



**2023**

Formosa Petrochemical Corporation

**Task Force on Climate-related  
Financial Disclosures (TCFD) Report**



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## Preamble

Global warming caused by the emission of greenhouse gases (referred to as "GHG") has brought significant risks to the growth of the global economy in recent years and will affect a greater number of businesses in the future. However, it may be difficult for investors to learn which companies are susceptible to the risks of climate change, which companies are adequately prepared, and which ones are taking proper actions. Accordingly, the Financial Stability Board (FSB) has assembled a special task force: the Task Force on Climate-related Financial Disclosures (TCFD). The Task Force published its "TCFD Recommendations Report" in June 2017 after spending 18 months gathering opinions from business and financial leaders. The Recommendations Report provides businesses and investors with a complete assessment framework for disclosing risks and opportunities associated with climate change and for reflecting risks in financial reports.

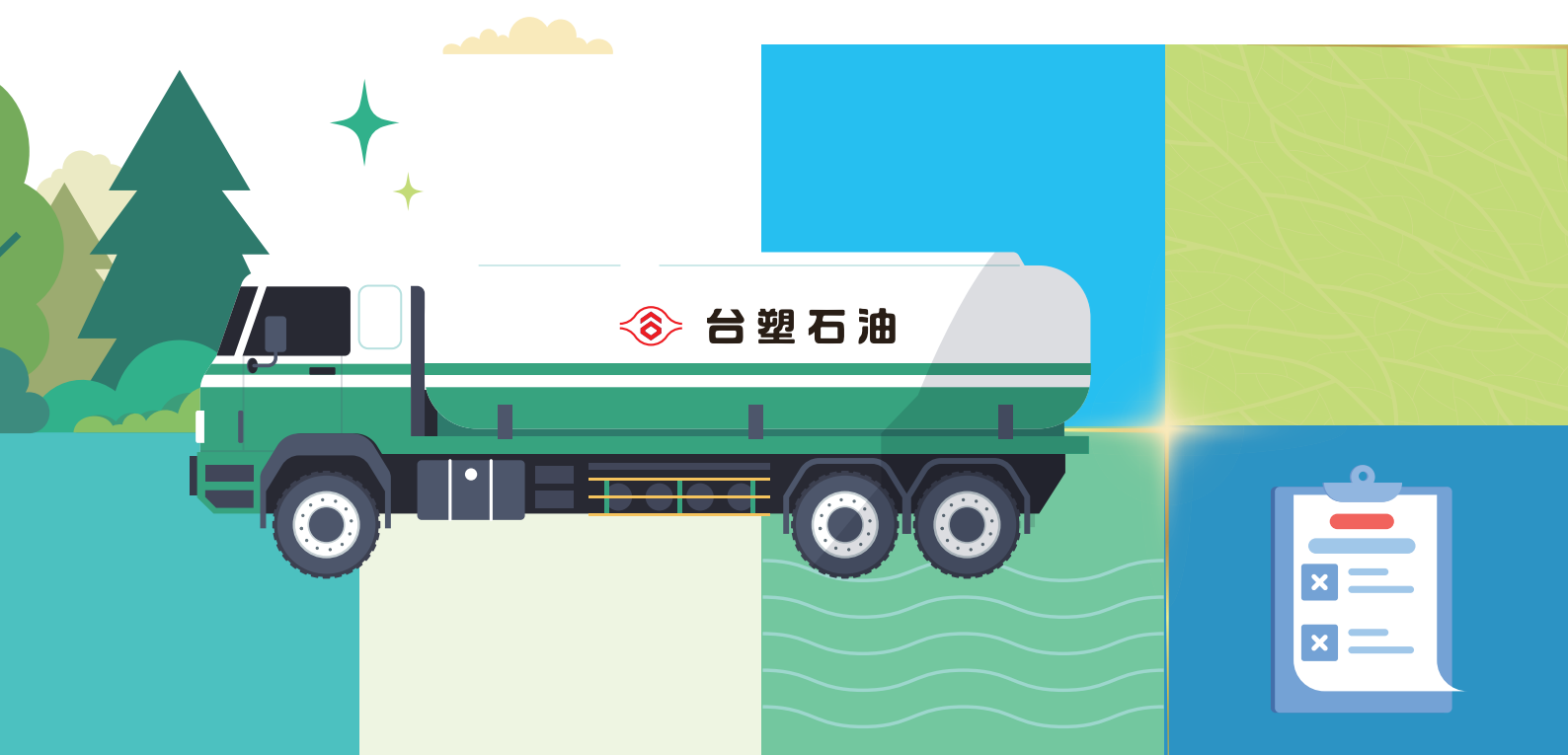

In responding to global trends, Formosa Petrochemical Corporation (FPCC) has disclosed risks and opportunities associated with climate change in accordance with the TCFD Recommendations Report and made a more reasonable and efficient allocation of resources with respect to the Company's responsibilities and strategies, in order to realize our vision toward low-carbon transition.





# CH1 Governance


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## 1.1 Company Profile

Formosa Petrochemical Corporation (FPCC) was incorporated in 1992, mainly engaging in the production and sales of petroleum products and basic petrochemical raw materials. FPCC is the only privately-owned petroleum refining company in Taiwan that produces and sells various petroleum products, including gasoline and diesel. Our naphtha cracker plants have the largest capacity in Taiwan producing basic petrochemical raw materials including ethylene, propylene and butadiene. We also have a qualified cogeneration system, which supplies steam, electricity, and other fluids required by various factories in the Mailiao Industrial Park.

◆ Table 1.1 Basic information on FPCC

 <b>Formosa Petrochemical Corporation</b>			
<p><b>Date of incorporation</b></p> <p>April 06, 1992</p> 	<p><b>Date of listed on TWSE</b></p> <p>December 26, 2003</p> 	<p><b>Capital</b></p> <p>NT\$95,259,596,520</p> 	<p><b>Credit ratings</b></p> <p>Taiwan Ratings:twAA Standard &amp; Poor's: BBB+</p> 
<p><b>Number of employees in 2023</b></p> <p>5,208</p> 	<p><b>Consolidated revenue in 2023</b></p> <p>712.58 billion</p> 	<p><b>Operating sites</b></p> <p>Headquarters: No. 1-1, Mailiao Industrial Park, Zhongxing Village, Mailiao Township, Yunlin County</p> <p>Taipei Office: 380 Section 6, Nanjing East Road, Neihu District, Taipei City (Formosa Plastics Neihu Building A2, 4F)</p> 	

Note: As of December 31, 2023

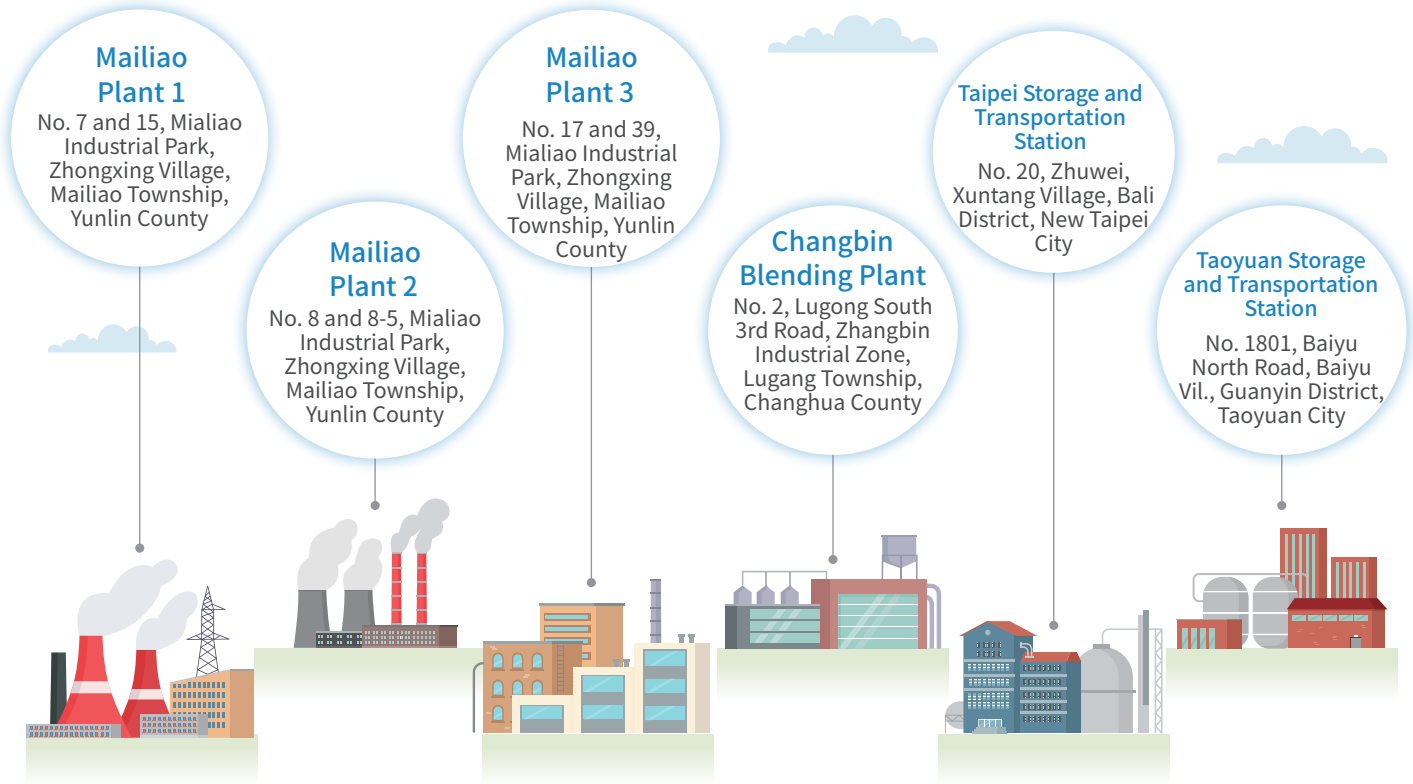
In of the oil refining business, our refinery has a daily refining capacity of 540,000 barrels, of which the output of naphtha can reach 3.75 million metric tons, which are supplied to relevant factories in the Mailiao Industrial Park, while producing gasoline, diesel, aviation fuels, and liquefied petroleum gas.

In the olefins business, we have three naphtha cracker, plants a total annual production capacity of 2,935,000 tons of ethylene. In terms of public utilities, the total installed capacity of our own power generation devices reaches 2.75 GW, of which the capacity of the qualified cogeneration system is 2.15 GW. The electricity and steam produced are supplied to all factories in the industrial park, and the surplus electricity is sold back to Taipower. In addition, we have a number of facilities in place, including industrial water, ultrapure water, air compressors, and an oxygen plant, to meet the fluid needs of the industrial park.

The annual output in 2023 remained stable without major differences from 2022. Petroleum products accounted for 74.5% of the revenue and petrochemicals accounted for 18.3%, both of which are our core products. In 2023, FPCC's consolidated revenue was NT\$712.57619 billion, a decrease of 16.0% from 2022; the consolidated net income before tax was NT\$24.69368 billion, an increase of 45.5% from last year. In 2023, due to the weak demand for petrochemical products, but benefiting from the decrease in coal price,FPCC's public fluid business cost decreased significantly, resulting in increased profit and return on equity compared to 2022.

