



5. Environmental management

Due to environmental degradation, energy and natural resource scarcity, intensified climate change, and stricter government regulations, businesses face pressure and challenges. Facing these external pressures is both a challenge and an opportunity. We continue to promote the work of "energy conservation and carbon reduction" with practical actions in an honest and responsible attitude. We set the environmental protection goals of power, energy and water conservation and carbon reduction and try our best to reduce the impact of business operations on the environment, further achieving the eco-friendly goals of low pollution and low energy consumption.

5.1 Environmental Management Policy

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CGPC (including subsidiaries TVCM and CGPCP, and excluding overseas invested affiliates, and the same applies to the rest of the chapter) considers the protection of its personnel’s safety and health, as well as the environment and ecosystem, as the goals of environmental management. We have always complied with environmental protection and occupational health and safety regulations, continuously and effectively implemented practices such as reusing and recycling of leftover materials, pollution prevention, energy/resource conservation and recycling, industrial waste reduction, and promoting harmonious relationships with our neighbors. All factories of CGPC have passed the ISO 14001 environmental management system verification, providing a good environmental protection framework, reducing the impact on the environment due to accidents, and ensuring compliance with regulations.

► The verification certificates or product-related certificates obtained by the Company in 2023 (please see the link to the official website [Environment/Product Certification Section](#)).



► Cleaner production

In terms of corporate sustainability, in recent years, CGPC has been committed to transforming our plant areas, spending about NT\$6 billion to reduce the energy consumption and environmental impact of manufactured products, improve environmental friendliness, and introduce smart production technologies to achieve our low-carbon goal of enhancing a safe working environment. In 2023, through the guidance of the Foundation Of Taiwan Industry Service, we conducted various assessments, improved our production processes, implemented various energy conservation and carbon reduction efforts, and implemented waste management. In June 2024, our company finally received recognition and obtained the [Cleaner Production Assessment System Certificate](#).

5.1.1 SASB Chemical safety and environmental management ► (SASB: RT-CH-410b.1)

The performance indicators of CGPC’s chemical safety and environmental management are calculated based on hydrochloric acid, caustic soda, and bleaching water used, and the chemical classification management and exposure assessment are carried out according to their related hazards. The data of various indicators are as follows:

1. The percentage of product revenue (%) of products containing chemical substances classified as Type 1 and 2 health and environmental hazards by the GHS hazard categories, CGPC is 10.94% and TVCM is 100%.
2. The percentage (%) of relevant products that have undergone hazard analysis is 100%. Besides, as hydrochloric acid, caustic soda, and bleaching water are not chemicals of high concern, they have less significant impact on humans and the environment.

5.1.2 Hazardous Substances and Waste Management ► (SASB : RT-CH-150a.1)

1. All raw materials and products used by CGPC have passed the inspection of Restriction of Hazardous Substances (RoHS) to prevent the impact of the products on the environment.
2. Hazardous air pollutants discharged from production all meet the emission standards for hazardous air pollutants from stationary sources to reduce the impact on the environment.

► Hazardous Substances and Waste Disposal and Management

◆ Hazardous Substances Disposal and Management

CGPC takes comprehensive measures in the management of hazardous substances across its research, procurement and production activities. From the assessment to the use, management and disposal processes, the company strictly adheres to standards and relevant regulations to minimize its operational impact on the natural environment and human health.

◆ Following Domestic and International Standards and Establishing Systems

In order to prevent hazardous substance-related accidents, reduce occupational hazards, ensure the health of employees, and comply with government regulations, CGPC has established operational standards such as "Hazardous Substance General Management Guidelines," "Specific Chemical Operations Management Guidelines," "Lead Operations Management Guidelines," "Dust Operations Management Guidelines," and "Organic Solvent Operations Management Guidelines." These guidelines are in place to effectively control the safe use of hazardous substances.

◆ Management Structure

Please refer to the ["CGPC Hazardous substance safety management structure"](#) link.

◆ Implementation Status:

Regarding the product design and development process, we adhere to international guidelines and standards. The content of hazardous substances in our products complies with environmental regulations and meets the green product requirements of our customers. We have established relevant management regulations to ensure proper control and management. In terms of the use, management, and disposal of hazardous substances, we strictly follow legal procedures. We require relevant personnel to obtain technical certifications and install detection and alarm systems in the work environment. In terms of environmental and safety aspects, we implement operational environmental monitoring for hazardous substances to ensure that the exposure concentration does not have adverse health effects on our employees. We also implement chemical classification management to effectively prevent potential health hazards caused by hazardous substances to our employees. During the production, service and related activities, we handle waste gases and wastewater properly, ensuring compliance with national emission standards. In 2023, we conducted measurements of harmful substance concentrations in the work environment air, covering a total of 20 types. The results showed good control of these substances.

Regarding the disposal of hazardous waste, in 2023, CGPC generated a total of 173.97 tons of hazardous waste. The proportion of waste that was recycled and reused was approximately 65.59% (as shown in the table below). Furthermore, CGPC conducts regular visits to the waste disposal contractors to ensure proper handling of the waste.



► Hazardous Substances Disposal and Management Regulations

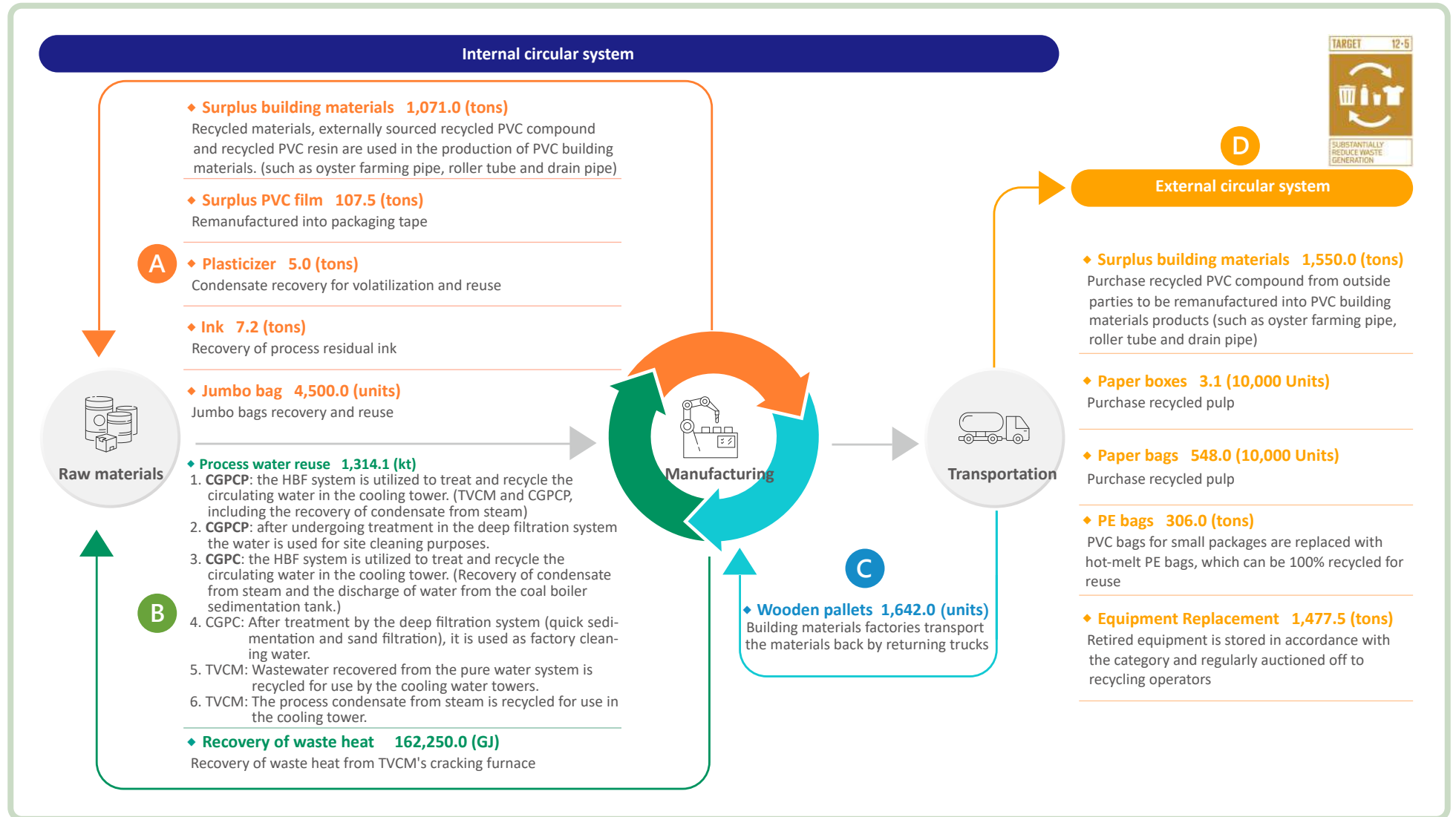


► 2023 Hazardous Substances Treatment Methods and Quantity Statistics

Final Disposal Method/Company	CGPC	TVCM
Landfill	21.81	38.05
Recycled and reused	114.08	--
Preparation for reuse	24.00	--
Description: In 2023, the total quantity of hazardous waste was 197.95 tonnes. The reuse rate accounts for 70% of the total quantity while the landfilling accounts for 30% of the total quantity.		

(Unit: ton)

5.1.3 Description of recycling → CGPC values the efficiency of resources use and have adopted the circular model of recovery and re-use of raw materials and supplies, manufacturing process and distribution. In 20223, the internal and external results of circular economy practices are shown as follows:



Implement GRS and acquire verification

The GRS adds the use of recycled materials in products and the reduction of environmental impact during production process based on the principles of tracking and tracing verified finished products and at the same time includes relevant requirements for environmental and social responsibilities, providing better monitoring and control measures for industry supply chains. The verification of GRS requires that the upstream.

