

2021 TCFD

Formosa Chemicals & Fibre Corporation Task Force on Climate-Related Financial Disclosure (TCFD) Report



CONTENTS

Preamble	2
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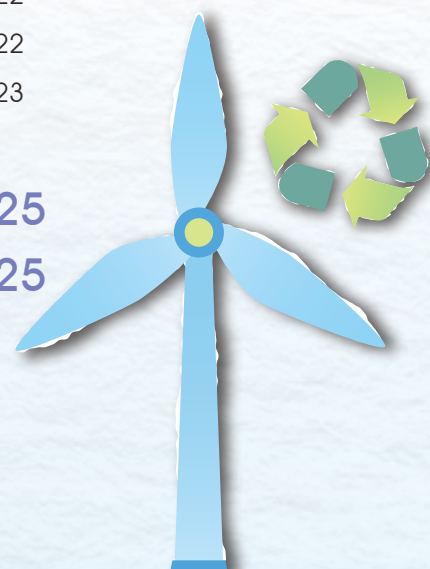
1 Governance	3
1.1 Company introduction	3
1.2 Organizational boundaries	6
1.3 Organization and responsibilities	6

2 Management of Climate Change Risks and Opportunities	7
2.1 Risk and opportunity identification process	7
2.2 Table of the impact of risks and opportunities on the Company	11
2.3 Impact of risk issues on finance	13
2.4 Analysis of climate risk scenarios	17

3 Strategy	19
3.1 Short-term strategies (0–5 years)	19
3.2 Medium-term strategies (6–10 years)	21
3.3 Long-term strategies (11 years and above)	21
3.4 Renewable energy strategy	21

4 Indicators and targets	22
4.1 Targets and indicators	22
4.2 Absolute reduction targets	22
4.3 Information on greenhouse gas emissions	23

Appendices I Report management	25
Appendices II TCFD Index	25



Preamble

Global warming caused by the emission of greenhouse gases 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 risks of climate change, adequately prepared, or taking response actions. This was the reason why the Financial Stability Board (FSB) has assembled a special task force called the Task Force on Climate-related Financial Disclosures (TCFD), which 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 and well-defined assessment framework for disclosing risks and opportunities associated with climate change and for reflecting risks in financial reports.

In response to global trends, Formosa Chemicals & Fibre Corporation ("the Company") 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 capital in line with the Company's responsibilities and strategies to realize our vision toward low-carbon transition.





1.1 Company introduction

The Company was founded in 1965. With the lack of natural fibers due to environmental factors in Taiwan, the Changhua Plant was built to produce pulp and rayon with hardwood and branch wood, along with yarn and dyeing downstream businesses in response to the rapidly growing textile industry. Since 1973, we have successively built factories to make nylon yarn, nylon textured yarn, and nylon fabrics. The Company's textile business includes two major segments: rayon and nylon. As business grew larger, we expanded our manufacturing plants to Longde, Jiaoxi, and Xingang additionally to the Changhua Plant, and have become one of the largest chemical fiber production companies in Taiwan.

To expand the scope of operations and diversify products and business, the Company built a PTA factory in the Longde Plant in 1987 and stepped into the petrochemical industry. We then branched out into the plastics industry by building the PS factory and the ABS factory in 1990 and 1994, respectively. In 1995, the Company participated in the 6th Naphtha Cracker Project and invested in the Aroma, SM, Phenol, PTA, DMF, PS, ABS, PP, PC, and HAC factories in the Yunlin Offshore Industrial Park in alignment with the strategy of the vertical integration of the upstream and downstream petrochemical raw material businesses. The products cover petrochemical midstream raw materials, general-purpose plastics, and engineering plastics. After more than 50 years of endeavor, we have developed into an enterprise spanning petrochemical and plastic raw material production with upstream and downstream production entities in the textile industry. The Company's profile and corporate governance structure are shown in Figures 1.1-1 and 1.1-2.

To cope with the potential risks and impacts of climate change, the Company has referred to the TCFD recommendations released by the Financial Stability Board (FSB) in 2020 to identify and manage climate change risks and opportunities and released the TCFD report starting in 2022. In addition, we participated in the CDP's climate change questionnaire from 2018 to 2021 and were rated A- and A. The ratings over the years are as follows, and we will continue to participate in the questionnaire in the future, enabling global investors to understand the Company's achievements in addressing global climate change issues.

We seek the balance among social prosperity, environmental conservation, and sustainable development. The Company's business philosophy of "giving what we have taken from society back to society" also aligns with this idea. To achieve sustainable development of both the environment and enterprises, the Company is committed to the implementation of a circular economy by using the least resources and the best facilities. We have also been engaged in a number of ESG events. Figure 1.1-3 lists the important events related to the Company's promotion of ESG, indicating our efforts in environmental sustainability. As a matter of fact, we will invest more in social prosperity, environmental protection, and corporate sustainable development in the future.

Figure 1.1-1 Overview of the Company

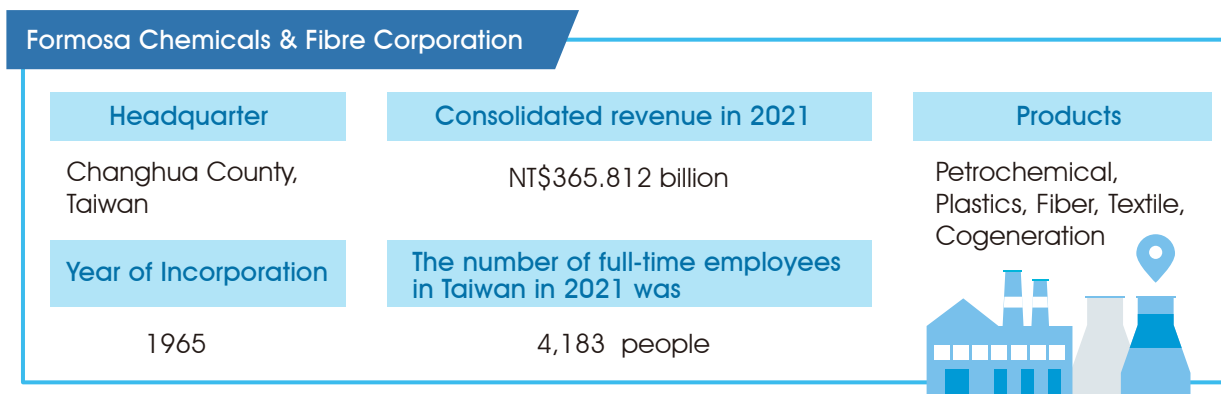


Figure 1.1-2 Corporate governance structure

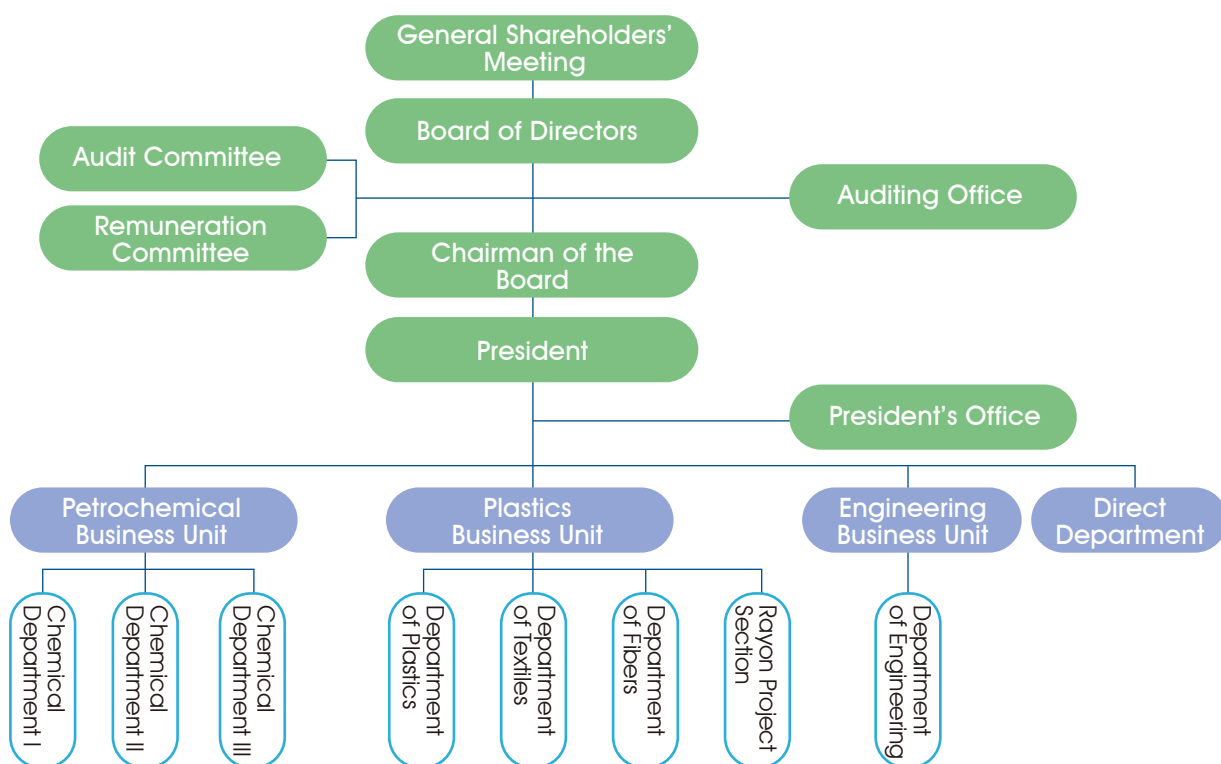
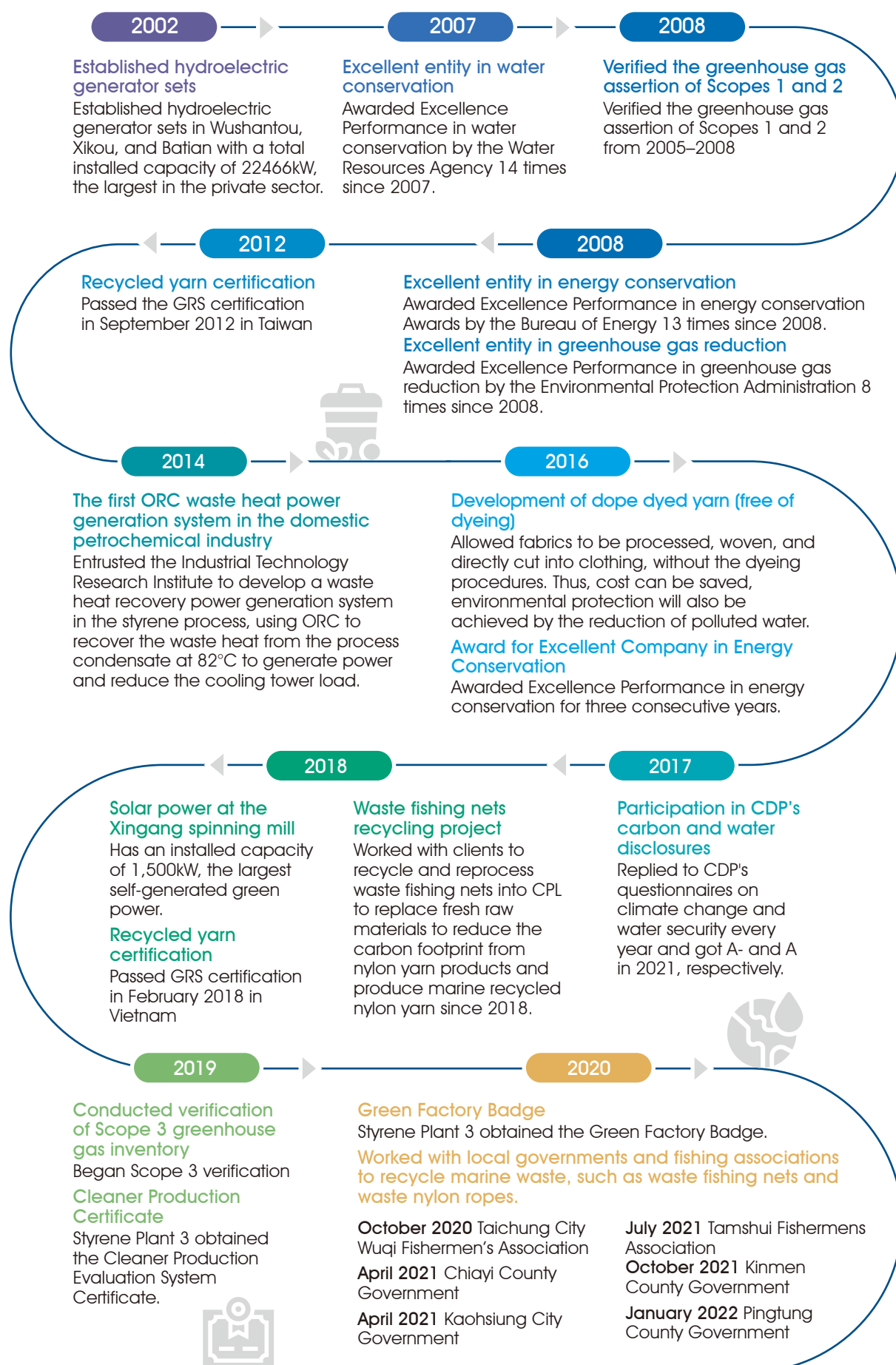