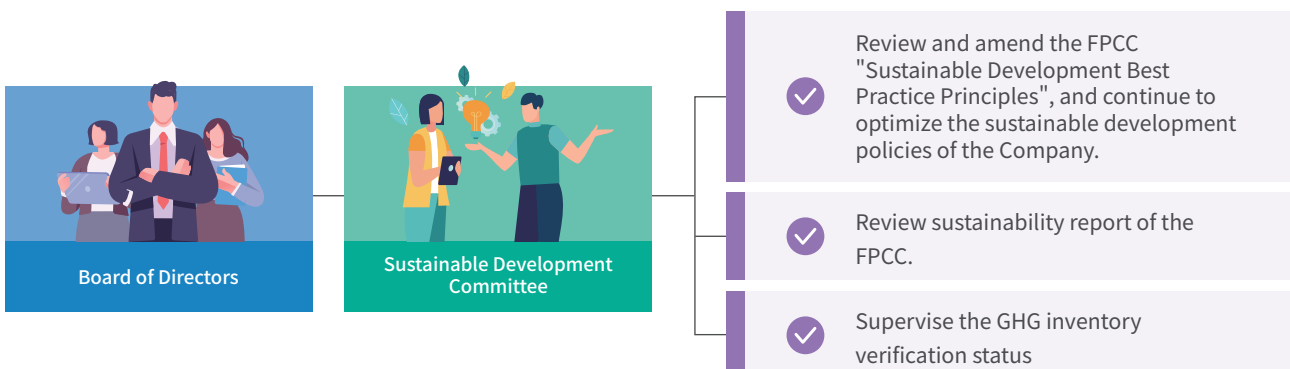
## 1.2 Organizational Boundaries

◆ Table 1.2 Organizational Boundaries of FPCC



## 1.3 Organization and Responsibility

FPCC's Board of Directors serves as the highest governance unit for climate change, and to enhance the supervisory responsibilities of the Board of Directors on sustainability related affairs as well as to promote and implement the vision of sustainable development, FPCC established the "Sustainable Development Committee" according to the approval of the Board of Directors in May 2022. The purpose of the committee is to supervise the implementation of sustainable development related works. In accordance with the requirements of corporate governance assessment, five members are selected for the committee. The President's Office is designated to be the administrative operation department in charge of the sustainability related works of promoting corporate risk management, corporate social responsibility and climate change adaptation. Through diverse and smooth communication channels, the opinions and demands of stakeholders can be understood in order to use such information as an important reference basis for the establishment of FPCC's sustainability policies.



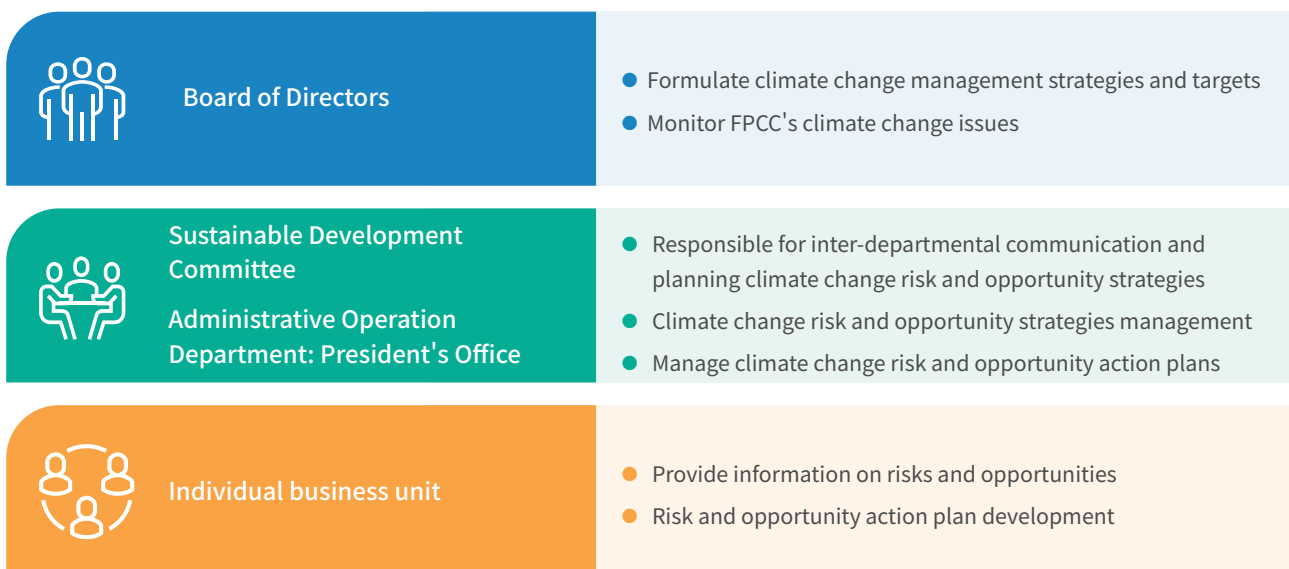
For the Sustainable Development Committee, the Chairman acts as the convener, and the President's Office acts as the administrative operation department, in order to coordinate supervisor of all business units to engage in cross-department communication. As for climate change issues, the FPCC has identified relevant risks, established management strategies, and carried out strategic risk management under the TCFD framework. The main responsibilities of the "Administrative Operation Department: President's Office" are:



"Administrative Operation Department: President's Office" holds monthly working meetings convened by the President. The President is responsible for supervising various energy conservation and carbon reduction and water consumption reduction projects and reviewing the progress of the energy conservation and carbon reduction projects and the achievement of goals, and then reporting on the implementation results of such projects to the Chairman at FPCC's weekly meeting on a quarterly basis, and the relevant materials are compiled into attachments to the agenda of Board meetings for further discussion and review.

FPCC convenes at least six Board meetings annually and regularly reports climate-related issues to the Board of Directors. These include long-term strategic goals for coping with climate change, energy conservation and carbon reduction strategies, medium- and long-term vision, annual energy conservation and carbon reduction performance, green manufacturing, and green product plans, etc.

◆ Figure 1.3 Division of Responsibilities under TCFD



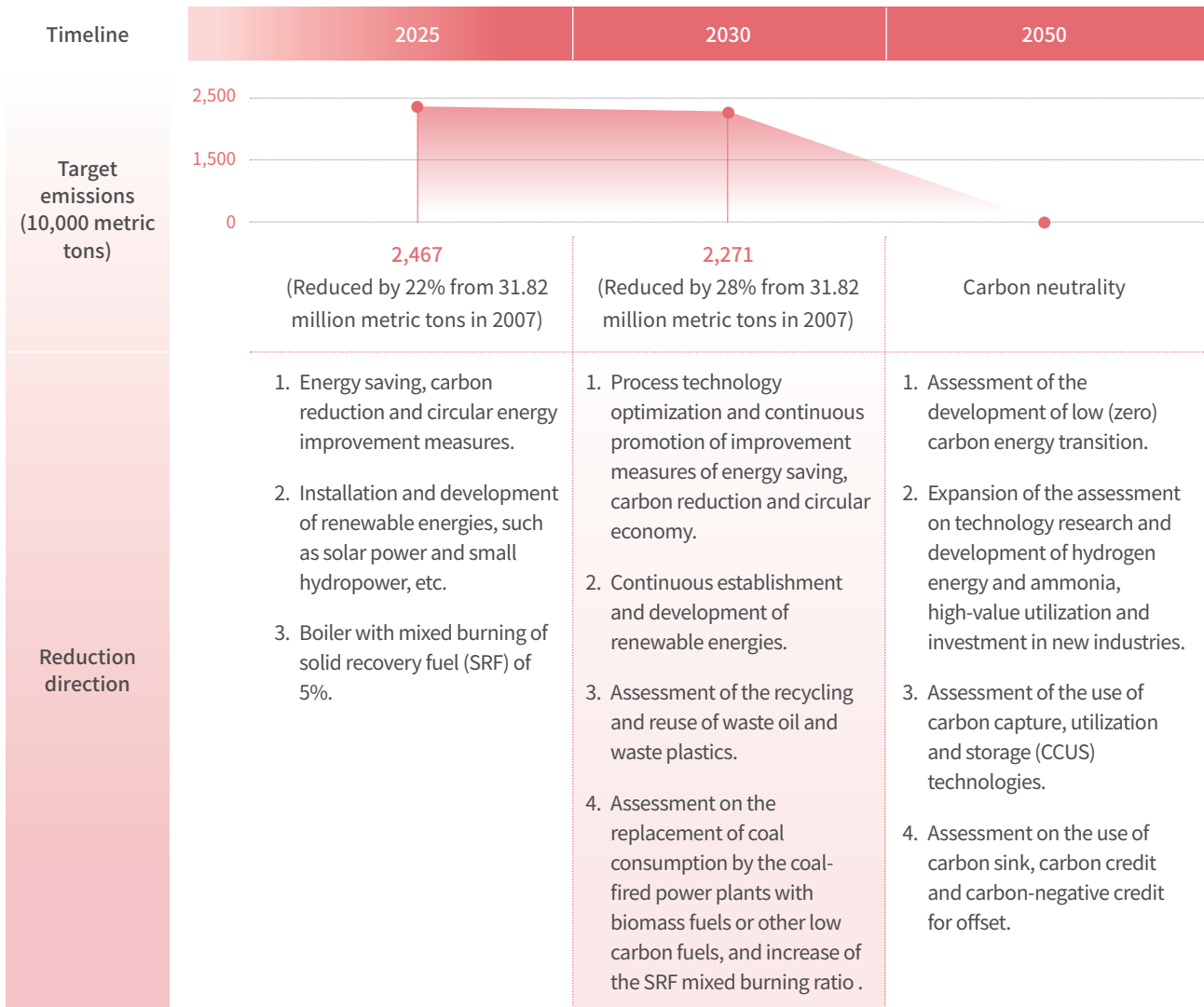


# CH2 Strategy

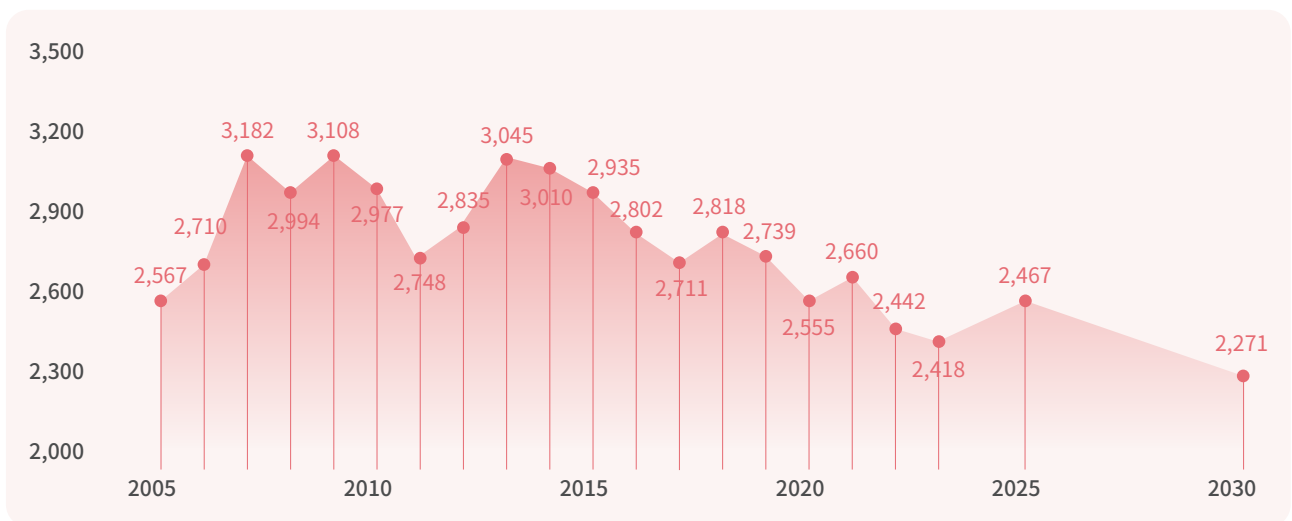




With the goal of achieving carbon neutrality by 2050, FPCC will continue to implement low-carbon measures, reduce energy consumption per unit of product, and establish (invest in) green energy generation facilities to achieve the vision of a low-carbon economic transition. The table below indicates the short-, medium- and long-term reduction targets planned by FPCC.