Content of standards

- ◆ To obtain GRS verification, a product must contain at least 20% of its raw materials consisting of recycled materials and be 100% free of contamination.
- ◆ Recycled materials should also clearly indicate pre-consumer waste or post-consumer waste, and the proportion of both pre-consumer and post-consumer waste in the recycled fiber materials.
- ◆ In addition to the regulations on raw materials, corporate social responsibility, pollution prevention and treatment in the production process, and chemical restrictions are all strengthened.
- ◆ To obtain the GRS verification mark (hang tag), the raw materials of the product must contain at least 50% recycled content.

Benefits

CGPC fully grasps the international trends and understands the customer needs, and provides certificates of recycled contents to become an excellent partner trusted by customers. We fulfill our social responsibilities and prioritize pollution prevention and treatment in the production process and the requirements of chemical restrictions. We put circular economy into practice to find more green business opportunities, which is a symbol of an excellent enterprise to enhance the corporate image.

GRS verification

In response to the net-zero carbon emission trend, brand owners have proposed policies to use recycled materials in their products. Our company started GRS (Global Recycling Standard) certification in March 2022, passed the review, and obtained the GRS certificate on December 29, 2022 and December 29, 2023, respectively.

Currently, the certification covers TPU and TPO recycled material products (with priority given to brand requirements). In the following years, other product categories can be added during the verification process. This certification will be beneficial for our business units in pursuing recycled economic products.

2023 circular economy implementation results for building materials products

Rigid tube production: **2,621** (tonnes), accounting for 14.3% of the tube production.



- ◆ Since 2021, the building materials plant has begun to collect all kinds of recycled materials and recovered PVC resin in the plant, and purchased recycled rubber pellets to be put into production of new products for sale, striving for environmental protection.
- ◆ 2023 recovery and reuse volume of pipes: 2,621 tonnes, the recovery and reuse rate accounts for 14.3% of the 2023 product volume of piping materials.

5.2 Climate Change and Energy Management ▶ (GRI 201-2、302-4、302-5、2-4、3-3)

CGPC is committed to mitigating greenhouse gas emissions for sustainable development. We formulate improvement plans on the basis of various management operating systems (ISO 50001, ISO 14064-1, ISO 14067, ISO 46001, ISO 14046, PSM, GRS) and with reference to several international and technological developments. Through academia-industry collaborations introducing AI, big data, and algorithmic technology, we combined professional knowledge with practice to elevate various performances. Examples include the establishment of renewable energy, separation and recycling of wastewater, rainwater and sewage, energy conservation and carbon reduction solutions, and the establishment of a smart energy management system. Additionally, annual carbon reduction targets are appropriately set according to the carbon reduction targets set by the Group. Each year, review is conducted for continuous implementation of the old facility replacement plan to build a smart factory.

Material issue: Climate change and energy management

- The Significance and Impact of CGPC**

With the deterioration of the environment and ecology, shortage of energy and natural resources, exacerbation of climate change and stricter government laws and regulations, CGPC takes concrete actions to continuously promote and implement energy conservation, carbon reduction, and the development of green products to meet government requirements.
Affected Parties: Government agencies, supply chains, communities, and employees.
- Develop Strategy**

Renovation and replacement of old equipment and Improve equipment efficiency in order to achieve the eco-friendly goals of low pollution and low energy consumption.
- Policy Commitment**

Reduce carbon emissions (Scope 1 and 2) by 27% in 2030 compared to 2017, long-term goal: carbon neutrality by 2050.
- Grievance Unit**

Engineering Department
- SASB Indicator**

RT-CH-110a.1、RT-CH-110a.2、RT-CH-130a.1

Promotion policy	Unit	2023 goal	2023 result	2024 goal	2025 goal	2030 goal
Actively implementing energysaving and carbon reduction programs, utilizing low-carbon fuels and renewable energy sources	Reduction of GHG emissions (10,000 tons of CO ₂ e)	36.80	31.96	30.10	33.74	29.97

Notes: 1. Starting from 2023, the scope of inventory includes subsidiaries in the consolidated financial statements of CGPC, with a coverage rate of 100%.
2. The greenhouse gas emissions in 2023 are third-party verified data.
3. Since Vinyl Chain achieved its goal ahead of schedule, the 2025 goal will be raised after a review and in accordance with production changes and carbon reduction plans.



5.2.1 Climate change management ▶ (GRI 201-2、302-3)

Climate change is a global challenge that requires collective action. In order to align with international standards and address the needs of sustainable development, the ROC government announced on February 15, 2023 the amendment of the “Greenhouse Gas Reduction and Management Act” to the “Climate Change Response Act”.

In the face of the impact of climate change, carbon reduction has become a global goal. In early 2022, USI Group set the 2030 carbon reduction goal of “27% reduction in carbon emissions in 2030 compared to 2017”, and in 2023, it set “carbon neutrality by 2050” as the long-term goal of the Company.

Striving to achieve its vision of corporate sustainability, USI Group actively implements corresponding countermeasures and management mechanisms. The Group continues to implement ISO 14064-1 greenhouse gas inventory and verification at its domestic production factories and plans and implements carbon reduction plans. It also develops external renewable energy projects. As of the end of 2023, the cumulative grid-connected capacity of solar energy projects has reached 7.2MW.

CGPC has planned a carbon reduction path in accordance with the Group's carbon reduction target by 2030. In 2023, greenhouse gas emissions have decreased by 22.2% from the baseline year (2017), and we will be more proactive in implementing energy-saving and carbon reduction plans in the future. The medium-term carbon reduction strategy will be towards low-carbon energy transformation, energy efficiency improvement, intelligent monitoring, and the installation and use of renewable energy. The long-term carbon reduction strategy will continue to focus on low-carbon fuels, carbon capture, and reuse technology, and carbon negative technology to implement carbon reduction strategies. It is a goal to achieve carbon neutrality and promote sustainable development.

Vinyl Chain Carbon Reduction Pathway Planning

(Unit: tons CO₂e)

By company	2017 Base year Scope 1, 2	2021 Performance Scope 1, 2	2022 Performance Scope 1, 2	2023 Performance Scope 1, 2	2030 Objective Scope 1, 2
CGPC	150,575	137,852	118,783	104,899	109,920
TVCM	210,713	199,173	179,079	176,682	153,821
CGPCP	49,292	48,595	38,978	38,026	35,984
Total	410,580	385,620	336,840	319,607	299,725

Note:

- The scope of the 2022 inventory includes CGPC Main plant, and TVCM and CGPCP plants in Linyuan. Scope of inventory starting in 2023: (1) CGPC includes: CGPC Main plant, Taipei office, and overseas subsidiaries. (2) TVCM Company includes: TVCM Linyuan plant, Taipei office, and GGTIC Company. (3) It was Linyuan plant for the CGPCP Company. The above are CGPC's subsidiaries in the consolidated financial statements, and their coverage rate is 100%. The difference between the emissions in the inventory scope in 2023 and the emissions in the inventory scope in the base year is 0.1%.
- Scope 1: The main emission sources include natural gas, fuel coal, gasoline, and diesel. Scope 2: Include purchased electricity and purchased steam. Scope 3 items are temporarily excluded from the carbon reduction pathway planning. GHG inventory includes: CO₂, CH₄, N₂O, and HFCs.
- CGPC (Main plant) has been conducting greenhouse gas emissions inventory based on ISO 14064-1:2018 and has obtained third-party verification since 2022.
- TVCM (Linyuan plant) and CGPCP (Linyuan plant) have been conducting greenhouse gas emissions inventory based on ISO 14064-1:2018 and have obtained third-party verification since 2021.
- The 2022 greenhouse gas emission volume of TVCM and CGPCP was originally self-inventoried, but the data is revised according to the third-party verification declaration for the current year.
- The greenhouse gas emissions data of the three companies in 2023 are third-party verified data.

Vinyl Chain Carbon Reduction Pathway Map

● Actual Emissions (Unit: 10,000 tons CO₂e)
○ Target Emissions (Unit: 10,000 tons CO₂e)



- Note 1: Between 2013 and 2022, the greenhouse gas emissions from the group's Taiwan facilities reached their peak in 2017. Therefore, the emission reduction targets are set based on 2017 as the base year.
- Note 2: Vinyl Chain's carbon reduction pathway falls into Scope 1 and Scope 2. Since the target was achieved earlier in 2023, the 2025 goal will be raised after a review and in accordance with production changes and carbon reduction plans.

	2023	2024
Target Emissions	36.8	30.1
Actual Emissions	31.96	
Achievement rate	115%	

Note: Achievement rate = 2023 target emissions/2023 actual emissions

Implementation and results



Promote establishment of the ISO-50001 energy management system

- As of 2022, the USI Group has successfully verified 9 plants.
- CGPC and CGPCP have obtained the ISO 50001 verification in 2019. TVCM has obtained the ISO 50001 verification in April 2021. (certificate in effect)



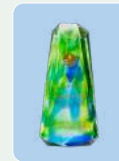
Actively carry out energy conservation and carbon reduction actions

- Continue to participate in the Earth Hour movement to reduce environmental impact.



Awarded the 「Performance of Excellence」 trophy by the Ministry of Economic Affairs

- Awarded the "Performance of Excellence" trophy for the promotion of the energy conservation service team from 2016 to 2018.