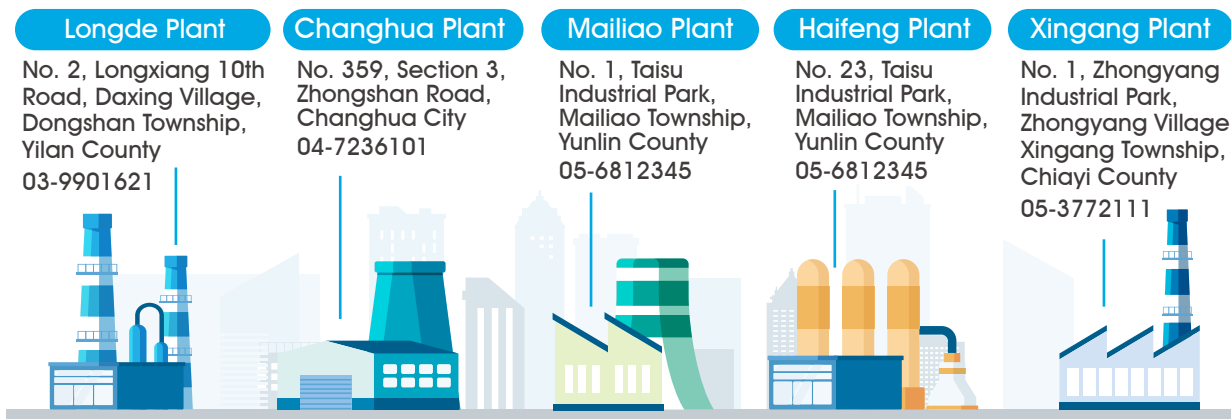
Table 1.1-1 CDP scores over the years

Year	2018	2019	2020	2021
Questionnaire scores				
Climate change questionnaire	A-	B	A-	A-
Water security questionnaire	B	A-	A	A

Figure 1.1-3 The Company's major ESG promotion events



1.2 Organizational boundaries



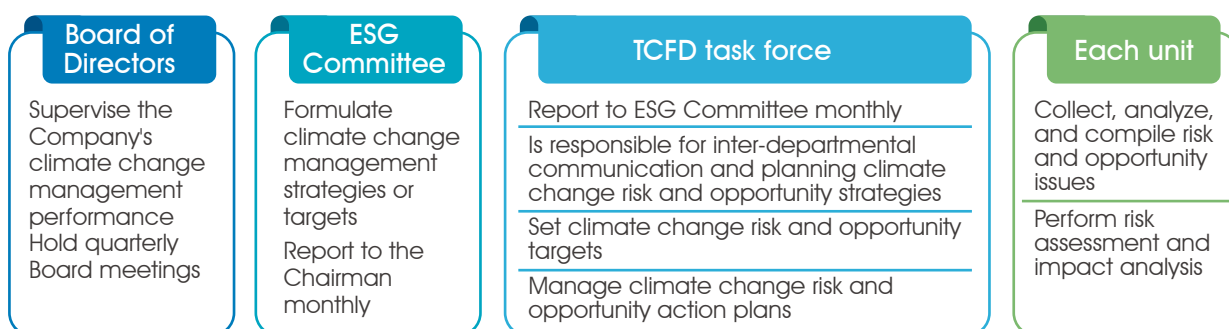
1.3 Organization and responsibilities

The work distribution regarding climate change issues are shown in the figure below. The Board of Directors is in charge of the Company's effective management and strategy of ESG risks and opportunities, who discuss the implementation of the ESG report at least once a year. The ESG Committee manages, maintains, and reviews policies regularly to manage climate-related risks.

The TCFD task force under the ESG Committee formulates short, medium, and long-term strategic plans for climate change risks and opportunities and compiles corresponding action plans. The representative of each unit is responsible for collecting and identifying climate change risks and opportunities, putting forth corresponding action plans, and regularly providing information to the TCFD task force. The TCFD task force compiles the TCFD risks and opportunities and the achievement of targets on a monthly basis. "The Digital and Energy Transition Task Force" is responsible for tracking the progress of the plans through the monthly "Energy Conservation and Emission Reduction Circular Economy Meeting" and the "ESG Promotion Meeting", while reporting to the ESG Committee. The ESG Committee then reports to the Board of Directors after compiling the materials.

TCFD risks and opportunities include physical risks and transition risks. The division of labor for risk and opportunity identification is illustrated in the figure below. The President's Office, along with the Safety and Health Department, collect and provide related information to each functional unit on a monthly basis, for the purpose of identifying climate change risks and opportunities and developing relevant countermeasures.

Figure 1.3-1 TCFD organizational structure



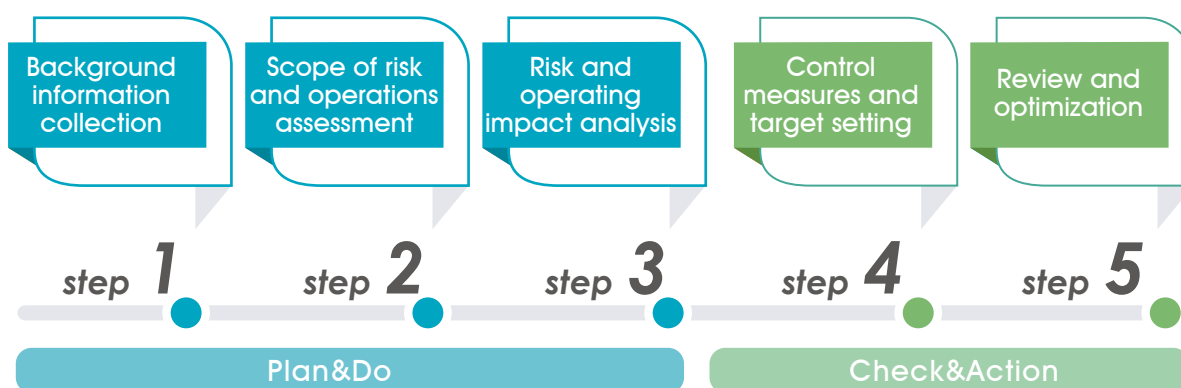
2 Management of Climate Change Risks and Opportunities

2.1 Risk and opportunity identification process

With respect to the climate change risk identification method, we follow the Recommendations of the Task Force on Climate-related Financial Disclosures (June 2017), thus taking the transition risks (Policy and Legal/Market/Technology/Reputation risks) and the physical risks (chronic and acute risks) into consideration when devising risk scenarios. Meanwhile, we provide risk descriptions for potential events, including the degree of financial impact, impact duration (short, medium, long), parties in the value chain impacted, and risk likelihood. As for the opportunity scenario, resource efficiency, energy, products and services, markets, and adaptability are taken into account. Opportunity descriptions will also be made, including the degree of financial impact, impact duration (short, medium, long), parties in the value chain impacted, and risk likelihood.

Therefore, in order to identify the risks and opportunities related to climate change and implement our corresponded measures within the Company, we established the Digital and Energy Transition Task Force. The climate change risk issue analysis process is shown in the figure below.

