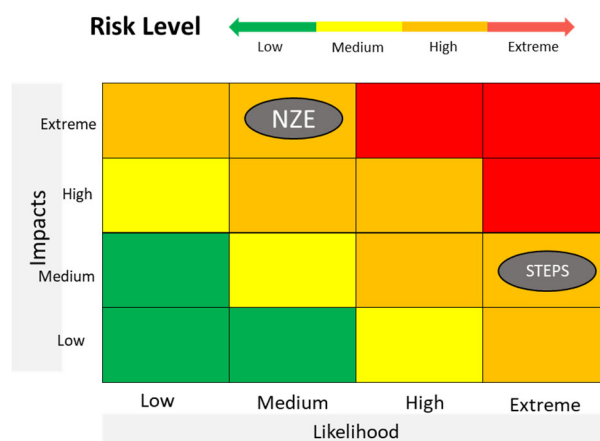


Figure 8: Risk Matrix and the Results

The final results on the financial impacts of the abovementioned transition risks are presented and discussed in STRATEGY Section.

How We Manage Risks

The Company has adopted international standards such as ISO 31000: Risk Management - Principles and Guidelines and the Committee of Sponsoring Organizations of the Treadway Commission (COSO) - Enterprise Risk Management together with the principles of good corporate governance, internal control system, business continuity management system, anti-corruption, Sustainability Management and Operational Excellence Management System. To make risk management more effective, certain tools have been developed, e.g., Key Risk Indicator, a leading indicator to help alert the Company prior to risk emergence, the Value at Risk Assessment Tool (VaR) to help the Company determine appropriate risk management measures.

As for the promotion and cultivation of risk management as part of corporate culture, the Company has raised the awareness, knowledge and understanding of the Board of Directors, executives and employees to realize the importance and necessity of implementing risk management standards and frameworks in order to allow the organization to securely advance in a sustainable manner. The implementation guidelines are as follows: The Board of Directors specified risk management principles and policy for the execution of executives and employees by identifying, analysing, evaluating and determining risk management measures, which would be submitted for approval of various committees earlier mentioned. After the approval, related parties would put them into practice with continuous follow-ups by both operational and executive committees. Risk management approaches would be regularly reviewed and updated. More importantly, there must be communication for continuous knowledge and understanding via various channels e.g., Board meeting, executive meeting, department meeting, workshop, e-mail, or e-learning notification, training. At present, the Company has urged the GRC (Governance, Risk Management & Internal Control, Compliance) to integrate the overall management and enhance risk management efficiency, reduce job redundancy and mutually make the most use of information.

Physical Climate Risk Adaptation

In order to safeguard our assets from physical climate risks that are mostly location and context specific and arrive to right responsive directions, we have applied this following practice to understand, systematically monitor and report the potential risks.

1) Apply International Standard for Internal Implementation

- a. Environmental Management System: ISO 14001
- b. Energy Management System: ISO 5001
- c. Business Continuity Management System (BCMS) to ensure preparedness in coping with natural disasters and conduct annual drills such as water shortages for industrial use from drought or dealing with acute floods, etc.

2) Establish Monitoring Plan and Annual Physical Risk Assessment

- a. Follow up information from reliable secondary resources, i.e., IPCC, IEA, World Bank, Water crisis prevention centre
- b. Conduct an annual climate change risk assessment. by incorporating it as part of the corporate risk assessment

3) Arrange an Annual Physical Risk Reporting to the Board

During which the potential risks have been continually monitored and reported to the Board level, our operational-levelled teams would explore adaptive actions and resilient plan subject to specific needs by facility type and location.

Strategic Responses in Dealing with Transition Risk

Our strategic responses put in place to handle, manage, take and convert the transition risk into opportunities have been continually carried out over the past decade.

Quantifiable Opportunity

On the other hand, we have also considered opportunities which might arise in the midst of climate change in order to stimulate the world's agenda on limit temperature rise no more than 2°C. considering the change of consumers' behaviour towards EV cars, we find that the shift in new vehicle purchase in responding to the government promotion of the EV manufacturing would result in an increase in sales of petrochemical products, such as Polypropylene Compound & Composite which are used for the production of both interior and exterior automotive parts. Besides, to attain the needs of battery manufacturing, the supply of Acetylene will also be higher. Thus, having consider the above business opportunity, IRPC potentially enjoy the financial benefits of 0.43% and 4% increase in the company's 2030 EBITDA.