Taiwan Highpolymer recognized by the Water Resources Agency for its water conservation efforts

- 2022.03.22 CGPCP recognized by the Water Resources Agency for its [water conservation efforts](#)

► The Group's cross-plant technical exchange seminar in 2023

On Wednesday, October 25, 2023, a "Group Plant Technical Exchange Meeting" was held at the TVCM Linyuan plant. Continuing from last year, with the core themes of "Occupational Safety and Environmental Protection", "Equipment Maintenance", "Energy Conservation and Carbon Reduction", each of the 12 plants in Taiwan proposed 1 or more technical cases. These cases underwent a written review and ultimately, 7 plants cases were selected as finalists. The final selection was made through voting and scoring by senior executives of the group and representatives from the presenting factories to determine the top three outstanding technical cases of the year. In accordance with the Group's Safety Incentive Measures - Cumulative Safety Days by each plant, trophies will be awarded and a group photo taken during the meeting as an encouragement.

Han-Fu Lin, Chairperson, commented at the event. He mentioned that this year's cases include improving the working environment of employees, deepening the implementation of energy conservation and carbon reduction, and professional exploration of the equipment pre-insurance, and other achievements. The performance of each plant is worthy of recognition, and it is still necessary for everyone to work together in the future to enable the Group to be able to continue to improve in various fields.



► Information on Award-Winning Technical Case Studies in 2023:

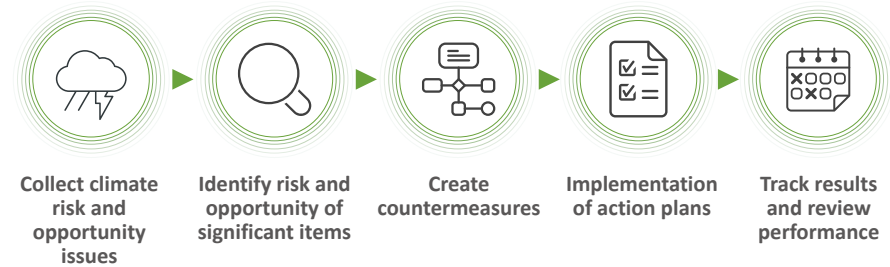
Item	CGPC (Main plant)	TVCM (Linyuan plant)
Award Descriptions	Awarded the Group's Technical Exchange Case Studies (Excellent)	Awarded the Group's Technical Exchange Case Studies (First Place) Reaching 1,000 safety days - Outstanding Performance Award
Project name	Activated carbon Fluidized Bed Technology for VOCs Adsorption and Control	TVCM Steam Boiler Optimization and Improvement
Presenter	Section Chief Yi-Hsien Huang	Section Chief Chieh-Lin Chuang

► TVCMs Linyuan plant has been awarded first place in the Technical Case Study Presentation for three consecutive years!

5.2.2 Climate change management framework

At CGPC, the ESG Committee under the Board of Directors is the highest committee for climate management. It is chaired by an independent director and the Committee reviews the Company's climate change strategy and goals, manages climate change risks and opportunities, and reviews the yearly implementation status, and reports to the Board of Directors. CGPC uses the framework provided by the Task Force on Climate-related Financial Disclosures (TCFD) to identify climate-related risks and opportunities. It assesses risks and opportunities across different departments, assesses the financial impact, and establishes response plans. It restarts the full assessment every three years and reviews and updates it every year.

► Climate risk and opportunity identification assessment procedures



► TCFD Structure



1 Governance

- ◆ **ESG Committee:** The climate change management is organized at the highest level, with an independent director serving as the Chair. Annually, they oversee the planning and progress reporting related to climate change initiatives and provide reports to the Board of Directors.
- ◆ **The Executive Management Meeting:** Chaired by the Chairperson, discusses and plans major energy-saving and carbon reduction policies on an irregular basis.
- ◆ **The Group's Environmental Division Quarterly Review Meeting:** Serves as the highest level of energy management in the USI Group. It takes place every quarter and involves reporting on the planning, progress, and making resolutions to the Chairperson.
- ◆ **The Green Energy Task Force:** Serves as the responsible unit for promoting green energy initiatives within the USI Group. Reports to the Chairperson on the progress and future plans of green energy development on a monthly basis.

2 Strategy

- ◆ **Scenario analysis:** Assess the physical risks faced under different climate scenarios.
- ◆ **Identify risks and opportunities:** Assess the significant risks and opportunities based on the degree of connection and possibility of occurrence of the risk items, and the operational execution and development of the opportunity item.
- ◆ **Assessment of potential financial impacts:** Assess the potential financial impacts of the identified significant risks and opportunities.

3 Risk management

- ◆ **Implementation of TCFD:** Adopted the TCFD structure to identify risks and opportunities associated with climate change. This involves effective communication with relevant units and final confirmation by senior executives.
- ◆ **Results identification and reporting:** Integrated into the annual company's risk management evaluation. The Project Secretary of the ESG Committee reports on the control measures and management operations situations to the ESG Committee and the Board of Directors on a yearly basis.

4 Indicators and objectives

- ◆ **The Group's energy management objectives:** Set energy management goals under the Group's carbon reduction goals with 2017 as the baseline year, set the goal of 27% carbon reduction by 2030, and carbon neutrality by 2050.
- ◆ **Climate adaptation strategies:** The medium-term carbon reduction strategy is set towards low-carbon energy transformation, energy efficiency improvement, intelligent monitoring, and the installation and use of renewable energy. The long-term carbon reduction strategy continues to focus on low-carbon fuels, carbon capture and reuse technology, and carbon negative technology to implement carbon reduction strategies.
- ◆ **Disclosure of GHG emissions:** The emission data of Scope 1 to 3 emissions are disclosed in the Sustainability Report every year, and the reasons for the increase or decrease are reviewed regularly.

Climate-related risk items are divided into 3 intervals according to the time period of occurrence of impacts: short-term (<3 years), medium-term (3-7 years), long-term (>7 years). The impact of climate-related opportunity items on the Company's development and technical feasibility is divided into 5 levels, corresponding to the following table:

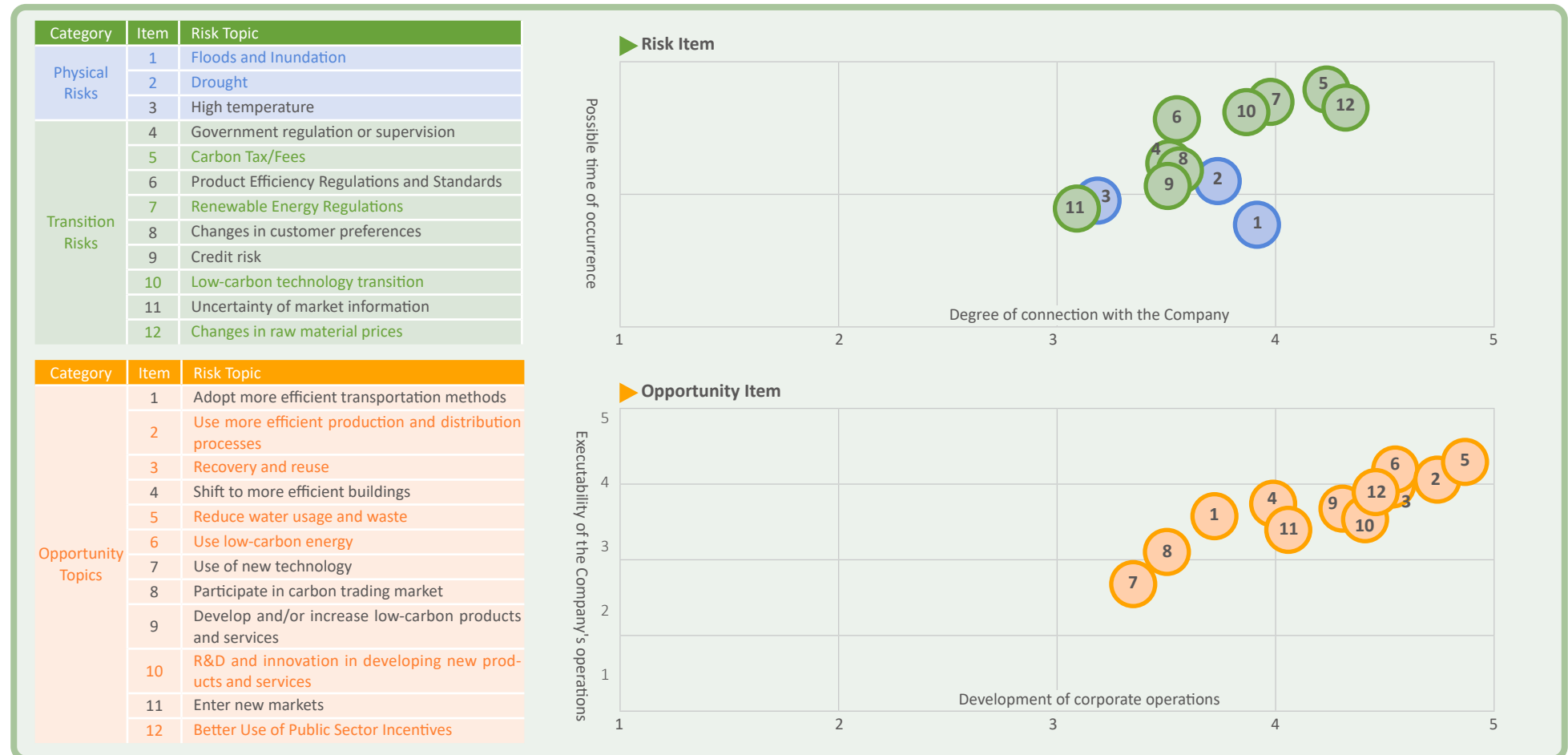
Type	Item	Time frame of occurrence
Physical Risks	Floods and Inundation	Intermediate-term (3 to 7 years)
	Drought	Intermediate-term (3 to 7 years)
Transition Risks	Carbon Fee	Short-term (< 3 years)
	Renewable Energy Regulations - Risk of Clause for Large Power Users	Short-term (< 3 years)
	Low-carbon technology transition	Short-term (< 3 years)
	Rising raw material prices	Short-term (< 3 years)