Figure 2.1-1 Climate change risk issue analysis process



The Digital and Energy Transition Task Force identifies environmental risks and opportunities each year. A list specifies the person responsible for collecting data of each risk category. Risks and opportunities that are expected to influence for less than 10 years will join the regular planning procedure, while those expected to influence over 10 years will be reported by the Chairman to the Board to set a specific strategy in correspondence. The Company's Digital and Energy Transition Task Force is responsible for tracking the progress of the plans through the Monthly Energy Conservation and Emission Reduction Circular Economy Meeting.

Each production divisions and the Safety and Health Department adopt a risk and opportunity matrix in the ISO 14001 environmental review guidelines to identify and evaluate the risks and opportunities related to climate change. The identified internal and external issues can be classified into physical risk and transition risk, including climatic risks, environmental policies and regulations, market risk, transportation and logistics, energy supply, reputation, and technology development.

2

Moreover, due to the increasing impact of the ever-changing internal and external environments, which poses certain threats to the enterprise, the Company aims to minimize the impact of each risk. Defects in risk management can be reported to the Company's Audit Office, independent directors, or the Board of Directors. Each risk department self-evaluates the performance of the identification and mitigation of risks, while the President's Office evaluates and offers them guidance to their performance afterwards.

Figure 2.1-2 Division of labor of climate change risk identification

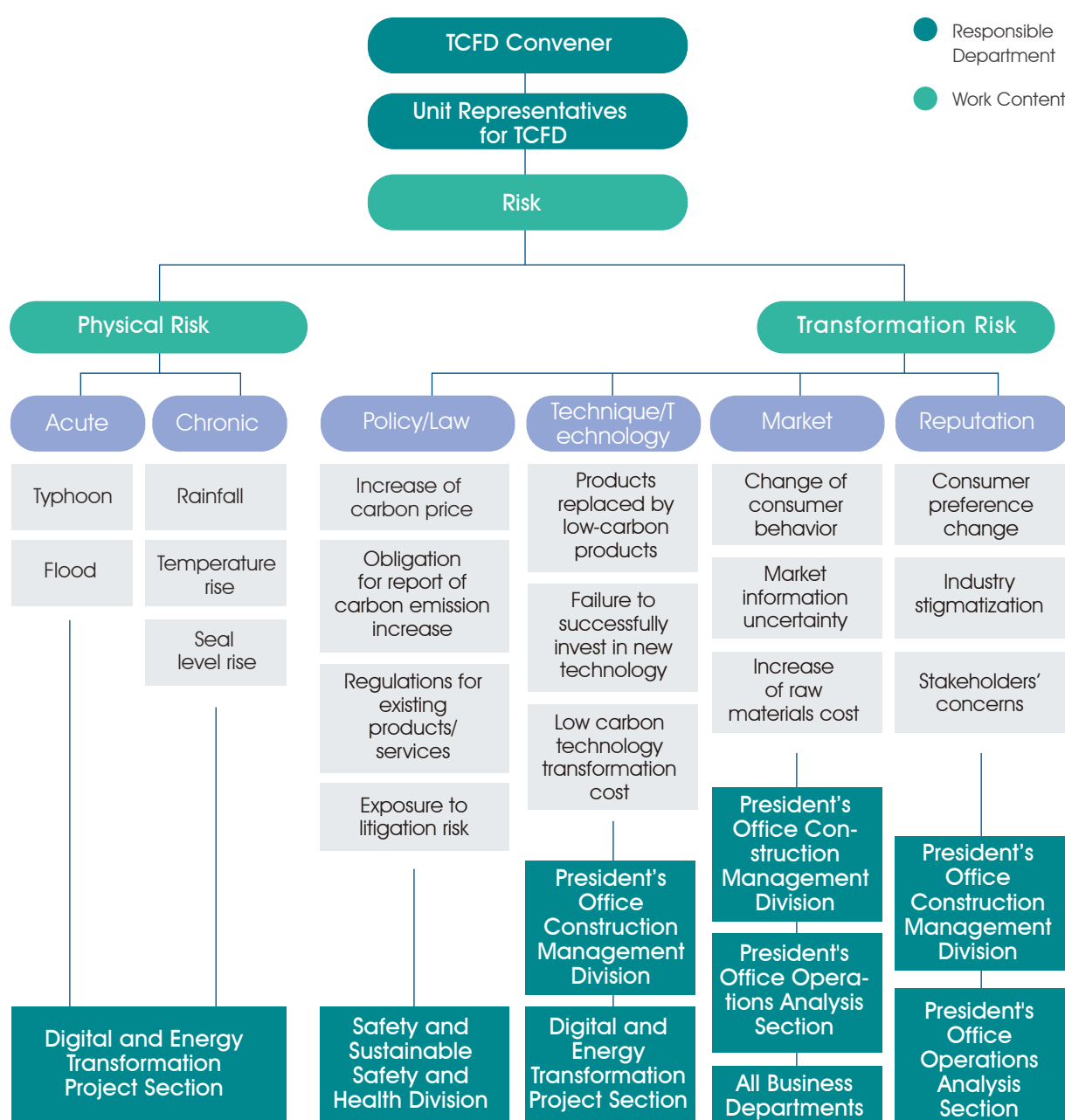
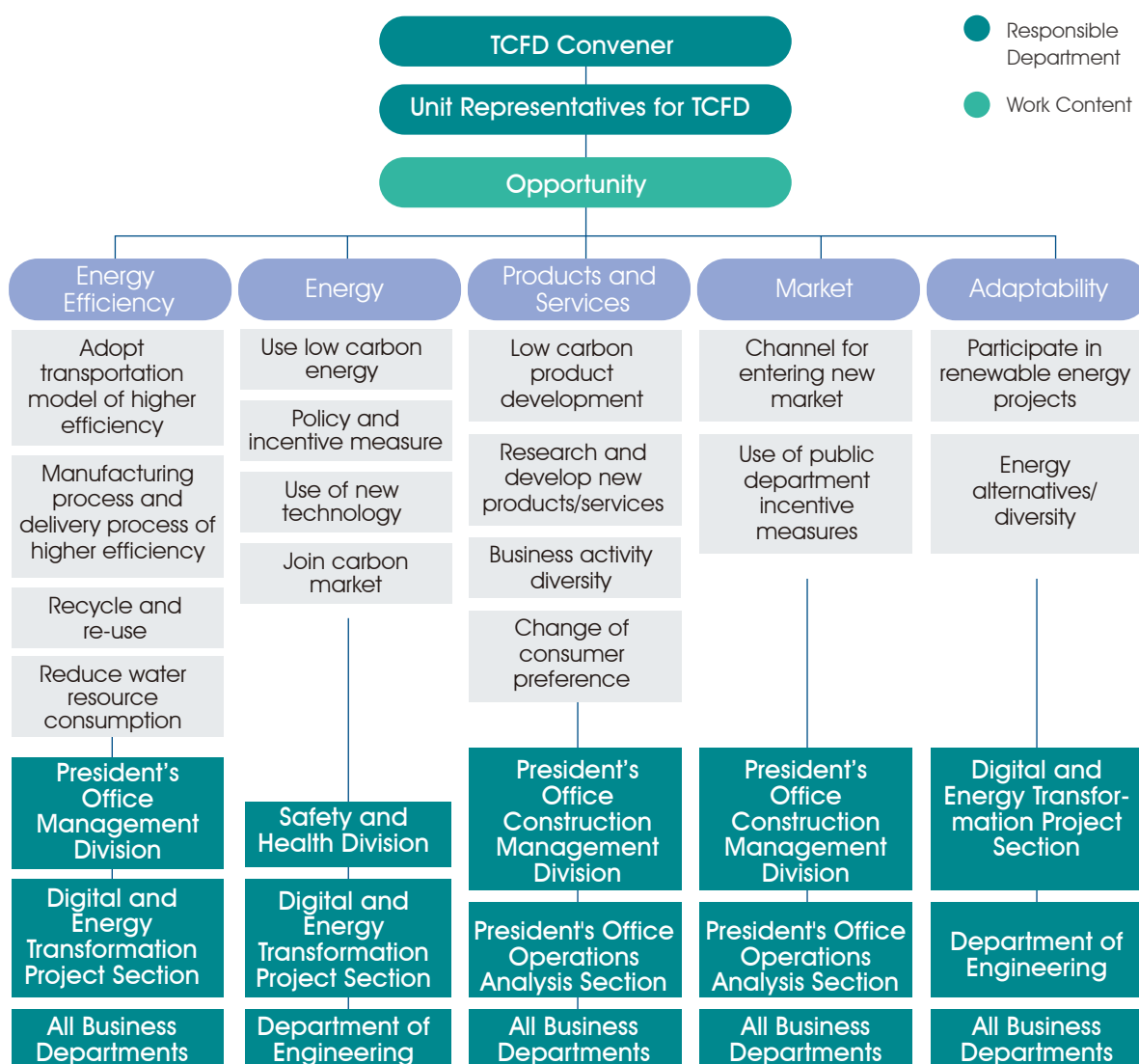


Figure 2.1-3 Division of labor of climate change opportunity identification



We consider the likelihood of each risk and opportunity, the degree of impact, and other factors while filling the risk and opportunity matrix, and split the severity and likelihood of the financial impact into five levels. Eventually, the financial impact should be weighted by likelihood, forming the risk matrix as follows:

Figure 2.1-4 Climate change financial impact and likelihood matrix

Amount					
NT\$300 million	5	10	15	20	25
NT\$180 million	4	8	12	16	20
NT\$120 million	3	6	9	12	15
NT\$60 million	2	4	6	8	10
NT\$10 million	1	2	3	4	5
	<20%	20%~50%	50%~75%	75%~95%	>95%
	Probability of Occurrence				

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When assessing climate risks, financial impact over NT\$1 million as will be defined as a physical impact.