◆ Figure 2.1 FPCC's GHG emission trend graph (2005–2030)



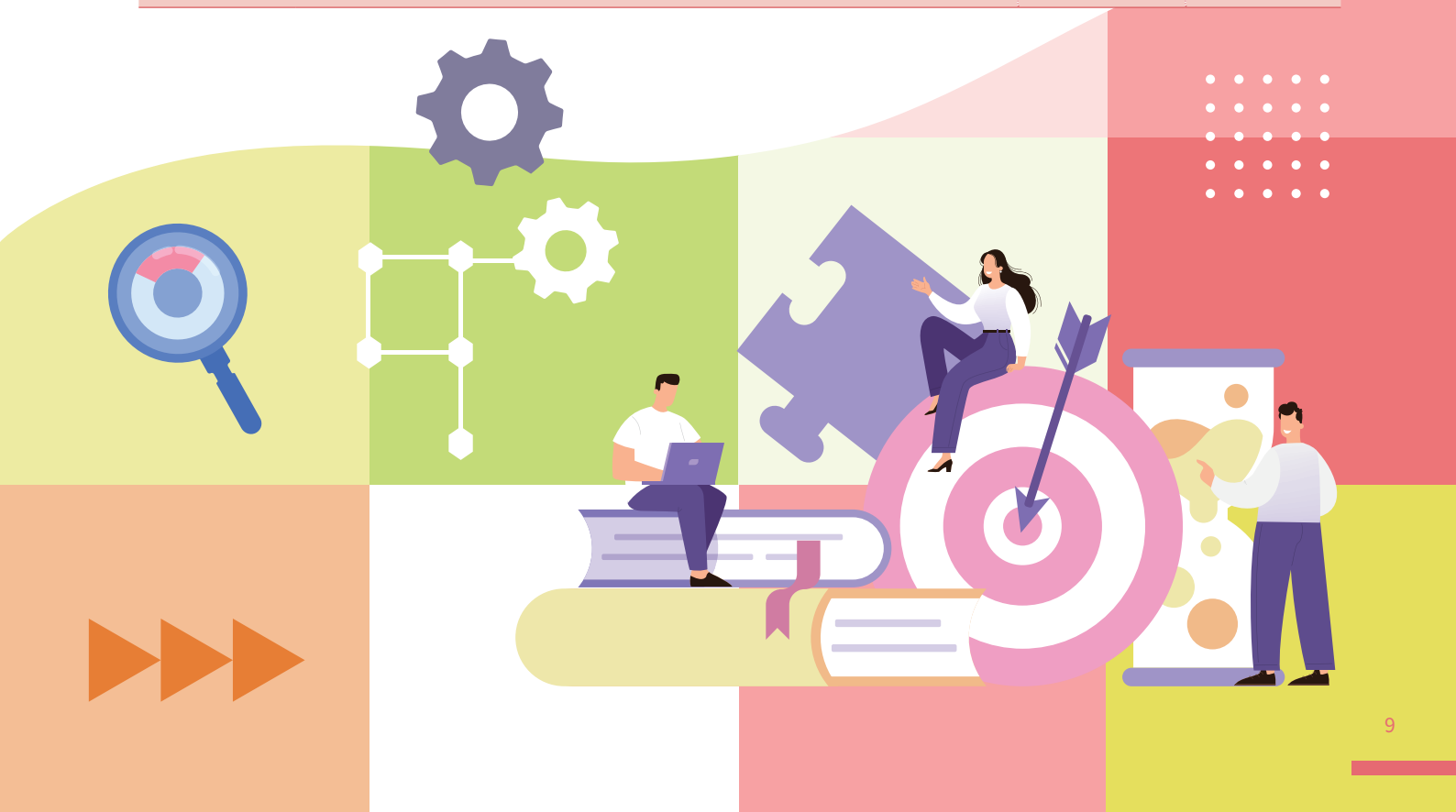
Unit: 10,000 tons

To achieve carbon neutrality by 2050, FPCC has established five strategies of process energy reduction, equipment efficiency improvement, heat recovery, energy management, and renewable energies, as explained in the following. The short-term strategic plan for the period from 2021 to 2025 is explained below. The strategies implemented in 2023 have led to a reduction of carbon emissions by approximately 275,249 metric tons. The implementation result of each strategy is as described in Table 2.2 2023 carbon reduction strategy performance summary table.

	<h3>Process energy reduction strategy</h3> <p>The process energy reduction strategy includes the optimization of the process control system and the improvement of the energy efficiency of relevant equipment.</p>
	<h3>Equipment efficiency improvement strategy</h3> <p>Equipment efficiency improvement strategy includes the installation of fluid couplings in rotating equipment, replacing motors with energy-efficient models, and installing new types of heat exchangers.</p>
	<h3>Heat recovery strategy</h3> <p>Recovery of heat and low-grade waste heat for reuse in order to reduce steam and gas consumption.</p>
	<h3>Energy management strategy</h3> <p>The energy management strategy includes energy conservation measures, such as optimization of the ratio of steam to amine, system voltage reduction for power conservation, and adoption of energy-efficient lights.</p>
	<h3>Renewable energy strategy</h3> <p>Continue to inspect potential fields and sites for the installation of solar power and wind power generation, assess the feasibility of construction, and increase the installation capacity of green power progressively.</p>

◆ Table 2.2 2023 carbon reduction strategy performance summary table

Promotion Strategy	Main Project Content	Carbon Reduction Total	Number of Cases
Process energy consumption reduction	Deoxidation tank V-910 with additional installation of an online analyzer to monitor the dissolved oxygen content	95,169	89
	RDS1 rectification tower (C-3300) with top water injection steam regulator improvement		
	Naphtha cracking furnace with introduction of APC to save fuel gas		
Equipment efficiency improvement	CFB2 steam turbine modification to increase steam extraction volume and efficiency	139,796	76
	CFB1 steam turbine modification to increase steam extraction volume and efficiency		
	CFB2 HPH changed to dual heating steam source to save coal consumption with improvement		
Waste heat recycling	SWS#2 tower top with recycling of returned low-grade heat	24,043	8
	SRU4 unit with a decrease of R-6901 temperature to increase steam generation		
	LHDC with additional installation of steam generator to recycle waste heat for steam generation		
Energy management	RDS#1 hydrogen supply compressor B-3411C with electricity saving improvement	15,072	30
	VGO C-2321 with steam reduction and operation improvement		
Renewable energy	Completion of solar power installation capacity of 1,053kW, power generation of 1.39 million kWh/year, and carbon reduction of 1,169 metric tons of CO <sub>2</sub> e/year	1,169	2
Total		275,249	205





# CH3 Management of Climate Change Risks and Opportunities

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## 3.1 Risk and opportunity identification and assessment process

With extreme climate change events, climate change has caused significant impacts on the planet and on enterprises. To reduce the impact of climate change on FPCC ("Company") with the Chairman as the convener, has established the "Sustainable Development Committee" (as shown in 1.3 Organization and responsibilities) as a functional committee under the Board of Directors. In addition, the President's Office is designated to act as the administrative operation department, responsible for coordinating supervisors of all business units to engage in cross-department communication, establishing management strategies, and implementing strategic risk management. The Company has identified relevant risks, established management strategies, and carried out strategic risk management under the TCFD framework. When formulating risk scenarios, we consider transition risks (policy and law, market, technology, and reputation) and physical risks (chronic and acute) and illustrate potential risk events, including the level of financial impact, impact duration (short-, medium- and long-term), parties impacted in the value chain, and risk likelihood. In the evaluation of opportunities, we consider resource efficiency, energy, products and services, markets, and adaptability. FPCC's risk identification and assessment of climate-related risk process are as follows:

01



### Background information collection

- Collect background information from news, the internet, and events happening in other countries or companies.
- Consider transition risks (including policy and law, market, technology, and reputation) and physical risks (including chronic and acute).

02



### Scope of risk and operations assessment

- Conduct climate change risk assessment of the upstream and downstream of the value chain within the scope of direct and indirect operations.

(as shown in Figure 3.1-1 and Figure 3.1-2)

03



### Risk and operational impact analysis

- Frequency of analysis: Annually.
- Analysis method: Risk mapping.
- High risk inspection and identification: When identifying and assessing climate-related risks and opportunities, we define a financial impact of more than NT\$1 million as a material impact and define 40 types of risk levels: risks involving more than NT\$1 billion and occurrence probability greater than 80% are classified as high risks; risks involving more than NT\$500 million and occurrence probability greater than 50% are classified as medium risks; the rest of the risks are classified as low risks. Low risks refer to acceptable risks, and medium risks, presently, do not require immediate action but still need to be continuously monitored for any changes. For high-risk events, a corresponding management plan must be established in order to reduce loss caused by the risk, such as reduction of the number of occurrences, reduction of financial impact, risk transfer, and risk aversion.