Type	Item	Development	Technical feasibility
Opportunities	Efficient production	With development potential, as part of the Company's policy	Under expansion
	Recycling and Reuse - Circular Economy	With development potential, as part of the Company's policy	Under expansion
	Reduce water usage and waste	With development potential, as part of the Company's policy	Matured
	Use low-carbon energy	With development potential, as part of the Company's policy	Matured
	R&D and innovation for developing new products and services - R&D of low-carbon energy-saving products	With development potential, as part of the Company's policy	Under expansion
	Better Use of Public Sector Incentives	With development potential, as part of the Company's policy	Under expansion

5.2.3 Identify climate risk and opportunity

To cope with the intensification of global climate change, we continue to adopt the TCFD framework to deepen the risk items that we may face in extreme climates and to grasp new business opportunities. With reference to the Taiwan Climate Change Projection Information and Adaptation Knowledge Platform (TCCIP) and the National Science and Technology Center, and based on the RCP 8.5 scenario, we estimate the temperature rise, rainfall, flooding, and drought between 2016 and 2035. List three physical risk topics, and based on the group's strategy, industry characteristics, country's Intended Nationally Determined Contributions (INDC), and TCFD indicators, 9 transition risks and 12 opportunity topics are listed, with a total of 24 potential risk and opportunity topics. In 2023, the ESG Committee and senior unit executives conducted a questionnaire survey to assess the relevance of various risks to the Company's operations, the timing of possible impacts, and the developmental and enforceability of various opportunities. A total of 21 questionnaires were collected. After the statistical analysis of the team, 12 material climate issues (2 physical risk items, 4 transition risk items, and 6 opportunity items) were identified. We assess the potential financial impacts and formulate countermeasures and management mechanisms of 12 major risks and opportunities. The goal is to grasp the possible impacts of climate change on all aspects, reduce the operational impact that may be caused by extreme weather, and establish a resilient climate change culture.

Note: The Taiwan Green Productivity Foundation was commissioned by CGPC Main plant to provide guidance for the implementation of TCFD scenario analysis. For details, see the [2023 CGPC Toufen Main factory's TCFD Report](#).



► **The Group promotes internal carbon pricing**

In February 2023, Taiwan announced the implementation of the “Climate Change Response Act”, adding a carbon fee collection mechanism. The Ministry of Environment will formulate relevant sub-laws for detailed content such as charging methods and specific rates. On the tax subjects, it is planned to collect from the large entities first then the smaller entities later in different stages. The fee rate will be reviewed periodically and gradually raised. To cope with government policies in advance, and to effectively cope with climate change and reduce carbon risks, USI Group will introduce an internal carbon pricing system in 2024. The price will refer to the domestic carbon tariff pricing basis, and it is planned to integrate this system into corporate decision-making and investment. During the assessment process, the impact of carbon emissions on business operations is assessed to accelerate the implementation of carbon reduction measures. At the same time, the Group will organize two education and training courses for employees of related units to understand the concept and application of internal carbon pricing, and assist each plant in implementing it as soon as possible. A carbon-related general education course is also planned and held to be widely attended by employees of the Group. Raising carbon awareness to achieve corporate sustainability goals.

5.2.4 Potential financial impacts of risks and opportunities, and response measures

Climate Change Topics	Topic Category	Description of Risks and Opportunities	Potential Financial Impact	Vinyl Chain Strategy and Countermeasures
Floods and Inundation	Physical Risk/Chronic	<ul style="list-style-type: none"> According to the data from the Water Resources Administration, if 500 mm of rain falls within 24 hours, it is estimated that 0 to 1 meters of flooding will occur in the near future (2016-2035) and will last for 1 day. The above heavy rainfall/flooding leads to the shutdown of the plant due to flooding, which will reduce the turnover. 	<p>Increasing operating costs</p> <ul style="list-style-type: none"> NT\$12.11 million was invested for the reconstruction of old rainwater gutters at CGPC Main plant. The cost of related flood control and drainage measures for Linyuan plant was about NT\$5 million. 	<ul style="list-style-type: none"> Reconstruction of old stormwater ditches at Toufen Main plant : Add two external discharge outlets and remove sludge. The second phase of stormwater renovation is reviewed in conjunction with the project of replacing the overlapped troughs with new ones before proceeding with planning. Relevant flood control measures in the TVCM plant : A stormwater interception pond was set up to ensure that the rainwater ditch would take 30 minutes to naturally overflow to the outside of the factory during heavy rainfall. During the period, rainwater was collected in the stormwater interception pond for storage and pumped to the wastewater treatment plant. <p>Note: The Taiwan Green Productivity Foundation introduced the TCFD scenario analysis in 2023 for the CGPC Main plant, and the “flooding” items were assessed to be minor risks and long-term risks.</p>
Drought	Physical Risk/Chronic	<ul style="list-style-type: none"> Taking 1986-2005 as the base period, the recent climate conditions (2016-2035) have shown that the maximum number of consecutive days without rainfall is 50-58 per year, and water shortage or drought may occur. In response to abnormal weather conditions, resulting in water restrictions or water shortages in the plant area, production line production will be reduced or work will be suspended altogether in severe cases. 	<p>Increased capital expenditures and increased costs of revenue</p> <ul style="list-style-type: none"> The cost of the centrifuge dryer process water recovery (HBF) project was about NT\$92.83 million, and the water saving volume in 2023 reached 597.4 million liters/year. The total investment for the construction of a new reservoir was approximately NT\$21 million. 	<ul style="list-style-type: none"> Continue to pay attention to internal and external water conditions. Implement water-saving measures such as “increasing the consumption of HBF recycled water” and “increasing the concentration ratio of the cooling water tower and reducing the amount of supplementary water”. Continue to implement water use improvement plans to enhance the water recovery rate (R2). In 2023, a filter tank and a pre-treatment device were added to the HBF system, which is expected to increase the water recycling volume by 35 million liters per year. CGPC Building Material plant promotes rainwater recycling and reuse. In 2021, a new 500-ton PE storage tank (20 pieces) was built. In 2022, a new 1,500-ton tap water storage tank was built.

Climate Change Topics	Topic Category	Description of Risks and Opportunities	Potential Financial Impact	Vinyl Chain Strategy and Countermeasures
Carbon Fee	Transition Risk/Policies and Laws	In December 2023, the Ministry of Environment released the “Draft Regulations on Carbon Fees and Charges”. It is expected that a carbon fee will be levied by 2025 for large carbon emission companies with annual emissions exceeding 25,000 tonnes.	<p>High initial investment costs, low carbon emissions in the long term, and reduced operating costs.</p> <p>Assuming that the carbon fee is calculated based on the price of NT\$300 per ton of CO₂e and the exemption from the credit of 25,000 tonnes of CO₂e:</p> <ul style="list-style-type: none"> ◆ The estimated carbon expenditure of CGPC and TVCM is NT\$62.25 million in 2024, accounting for about 0.5% of the combined revenue in 2023. ◆ Vinyl Chain implemented a number of carbon reduction projects in 2023, achieving a carbon reduction of 9,970 tonnes and a carbon reduction benefit of NT\$2.991 million. 	<ul style="list-style-type: none"> ◆ CGPC uses internal carbon pricing as the shadow price to incorporate carbon costs into investment considerations to enhance the chances of implementing carbon reduction projects. ◆ Actively implement carbon reduction projects, such as equipment replacement, process improvement, heat energy recovery, and other projects. ◆ Introduce AI into the plant and the distillation column into the AI model to find the optimal operating conditions and reduce the steam consumption per product. ◆ CGPC and TVCM have obtained credits from the greenhouse gas offset project, with a total of 7,464 tonnes of CO₂e and a carbon reduction benefit of NT\$2,239,200 (NT\$300 per ton). ◆ The plant will evaluate and propose voluntary reduction plans for preferential tariff rates and reduction of carbon fees from reduction credits after the relevant sub-laws are announced.
Renewable Energy Regulations - Risk Clause for Large Power Users	Transition Risk/Policies and Laws	The Ministry of Economic Affairs “Regulations for the Management of Setting up Renewable Energy Power Generation Equipment of Power Users above a Certain Contract Capacity” came into effect in 2021, requiring large power consumers with a contracted capacity greater than 5,000 kW to install renewable energy equipment with 10% of the contracted capacity before 2025.	<p>Increasing capital expenditure</p> <p>Installed a solar power installation with a capacity of 2.12MW on the roof.</p> <p>A total of NT\$102.4 million has been invested, and the Company plans to meet the regulatory requirements for setting renewable energy by large power users in 2024 ahead of schedule.</p>	<ul style="list-style-type: none"> ◆ A 2.12 MW solar power installation has been installed on the rooftop of the CGPC Main plant.
Low-carbon technology transition	Transition Risk/Energy, Technology	The development of low-carbon technologies such as energy transition, efficiency improvement, and fuel substitution for carbon reduction leads to increased technology investment costs for enterprises.	<p>Increased capital expenditures and decreased cost of revenue</p> <ul style="list-style-type: none"> ◆ In 2023, Vinyl Chain invested about NT\$195,084,000 in energy saving and carbon reduction projects, reducing 9,970 tonnes of CO₂e. ◆ In 2023, the amount of self-assessed purchases of government-approved green products was NT\$71.45 million. ◆ Vinyl Chain's 2023 water collector replacement and optimization of the hot water vapor heating system project was an investment of about NT\$7.24 million. 	<ul style="list-style-type: none"> ◆ All three factories of Vinyl Chain have passed the ISO 50001 Energy Management System certification. ◆ Continue to implement energy-saving and carbon reduction equipment improvement plans, such as replacing old equipment with new ones, heat energy recovery, introducing AI energy-saving projects, and pyrolysis furnace energy-saving coating projects. ◆ In 2019, we began to implement the green procurement plan. Through online project declaration, the green products that we mainly purchased were energy-saving equipment. ◆ Performance of investment in energy-saving equipment (pumps, motors, IE3 high-efficiency induction motors, inverters, gas boiler burners, LED bulbs, cooling tower circulation pumps, fans, or fans with inverters). ◆ The project of replacing the old water collectors and the optimization of hot pure water vapor heating system projects of the three factories of Vinyl Chain can save about 14,213 tonnes of steam and 2,386 tonnes of CO₂e annually. ◆ Due to the increase in Taipower's electricity price in April 2024, it is estimated that the electricity bill for the 3 core production factories will increase by NT\$82.34 million per year. We will actively invest in low-carbon technology transitions to reduce the impact of electricity price increases.