The results of the above risk and opportunity matrix were classified as follows:

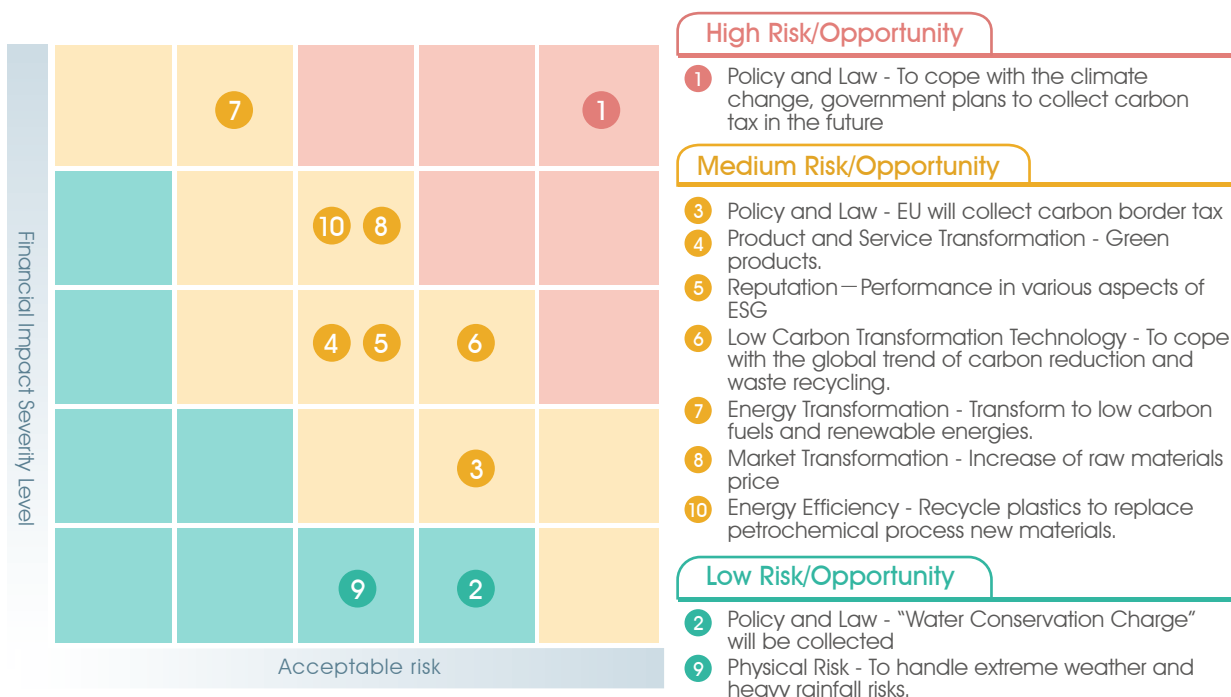
- i. A score of 1–4 points is defined as low risk: It is an acceptable risk.
- ii. A score of 5–14 is defined as moderate risk: No action is required at the moment, yet changes should be closely monitored.
- iii. A score of 15–25 is defined as high risk: Corresponding management plans is prioritized, and performance should be tracked.

Figure 2.1-5 Climate change risk matrix



After assessment, a risk and opportunity matrix was formed, shown as the figure below:

Figure 2.1-6 Risk and opportunity matrix



2.2 Table of the impact of risks and opportunities on the Company

Types of risk recommended by the TCFD	Relevance and inclusivity	Impact of risks and opportunities on the Company
Existing regulations	Relevant and inclusive	The Environmental Protection Administration (EPA) announced the launch of the Greenhouse Gas Reduction and Management Act on July 1, 2015. Since the Company belongs to “plants(factories) that emit more than 25,000 metric tons of carbon dioxide by direct emissions from the combustion of fossil fuels” noted in Article 16, paragraph 1, it is required to develop and record greenhouse gas inventory every year. The Company's greenhouse gas emission amounts to approximately 8 million tons per year, which is far greater than 25,000 tons of CO ₂ e. If carbon should be priced, it will account for NT\$800 million, posing a high risk to the Company. Therefore, the existing climate-change-related laws and regulations are very relevant to the Company and should be always considered during risk assessment. The Company's Safety and Health Department tracks the latest progress on a monthly basis.
Emerging regulations	Relevant and inclusive	With regard to the existing regulatory risks, for the Renewable Energy Development Act, main electricity users with a contracted capacity of more than 5000kW need to establish renewable energy power generation facilities or purchase renewable energy certificates. If the Company's cogeneration plant cannot undertake an energy transition project in the near future, we are bound to fail to achieve the targets set by the government. We will surely purchase renewable energy certificates, which will result in an expenditure of NT\$100 million; thus, it is a moderate risk. Therefore, emerging climate change-related regulations are very relevant to the Company and are always included in the risk assessment.
Technology	Relevant and inclusive	With regard to design and development, the Company includes international low-carbon green trends, circular economy, zero waste, and UN Sustainable Development Goals (SDGs) in the risk and opportunity assessments. We identify risks through the risk-opportunity matrix and collect and update information regularly. The Company believes that a circular economy will lead to new technologies, which will impact products and affect the Company's business development. For example, apparel consumers have begun to realize the importance of the circular economy in recent years, and competitors have begun to invest in the development of recycled fibers. The Company has evaluated the development of recycled fibers and begun research on the recycling of nylon particles with clients. In 2018, we identified the technology of using waste fishing nets to make nylon particles, which can significantly reduce the carbon footprint of products. We aim to increase production from 750 to 1250 tons per month in the period of 2022 to 2025. It is perceived as a medium level of opportunity. Successful development of the green product has reduced the risk arising from technology.
Litigation	Relevant and inclusive	With regard to the environmental policy, the Safety and Health Department should collect and update information on all existing regulations, emerging regulations, and international initiatives and regulations related to climate change on a monthly basis. The Company incorporates the litigation cases collected into the risk and opportunity assessments, to identify the degree of risk impact to plan response strategies and action plans through the risk-opportunity matrix. The Company's legal department monitors all lawsuits. There were two lawsuits related to climate change. The legal risks caused by climate change are not strongly relevant for the time being. According to the past experience, different disputes will arise due to the standards and regulations under the future greenhouse gas reduction and management regulations. The Company may file lawsuits to strive for rights and interests if necessary, so lawsuits are included in the risk assessment. However, such risks may be considered in the emerging risks category, and prevention measures will be formulated.

Types of risk recommended by the TCFD	Relevance and inclusivity	Impact of risks and opportunities on the Company
Market	Relevant and inclusive	<p>With regard to design and development, each production department and the President's office should collect and update all trends and issues related to product design and development, raw materials, market, business, process technology, which will then be compiled by the Safety and Health Department. The Company includes the market trends collected in the risk and opportunity assessments. We identify the existence of each risk through the risk-opportunity matrix.</p> <p>The Company belongs upstream of the plastics industry supply chain. As the international demand for green products increases, the Company is also requested by clients to provide products with low carbon emissions. To maintain the market share, the Company should invest in the research and development (R&D) of low-carbon products. Therefore, market risks are relevant to the Company and are taken into consideration.</p>
Reputation	Relevant and inclusive	<p>With regard to reputation, including corporate image and negative attention from stakeholders, the Company will include the collected media information that affects the Company's reputation in the risk and opportunity assessments. We identify the existence of each risk through the risk-opportunity matrix.</p> <p>Since the great impact of climate change, which can be ascribed to the greenhouse effect, is caused perhaps not only yet most significantly by the side effects of producing petrochemical energy, Environmental groups have raised questions about the greenhouse gas emissions from the plastics industry, which will affect the Company's reputation, and the negative perceptions of the public will indirectly affect investors' willingness. Local governments misunderstand that the petrochemical industry is an energy-intensive industry that produces large amounts of greenhouse gas emissions, aggravating climate change. Government agencies have become more stringent in reviewing investment plans related to the petrochemical industry, so the businesses in this industry are unable to invest in new technologies and new equipment to improve production efficiency, affecting industrial competitiveness.</p> <p>Therefore, reputational risks are relevant to the Company and should be taken into account.</p>
Acute physical	Relevant and inclusive	<p>As per the climate data collected by the Safety and Health Department, it was discovered that there were eight typhoons from 1970 to 1994 and 16 typhoons from 1995 to 2017, indicating that the frequency of typhoons with extreme torrential rains is becoming higher. In 2009, the accumulated precipitation of Typhoon Morakot within 24 to 48 hours was close to the world precipitation record. Affected by typhoons with extreme torrential rains, the quality of the Company's water sources contains a great deal of sediment, which is no longer feasible for production. The Company should consider reducing production or purchasing clean water from other cities or counties, which will result in a decrease in our revenue or an increase in our operating costs. Therefore, actual acute risks are relevant to the Company and taken into account.</p>
Chronic physical	Relevant and inclusive	<p>Data and information regarding natural disasters, including extreme weather and other chronic physical risks, is collected and updated by the Safety and Health Department. Physical risks are taken into account during the risk and opportunity assessments. We identify the existence of each risk through the risk-opportunity matrix.</p> <p>The greenhouse effect has shortened winter and lengthened summer in Taiwan while raising the average summer temperature to 37 °C above at present since 2017. Under the extended summer with rising temperatures on average, chillers in the Company's plants are operated for longer hours at lower cooling efficiency, which increases power consumption and operation costs. The conditions of process equipment are also affected by the high temperature. Therefore, chronic physical risks are relevant to the Company should be concerned.</p>

2.3 Impact of risk issues on finance



Low risk/Opportunity



Medium risk/Opportunity





High risk/Opportunity

Climate Issues	Impact analysis	Level of risks/opportunities
Potential impact on company/organization	Issue category	Risk level
Current risk or opportunity analysis		
<p>The EPA has formulated the Greenhouse Gas Reduction and Management Act (renamed the Climate Change Response Act), which is the main domestic regulation regulating the enterprises' reduction of greenhouse gases. In the identification of "environmental policy" risk, the financial impact is estimated as per the existing Greenhouse Gas Reduction and Management Act.</p> <p>The "National Climate Change Action Guideline" and the "Greenhouse Gas Reduction Management Act" specify Taiwan's long-term greenhouse gas reduction targets and establish a total greenhouse gas emission control and allocation method for manufacturing departments, regulating the emission intensity for different industries and the establishment of a carbon trading system.</p> <p>In response to the above regulatory requirements, the Company has to reduce the greenhouse gas emissions from the processes, so we may have to purchase emission amounts, and energy bills will rise, causing our production costs to go up. If we want to maintain product price competitiveness, we may not be able to transfer these carbon costs, which will cause a material financial impact.</p> <p>In addition, EPA controls companies that emit more than 25,000 tons of CO₂e. It is estimated that a carbon fee will be levied in 2024 at NT\$100–300/ton as per the draft. The Company's annual emissions exceed eight million tons. We are one of the first groups of businesses to be put under control. It is estimated that the Company will be required to pay carbon fees in 1–3 years. Based on the trial calculation of carbon emissions in 2021, it is estimated to operating costs will increase by 0.37%–1.12%.</p>	Transition risk/ Policy and law	 High risk/ Opportunity
<p>In May 2016, the government announced the amendment to the "Water Act" to levy a "water consumption fee" on major water users with monthly water consumption of more than 1,000 m³. The six major conditions for fee reduction include meeting the required recycling rate of the plant-wide process water, passing the cleaner production assessment, passing the water footprint assessment of the ISO (International Organization for Standardization), obtaining the green factory or green building label, winning the Excellence Award at the Water Conservation Awards by the Water Resources Agency, cooperating with the government's domestic sewage recycling policy, and paying the sewage fee. The Company is a major water user, with monthly water consumption of more than 1,000 m³. 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. Therefore, water is important to the Company. The Company consumes about 16 million tons of water during the dry season (January to April and November to December), and NT\$1.5 is charged per ton of water consumed as the water consumption feet (before 2024), which will result in an increase by NT\$24 million in our operating costs.</p>	Transition risk/ Policy and law	 Low risk/ Opportunity
<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. The Company's current export products are not included in the scope of the levy, in which VCM, PVC, phenol, and acetone are set out in the product emission standards under the Commission Implementing Regulation (EU) 2021/447. 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. We will continue to pay attention to the latest development.</p>	Transition risk/ Policy and law	 Medium risk/ Opportunity