Other Initiatives

Upstream Project for Hygiene and Value-Added Products

Implemented since 2014, the Upstream Project for Hygiene and Value-Added Products (UHV) was to modify fuel oil to polypropylene and convert polypropylene into polypropylene and polypropylene compound products. The plant construction was completed and the Project is currently commercialized. In the future, studies will be conducted to improve the condition of heavy naphtha and aromatics, a component of gasoline, to be Paraxylene or other substances for higher added value.

HDPE Plastic Products

Risk from government measures to reduce the use of plastics, which have a direct impact on the Company's revenue from sales of plastic granules as the government tends to issue laws and orders prohibiting single-use plastics in the future. In addition, the social sector is currently more active and aware with widespread campaign to reduce the use of single-use plastic bags. To cope with the impact, the Company has modified the production process for HDPE plastic products, used to produce single-use plastic bags, to produce pipe products used in infrastructure construction industry, housing industry. Risk assessments for other plastics that may be banned in the future are also carried out to find further solutions.

Digital Trading Platform Business

Risk from changing customer behaviour in trading and financial transactions: Customers are more likely to trade through online channels, instead of regular channels or dealers. As a result, the sales of the Company's products decreased due to the more convenient, faster and cheaper channel and this tends to increase every year. Therefore, the Company has managed the risk by establishing a joint venture with Guangzhou Saiju Performance Polymer Ltd., a specialist in trading in the Chinese market, to set up a digital platform business, in which the Company holds 55% stake and the Chinese capital 45%. The PLASTKET.COM platform, officially launched to trade in February 2020, has been developed as the first plastic e-commerce platform in Thailand and ASEAN to bring AI technology to ease the development of plastic e-commerce platform, trading plastic pellets, chemicals, and semi-finished and finished products.

Integrating Climate-related Risks into our Risk Management

Provided the fact that IRPC has been on the learning curve to understand the highly-dynamic consequences of climate change, solid processes for identifying, assessing, and managing climate-related risks will need to be regulated attentively. At the time of this report development, these processes applied were at a very primitive stage. IRPC intends to revisit the processes once understand more on the actual situations that followed. Mature **แสวงหา** risk assessment processes will be integrated into the Company's overall risk management and our *Enterprise Risk Management: Procedural Manual* in the near future.

METRICS AND TARGETS

This section demonstrate how IRPC measures and monitors our climate-related risks and opportunities in order to assess the potential risk-adjusted returns, ability to meet financial obligations, general exposure to climate-related issues, and progress in managing or adapting to those issues.

Our Environmental Performance and other Relevant Metrics

In assessing the climate-related risks and opportunities in line with the Company's strategy and risk management process, key metrics including GHG emissions (illustrated in the following sub-section), energy, water, other physical risk exposures, investments in climate adaptation and mitigation, displaced investment value using internal carbon pricing to lead major capital investments, and so on and so forth are records and depicted in *Table 9*. Each of metrics supports the scenario analysis and strategic planning process and that are used to monitor the company's business environment from a strategic and risk management perspective.

- *Energy-related metrics* are monitored in order to track the performance on overall energy consumption in the Company by observing the Energy Intensity Index (EII), as well as the utilisation of renewable energy sources (wind, solar, biomass, hydroelectric, geothermal, etc.)
- *Water consumption and water supply* are highly important to our business. The disruption due to water shortage would result in a tremendous financial loss.

In addition to the above metrics, we plan to cover the below in the near future.