Climate Change Topics	Topic Category	Description of Risks and Opportunities	Potential Financial Impact	Vinyl Chain Strategy and Countermeasures
Rising raw material prices	Transition Risk/Market	Under the consideration of future carbon taxation, the cost of carbon emissions will be added to raw materials, and the price will increase.	<p>Increased cost of operating revenue</p> <p>Due to factors such as inflation and uncertainties about the future economy, the global price of ethylene has declined. To strengthen the vertical integration of the industrial chain and flexibly adjust production and sales plans, CGPC built an ethylene storage tank, and TVCM added a storage tank at the Intercontinental Wharf. This can provide a buffer during drastic market changes. The total construction cost is about NT\$3.5 billion.</p>	<ul style="list-style-type: none"> Promote circular economy: Recycle and reuse raw materials. For example, the quantity of pipes recycled and reused by the building materials plant in 2023 was 2,621 tonnes, and the recycling and reuse rate accounted for 14.3% of the pipe production in 2023. The Company adopts a vertically integrated strategy for the procurement of materials, production, and sales, and regularly reviews the inventory of raw materials and finished products. Inventory changes are reviewed on a rolling basis in response to market changes. The projects are: <ul style="list-style-type: none"> TVCM has built storage tanks for ethylene, vinyl chloride, and ethylene dichloride at the Intercontinental Wharfs. A new ethylene storage tank was built at the CGPC Main plant. Ensure flexible scheduling of production and sales of key raw materials.
Efficient production	Opportunity/resource efficiency	Improve overall production efficiency and reduce energy consumption with production tools such as AI smart production, industrial motors, and automatic packaging.	<p>Increased capital expenditures and reduced operating costs</p> <p>Take the #5 dryer optimization project for example, about NT\$4.15 million has been invested. The AI model provides the optimal program operating condition setting (SP) for intelligent control, saving about 1,100 tonnes of steam and annual expenses of NT\$1.13 million, and annual carbon reduction up to 175 tonnes of CO₂e.</p>	<p>Introduce AI to create intelligent management (see Chapter 3.6)</p> <ul style="list-style-type: none"> Introduce AI into the process, find the best process operating condition settings through models, and perform intelligent control to optimize energy efficiency. Combined with image identification (AOI), it is used for the thermal image identification of power panels and sensing safety system of forklifts to improve the safety of the working environment. For example, the implementation of intelligent control on a 35-ton boiler saved 460,504 kWh of electricity, 1,400,000 M³ of natural gas, 3,138.5 tonnes of CO₂e, and NT\$15.45 million in expenses.
Recycling and Reuse - Circular Economy	Opportunity/resource efficiency	Based on the three principles of circular economy (3R): Reduce, reuse, and recycle. Reduce waste disposal Cost, or raw material consumption	<p>Increasing operating costs</p> <ul style="list-style-type: none"> In 2023, about NT\$800,000 was invested in the GRS global recycling system certification project. In 2023, about NT\$500,000 was invested in the TPE rubber project for the final product Recycle. In 2023, about NT\$800,000 was invested in the TPO fish-electricity symbiotic water pond fabric project. 	<ul style="list-style-type: none"> Since 2021, the CGPC building materials plant has begun to collect all kinds of recycled materials and recovered PVC resin in the plant, and purchased recycled rubber pellets to be put into the production of new products for sale. In 2023, the recycling rate reached 14.3%. The TPE eco-friendly leather products of CGPC use 30-60% of recycled plastics, and have obtained GRS global recycling system certification. CGPC's PVC bags for small packages are replaced with hot-melt PE bags, which can be 100% recycled for reuse.
Reduce water usage and waste	Opportunity/resource efficiency	Water is an irreplaceable resource in the manufacturing processes. To reduce plant water leakage and increase the proportion of water recycling and reuse, we can save operating costs and improve plant resilience.	<p>Increased capital expenditures and reduced operating costs</p> <p>Centrifugal Drying High-performance Bio-treatment and Filtration system (HBF) project The input cost was about NT\$92.83 million.</p>	<ul style="list-style-type: none"> CGPC Building Materials plant has installed a rainwater recycling and reuse device that can store about 5 tonnes of rainwater for watering flowers and for use in the toilets to save water consumption. Centrifugal dryer process water recovery (HBF) was installed at CGPC Main plant and CGPC Linyuan plant. The biological treatment system and COD adsorption system enhance the cooling water recovery rate, saving water up to 597.4 million liters per year in 2023. In 2023, a filter tank and a pre-treatment device were added to the HBF system, which is expected to increase the water recycling volume by 35 million liters per year. At the TVCM Linyuan plant, the process steam condensate is recycled and reused in the cooling water tower.

Climate Change Topics	Topic Category	Description of Risks and Opportunities	Potential Financial Impact	Vinyl Chain Strategy and Countermeasures
Use low-carbon energy	Opportunity/resilience, energy source	Promote coal-to-gas conversion, increase the proportion of renewable energy use, reduce carbon costs, lower product carbon footprints, and enhance corporate image and brand value.	<p>Increased capital expenditures and reduced carbon fees</p> <p>Energy saving improvement project for chlorine natural gas boilers of CGPC and TVCM, with an investment cost of about NT\$63 million.</p>	<ul style="list-style-type: none"> The installation of a 30-ton natural gas boiler at the CGPC Main plant was completed in October 2023, which can save natural gas by 1,235,889 NM³/year and reduce carbon by 2,345 tonnes CO₂e/year. Since 2021, we have promoted the conversion of coal-fired boilers to natural gas boilers. It is planned to switch to natural gas before 2025, and the estimated carbon reduction is about 16,000 tonnes CO₂e. TVCM Linyuan plant - The 35 ton Steam Boiler Optimization and Improvement was completed in July 2023. After optimization, the boiler can save 1,400,000 NM³ of natural gas/year. Switching to inverter control for windmills can save 460,504 kWh of electricity and 3,139 tonnes of CO₂e/year in total.
R&D and innovation in developing new products and services - Research and development of low-carbon energy-saving products	Opportunities/Products and Services	Develop circular economy, low-carbon, and energy-saving products. Invest in technology from the perspective of the complete life cycle of products and services to develop low-carbon products.	<p>Increase in research and development expenses, increase in operating costs</p> <ul style="list-style-type: none"> In 2023, we have obtained the GRS Global Recycling System certification project which will enhance the Company's corporate image, obtain brand certification, and increase market competitiveness. An investment of about NT\$800,000 was made. NT\$500,000 was invested in the bio-shell powder antibacterial and anti-mold rubber project in 2023. 	<p>Continue to develop circular recycled products:</p> <ul style="list-style-type: none"> We adopt post-consumer TPO or industrial waste TPU materials and utilize a compression molding process along with post-consumer recycled PET bottles to produce polyester non-woven fabric (base fabric) for environmentally friendly synthetic leather. The percentage of recycled plastics reaches 30-60%, and with GRS global recycling system certification. Oyster shell powder is made from waste oyster shells and calcined at high temperature. It is a natural material and has been used in artificial leather to replace synthetic antibacterial agents. It can minimize environmental impact and pollution. It has been tested and certified to have antibacterial and anti-mold properties effect.
Better Use of Public Sector Incentives	Opportunity/Market	Use the government incentive mechanism to reduce input costs, adopt new technologies, and enhance competitiveness.	<p>Higher capital expenditures and higher revenues</p> <ul style="list-style-type: none"> CGPC Main plant was selected by the Taiwan Green Productivity Foundation to become a TCFD demonstration manufacturer. The CGPC Main plant was selected by the Taiwan Industrial Development Foundation as the guidance vendor. The Company applied for a green factory label (cleaner production + green building certification) with an investment of NT\$1.5 million. Application items for low interest rates: <ul style="list-style-type: none"> CGPC's application plan: Deeply-rooted Taiwanese enterprises - automatic warehousing - Taiwanese business participants returning to invest in Taiwan - VCM storage tanks. TVCM: The SME - Intercontinental Phase II project received government support for a low-interest project of about NT\$18.56 million in 2023. In 2023, government subsidies totaled NT\$1.394 million. 	<ul style="list-style-type: none"> During the 2023 TCFD event, CGPC arranged five consultation sessions to estimate the future scenarios of three climate disasters - "flooding, drought, and high temperature" between 2016 and 2035 based on the RCP 8.5 scenario. For transition risk, the IEA is referred to. The scenario is set as "the future global temperature will rise by 1.5°C" to facilitate medium and long-term strategy planning, allowing the Company to better grasp risks and opportunities, and share TCFD implementation experience with various industries in 2024. In 2023, CGPC applied for a green factory label and we have arranged five consultation sessions. The document was submitted for review in December, and we expect to arrange a cleaner production assessment for on-site inspection and evaluation in April 2024. On green building, improvements are made to the air conditioning system. Obtain government subsidies and low-interest loans to effectively reduce costs and prepare sufficient funds for operating needs. Government subsidies in 2023 (unit: NTD Ten thousand) <ul style="list-style-type: none"> Domestic investment interest subsidy of NT\$102 Occupational Safety and Health Administration, Ministry of Labor NT\$20.6 Water Resources Agency, Ministry of Economic Affairs NT\$10 Bureau of Labor Insurance, Ministry of Labor NT\$4.9 Taoyuan-Hsinchu-Miaoli Branch of the Workforce Development Agency, Ministry of Labor NT\$1.8 Environmental Protection Administration, Executive Yuan NT\$0.1

Note: The above scope includes the three Vinyl Chain factories (CGPC Main plant, TVCM Linyuan plant, and CGPC Linyuan plant).