Climate Issues	Impact analysis	Level of risks/opportunities
Potential impact on company/organization	Issue category	Risk level
Current risk or opportunity analysis		
<p>The design and development category of the climate change risk and opportunity identification includes risks arising from product design and development, raw materials, market, business, and process technology.</p> <p>The Company provides products to many clients, and the number of clients who require eco-friendly products continues to increase. Therefore, if the product life cycle and product value chain are considered, high-carbon products will have an impact on the Company.</p> <p>At present, the Company's main clients include HP, Google, and other brand companies, as well as upstream and downstream clients, including Nan Ya Plastics Corporation and Formosa Petrochemical Corporation. The sales to the above-mentioned clients account for more than 16% of the Company's annual revenue. Nan Ya Plastics Corporation and Formosa Petrochemical Corporation requested the Company to conduct a Scope 3 carbon footprint inventory in 2017 and requested the Company develop low-carbon products or provide more low-carbon products in 2018. HP, Google, and other brand companies required low-carbon products containing post-consumer recycled (PCR) content. If the Company fails to meet its demand for low-carbon products, it will affect the number of orders received or we may lose our competitive advantage. Therefore, we actively invest in the R&D of green products and have completed the inventory of carbon footprint of 26 products, while providing the data to clients for reference. It is estimated that the percentage of green products in our revenue will increase by 1% in 2021. Based on the target revenue of NT\$189,331,869,000, the estimated annual revenue is NT\$1.89 billion per year. In the future, we will continue to carry out research on the improvement of energy efficiency and reduction of emissions in the processes and produce and develop low-carbon products.</p>	Transition risk/ Technology	 Medium risk/ Opportunity
<p>As ESG goes viral in recent years, institutions take ESG performance into account while making risks assessment of investments and loans, since ESG performance may affect a company's business reputation. Therefore, financial institutions may require higher interest rate, or even refuse to offer loans to entities with high carbon emissions. The Company perceives bad reputation and prohibition on coal as urgent and high-level risks.</p>	Transition risk/ Reputation	 Medium risk/ Opportunity
<p>To build up supply chain resilience, we review the types of alternative raw materials (including biomass raw materials), the increase in the cost for the alternatives, and the resulting new product sales opportunities and the increase in revenue. We use alternative raw materials and biomass energy, such as bio-naphtha and recycled waste plastics, to replace some of the raw materials.</p>	Transition risk/ Technology	 Medium risk/ Opportunity
<p>In the energy supply category in the identification of climate change risks and opportunities, the Company identified the risk of using high carbon emission fuel and has planned 20% for renewable energy and 50% for gas in alignment with "A Nuclear-Free Taiwan by 2025". As for the Renewable Energy Development Act - Energy-heavy Industries Clause, the Company cannot carry out energy transition in a short time mainly as the establishment of natural gas storage tanks requires permission from the government and we are unable to establish natural gas storage and transmission facilities in a short time. In addition, we have adopted low-carbon fuels or renewable energy gradually, including the establishment of renewable energy demonstration sites and the ORC power generation response plans. The Works Department will conduct a preliminary assessment of the site and the type of renewable energy. As our plant is located in central and southern Taiwan, the strong sunshine is suitable for establishing solar power generation facilities. After evaluation, the facilities will be established in the Xingang Plant with an estimated installed capacity of 1500KW and a total installed capacity of solar energy of 11,767 kW by 2023. It is estimated that the total installed capacity of hydroelectric generator sets by 2023 will be 22,671 kW.</p>	Transition risk/ Technology	 Medium risk/ Opportunity
<p>In the upstream value chain category in the identification of climate change risks and opportunities, we assessed that the insufficiency of upstream raw material production capacity due to climate change will prompt the prices of raw materials to continue to rise in the future. The plastic raw material is crude oil. Gasoline prices in Europe and the U.S. surged by more than 350% and 120%, respectively, while crude oil prices surged by about 50% in 2021. Goldman Sachs, a financial analysis company, predicted that the price of Brent crude oil would rise from about US\$50 per barrel in 2021 to US\$85 by the end of the year. The Company estimated that raw materials accounted for 80% of the total revenue, and the rise in the prices of raw materials will have a significant impact on the revenue.</p>	Transition risk/ Market	 Medium risk/ Opportunity

Climate Issues	Impact analysis	Level of risks/opportunities
Potential impact on company/organization	Issue category	Risk level
Current risk or opportunity analysis		
<p>The Company's main raw material supplier is Formosa Petrochemical Corporation, which also supplies water to the Company's Mailiao Plant. The amount of raw materials purchased from Formosa Petrochemical accounts for 40–50% of our total raw material purchase amount. Whether Formosa Petrochemical can stably supply raw materials and water to the Mailiao Plant is important to the Company. Therefore, the risk of water resources is assessed to have a potential substantive financial or strategic impact. The main plant of Formosa Petrochemical is located in Mailiao, using water mainly from the Jiji Weir. During the dry season, its allocation of water sources affects the water for agriculture and people's livelihood. If the water is running short, the government will give priority to supplying water for domestic water, which will squeeze the room for water that Formosa Petrochemical can provide the Company with production water. In this case, the Company must purchase industrial water from another water source, resulting in an increase in our operating costs.</p>	Transition risk/ Market	 Medium risk/ Opportunity
<p>Regarding the design and development category in the identification of climate change risks and opportunities, carbon reduction in products became a key technology in response to the international trend. It will be easier for us to adapt to the future market, and the products we produce will be more competitive if we can outperform our competitors in sustainability. Thus, it is a critical part of the Company's assessment of climate risks. The Company's ECT plans a process carbon reduction plan and carries out energy efficiency and emission reduction improvements in the process. Adopting more advanced processes and updated equipment, using high-efficiency inverter motors and multi-functional distillation towers, investing in process improvement, and using low-carbon process equipment or technologies are all the methods adopted by the Company to continue to reduce such risks.</p> <p>In recent years, the sales of nylon yarn products have been declining. Product competitiveness is insufficient, and the sales cannot increase effectively. The Company has conducted a greenhouse gas inventory of the value chain based on the circular economy and worked with clients to recycle and reprocess waste fishing nets into CPL to replace fresh raw materials to reduce the carbon footprint from nylon yarn products and produce marine recycled nylon yarn since 2018. In 2021, the revenue of marine recycled nylon yarn increased by 215.5% compared with 2020, an increase of NT\$93,940,000.</p>	Opportunity/ Products and services	 Medium risk/ Opportunity
<p>In the energy supply category in the identification of climate change risks and opportunities, the Company identified the risk of using high carbon emission fuel and cooperated with the government's "A Nuclear-Free Taiwan by 2025", "renewable energy accounting for 20% of the total power generated by 2025", and "gas-fired power generation", as well as the Renewable Energy Development Act - Energy-heavy Industries Clause. The Company cannot carry out an energy transition in a short time as the establishment of natural gas storage tanks requires permission from the government and we are unable to establish natural gas storage and transmission facilities in a short time; however, we have adopted low-carbon fuels or renewable energy gradually and put forth proposals for the establishment of renewable energy demonstration sites and the ORC power generation response plans. The Works Department will conduct a preliminary assessment of the site and the type of renewable energy. As our plant is located in central and southern Taiwan, the strong sunshine is suitable for establishing solar power generation facilities. After evaluation, the facilities will be established in the Xingang Plant with an estimated installed capacity of 1,500KW and a total installed capacity of solar energy of 11,767 kW by 2023. It is estimated that the total installed capacity of hydroelectric generator sets by 2023 will be 22,671kW.</p>	Opportunity/ Energy	 Medium risk/ Opportunity
<p>Each production department under the Company's organizational structure adopts the Environmental Risk and Opportunity Table in the ISO 14001 environmental management system to identify risks and opportunities and integrate and systematize them. Relevant risks and opportunities include internal and external issues. In the natural environmental disasters - climate and weather category, including energy or resource management, in terms of water resources management, the Company has conducted water resource management since the establishment of the plants. The Company's annual water consumption is about 33 million tons as a major water user defined by the government. To strengthen water resource management, the Company has set a target of reducing the water withdrawal in the process by 2% and increasing the plant-wide recycling rate to over 80% to reduce the operational risks potentially from water resources and optimize the water efficiency.</p> <p>The Company has four plants, namely the Longde, Changhua, Mailiao, and Xingang Plants, and each of the plants consumes a large amount of water, with a plant-wide recycling rate of 90%.</p>	Opportunity/ Resource efficiency	 Medium risk/ Opportunity