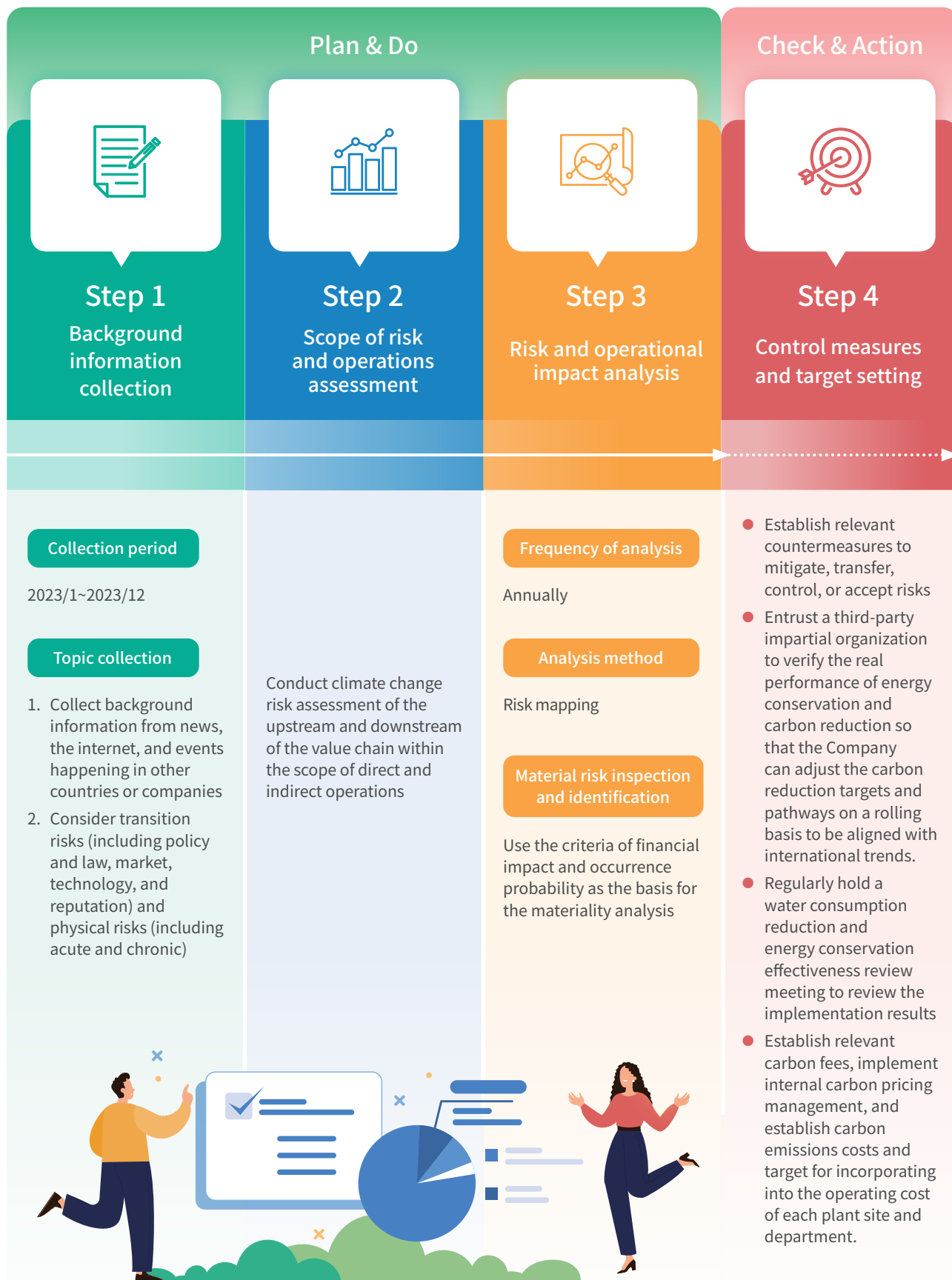
04



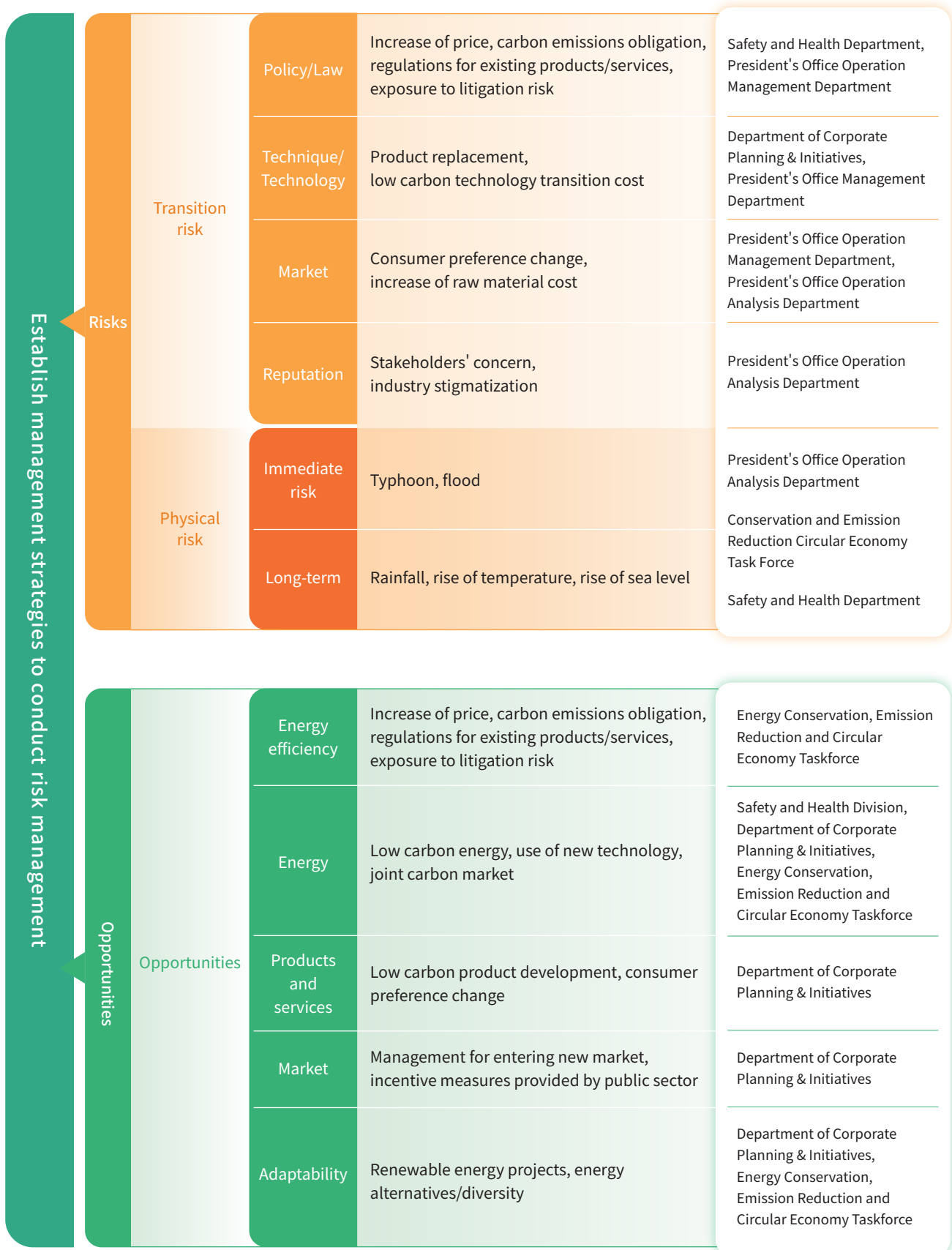
### Control measures and target setting

- "Administrative Operation Department: President's Office" evaluates risk indices based on criteria such as consequences and likelihood levels. Once the risks and opportunities are identified, relevant countermeasures to mitigate, transfer, control, or accept risks are formulated to set short-, medium-, and long-term targets.

◆ Figure 3.1-1 Climate change risk topic analysis process



◆ Figure 3.1-2 Climate change risk and opportunity identification and analysis framework



## 3.2 Risk and opportunity management method

After identifying climate risks and opportunities, the Administrative Operations Department: President's Office evaluates risk indices based on criteria such as consequences and likelihood levels. As the levels of risks and opportunities are identified, relevant countermeasures to mitigate, transfer, control, or accept risks are established in order to specify the short-, medium- and long-term targets. Establish a plan for targets. The Administrative Operation Department: President's Office convenes work meetings monthly to review the implementation progress and target achievement status, and it also participates in monthly energy saving and carbon reduction review meetings for all enterprises. The energy conservation and carbon reduction implementation results are reported to the Chairman and President at the Company's weekly meeting on a quarterly basis, and the results are also summarized in the Board of Directors meeting agenda attachment for reference and discussion.

The Company comprehensively assesses the global ESG trend and FPCC's operational and development goals, analyzes major topics in all aspects of governance, economy, environment, and society, and also discloses the response methods established for topics assessed to have a relatively greater impact, as shown in Tables 3.2-1 and 3.2-2:

◆ Table 3.2-1 Summary table of the most significant financial impact opportunities and management plans

	Risk type Transition/ Physical	Risk level	Main climate-related risk factors	Risk management plan
1	Transformation risk-Policy and law	High risk	<p>Climate Change Response Act- Carbon fee</p> <p>1. Non-excessive GHG emissions: To implement carbon reduction regulatory requirements, the government has announced the amendment of the "Greenhouse Gas Reduction and Management Act" to the "Climate Change Response Act" in 2023. Based on the estimation of the GHG emissions of approximately 24.18 million metric tons of CO<sub>2</sub>e in 2023, if no measures are adopted to reduce carbon emissions, with the carbon emissions fee of NT\$300 per metric ton for calculation, then it is estimated that an amount of NT\$4.6 billion of carbon fee will need to be paid annually.</p> <p>2. Excessive carbon emissions: For carbon emissions that exceed the amount approved by the central competent authority, the upper limit of the penalty for excessive carbon emissions remains at NT\$1,500 per metric ton. The Company's GHG emissions in 2023 were estimated to be roughly 24.18 million metric tons of CO<sub>2</sub>e. If the carbon emissions are not reduced and no carbon credit is purchased to offset the emissions by 2050, the Company may be required to pay the carbon fee at an amount of NT\$1,500 per metric ton for the excessive part of emissions.</p>	<p>1. To increase all employees' awareness, the Company has implemented the internal carbon pricing mechanism in 2022 with reference to the draft of the "Climate Change Response Act" in terms of carbon fees and charges for excessive carbon emissions. The carbon emission cost is included in the internal income statement as the basis for the implementation of carbon risk management. In addition to continuing to formulate GHG emission reduction measures, the relevant information is an important indicator for performance evaluation, products and operations, and investment assessment to maintain the Company's competitiveness.</p> <p>2. Promote various energy saving and carbon reduction plans, head toward low-carbon transition progressively, and perform assessment on the investments of</p> <p>(1) Renewable energy power generation facilities (wind energy, solar PV) and energy storage system</p> <p>(2) Self-recycle and reuse of waste oil and waste plastics, (3) hydrogen energy and ammonia energy industries</p>
2	Transformation risk-Policy and law	Low risk	<p>The Ministry of Economic Affairs (MOEA) has announced that, starting on February 1, 2023, for large water consumption users with single-month water consumption exceeding 9000 (m<sup>3</sup>) during the dry period, water conservation charge will be collected, the charge collection rate is NT\$3 per m<sup>3</sup> of water consumption. For those with water reclamation rate achieving the standard specified, the charge collection rate can be discounted and reduced to NT\$2 or NT\$1 per m<sup>3</sup> of water consumption. In addition, grace period is also provided such that for large water consumption users, the water conservation charge will be collected at half of the original charge collection rate before June 30, 2025.</p>	<p>To cope with the risks of drought, water shortage and water conservation charge, etc., the Company has established two strategies for water resource management, and the two strategies refer to diverse water withdrawal sources and water saving management.</p>



	Risk type Transition/ Physical	Risk level	Main climate-related risk factors	Risk management plan
2	Transformation risk-Policy and law	Low risk	Based on the estimation of the Company's water consumption of 19.33 million m3 of water during the dry period (January ~ April, November ~ December) in 2023, it is estimated that it will cause the financial impact at an amount of NT\$9.64 million annually.	<ol style="list-style-type: none"> <li>1. Construction of seawater desalination plant To increase the sources of water resources and to reduce reliance on freshwater resources, the Company has planned the construction of a seawater desalination plant with a daily water generation volume of 100 thousand tons, and the whole-year water generation volume is able to reach 17 million tons. Accordingly, 17 million tons of freshwater consumption can be reduced annually, and it is expected to save the water conservation charge at an amount of NT\$2.89 million.</li> <li>2. Promotion of water saving measures annually The Company invested a total amount of NT\$12.1 million in 2023 for 27 water-saving and improvement projects, which achieved a daily water-saving amount of 157 tons with an annual improvement benefit of NT\$604 thousand.</li> </ol>
3	Transition Risk - Change of customer behavior	Medium risk	The International Energy Agency stated that about 240 million electric vehicles will be on the road by 2030, which will reduce the global demand for petroleum by 5 million barrels per day. The transportation demand for petroleum will fall by 18.8% based on an estimate of 26.6 million barrels of petroleum for transportation per day in 2023. Consequently, it will cause decline of fuel market, decrease of revenue and property loss.	To cope with the decreasing demand for transportation petroleum, the Company plans to produce high-value products. With the increase in the production of high-value products, we are able to respond to property loss caused by the change in customer behavior.

◆ Table 3.2-2 Assessment and management of topics with the most significant financial impact in each opportunity category

	Opportunity topic	Opportunity level	Main climate-related risk factors	Risk management plan
1	Transition opportunity - Low carbon energy transformation technologies	Medium opportunity	The Company considers the opportunities of low carbon energy transition and circular economy for the Company in terms of the transition technology. In recent years, the Company has developed low temperature waste heat recovery thermoelectric system plan and refuse derived fuel (RDF) plan, in order to reduce large amount of fuel consumption and to reduce GHG emissions.	<p><b>Low temperature waste heat recovery thermoelectric system</b></p> <p>The Company plans to implement a ten-year GHG offset program (low-temperature waste heat recovery for power generation), and it is estimated that 13,220 metric tons of CO2e carbon credits can be obtained. Based on the estimation of the carbon fee of NT\$300/metric ton of CO2e, the potential profit is approximately NT\$3.96 million. The annual power generation is 1,559,160 kWh. If the average electricity price is NT\$3.12/kWh, the ten-year power generation is able to save the electricity purchase cost of NT\$4.865 million.</p> <p><b>Refuse derived fuel (RDF) plan</b></p> <p>Since 2019, RDF has been used to partially replace coals. It is estimated that the maximum consumption of RDF is 49,932 metric tons per year, and the cost per metric ton is NT\$900. It is estimated that the fuel cost will increase by NT\$44.94 million, while 23,349 tons of coal are reduced. If calculated at US\$132 per ton of coal, it can reduce the energy purchase cost of NT\$47.52 million, while it can reduce GHG emissions by approximately 720 thousand metric tons. If the carbon fee collection rate of NT\$300/metric ton is used for calculation, it is estimated to reduce NT\$21.6 million, and the overall potential financial income of this plan is approximately NT\$69.12 million.</p>

	Opportunity topic	Opportunity level	Main climate-related risk factors	Risk management plan
2	Transition opportunity – Enhancing energy efficiency	High opportunity	The Company adopts the concept of circular economy and considers the opportunity of reduction by increasing the energy efficiency. The tail gas generated from the production processes is recycled and reused in order to reduce air pollution. By converting the process tail gas into fuel for use, we are able to reduce fuel consumption.	In 2023, a total of 40.986 thousand tons of excess process gas was recycled for reuse, such that approximately 680.7 million metric tons of GHG emissions was reduced, and approximately 56.006 thousand tons of coal consumption was replaced. If the fee rate of US\$132 per ton of coals is used for calculation, it is estimated that the coal consumption expense of NT\$220 million can be saved (USD exchange rate: US\$1 to NT\$30).
3	Transition opportunity - Establishment of renewable energy facilities	Medium opportunity	Among the Company's strategies for carbon reduction opportunities, the establishment and purchase of renewable energies are part of the carbon reduction opportunities, and establishment of solar power is able reduce the fuel consumption.	<ol style="list-style-type: none"> <li>"Renewable energy power generation system establishment project": Presently, 32 sites of solar energy generation facilities have been planned for construction, and the total installation capacity is 19MW.</li> <li>The total investment cost of the solar power generation facilities is NT\$1.37 billion, and it is expected to generate electricity of 25,300 thousand kWh, and an amount of NT\$79 million of electricity expense can be saved (calculated based on the solar photovoltaic capacity factor in Yunlin area in 2021=14.67% and the electricity price of NT\$3.12 per kWh).</li> </ol>

### 3.3 Integration of climate change-related issues

An enterprise must take into account various potential risk issues and assess its operations to achieve sustainable development. FPCC continues monitor the global risk trends in order to implement the philosophy of sustainable development. Risk issues have evolved from the single economic aspect in the past to multiple aspects of the environment, society, technology, and geopolitical issues, and climate change-related issues have been integrated into the environmental aspect. "Administrative Operation Department: president's Office" acts as the center to implement risk management. It identifies the risks that may affect the Company's operations and works with different business units to jointly assess the probability of occurrence and the level of impact of such risks according to their nature, while reporting to the Company in a timely manner to adjust the operation strategies.