5.2.5 Development of innovative products in response to climate change

GRS Certified Products



Antiviral Products



♦ Testing Method: ISO 22196: The antibacterial efficacy should exceed 2.0 according to the JIS Z2801 standard to be considered effective against bacteria.

Test Microorganism	Antibacterial Value (R)	Antibacterial Effect
Escherichia coli	3.0	99.9%
Staphylococcus aureus	2.8	99.9%

♦ Testing Method: ISO 21702: The antiviral activity should exceed 2.0 according to the SIAA specification to be considered effective against viruses.

Sample Name	Antiviral Activity Value	Antibacterial Effect
PVC leather (H3N2)	3.9	99.99%
TPO leather (H3N2)	3.3	99.99%
UVDoor Panel (H3N2)	3.5	99.99%
Veneer Door Panel(Feline calicivirus)	3.8	99.99%

5.2.6 Energy management ▶ (GRI 302-1、302-3)

CGPC's factories primarily use purchased electricity, natural gas, and fuel coal. The scope of energy use inventory in 2023 includes CGPC Main plant and TVCM and CGPCP plants in Linyuan, with a coverage rate of 100%.

▶ Energy management

In compliance with the government's net-zero carbon emission goals, energy-saving measures are being implemented: Voluntary reductions and the implementation of various energy-saving initiatives within the facilities, surpassing regulatory requirements.

◆ 2023 Energy Conservation Performance (Target: 1%)



Description:

1. The data comes from the Energy Administration's annual energy conservation inspection system reporting form.
2. Achievement rate description: CGPC and CGPCP plant II have achieved the electricity saving rate target. CGPCP mainly proposes steam saving solutions, but the improvement measures are concentrated on H2. Therefore, the annual electricity saving rate is slightly lower than the target. It is expected that energy-saving in 2024 will increase by more than 1%.

▶ Banks' green finance ESG indicators

In response to the government's promotion of green sustainability, CGPC, as an enterprise of excellence, has actively cooperated with banks in bundling the ESG loan line of credit, and obtained the approval of 3-year energy conservation and carbon reduction indicators, and the indicators are as follows:

1. Energy consumption per unit product of CGPC's PVC resin.
2. Greenhouse gas emission intensity per unit product of CGPC's PVC resin.
3. CGPC increased the growth rate of recycled water.
4. CGPC unit water consumption.
5. The total amount of waste generated by CGPC.
6. Water consumption of TVCM Linyuan plant.

▶ Promotion of renewable energy

1. CGPC starts it from the construction of solar photovoltaic equipment on the plant roof, and gradually expanded the use of green electricity in each plant area. In 2019, the rooftop of CGPC Main plant rented out 1437.9 kWp of solar power equipment in the plant. CGPC purchased the solar photovoltaic equipment back in May 2022. In 2023, the 1.73 million kWh of solar power generated was sold entirely to Taipower.
2. CGPC will continue to expand the capacity of solar energy equipment and completed the installation of 679.82kWp solar energy in the plant before the end of 2023.
3. TVCM Linyuan plant does not have a suitable roof space to put solar energy equipment. It plans to purchase 1.64 million kWh of green electricity and certificates by the end of 2025.

▶ CDP Questionnaire

Our supply chain was invited to participate in the CDP questionnaire: Climate Change and Water Security in 2023, which received B- and B, respectively.

▶ Application items for obtaining bank ESG financing lines and low interest rates

1. CGPC and TVCM continue to implement ESG development, signing sustainability-linked loans with Chang Hwa Bank, Fubon Bank, and other banks.
2. Application items for the low interest rate program of CGPC and TVCM:
 - ◆ CGPC's application plan: Deeply-rooted Taiwanese enterprises - automatic warehousing; Taiwanese business participants returning to invest in Taiwan - VCM storage tanks.
 - ◆ TVCM: Small and Medium Enterprises - Intercontinental Phase II Project
3. The low-interest rate projects supported by the government in 2023 were approximately NT\$18.56 million.

Energy usage in the last 3 years

(Unit: GJ)

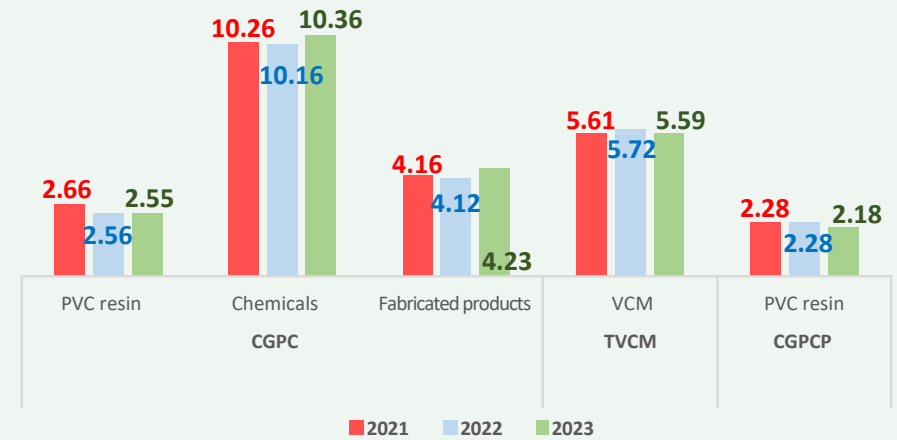
By company	Energy type	2021	2022	2023
CGPC (Main plant)	Purchased electricity	642,323	605,925	546,155
	Fuel coal	423,571	70,108	32,229
	Natural gas	242,222	517,934	516,187
	Diesel fuel	4,848	4,299	4,384
	Gasoline	106	114	183
	Total energy consumption		1,313,070	1,198,380
TVCM (Linyuan plant)	Purchased electricity	346,369	339,825	344,205
	Purchased steam	268,180	86,934	119,687
	Natural gas	1,902,346	2,005,950	1,991,576
	Diesel fuel	89	257	312
	Gasoline	67	69	129
	Total energy consumption		2,517,051	2,433,035
CGPCP (Linyuan plant)	Purchased electricity	138,547	129,593	135,440
	Purchased steam	340,650	294,365	298,127
	Diesel fuel	65	150	265
	Gasoline	22	19	21
	Total energy consumption		479,284	424,127

Note 1: The fuel coal and natural gas of the CGPC Main plant are calculated according to the unit calorific value table of energy products announced by the Energy Administration.

Note 2: In line with the inventory method of GHG emissions, TVCM and CGPCP have revised the distribution method for purchased electricity and the statistical method for purchased steam since 2021.

Energy consumption of products of each unit in the last 3 years

(Unit: GJ/ton)



Description of product energy consumption of each unit:

- ◆ CGPC revised the unit consumption of PVC resin in 2021, which was due to the change of electricity statistics (consistent with energy reporting).
- ◆ CGPC revised the chemical unit consumption for 2021-2022 due to a change in the method of calculating production (consistent with the annual report).
- ◆ TVCM's revision of the VCM unit consumption for 2021-2022 is based on the revision of the distribution method of purchased electricity and deduction of the volume of steam sold.
- ◆ CGPCP has revised the PVC resin unit consumption per unit of 2021-2022 to revise the method for allocating purchased electricity.
- ◆ In 2023, CGPC chemical unit's increase in unit product energy consumption was mainly due to electrolytic cell shutdown and production volume reduction.
- ◆ In 2023, the energy consumption per unit of product processed by CGPC increased, mainly due to the demolition and renovation of the adhesive tape machine.

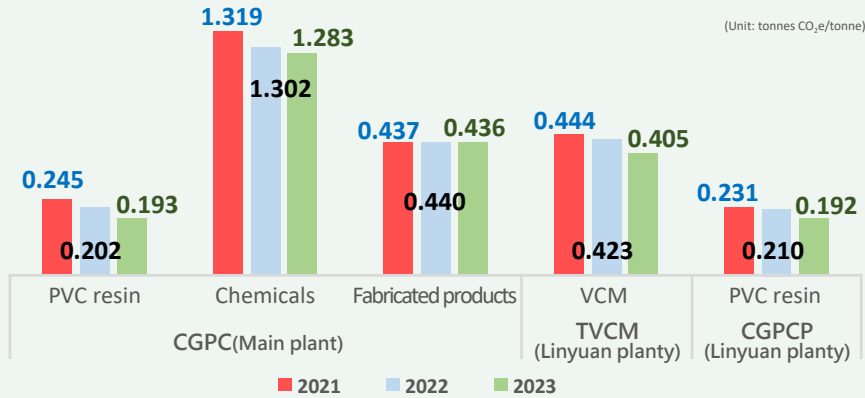
5.2.7 Greenhouse gas management ▶ (GRI 305-1、305-2、305-3、305-4、305-5)

GHG inventory is carried out every year to effectively manage the emissions of each plant of CGPC. Starting from 2023, the scope of inventory includes the subsidiaries of CGPC in the Consolidated Financial Statements, with a coverage rate of 100%. Among them, CGPC Main plant and TVCM Linyuan plant must register and verify greenhouse gas emissions because they are subject to the “Climate Change Response Act”. Therefore, relevant operations are carried out in accordance with the Ministry of Environment’s “Greenhouse Gas Emissions Inventory Registration and Verification Management Regulations”, and the inventory data is regularly verified by an impartial third-party verification unit.