- *Physical risk exposures* are also encouraged to continually monitor on a site-specific basis since this type of risks may occur in various forms depending mainly on the locations. Thus, adaptive responses will have to planned accordingly. Understanding type, magnitude, likelihood and frequency are the keys to planning preventive measures.
- *Green Investments* are on our planned to be continually monitored. The investments are likely to be in alignment with the foreseen future climate-related risks and divided into mitigation and adaptation project types. We plan to set up financial system to gorge this investment purpose in particular and that should be ready in the coming years. In the meantime, we see our past records of *Investment costs to reduce environmental impacts and the benefits* resulted from these investments are monitored could be considered a good indication of baseline to green investment and its benefits.
- *Internal Carbon Price (ICP)* has been first applied to IRPC investment decision in 2021 as a screening tool to discourage and encourage the investments of carbon emission and reduction projects, respectively. As a result of ICP application, we will also record the annual total displaced investment value using the tool to lead major capital investments of the Company. **The ICP value applied and the displaced investment value resulted from the application of ICP should be reported in the next TCFD report.**

Our GHG-specific Performance

We have conducted GHG reporting based on GRI standard, all three GHG scopes have been recorded with gradual improvement in method over time. Besides, we are in the process of identifying specific target and relevant base year to some of the GHG-related as needed be. *Table 10* demonstrates our past performance on greenhouse gases emissions.

Table 9: Environmental Performance and other Key Metrics during 2017-2021

Data	Unit	Target	2017	2018	2019	2020	Past Year Performance
Energy							
- Total energy consumption	GJ	2020: <69 M 2025: <66 M	52,080,051	59,020,452	58,719,745	57,519,116	Achieved
- Total renewable (wind, solar, biomass, hydroelectric, geothermal, etc.) purchased or generated	GJ	N/A	0	0	0	22,406	N/A
- Energy Intensity Index (EII)	-	2020: 89.7 2025: 86.9	90.4	90.9	90.1	89.2	Achieved
Water Supply							
- Total water withdrawal	Million M ³	N/A	37	42	40	40	N/A
- Total water consumption	Million M ³	N/A	15	19	15	15	N/A
- Results of water volume in Reservoir on 1st January and 31st December of that year	Million M ³	N/A	3.11	3.18	1.45	0.64	N/A
Investment costs to reduce environmental impact	THB Million	N/A	609	194	311	435	N/A
Environmental investment benefits	THB Million	N/A	2,581	2,616	1,427	381	N/A

Table 10: GHG Performance during 2017-2021

Data	Unit	2017	2018	2019	2020
Operational Control					
Direct emissions of GHG (Scope 1)	Million tCO ₂ e	3.681	3.953	3.784	3.712
- CO ₂	Million tCO ₂ e	3.674	3.946	3.674	3.701
- CH ₄	Million tCO ₂ e	0.002	0.002	0.002	0.003
- N ₂ O	Million tCO ₂ e	0.003	0.004	0.003	0.004
- HFC	Million tCO ₂ e	0.002	0.000	0.002	0.004
- SF ₆	tCO ₂ e	38	863	38	520
- Biogenic CO ₂ emissions	tCO ₂ e	184	192	374	399
Indirect emissions of GHG (Scope 2)	Million tCO ₂ e	0.296	0.315	0.341	0.341
- Location based	Million tCO ₂ e	0.049	0.029	0.031	0.025
- Market based	Million tCO ₂ e	0.247	0.287	0.224	0.230
Other indirect emissions of GHG (Scope 3)	Million tCO ₂ e	17.903	20.295	16,623	16,663
Equity Basis					
Direct emissions of GHG (Scope 1)	Million tCO ₂ e	3.905	4.403	4.365	4.111
indirect emissions of GHG (Scope 2)	Million tCO ₂ e	0.297	0.316	0.254	0.255
GHG Emission Intensity	tCO ₂ e/t on of production	0.370	0.343	0.345	0.334

Our GHG Target and Tackling Approaches

In line with the ultimate goal of the global treaty, the Paris Agreement, countries and private enterprises have joined hand in combating the climate change, setting a long-term goal to achieve the net-zero emissions across the value chain by 2050. IRPC has committed on GHG reduction goals to achieve 20% reductions by 2030 and a longer-term commitment to become a Net Zero Emission Organization in 2060. Based on our climate strategy, our GHG reduction targets, divided into two different time horizons, can be simply illustrated in *Table 11*.

Table 11: IRPC's GHG Targets and Approaches

Time Horizon	GHG Target	GHG Scope	Climate Scenario	Main Drivers and Actions to Achieve Target
Medium term (2030)	20%	Scopes 1, 2	NZE (1.5C)	Avoid high emission investment into the portfolio
Long term (2060)	0%	Scopes 1, 2, 3	NZE (1.5C)	Application of high technologies commercially viable at the time