For risk management, the Company further classifies risks into two categories: "Inherent operational risks" and "Emerging risks". The inherent operational risks are determined based on the 12 risks required to be disclosed in accordance with the "Regulations Governing Information to be Published in Annual Reports of Public Companies", and the Administrative Operation Department: President's Office conducts analysis and assessment one by one. The emerging risks refer to risks that may be faced by the Company in terms of the operation for five years, and topic collection is performed according to the Enterprise Risk Management (ERM) Framework released by the Committee of Sponsoring Organizations of the Treadway Commission (COSO), and ESG experts are also invited to analyze the emerging risks jointly. At present, most of the issues related to climate change fall in the category of emerging risks.

Inherent operational risks and emerging risks have been identified as per the Company's integrated risk analysis and assessment process. The risk topics analyzed and assessed in relation to climate change include: Corporate image change, technological change, physical risks of climate change, stakeholders' attention to low-carbon energy, energy transition, and compliance with domestic and international energy policies.

"Administrative Operation Department: President's Office" re-examines the physical risks of climate change, and, in terms of risks, identifies the transition risks of climate change (policy and law, market, technology, and reputation) and physical risks of climate change (chronic and acute); in terms of opportunities, the aspects considered included improvement in resource efficiency, other alternative energy sources, low-carbon products and services, low-carbon product markets, and low-carbon product adaptability.

After identifying and assessing climate-related risks and opportunities, we defined a financial impact of more than NT\$1 million as a material impact, as shown in Figure 3.3-1, and classified risks and opportunities as i) great financial impact and high likelihood, ii) great financial impact but low likelihood, iii) low financial impact but high likelihood, and iv) low financial impact and low likelihood.

FPCC adopts a climate change risk identification procedure along with the use of the matrix of financial impact level and risk occurrence probability to determine high risks. The indicators for risk likelihood are divided into eight levels: 5%, 5–20%, 20%–35%, 35%–50%, 50%–65%, 65%–80%, 80%–95%, and higher than 95%. As the financial impact involving more than NT\$1 million is considered material, the indicator is classified into five levels: over NT\$2 billion; between NT\$2 billion and NT\$1 billion; between NT\$1 billion and NT\$500 million; between NT\$500 million and NT\$20 million; between NT\$20 million and NT\$1 million. Then, a risk matrix is created, with the horizontal axis representing the risk occurrence probability and the vertical axis representing the financial impact, as shown in Figure 3.3-2.

The completed risk matrix, as shown in Figure 3.3-3, defines 40 risk levels: risks involving more than NT\$1 billion and having occurrence probability greater than 80% is classified as high risks; risks involving more than NT\$500 million and having occurrence probability reaching 50% are classified as medium risks; the rest of risks are classified as low risks. Low risks refer to acceptable risks, and medium risks do not require immediate action but still need to be continuously monitored for any changes. For high-risk events, a corresponding management plan must be established in order to reduce loss caused by the risk, such as reduction of the number of occurrences, reduction of financial impact, risk transfer, and risk aversion.

◆ Figure 3.3-1 Process for assessing the materiality of climate change topics

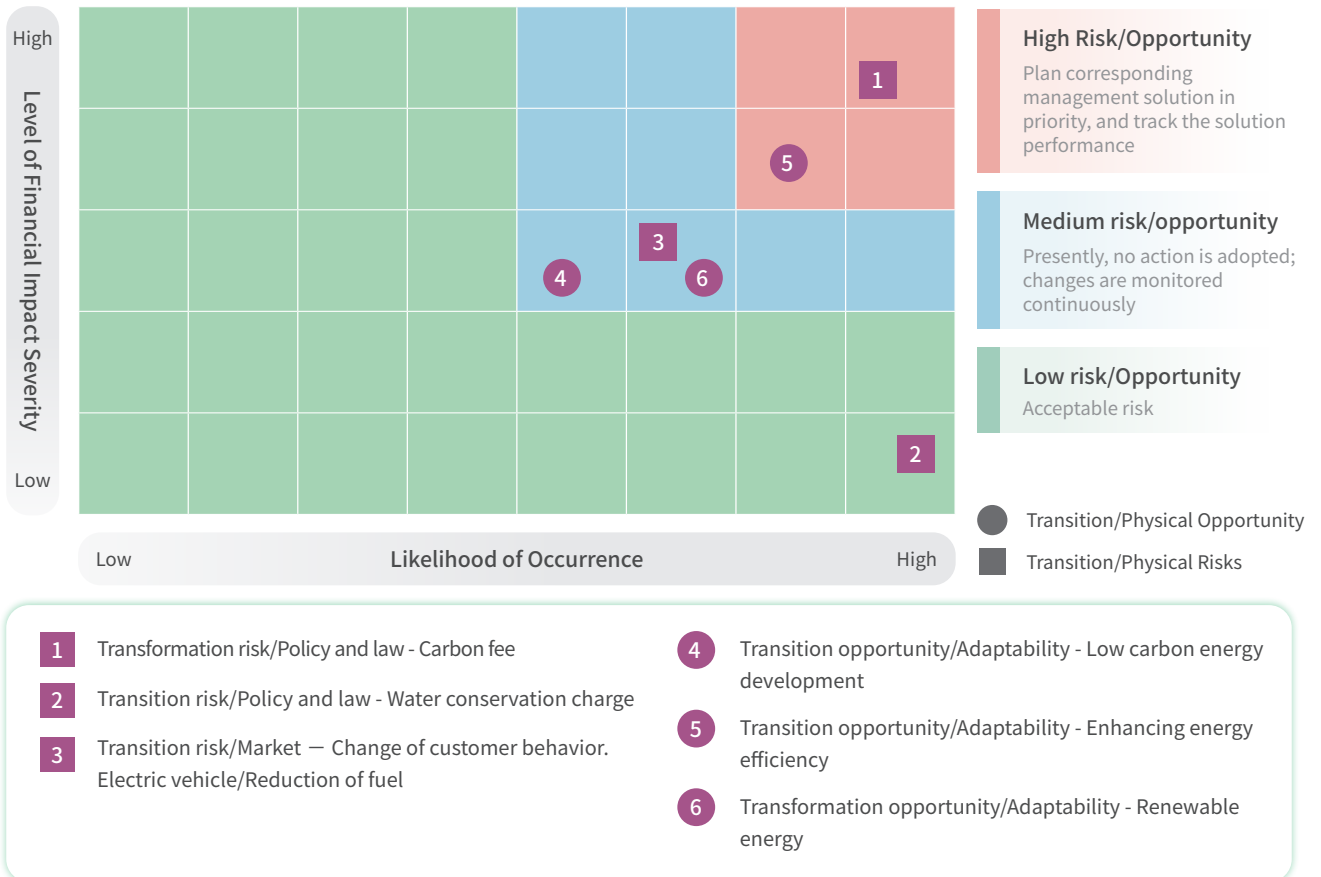


◆ Figure 3.3-2 Risk matrix

▲ High risk/opportunity    ■ Moderate risk/opportunity    ● Low risk/opportunity

Level of Financial Impact	Amount (TWD)	Likelihood							
		Almost improbable (<5%)	Very unlikely (5%<x<20%)	Unlikely (20%<x<35%)	Slightly unlikely (35%<x<50%)	Slightly likely (50%<x<65%)	Likely (65%<x<80%)	Very likely (80%<x<95%)	Almost Certain (>95%)
High	Above NT\$2 billion	●	●	●	●	■	■	▲	▲
Medium High	Between NT\$1 billion and NT\$2 billion	●	●	●	●	■	■	▲	▲
Moderate	Between NT\$1 billion and NT\$500 million	●	●	●	●	■	■	■	■
Medium Low	Between NT\$500 million and NT\$20 million	●	●	●	●	●	●	●	●
Low	Between NT\$20 million and NT\$1 million	●	●	●	●	●	●	●	●

◆ Figure 3.3-3 A comparison table of climate change risk and opportunity and Risk Mapping



## 3.4 Summary Table of Impact of Risks and Opportunities on the Company

Climate Issues	Risks/ Opportunities	Climate- Related Factors
Potential impact on company/organization	Issue	Level Classification
Current risk and opportunity analysis and strategy		
<p>The President amended the "Greenhouse Gas Reduction and Management Act" to the "Climate Change Response Act" on February 15, 2023, and relevant provisions were also amended. The reason for the amendment is that based on the consideration of serious global climate change status, continuous increase of international industry supply chain's demand on carbon reduction, enhanced carbon emission control measures implemented by countries worldwide, to promote the net zero transition and to increase the industry competitiveness of our nation, the government of R.O.C. has decided to include provisions related to the 2050 net zero emission goal, collection of carbon fees for specialized purpose of use as the key focus of the regulatory amendment. The Ministry of Environment implements regulatory control on enterprises with emissions exceeding 25 thousand metric tons of CO<sub>2</sub>e. FPCC with annual emissions exceeding 20 million metric tons of CO<sub>2</sub>e, the Company is defined as a large carbon emissions enterprise and is one of the first companies listed for control by the government. In addition, the carbon fee is expected to be collected starting in 2025. Based on the estimation of the GHG emissions of approximately 24.18 million metric tons of CO<sub>2</sub>e in 2023, if no measures are adopted to reduce carbon emissions, with the carbon emissions fee of NT\$300 for calculation, then it is estimated that an amount of NT\$4.6 billion of carbon fee will need to be paid annually. To cope with the collection of carbon fee, FPCC will continue to exert effort in the energy saving and carbon reduction operations, and will also actively seek collection reduction items.</p>	Transition risk/ Policy and law	High risk
<p>In view of the regulations of the government's "Climate Change Response Act", "A Nuclear-Free Taiwan by 2025," "Policy for the renewable energy to reach 20% of total power generated by 2025," "Gas-fired power generation," "Renewable Energy Development Act - Energy-heavy Industries Clause", reduction of emissions and energy transition will cause an increase of electricity price and electricity instability, resulting in medium-term of high risks for companies.</p>	Transition risk/ Technology	High risk
<p>The European Union (EU) will begin to levy a carbon border adjustment tax after 2026. The initially regulated products are the direct emissions from the products in the five major industries of electricity, cement, chemical fertilizers, steel, and aluminum. FPCC's current export products are not included in the scope of the levy as VCM, PVC, phenol, and acetone set out in the product emission standards under the Commission Implementing Regulation (EU) 2021/447 are not used in our products. In the risk identification in the environmental policy category, the EU carbon border adjustment tax may have an impact in the future. The U.S., the U.K., Japan, Canada, and Singapore have shown their support for the tax. It will not cause any impact in the short term, and we will continue to pay attention to the latest developments.</p>	Transition risk/ Policy and law	Low Risk
<p>The Glasgow Climate Pact at the UN Climate Change Conference (COP26) is an indication that the UN COP has clearly stipulated the reduction of coal consumption and the phasing out of subsidies for unabated coal and fossil fuels for the first time in history. This is a medium- and long-term high risk for FPCC. In the identification of climate change risks and opportunities in the "Energy supply" category, FPCC identified the consumption of high carbon emission fuels as a medium-to-long-term high risk. FPCC not only plans renewable energies but also seeks other alternative energies, and has planned the "RDF Plan". This demonstration program is carried out in alignment with government policies to help the government reduce the amount of domestic waste in the private sector and effectively improve the Company's reputation. Since 2019, RDF has been used to partially replace coals. It is estimated that the maximum consumption of RDF is 49,932 tons per year, and the cost per ton is NT\$900. It is estimated that the fuel cost increases by NT\$44.94 million, while 23,349 tons of coal are reduced. If calculated at US\$132 per ton of coal, it can reduce the energy purchase cost of NT\$47.52 million, while it can reduce GHG emissions by approximately 72 thousand metric tons. If the carbon fee collection rate of NT\$300/metric ton is used for calculation, it is estimated to reduce NT\$21.6 million, and the overall potential financial income of this plan is approximately NT\$69.12 million.</p>	Transition opportunity/ Energy	Medium risk