Greenhouse gas emissions intensity by product the last 3 years

(Unit: tonnes CO₂e/tonne)

By company	By product	2021	2022	2023	goal	Achievement
CGPC (Main plant)	PVC resin	0.245	0.202	0.193	0.248	✓
	Chemicals	1.319	1.302	1.283	1.366	✓
	Fabricated products	0.437	0.440	0.436	0.455	✓
TVCM (Linyuan plant)	VCM	0.444	0.423	0.405	0.446	✓
CGPCP (Linyuan plant)	PVC resin	0.231	0.210	0.192	0.234	✓

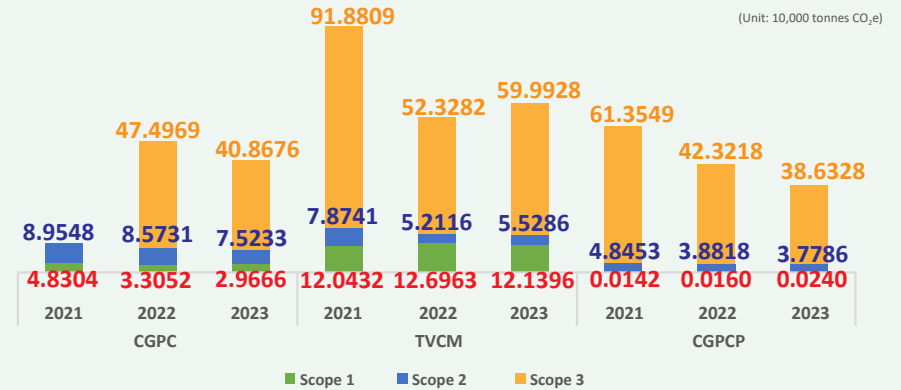


- Notes:
1. Calculation formula = Total GHG emissions by product (CO₂e tonnes)/Total production by product (tonnes)
 2. CGPC revised the processed products for 2021-2022 due to a change in the method of output statistics.
 3. TVCM revised the VCM products in 2022 because the inventory data was obtained after the reporting.
 4. CGPCP revised the PVC resin products in 2022 because the inventory data was obtained after the reporting.
 5. The 2022 target was based on the average of the emission intensity by product between 2019~2021, and it is expected that after the review in 2025, the target will be revised.
 6. The 2023 greenhouse gas emissions data of CGPC, TVCM, and CGPCP are all third-party verified data.

Greenhouse gas emissions of each plant in the last 3 years

(Unit: 10,000 tonnes CO₂e)

By company	Scope	2021	2022	2023
CGPC	Scope 1	4.8304	3.3052	2.9666
	Scope 2	8.9548	8.5731	7.5233
	Scope 3	-	47.4969	40.8676
TVCM	Scope 1	12.0432	12.6963	12.1396
	Scope 2	7.8741	5.2116	5.5286
	Scope 3	91.8809	52.3282	59.9928
CGPCP	Scope 1	0.0142	0.0160	0.0240
	Scope 2	4.8453	3.8818	3.7786
	Scope 3	61.3549	42.3218	38.6328



- Note:
1. Scope of inventory in 2023: (1) **CGPC** includes: CGPC Main plant, Taipei Office, and overseas subsidiaries. (2) **TVCM** Company includes: TVCM’s Linyuan plant, Taipei office, and **GGTC** Company. (3) It was Linyuan plant for **CGPCP** Company. The above scope includes CGPC’s subsidiaries in the consolidated financial statements, and the coverage rate is 100%. GHG inventory includes: CO₂, CH₄, N₂O, and HFCs.
 2. Scope 3 coverage was added to TVCM and CGPCP starting from 2021, and Scope 3 coverage was added to CGPC from 2022.
 3. The calculation adopts the operational control method, and the emission coefficient adopts the coefficient announced by the Ministry of Environment. (The carbon emission coefficient of electricity provided by the Energy Administration)
 4. TVCM and CGPCP revised its greenhouse gas emissions in 2022 because the inventory data was obtained after the reporting.
 5. For other information, see: Remarks on Carbon Reduction Pathway Planning.
 6. Subsidiaries in the consolidated financial statements of CGPC - Categories covered in Scope 3:
 - GHG emissions from upstream and downstream transportation and cargo distribution, GHG emissions from employee commuting, and GHG emissions from business travel and GHG emissions from the organization’s procurement of raw materials, extraction, manufacturing, and processing, and GHG emissions from the disposal of solid and liquid wastes.

5.2.8 Energy conservation and carbon education solutions and performance

By company	Energy conservation and carbon reduction solutions	2023 performance	
		Amount of energy conservation (GJ)	Amount of carbon reduction (CO ₂ e tonnes)
CGPC (Main plant)	Replacement of Supercharged D set of compressors, replacement of 800RT refrigerators, and improvement of energy savings and improvement of the external circulation pump of the chilled water system, and improvement of Supercharged compressed air pressure for energy saving. Improvements in thermal insulation, replacement of old air compressors with new models, and improvement of energy-saving screw sleeve electric heaters in the extrusion machine.	58,347	3,679
TVCM (Linyuan plant)	<ul style="list-style-type: none"> Replacement of the cooling tower circulation pump (P-6010A) Replacement of Cooling Tower Circulating Water Motor (PM-6010C) Add variable frequency control to the cooling tower fan B-6001A Plant-wide Cooler Improvement Project (Phase 2) Intelligent control of 35-ton boiler 	66,670	4,226
CGPCP (Linyuan plant)	<ul style="list-style-type: none"> Replacement of Obsolete RF-2401A Chiller Equipment Replace old water dispensers in the plant with new ones Optimization of hot pure water vapor heating system 	28,850	2,065
Total		153,867	9,970

2024 Carbon Reduction Plan and Targets (CO₂e tonnes)

	Major Energy Conservation and Carbon Reduction Solutions	<u>Target Carbon Reduction Amount</u>
 CGPC (Main plant)	<ul style="list-style-type: none"> Powder conveying system improvement and motor replacement Replacing old refrigerators with new ones, windmills for energy-saving improvements Replace old air compressors with new ones and improve energy-saving screw sleeve electric heaters of extruder machines. 	405
 TVCM (Linyuan plant)	<ul style="list-style-type: none"> Replacement of the cooling tower circulation pump (P-6010C) Replacement of Cooling Tower Circulating Water Motor (PM-6010A) Replace the instrument air with a low-horsepower air compressor. VCM Tower (C-6203) Implemented AI Energy Saving Project 	1,032
 CGPCP (Linyuan plant)	<ul style="list-style-type: none"> CO-0001AB Air Compressor Replacement 	148

Note: 1. The data comes from the Energy Administration's annual energy conservation inspection system reporting form

2. Calculation benchmark:

(1) Refer to the unit calorific value conversion coefficient for energy products announced by the Energy Administration (for energy statistics only), which is: electricity 860 kcal/kWh, fuel coal 5,600 kcal/kg, natural gas 9,000 kcal/m³, and gasoline 7,800 kcal/L and diesel 8,400 kcal/L, of which 1cal is 4.187 J.

(2) The 2023 CO₂ emission coefficient from fuel coal at the CGPC Main plant is calculated based on 1.9457 kg CO₂ e/kg.

(3) The CO₂ emission coefficient for the natural gas used in the CGPC Main plant in 2023 is calculated as 1.897 kg CO₂ e/m³.

(4) The CO₂ emission coefficient for the natural gas used in the TVCM's Linyuan plant in 2023 is calculated as 2.079 kg CO₂e/m³.

(5) The calorific value conversion factors of the purchased steam used by TVCM and CGPCP's Linyuan plants in 2023 were 669,000 kcal/ton and 665,534 kcal/ton, respectively, and the CO₂ emission factors were calculated at 182.4 kg CO₂e/ton and 213.5 kgCO₂e/ton, respectively.

(6) The types of gases included in the calculation of carbon reduction in the energy conservation and carbon reduction plan include carbon dioxide, methane and nitrous oxide.

3. This program does not include the carbon reduction benefits of offset projects. Please refer to the explanation provided in the Greenhouse gas replacement project Quota Application for further details.

4. In 2023, the investment amounts of various energy conservation and carbon reduction programs, and the energy conservation and carbon reduction are as shown in the [Table](#).

► Greenhouse gas replacement project quota obtained

Since 2018, CGPC has implemented two greenhouse gas offset projects. These projects, namely the "Updated replacement project of the IEM Alkali Evaporator Tank" by CGPC and the "Cracking Furnace Replacement Project for Furnaces F-6201 and F-6202" by TVCM, have undergone third-party verification and registered for approval. On February 23, 2022, and May 3, 2022, respectively, both projects were approved in the first round of quota applications by the Ministry of Environment, obtaining a total reduction quota of 7,464 tonnes of CO₂e. These measures were taken to reduce future carbon regulatory risks.