Climate Issues	Impact analysis	Level of risks/opportunities
Potential impact on company/organization	Issue category	Risk level
Current risk or opportunity analysis		
<p>The Company is a major water user, with monthly water consumption of more than 6,000 m³. 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, we have continued to invest in the implementation of energy conservation and water consumption reduction projects to reduce costs.</p> <p>Energy conservation and water conservation projects are divided into four categories: electricity conservation, water conservation, steam conservation, and fuel conservation. The wastewater recycling and water reduction improvement, rainwater storage, use, and improvement, cooling water system, refrigeration and air conditioning system improvement, distillation tower optimization and improvement, high- and low-grade energy recovery improvement, steam piping system, equipment thermal insulation and steam trap improvement, combustion rotating equipment improvement including wastewater recovery/ water reduction improvement, rainwater storage and use improvement, cooling water system, and refrigeration and air conditioning system improvement are all measures for water conservation improvement projects, to reduce the dependence on water resources and the risk from water consumption.</p> <p>For example, the wastewater and rainwater recycling in 2021:</p> <p>The Mailliao PTA Plant is equipped with an MBR+RO wastewater recycling system and the Synthetic Phenol Plant is equipped with a UF+RO wastewater recycling system. In 2021, a total of about 1.05 million tons of wastewater was recycled, reducing water consumption by about 3%.</p> <p>The Company recycled about 1.8 million tons of rainwater will in 2021, accounting for 6% of the total water consumption. The recycled wastewater and rainwater led to a 10% decrease in water consumption in 2021.</p>	Opportunity/ Resource efficiency	 Moderate risk/ Opportunity
<p>Clients' awareness of green consumption has increased. The Company continues to invest in the R&D funds to research green products or low-carbon products. Considering the product life cycle and product value chain, we invest NT\$500–600 million in R&D each year to develop low-carbon products, including the reduction of the use of new materials, increase in the use of recycled materials or by-products, process improvement, and reduction of transportation in supply chains, which will improve our product competitiveness, increase our product sales, and enhance our corporate image.</p> <p>Between 2017 and 2020, our investment in R&D was about NT\$2.4 billion. We budget each project annually to continue to invest in R&D. The definition of green products is based on the reduction at each stage of the life cycle. As long as the reduction can be achieved at each stage, a product will be classified as a green product. The green products developed to reduce water consumption between 2017 and 2021 are as follows:</p> <p>Yarn Plant</p> <p>In the textile industry, the problem of wastewater pollution in dyeing and finishing processes has attracted much attention. The use of dope dyed yarns to make finished fabrics reduces wastewater pollution caused by dyeing and finishing. In 2021, the sales of dope dyed yarn were 137.4 tons/month, which could reduce 116 tons of water per ton and save an average of 16,000 tons of water per month.</p>	Opportunity/ Products and services	 Moderate risk/ Opportunity
<p>In the natural environmental disasters - climate and weather category, including risks of energy and resource management, considering the impact of a water shortage caused by abnormal climate events, it is necessary to take relevant water consumption reduction and improvement measures for the processes, or adopt water-saving processes or equipment, which will lead to an increase in the investment cost of improving or updating equipment. The Company's annual water consumption is more than 6,000 m³ per month, about 33 million tons as a major water user defined by the government. As the Company's production requires a large amount of water for process cooling, the quality and quantity of process water are important and highly relevant, if we are unable to reduce the production of each process when water resources are limited, the production load of the process will decrease or the production will be halted in the event of a serious water shortage. With the increasing frequency of typhoons with torrential rains that cause water pollution, if we want to purchase high-quality water or treat the water into usable resources, the operating costs will increase and we will suffer operating losses.</p>	Physical risk/ Acute	 Moderate risk/ Opportunity
<p>In the natural environmental disasters - climate and weather category, including risks of energy and resource management, the recent (2016–2035) climate conditions in RCP4.5 and RCP8.5 (Base period:1986~2005): the maximum days of consecutive rainfall is 7.5 days, 1,078 mm–1,085mm; the total rainfall increases by 15% compared with the average; in the RCP8.5 scenario, the number of typhoons in Taiwan decreases by 15%, the percentage of strong typhoons increases by 100%, and the typhoon rainfall increases by 20%. Considering the impact of strong winds or typhoons caused by abnormal climate events, strong winds or typhoons cause the plant to halt operations to avoid process hazards, and the shutdown will result in a loss of revenue.</p>	Physical risk/ Acute	 Low risk/ Opportunity

2.4 Analysis of climate risk scenarios

As per the TCFD's recommendations, the Company adopts the worst-case scenarios based on the transition and the physical risks, and includes the analysis results in the strategic resilience assessment.

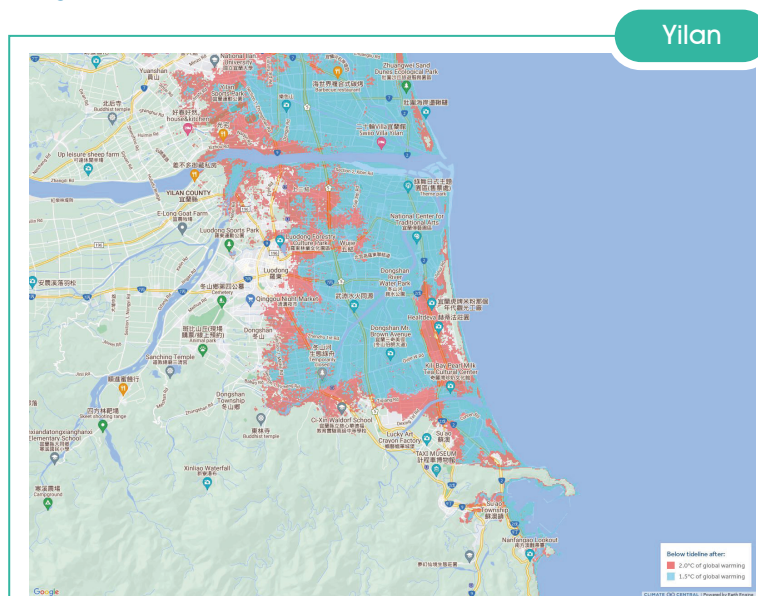
The transition risk refers to the IEA WEO 450 Scenario (2016) and the Nationally Determined Contribution (NDC) target set by each manufacturing site. In Taiwan's Intended Nationally Determined Contribution (INDC) report in 2015, the greenhouse gas emissions are set to be reduced by 50% in 2050 based on the business-as-usual (BAU) scenario. In this scenario, the power generation structure in 2025 will be 20% for renewable energy, 30% for coals, and 50% for gases. After the above scenarios are imported, the impact on the Company is analyzed in terms of market, technology, reputation, finance, and operations in the future.

As for physical risks, with reference to World Bank's Climate Change Knowledge Portal, Taiwan Climate Change Projection Information and Adaptation Knowledge Platform (TCCIP), and National Science & Technology Center for Disaster Reduction, the temperature rise and rainfall between 2020 and 2040 in the scenarios of RCP2.6, RCP4.5, and RCP8.5 are estimated.

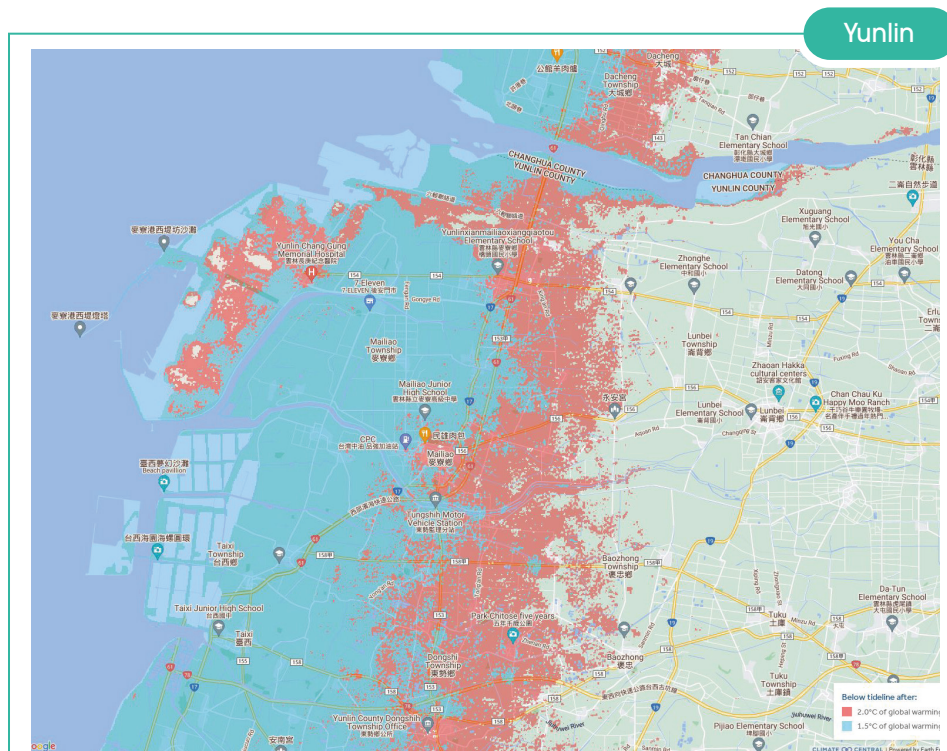
Table 2.4-1 Risk impact on each plant

	Longde Plant	Mailiao Plant	Xingang Plant
Scenario Analysis	Estimates were made using scenarios RCP2.6, RCP4.5, and RCP8.5; risks of extreme weather were evaluated using scenario RCP 8.5		
Rising sea levels	Partially impacted	Impacted	No impact
Below-tidal-line area (risk of flooding)	No impact	Partially impacted	No impact
Area below the 2050 flood line	No impact	Impacted	Partially impacted
Average drought length	2 months	2 months	2 months
Temperature rise °C	2.66 °C	2.59 °C	2.57 °C
Total rainfall	1,085mm	1,085mm	1,085mm
Maximum rainfall intensity	Maximum 7.5 days of consecutive rainfall	Maximum 7.5 days of consecutive rainfall	Maximum 7.5 days of consecutive rainfall