Climate Issues	Risks/ Opportunities	Climate-Related Factors
Potential impact on company/organization	Issue	Level Classification
Current risk and opportunity analysis and strategy		
<p>The categories of "Climate change risk and opportunity identification" and "Design and development" include risks of product design and development, raw material, market, business, and process technology. The change in customer behavior is reviewed based on consumer preferences (such as a decrease in gasoline demand due to electric vehicles and a decrease in plastic consumption), resulting in a decrease in demand for goods and services. In addition, the impact on the revenue is also further assessed. With the progressive growth of the electric vehicle market, the International Energy Agency has stated that the global demand for petroleum will be reduced by 5 million barrels per day by 2040. The transportation demand for petroleum will decrease by 18.8% based on an estimate of 26.6 million barrels of petroleum for transportation per day in 2023.</p>	Transition risk/ Market	High risk
<p>In recent years, due to the trend of ESG, investment institutions tend to assess clients' ESG performance during their evaluations for investments and loaning of funds. If a company cannot meet the ESG sustainability requirements, the company's reputation can be negatively affected, and financial institutions may increase the loan interest rate, or may even refuse to provide loans to industries with high carbon emissions. FPCC has assessed the risk associated with "Reputation", and the result indicates that the risk immediate but its impact is still limited.</p>	Transition risk/ Reputation	High Risk
<p>FPCC is a major water user, with a monthly water consumption of more than 1,000 m<sup>3</sup>. Stable water quality and sufficient water supply will directly have a significant impact on the stable production and excellent product quality of various products in our plants. To reduce the dependence of our products on water and increase their competitiveness, FPCC continues to invest in the implementation of energy conservation and water consumption reduction projects to reduce costs. We implemented 27 water consumption reduction and improvement projects in 2023. The daily water-saving volume reached 157 tons and the annual benefit was NT\$604 thousand.</p>	Opportunities/ Adaptability	Medium opportunity
<p>FPCC considers product life cycle and product value chain and also actively seeks and assesses the opportunities for the development of low carbon and renewable products. The Company introduces the concept of circular economy, and in addition to the recycle and reuse of resources of waste gas and wastes generated in the existing processes, the Company also plans and assesses the use of eco-friendly biomass or recycled materials, such that resource sustainable use can be achieved and the existing factory processes can be maintained:</p> <ol style="list-style-type: none"> <li>As the awareness of countries worldwide on the circular economy development increases, the global recycled plastics and waste plastic circular market continues to growth with great development opportunities.</li> <li>Through the use of bio-based raw materials (such as bio-naphtha) or waste plastic pyrolysis oil converted via the chemical pyrolysis technology, the pyrolysis oil can be purified via the purification equipment to satisfy the naphtha specification quality, followed by feeding to the olefin plants in order to be used as a portion of the raw materials of olefin plants. In addition, after the certification via the global verification system, the recycled products of recycled ethylene, recycled propene, and recycled C4, etc. equipped with international certification can be generated, such that the product value of the Company can be increased, the development of the circular economy can also be promoted while maintaining the existing processes of olefin plants.</li> </ol>	Transition Opportunities/ Energy	High opportunity
<p>FPCC's production process requires a stable and large supply of high-quality water resources. FPCC's production plant is located in Mailiao and the water for production is mainly obtained from the Jiji Weir. The Shared Socioeconomic Pathways (SSP) defined in the IPCC Sixth Assessment Report (AR6) in 2023 is used to predict the future emissions status and the potential impact of climate change for the medium term (2041~2060). For all plant sites in Taiwan, we have performed detailed scenario analysis and climate risk assessment. For high temperatures and drought they are considered as high risk only under SSP5. Nevertheless, FPCC responds to the issue of possible water resource shortage early and has established water resource management strategies at the early stage, including: various water saving, wastewater recycle and reuse plans, rainwater reclamation and reuse plans, and the seawater desalination plant with a daily water generation capacity of 100 thousand tons (annual water generation capacity reaches 17 million tons) implemented in recent years, in order to gradually reduce Mailiao plant's dependence on water resource. These measures also bring opportunities to FPCC along with reduction of operational risks and increase of our competitiveness.</p>	Physical risk/ Chronic	Medium risk

Climate Issues	Risks/ Opportunities	Climate-Related Factors
Potential impact on company/organization	Issue	Level Classification
Current risk and opportunity analysis and strategy		
<p>According to SSP5-8.5 scenario, extreme climate risk management is implemented on the medium-term scenario of climate change (2041--2060), and the average total rainfall for 2041~2060 increases by 8.8%.</p> <ol style="list-style-type: none"> <li>1. Torrential (heavy) rain occurs most often in the plum rain season from May through June, the typhoon season from July through September, or convectional rainfall caused by fronts in spring and autumn or strong southwesterly airflows in summer.</li> <li>2. Due to the impact of global climate change, the frequency of extreme weather events (such as heavy rainfall/flooding) increases, and equipment may be flooded and damaged due to torrential rains, affecting the process's stable operation. Based on the 2023 revenue estimation, one day of work suspension due to heavy rainfall and flooding can cause a revenue loss of NT\$2 billion.</li> </ol>	Physical risk/ Acute	Medium risk
<p>In pursuit of sustainable development, FPCC promotes risk management, corporate social responsibility, and climate change adaptation initiatives via the "Sustainable Development Committee". In response to climate change, we make every effort to recycle and reuse raw materials, water resources, energy, and waste across plants and companies to head toward the goals of energy saving, emission reduction, resource integration, and zero waste. In recent years, we have continued to enhance resource efficiency and reduce our operating costs, while reducing GHG carbon emissions due to the possibility of reusing process waste or exhaust gas in the plants, in order to achieve FPCC's sustainable development goals.</p> <p>The excess process gas produced from FPCC's manufacturing processes was originally sent to the flare tower for combustion before emission. After the Company's integration of energy resources across plants, the excess process gas is now recovered to the boilers of Utility Plant 4 in order to partially replace coals. In 2023, a total of 40,986 metric tons of excess process gas was recycled for reuse, such that approximately 68,070 metric tons of GHG emissions was reduced, and approximately 56,006 tons of coal consumption was replaced. If the fee rate of US\$132 per ton of coals is used for calculation, it is estimated that the coal consumption expense of NT\$220 million can be saved (USD exchange rate: US\$1 to NT\$30).</p>	Opportunities/ Adaptability	High opportunity




### 3.5 Scenario Analysis of Climate Change

The Company mainly uses the Shared Socioeconomic Pathways (SSP) defined in the IPCC Sixth Assessment Report (AR6) in 2023 to predict the future emissions status. The SSP pathways consider the future uncertainty, and also provides broader assessment, including the possible impact of GHG emissions, land use and air pollutants on future climate. The four SSP emissions scenarios used by FPC include: Low emissions (SSP1-2.6) referring to slow achievement of sustainable goals by countries worldwide; Medium emissions (SSP2-4.5) reflecting that countries may focus more on the internal economic and safety issues under regional competition such that broad development needs may be overlooked; High emissions (SSP3-7.0) referring to that based on the consideration of inequality among various countries, environmental policies may be implemented at regions of medium and high income, and the global energy sector relies on carbon-intensive fuel; Extremely high emissions (SSP5-8.5) indicates that under the condition where no climate policy is implemented, GHG emissions would be high.

The physical risk scenarios adopt the four scenarios of (SSP1, SSP2, SSP3, SSP5) of the "Shared Socioeconomic Pathway (SSP)" proposed by the IPCC AR6 (The Sixth Assessment Report of the Intergovernmental Panel on Climate Change). Under different GHG emissions scenarios, the hazards of climate risk are analyzed according to the climate indicators of domestic temperature rise, average total rainfall and flood, and number of days without rainfall in one year, etc. in order to assess flood, drought, high temperature and debris flow, for the time period of 2041~2060. Relevant data sources include the Climate Change Knowledge Portal, Taiwan Climate Change Projection Information and Adaptation Knowledge Platform (TCCIP), and National Science & Technology Center for Disaster Reduction, such that climate disaster risk can be determined according to the climate change key indicator result. Please refer to the following table for details of the scenarios.

◆ Table 3.5-1 Climate Change Scenario Assumptions



Physical Risk Scenario	Mailiao Plant
Average temperature (temperature change °C )	25.3°C
Daily maximum high temperature (temperature change °C )	+1.5 °C Base period: 34.2°C
Heat Wave Duration Index (HWDI) (days)	+62.2 days Base period: 9.9 days
Total rainfall (rainfall change rate %)	+11.2% Base period: 1064.0 mm
2060 flood line overflow risk	Not directly located in the overflow area, but there are within 500 meters
Sea level rise overrun risk (2m)	Not directly located in the overflow area, but there are within 500 meters
Longest consecutive days without rainfall in one year	+2.7 days Base period: 69.3 days

\*Note: Values in this table are based on SSP5-8.5 scenario, the medium-term scenario of climate change (2050) for extreme climate risk management.



◆ Climate change physical risk scenario analysis summary table (by plant site and scenario)

Plant Site	Scenario	Climate Disaster				
		Acute Flooding	Draught*	High Temperature	Landslide	Slope*
FPCC-2 Mailiao Plant	SSP1-2.6	2	1	3	2	4
	SSP2-4.5	4	1	3	2	4
	SSP3-7.0	4	1	3	2	4
	SSP5-8.5	4	4	2	2	4

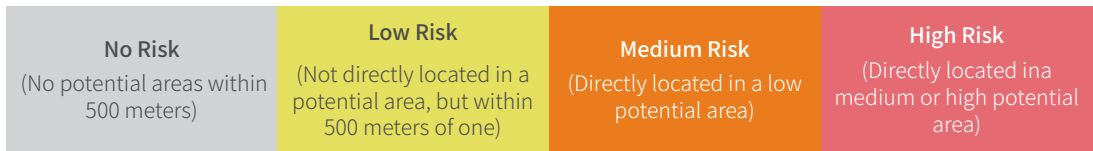
Risk Level Classification



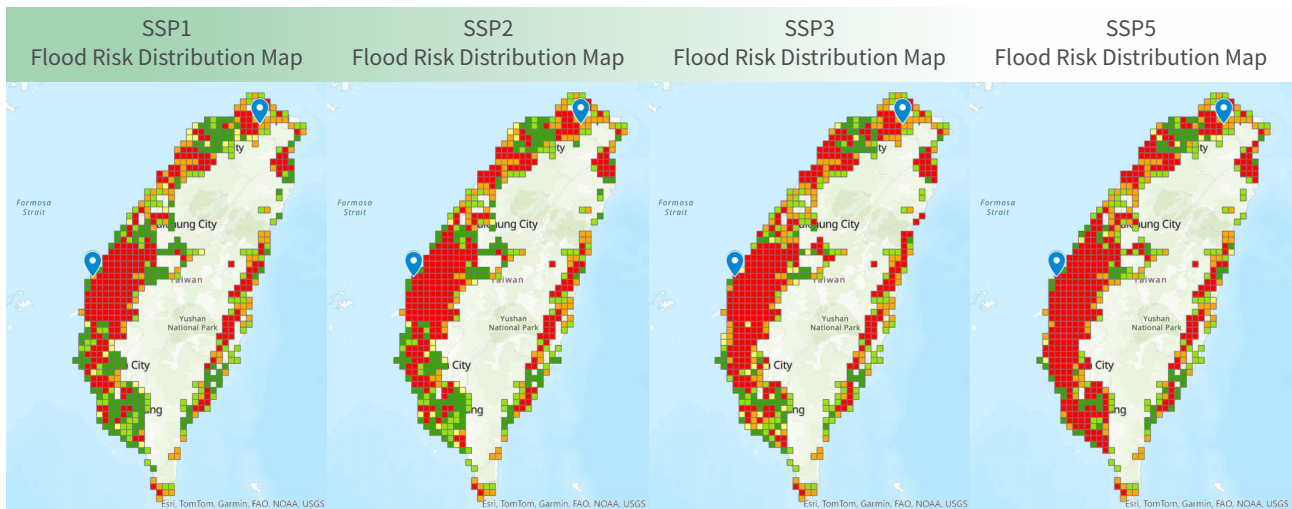
\*Note No Data  
 \*Note 2: Analysis of slope disasters is based on historical events.

Disaster Potential	Potential debris flow torrent	Large-scale landslide potential areas	Dip slope	Rockslide	Debris slide	Falling rocks	Soil liquefaction potential areas	Active fault
Mailiao Plant	1	1	1	1	1	1	4	1

Risk Level Classification



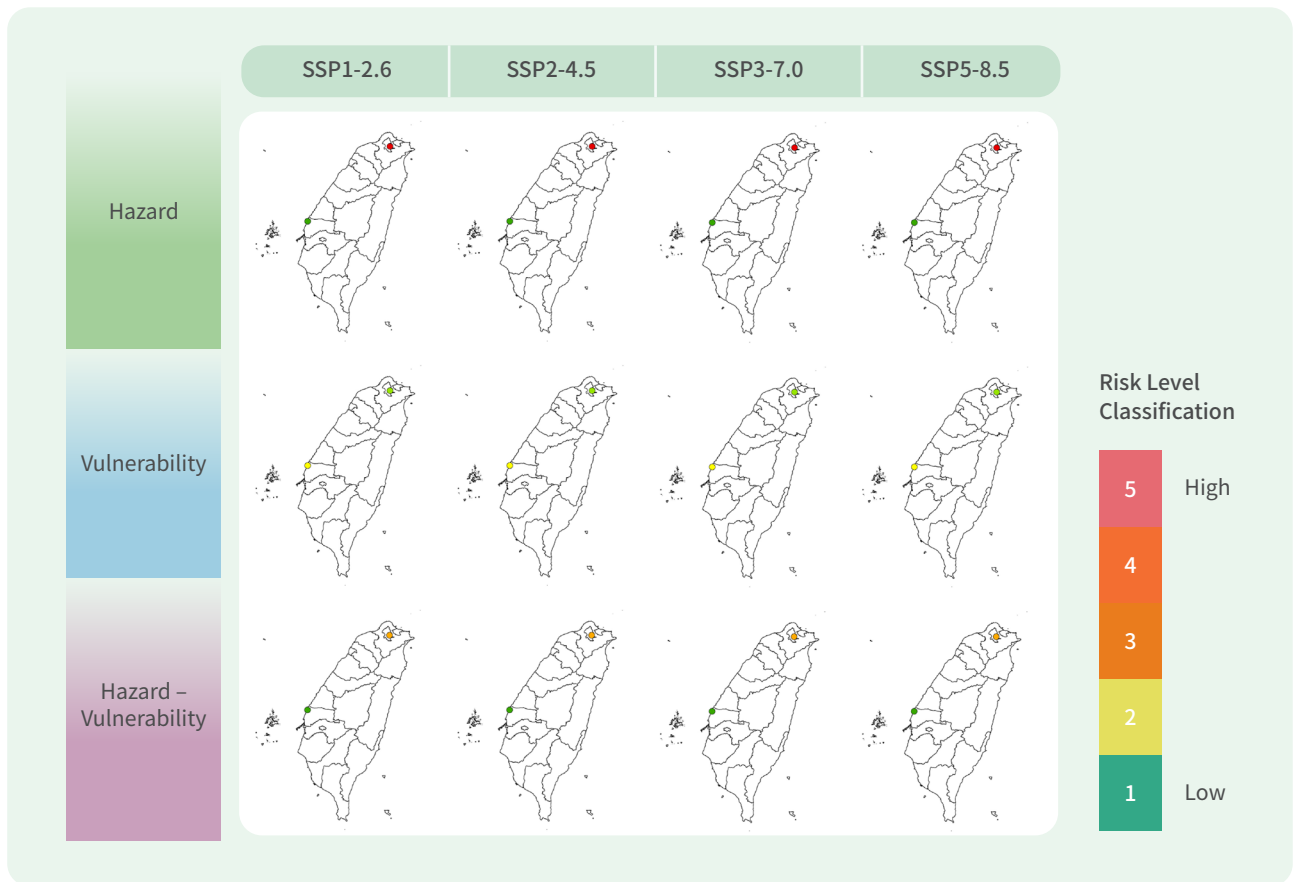
◆ Flood risk scenario simulation summary map



Hazard – Vulnerability



◆ Flood disaster hazard - Vulnerability risk simulation summary map

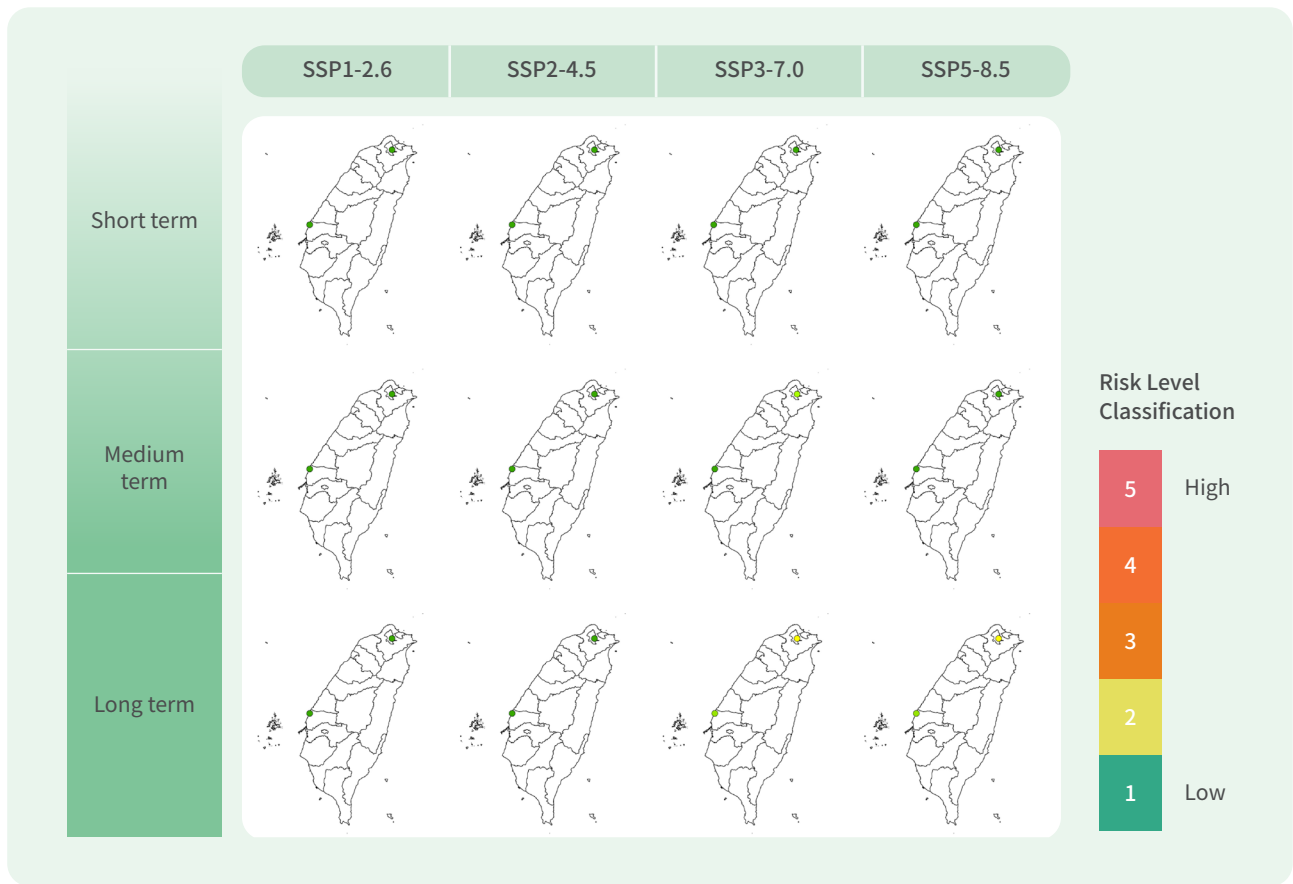


◆ Drought disaster risk simulation summary map



\*According to the reference period used by IPCC AR6, the future period is divided into short-term 2021-2040, medium-term 2041-2060, and long-term 2061-2100.

◆ High-temperature disaster risk simulation summary map



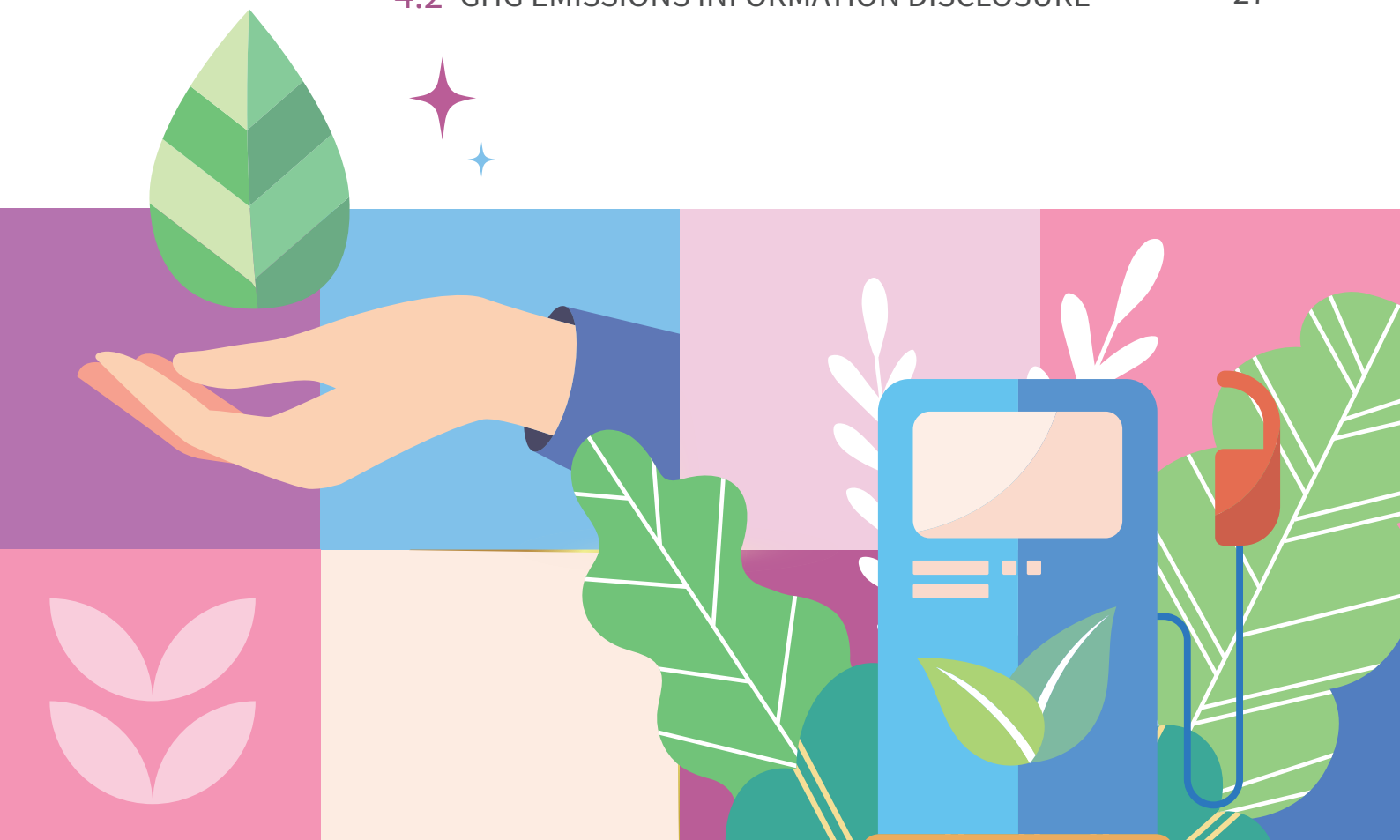
\*Note: According to the reference periods used by the IPCC AR6, the future periods are divided into short-term (2021–2040), mid-term (2041–2060), and long-term (2081–2100).