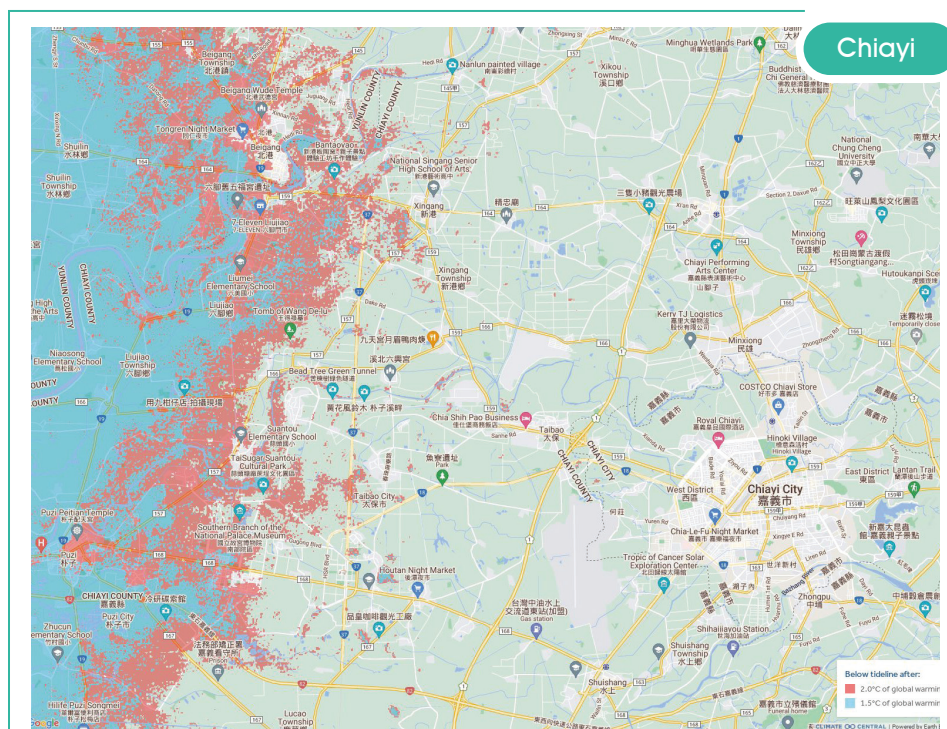
Figure 2.4-1 Simulation of the impact of sea level rise



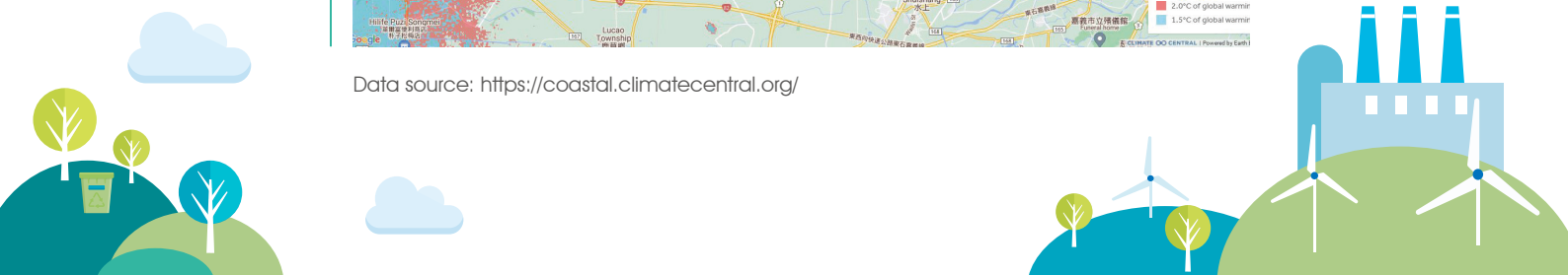
Data source: <https://coastal.climatecentral.org/>



Data source: <https://coastal.climatecentral.org/>



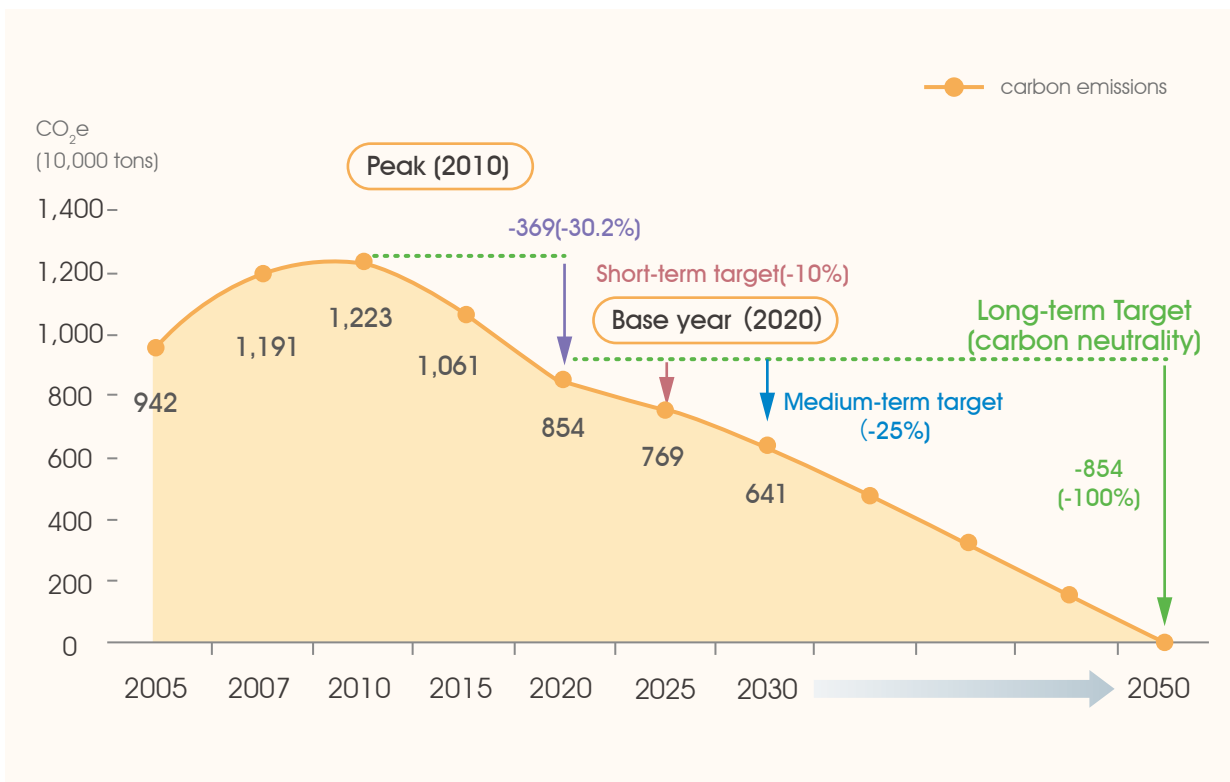
Data source: <https://coastal.climatecentral.org/>



3 Strategy

After analyzing the risks and opportunities of climate change, a carbon reduction strategy is made with the aim to achieve carbon neutrality by 2050, notably under the scenario of temperature rise within 2° C.

Figure 3-1 Targeted level of carbon emissions




3.1 Short-term strategies (0–5 years)

The short-term target is to reduce the greenhouse gas emissions by 10% in 2025 considering 2020 as the base year. Carbon reduction measures in 2025 and 2030 include developing fuel transformation, green electricity, process optimization with AI, and recycling carbon dioxide. To fulfill our corporate social responsibility and respond to government policies, we provide a direct subsidy to employees in 2022 for them to purchase (replace) electric scooters in the same amount as that of the government's subsidy and work with domestic electric scooter manufacturers to jointly implement carbon reduction initiatives. The subsidy amount for the purchase of a new electric scooter is NT\$10,000, and NT\$16,000 for replacement. The estimated total subsidy amount is about NT\$45.04 million to NT\$720.64 million. It is estimated that 937 tons of carbon emissions can be reduced each year. As the carbon emission of energy efficient vehicles is more than 20% lower than that of fossil fuel vehicles, the Company will implement low-carbon transportation policies by giving priority to fuel efficient vehicles, such as hybrid or electric vehicles, when replacing passenger cars and vans. Before the end of 2022, we will replace fossil fuel vehicles with an age of more than 11 years with an estimated investment of NT\$2.76 million, which will help reduce carbon emissions by around 4.62 tons per year.

The planned carbon reduction strategies and estimated amount of carbon reduction are as follows:

Table 3.1-1 Estimated amount of carbon reduction among different measures

Resource			Unit	2025	2030
 Carbon reduction strategy	Energy efficiency improvement		thousand tons/year	725	59
	Fuels Transition	Oil to gas	thousand tons/year	9	0
		Coal reduction strategy	thousand tons/year	351	526
	Energy	Fossil fuel vehicles to electric ones	thousand tons/year	26	282
	Conversion	Steam not to generate electricity	thousand tons/year	90	0
	Green power		thousand tons/year	18	67
	Adoption of AI		thousand tons/year	0	0
	Recovery and reuse of CO ₂		thousand tons/year	9	9
TOTAL			thousand tons/year	1,228	943

In 2021, a total of 338 projects were completed, reducing carbon emissions by 293,000 tons of CO₂e. A total of 250 projects are being executed or planned. The completed projects mainly include:



ARO3 plant process improvement:

1. The pre-distillation twin units were integrated into a stacked tower
2. A heat separator was added to the heterogeneous unit to reduce the evaporation of cooling water



Energy transition: Switching from fuel oil to natural gas

13 plants have been constructed by 2021. A cumulative completion of 21 plants is expected to be completed by the end of 2022, while the rest of the plants should be finished by the end of 2024, accounting for 25 plants in total.

Plant	Completed	In progress
SM Mailiao Plant	2	0
Phenol Plant	2	0
Mailiao PABS Plant	0	5
Xingang PABS Plant	6	5
PC Plant	0	2
Xingang Polymer Plant	3	0
Total	13	12

3.2 Medium-term strategies (6-10 years)

The medium-term target is to reduce the greenhouse gas emissions by 25% in 2030 considering 2020 as the base year, and the carbon reduction measures are planned as follows:



1. Contribution to a cleaner industry: Help clients reduce greenhouse gas emissions and invest more in R&D for products with low energy consumption.
2. Cleaner production: Improve production energy efficiency and reduce the carbon intensity of products.
3. Purchase low-carbon or green products: In response to the government's green procurement policy, the Company adopts products that labels energy-saving, water-saving, eco-friendly, low-carbon, or green building materials. Procurement of green products in 2021 accounted for NT\$250 million. Part numbers of the green products will be revealed on a quarterly basis starting from 2022. Besides, such products will be given precedence in procurement to reduce the consumption of resources, environmental pollution, and impact on the Earth.
4. Cooperate with the government's INDC policy: We continue to carry out carbon reduction measures and evaluate the implementation of SBTi.
5. In alignment with the global energy conservation, carbon reduction and new energy development trends, we will invest NT\$1.4 billion to jointly establish Formosa Plastics New AI Technology Co., Ltd. to promote the transformation and development of the energy industry, which will integrate the new energy-related departments within the enterprise to build a layout in the new energy industry.

3.3 Long-term strategies (11 years and above)

The long-term target is to achieve carbon neutrality by 2050, and the planned carbon reduction strategies are as follows:



- | | |
|---|---|
| 1. Improve energy efficiency | 4. Recycle CO ₂ to reduce the consumption of petrochemical materials |
| 2. Recover waste heat and improve heat integration | 5. Waste recycling |
| 3. Establish renewable energy power facilities and increase the proportion of renewable energy power used | |

3.4 Renewable energy strategy

In addition to actively improving energy conservation and carbon reduction projects for the processes, we cooperate with the government's renewable energy policy by seeking green power investment opportunities, and increasing the percentage of renewable energy used to reduce the impact of climate change. Jianan Industrial Co., Ltd., jointly funded by the Company and Jianan Irrigation Association, invested in the construction of three hydropower plants in Wushantou, Xikou, and Batian, in Tainan City with a total power generation capacity of 44 million kWh in 2021, which reduced CO₂ emissions by 22,000 tons.






In addition to hydropower generation, we established the 1,500 kw solar power generation facilities in the Xingang Plant, with a total power generation capacity of 2 million kWh in 2021, reducing CO₂ emissions by 1,000 tons. The short-term target installed capacity is 9.5MW, and the estimated total installed capacity in 2023 will be 11.767 MW. It is estimated that the total installed capacity of hydroelectric generator sets by 2023 will be 22,671kW.

4 Indicators and targets

4.1 Targets and indicators

With the aim to achieve the Company's carbon neutrality goal by 2050, short-term targets are set for 2022, 2023, and 2025, respectively, based on the carbon reduction strategies. Above all, each target will be regularly reviewed. The table summarizes the indicators and targets mentioned above.

Table 4.1-1 Short-term targets

Indicator	Target	Short-term target		
		2022	2023	2025
 The Company's policy	Align targets with international initiatives	Announce TCFD and pass SBTi certification	Complete product carbon footprint inventory	Reduce carbon footprint of products
 Carbon reduction	Reduce carbon emissions by 25% in 2030 compared to 2020	Reduce carbon emissions by 5% compared to 2020	Reduce carbon emissions by 7% compared to 2020	Reduce carbon emissions by 10% compared to 2020
 Green power	2030 Total installed capacity: 72MW Photovoltaic: 49MWp Hydropower: 23MW	Total installed capacity: 32MW Photovoltaic: 9.5MWp Hydropower: 22.5MW	Total installed capacity: 35MW Photovoltaic: 12MWp Hydropower: 23MW	Total installed capacity: 38MW Photovoltaic: 15MWp Hydropower: 23MW
 Green products	Recycled plastic products by 2026 As a percentage of the total sales of hard rubber: 10%	Sales: 5,000 tons/year	Sales: 10,000 tons/year	Sales: 35,000 tons/year
	Recycled nylon 6 products by 2023 As a percentage of the total sales: 12%	Sales: 750 tons/month	Sales: 1,250 tons/month	Sales: 1,250 tons/month
	Eco-friendly yarn products by 2026 As a percentage of the total sales: 50%	Sales: 10,000 pieces/month	Sales: 13,000 pieces/month	Sales: 18,000 pieces/month
 Digital transformation	Completion of a simulation factor by 2024	54% completed	91% completed	100% completed
	Completion of digital transformation by 2025	Complete the digitalization of operations management	Complete the digitalization of production management	Complete comprehensive digital optimization and transformation

4.2 Absolute reduction targets

According to the requirements of SBTi, the Company sets absolute targets (benchmarks at the operating site). The details of the targets are shown in the table below:

Table 4.2-1 Absolute target of carbon emission reduction

Absolute reduction target	Base year	Target year	Reduction from the base year	% of 2020 target achieved	Status	Whether it meets SBTi requirements
Target 1 (covering both Scope 1 and 2)	2018	2027	22.5%	7.6%	In progress	Yes

4.3 Information on greenhouse gas emissions

The Company has conducted an inventory of greenhouse gas emissions in accordance with ISO 14064-1 since 2009, and the data has been verified. The data on the Mailiao Plant in Yunlin has been verified by the British Standards Institution (BSI), and data on the Changhua, Xingang (in Chiayi) and Longde (in Yilan) Plants has been verified by System & Serviced Certification (SGS). After the verification was completed in 2020, the data was reported and registered on the National Greenhouse Gas Registration Platform at the end of August in accordance with the EPA's Greenhouse Gas Emissions Inventory Registration Management Regulations. The greenhouse gas emissions from each plant disclosed in this report are the data for 2020, as shown in the figure below:

Table 4.3-1 The Company's greenhouse gas emissions in 2020

2020 GHG Emissions					Unit: metric tons of CO ₂ e
Plant	Mailiao Plant (including the Haifeng Plant and acetic acid)	Xingang Plant	Changhua Plant	Longde Plant	Subtotal for each scope
Scope 1	1,784,610	2,468,056	1,338	1,006,580	5,260,584
Scope 2	3,238,218	8,915	28,671	2,600	3,278,404
Subtotal for each plant	5,022,828	2,476,971	30,009	1,009,180	8,542,798

The Company conducts an annual inventory of the relevance and emission data of Scope 3 and such data has been verified by a third party (please refer to Table 4.2-1 for details).




Table 4.3-2 Scope 3 emissions

Scope 3 emission sources	Relevance	emissions (ton of CO ₂ e)	Scope
Products and services purchased	Relevant and counted	12,342,501.6477	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	226,042.6933	The scope of this inventory covers 100% of real property in 2020. In 2019, the total amount of real property was NT\$124,671,052,000, and for every NT\$30 million invested 260 tons of CO ₂ e would be produced, and the total carbon emissions from real property calculated were 1,235,866.667 tonCO ₂ e.
Fuel and energy-related activities (not included in Scope 1 or 2)	Relevant and counted	1,074,887.7144	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 transport and distribution	Relevant and counted	9,264.0552	The inspection boundary is the carbon emissions derived from the transportation of upstream items in FCFC, excluding fuel, energy and returned items, which accounts for approximately 80% of the purchased goods.

4

Scope 3 emission sources	Relevance	emissions (ton of CO ₂ e)	Scope
Business waste output	Relevant and counted	2,892.0755	The scope of this inventory covers 100% of the emissions from the disposal of business waste.
Business trips	Relevant and counted	64.3193	The scope of this inventory covers 100% of the emissions from business trips by air.
Employee commuting	Relevant and counted	223.0187	The scope of this inventory covers 100% of the emission from transportation services of vehicles used for employee commuting.
Upstream asset leasing	Irrelevant	-	The Company does not engage in upstream asset leasing activities.
Downstream transport and distribution	Relevant and counted	213,055.9851	The scope of this inventory covers 100% of products shipped to main clients.
Processing of sold products	Relevant and counted	4,846,638.1214	The Company's products are usually upstream products, which are used in the products of the value chain, such as food, medical care, agriculture, automobiles, and daily necessities. For example, we have more than 20,000 different clients in different areas for our products, and these clients' greenhouse emissions are very different. Clients will sell their products to a wider variety of end users. After investigation, only PS, ABS, PP, PC, and PET could be identified. After these raw materials are sold, they are processed through injection or extrusion, and the remaining products will be processed multiple times and unable to be analyzed for now. Based on the annual sales, the output of PS, ABS, PP, PC, and PET accounts for 24.05% of the total output.
Use of products sold	Irrelevant	-	The Company manufactures plastic raw materials. Our products need to be processed after being sold, and our products after sold do not produce greenhouse gas emissions.
Final disposal of sold products	Relevant and counted	10,255.7672	The Company's products are usually upstream products, which are used in the products of the value chain, such as food, medical care, agriculture, automobiles, and daily necessities. For example, we have more than 20,000 different clients in different areas for our products, and these clients' greenhouse emissions are very different. Clients will sell their products to a wider variety of end users. After investigation, only PS, ABS, PP, PC, and PET could be identified. After these raw materials are sold, they are processed through injection or extrusion. The products are manufactured as general daily necessities. As per the EPA's survey, the recycling rate of plastic resources is about 73%. It is estimated that about 27% of PS, ABS, PP, PC, and PET raw materials will be discarded at the landfill for incineration. The final disposal of the products sold by the Company is based on the carbon emissions produced from the incineration of 27% of PS, ABS, PP, PC, and PET.
Downstream asset leasing	Irrelevant	-	The Company does not engage in downstream asset leasing activities. None of the downstream assets leased generated additional greenhouse gas emissions in 2019.
Franchising	Irrelevant	-	The Company does not have franchise rights.
Investment	Irrelevant	-	During the Company's assessment of greenhouse gas emission sources, no investment has been found to produce additional greenhouse gas emissions.
Others (upstream)	Irrelevant	-	The Company has not considered other relevant upstream greenhouse gas emission sources in the assessment of greenhouse gas emission sources.
Others (downstream)	Irrelevant	-	The Company has not considered other relevant downstream greenhouse gas emission sources in the assessment of greenhouse gas emission sources.

Appendices Report management

-  This report covers the period from January 1, 2021 to December 31, 2021.
-  Frequency of report preparation: Annually.
-  This report has been prepared primarily based on the Recommendations of the Task Force on Climate-related Financial Disclosures (June 2017).




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TCFD Index

Core Elements	Recommended Disclosures	Pages
Governance	Describe the board's oversight of climate-related risks and opportunities.	P3-6
	Describe management's role in assessing and managing climate-related risks and opportunities.	P3-6
Strategy	Describe the climate-related risks and opportunities the organization has identified over the short, medium, and long term.	P19-21
	Describe the impact of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning.	P19-21
	Describe the resilience of the organization's strategy, taking into consideration different climate-related scenarios, including a 2° C or lower scenario.	P17-18
Risk Management	Describe the organization's processes for identifying and assessing climate-related risks.	P7-P17
	Describe the organization's processes for managing climate-related risks.	P7-P17
	Describe how processes for identifying, assessing, and managing climate-related risks are integrated into the organization's overall risk management.	P7-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.	P22-24
	Disclose Scope 1, Scope 2, and, if appropriate, Scope 3 greenhouse gas (GHG) emissions, and the related risks.	P22-24
	Describe the targets used by the organization to manage climate-related risks and opportunities and performance against targets.	P22-24



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