# CH4 Indicators and Targets

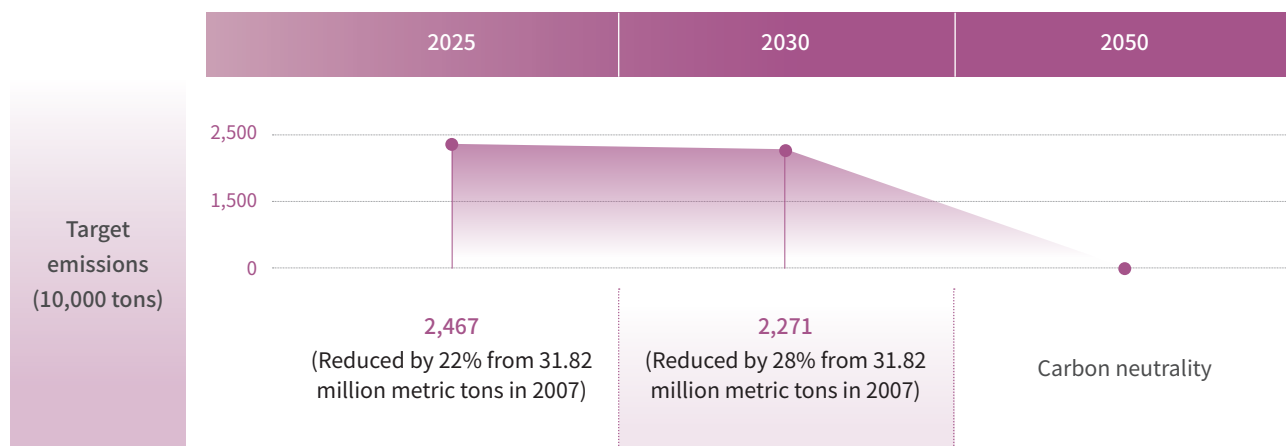
4.1 CARBON NEUTRALITY BY 2050	27
4.2 GHG EMISSIONS INFORMATION DISCLOSURE	27



## 4.1 Carbon neutrality by 2050

To achieve the vision of low-carbon economic transition, FPCC has established the long-term goal of achieving carbon neutrality by 2050 and has also set up the short- and medium-term targets (short-term by 2025 and medium-term by 2030) in order to review the target achievement progress. The timeline and target emissions are shown in the table below:

◆ Table 4.1-1 Short, medium, and long term carbon reduction targets



## 4.2 GHG emissions information disclosure

FPCC has performed GHG inventory inspection in accordance with ISO 14064-1 since 2005, and also entrusts BSI Taiwan to perform relevant verifications. For the disclosure of this report, the 2023 GHG Scope 1 and 2 emissions data has been inspected and verified (expected to be completed in April) as shown in the following table.

◆ Table 4.2-1 FPCC's 2023 GHG emissions status

Plant (metric ton/year)	Scope 1	Scope 2	Total emissions
Mailiao Plant 1	14,322,860	0	14,322,860
Mailiao Plant 2	4,046,892	190,725	4,237,617
Mailiao Plant 3	5,634,889	39,129	5,674,018
Taipei Storage and Transportation Station	9	655	664
Taoyuan Storage and Transportation Station	20	803	823
Changbin Blending Plant	10	586	596
<b>Total</b>	<b>24,004,680</b>	<b>181,692</b>	<b>24,186,372</b>

\*Note: Mailiao Plants 2 and 3 Scope 2 emissions include purchased electricity from Taipower and purchased steam from facilities not registered under the same entity as the Company's. The total is calculated by deducting emissions from steam purchased from facilities not registered under the same entity as the Company's.

In addition to the disclosure of GHG emissions, the Company also calculates the GHG emissions intensity according to the international oil and gas industry benchmark enterprises, in order to explain the decreasing trend of the Company' product unit GHG emissions intensity as the Company continues to promote energy saving, carbon reduction and process improvements of plant sites:

◆ Company's unit product energy GHG emissions (kg of CO<sub>2</sub>e/KWH)



Since 2019, the Company has inspected the relevance and the emissions data of Scope 3 annually, and such data has been verified by a third party (please refer to Table 4.2-2 for details). The 2023 GHG Scope 3 emissions are still under inventory inspection before the publication of this report (expected to be completed in September), and the 2022 Scope 3 data is disclosed in this report.

◆ Table 4.2-2 Scope 3 emission indicator information in 2022

Scope 3 Emission Source	Relevance	Emissions (metric ton of CO <sub>2</sub> e)	Calculation Scope
Products and services purchased	Relevant and counted	6,965,530	The scope of this inventory is the emissions from the first-tier raw material suppliers' manufacturing, covering 100% of the main raw material suppliers.
Capital goods	Relevant and counted	18,318	The scope of this inventory covers 100% of capital goods in 2022.
Fuel and energy-related activities (not included in Scope 1 or 2)	Relevant and counted	1,218,845	The scope of this inventory covers 100% of fuel and energy activities not included in scope 1 or 2, such as coal, pyrolysis low sulfur fuel oil, and natural gas, as well as energy extraction and transport activities.
Upstream transportation and distribution	Relevant and counted	6,553,088	The scope of this inventory covers 100% of emissions from the first-tier raw material suppliers' transport activities.
Business waste output	Relevant and counted	11,241	The scope of this inventory covers 100% of the emissions from the disposal of business waste.
Business trips	Relevant and counted	23	The scope of this inventory covers 100% of the emissions from business trips by air.
Employee commuting	Relevant and counted	696	The scope of this inventory covers 100% of the emission from transportation services of vehicles used for employee commuting.
Upstream asset leasing	Irrelevant	-	FPCC does not engage in upstream asset leasing activities.
Downstream transportation and distribution	Relevant and counted	1,817,759	The scope of this inventory covers 100% of products shipped to main clients.
Processing of sold products	Relevant and counted	4,301,487	The Company's products are usually upstream products. FPCC has identified that for the existing products of naphtha, gasoline, diesel, aviation fuel, and base oil, the products of naphtha and base oil are used in products of the value chains of food, medical care, agriculture, automobiles, and consumer goods. For example, we have more than 20,000 different clients in different areas for our products, and these clients have very different GHG emissions status. Clients also further sell their products to a greater variety of end users. Gasoline, diesel, and aviation fuels are used in mobile transportation. After identification, gasoline, diesel, and aviation fuels are used in automobiles, scooters, and airplanes. There are no GHG emissions from the processing of sold products. Naphtha is processed into other products after being sold, and the types of processes are also diverse, such that they cannot be identified and statistically counted. The base oil is mainly reprocessed into lubricating oil, and the carbon emissions from the processing of sold products are mainly based on the carbon emissions from the processing of base oil into lubricant oil.

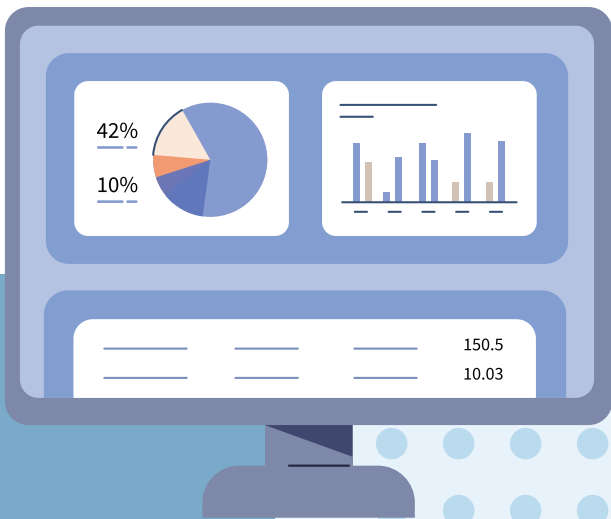
Scope 3 Emission Source	Relevance	Emissions (metric ton of CO <sub>2</sub> e)	Calculation Scope
Use of products sold	Relevant and counted	37,024,763	The Company's products are usually upstream products. FPCC has identified that for the existing products of naphtha, gasoline, diesel, aviation fuel, and base oil, the products of naphtha and base oil are used in products of the value chains of food, medical care, agriculture, automobiles, and consumer goods. For example, we have more than 20,000 different clients in different areas for our products, and these clients have very different GHG emissions status. Clients also further sell their products to greater variety of end users. Gasoline, diesel, and aviation fuels are used in mobile transportation. After identification, gasoline, diesel, and aviation fuels are used in automobiles, scooters, and airplanes. There are no GHG emissions from the processing of sold products. Naphtha is processed into other products after being sold, and the types of processes are also diverse, such that they cannot be identified and statistically counted. The base oil is mainly reprocessed into lubricating oil, and the carbon emissions from the processing of sold products are mainly based on the carbon emissions from the processing of base oil into lubricant oil.
Final disposal of products sold	Irrelevant	N/A	The Company's products are usually upstream products. FPCC has identified that for the existing products of naphtha, gasoline, diesel, aviation fuel, and base oil, the products of naphtha and base oil are used in products of the value chains of food, medical care, agriculture, automobiles, and consumer goods. The range is too wide to quantify the emissions associated with the disposal of the end products.
Downstream asset leasing	Irrelevant	N/A	FPCC does not engage in downstream asset leasing activities. None of the downstream assets leased generated additional GHG emissions in 2022.
Franchising	Irrelevant	N/A	FPCC does not have franchise rights.
Investment	Irrelevant	N/A	Investments are mostly in specific product innovation activities with limited impact. As a result, we are of the opinion that this Scope 3 category is irrelevant.
Others (upstream)	Irrelevant	N/A	FPCC has not considered other relevant upstream GHG emission sources in the assessment of GHG emission sources.
Others (downstream)	Irrelevant	N/A	FPCC has not considered other relevant downstream GHG emission sources in the assessment of GHG emission sources.
Total emissions (tonCO <sub>2</sub> e)			57,911,750





# Appendices

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## Report management

- ◆ This report covers the period from January 1, 2023 to December 31, 2023.
- ◆ Preparation frequency of this report Annually.
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## TCFD Report Index (to be drafted at the end)

Themes	TCFD Recommended Disclosure	Corresponding Pages
Governance	Describe the board's oversight of climate-related risks and opportunities.	P4-P5
	Describe management's role in assessing and managing climate-related risks and opportunities.	P4-P5
Strategy	Describe the climate-related risks and opportunities the organization has identified over the short, medium, and long term.	P7-P9
	Describe the impact of climate-related risks and opportunities on the organization's business, strategy, and financial planning.	P18-P21
	Describe the resilience of the organization's strategy, taking into consideration different climate-related scenarios, including a 2° C or lower scenario.	P22-P25
Risk Management	Describe the organization's processes for identifying and assessing climate-related risks.	P11-P13
	Describe the organization's processes for managing climate-related risks.	P11-P13
	Describe how processes for identifying, assessing, and managing climate-related risks are integrated into the organization's overall risk management.	P16-P17
Metrics and Targets	Disclose the metrics used by the organization to assess climate-related risks and opportunities in line with its strategy and risk management process.	P28
	Disclose Scope 1, Scope 2, and if appropriate, Scope 3 greenhouse gas (GHG) emissions, and the related risks.	P27,P29-P30
	Describe the targets used by the organization to manage climate-related risks and opportunities and performance against targets.	P27-P30



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