Please refer to the official letter of the Ministry of Environment, Executive Yuan: [Updated the IEM Alkali Evaporation Tank Offset Project](#) and Replacing [two pyrolysis furnaces \(F-6201 and F-6202\)](#).

5.2.9 Energy conservation and carbon reduction equipment improvement solutions ► (GRI 302-4, 303-3, 305-5)

We continue to promote the work of "energy conservation and carbon reduction" with practical actions in an honest and responsible attitude. In recent years, we have invested a lot of resources in adding new equipment and replacing old equipment with new ones, hoping to reduce the impact of the overall operating activities on the environment.

Program name	CGPC Main plant Update of compressor set coincides with Course D	CGPC Main plant Addition of a 30-ton steam boiler to the Public Affairs Section	CGPC Main plant/TVCM Linyuan plant/CGPC Linyuan plant Steam Drainer Improvement Project
Condition before improvement	<ol style="list-style-type: none"> Originally, the reclosing and blowing recycling compressor required three sets of compressors (C, old D, and E) with a total of 960kW. All three of them did not have backup units. When one of the pieces of equipment is damaged, it will prolong the recycling and compression time. The motors of the first stage and second stage of the old D set of recycling compressors were 120kW and 200kW, respectively. 	<p>The natural gas consumption per unit of steam of the original #7 natural gas boiler was 66.5 NM³/ton, due to the old boiler equipment, the combustion efficiency was still at 88-89%, and it did not meet the current laws and regulations for energy conservation and carbon reduction.</p>	<ol style="list-style-type: none"> Most steam eliminators are clogged, resulting in the accumulation of condensed water back in the main pipe, and the condensed water is carried into the heat exchanger resulting in poor heat energy conversion performance. Due to serious steam leakage from some of the coolers, the outlet temperature could not be kept below the saturation temperature of atmospheric steam.
Program Description	<ol style="list-style-type: none"> Among the three sets of compressors, the old D set is relatively inefficient. To improve the overall recycling efficiency, the D set of recycling compressors were completely updated. The motors of the first and second stages were improved to 132kW and 170kW, respectively. After the new D sets of compressors are replaced, dual-purpose and one standby operation can be adopted to reduce the number of compressor combinations by 2 sets (C + new D sets or new D sets + E sets) and still maintain the process operating load. Therefore, it is possible to increase the overall compression efficiency, thereby reducing electricity consumption. 	<p>By installing a #2 natural gas 30-ton steam boiler in place of the #7 boiler as the main boiler operation, and converting the existing #7 boiler as a standby, the actual unit steam and natural gas consumption of the new #2 boiler can be reduced to 59.1 NM³/ton, and the combustion efficiency can be increased by up to 93.5%, reducing the overall natural gas consumption of the steam boiler and achieving the results of energy saving and carbon reduction.</p>	<ol style="list-style-type: none"> On the basis of the venturi design principle, the ARISTI steam trap is designed so that the steam can effectively reduce the pressure inside the main body. The pressure difference generated by the fluid in the steam trap causes the condensed water to drain through the nozzles designed according to the flow rate. It is adsorbed and released (producing a spray effect). Conduct a comprehensive leak inspection and assessment of all water eliminators in each plant of the three companies, and compare ARISTI and other brands according to the ISO 7841 test specification, the method for determining steam leakage of "active drain water valves" was by comparison of leakage of the steam traps of different brands, and then replace the steam traps with abnormality.
Completion date	August 2023	October 2023	October 2023 for CGPC/February 2023 for TVCM/July 2023 for CGPC
Expected benefits after improvement	<p>After upgrading, the compressors could save electricity by 737,537 kWh/year and reduce carbon by 365 tonnes CO₂e/year.</p>	<p>The new boilers can save natural gas by 1,235,889 NM³/year, which is equivalent to a reduction of 46,572 GJ/year of thermal energy and 2,345 tonnes of CO₂e/year.</p>	<p>CGPC: 1,326 tonnes/year of steam saved and 164 tonnes CO₂e/year of carbon reduction. TVCM: 3,327 tonnes/year of steam saved and 462 tonnes CO₂e/year of carbon reduction. CGPC: 1,300 tonnes/year of steam saved and 238 tonnes CO₂e/year of carbon reduction. Total: 5,953 tonnes/year of steam saved and 864 tonnes CO₂e/year of carbon reduction.</p>
Photos			

Program Name	TVCM Linyuan plant The 35 ton Steam Boiler Optimization and Improvement	TVCM Linyuan plant Improvement of the pumping efficiency of the cooling tower and installation of variable frequency control for the fan	CGPCP Linyuan plant Optimization of hot pure water vapor heating system
Condition before improvement	In the face of carbon costs and improvement of air quality, etc, in response to the related impacts, we carried out boiler equipment transformation in 2014 in response to environmental protection policies. The fuel was transformed from heavy oil to using natural gas. However, the boilers still failed to improve efficiency.	<ol style="list-style-type: none"> 1. The motor of the cooling tower's cooling fan is controlled at a fixed frequency. It runs at full speed regardless of seasonal changes and the surrounding temperature, which consumes both energy and money, and increases unnecessary carbon emissions. 2. The pumping efficiency of the three cooling water pumps used in parallel is not good. Since they are used in parallel, P-6010A and P-6010B will be improved first, and then P-6010C will be improved in 2024. 	<ol style="list-style-type: none"> 1. Due to the batch reaction of CGPCP, the original design and production of hot water are of batch production. 2. Batch production of hot water causes the steam to sway greatly during use, and stays in the tube to consume energy when not in use.
Program Description	<p>The 35 ton boiler adopts an intelligent control combustion system. The microcomputer intelligent control, program compensation, and exhaust gas analyzer analysis are fed back to the control system to adjust the operating conditions. In addition, motor inverters were retrofitted, air valves were replaced with servo motors, and natural gas control components were replaced with sliding rod control valves for equipment upgrading.</p> <p>The intelligent control combustion system is equipped with an exhaust gas analyzer, which uses a microcomputer burner to control the air-fuel ratio of the boiler, calculates the optimal efficiency of natural gas and O₂, and is equipped with an exhaust gas analysis system to continuously monitor and analyze the exhaust gas content and feed the feedback to the intelligent control system to achieve the best combustion efficiency. It reduces natural gas consumption and precisely controls the air-fuel ratio of the boiler. Even if the demand for process steam increases, low-volume operation can still be done without compromising efficiency.</p>	<ol style="list-style-type: none"> 1. The cooling fan motor (B-6001A) is equipped with an inverter. In winter, the heat energy generated by the manufacturing process is reduced, the ambient temperature is lower, and the heat dissipation demand of the cooling tower decreases. Therefore, one cooling fan motor is changed to inverter control to reduce power consumption and carbon emissions. 2. Improved the performance of the P-6010A and P-6010B cooling pumps. Recalculated the hydraulics and piping design for the cooling pumps and updated the equipment to achieve the effect of energy saving and reduce a lot of electricity consumption. 	<ol style="list-style-type: none"> 1. Change the batch production of hot water to continuous operation. 2. New pipelines are planned to be prepared at the bottom of the pure water tank. By adding a new pump and a flow meter, the appropriate operating volume can be adjusted to deliver the water to the hot water system.
Completion date	July 2023	July 2023	June 2023
Expected benefits after improvement	After optimizing the boiler, 1,400,000 NM ³ /year of natural gas can be saved. Switching to the inverter-controlled windmill can save 460,504 kWh of electricity per year, and the total carbon reduction is 3,139 tonnes of CO ₂ e/year.	After the implementation of the above energy saving improvement plan for cooling towers, a total of 1,443,675 kWh of electricity and 715 tonnes of CO ₂ e/year of carbon were saved.	After the optimization of the hot water heating system, 8,260 tonnes of steam can be saved per year and 1,522 tonnes of CO ₂ e/year can be reduced.
Photos			

5.3 Water Resources Management ▶ (GRI 2-4、3-3、303：2018)

Continuous monitoring and compilation of daily, monthly and annual water consumption records. In terms of management, we will continue to study feasible solutions and use manufacturing processes to improve water conservation and enhance water recycling and reuse rates. Improve pipelines, conduct regular leak-prevention inspections, follow up and review the progress, and propose improvement plans. The scope of 2022 inventory includes CGPC's Main plant, and TVCM and CGPCP's plants in Linyuan, with a coverage rate of 100%. Our supply Chain is invited to participate in the CDP - Water Security Questionnaire 2023, receive a B management grade.

Material issue: Water resource management

- The Significance and Impact of CGPC**

Value water resources, reduce the consumption of water resources in the production process, and improve the reuse rate of water recycled to reduce the impact on the environment. Affected parties: employees, government agencies, community residents.
- Develop Strategy**

Implement ISO 46001 and ISO 14046 to reduce and reduce water waste, improve and replace water-consuming equipment, increase the water reuse ratio R2, and actively implement the plan to apply for water consumption reduction.
- Policy Commitment**

Starting from 2023, the annual water reuse ratio R2 will be increased by 1% (total of the three factories).
- Grievance Unit**

Public Utility Course
- SASB Indicator**

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Promotion policy	Unit	2023 goal	2023 result	2024 goal	2025 goal	2030 goal
Increase the water reuse ratio R2 by 1% every year.	R2 ratio (%)	71.0	71.9 	72.0	73.0	78.0

Note: Starting in 2023, statistics are calculated based on the water reuse rate R2 of water consumption fees.

Exceeded Target
 Achievement
 Partially achieved
 Not met

Centrifuge dryer wastewater recovery systems (HBF) for CGPC Main plant and CGPCP Linyuan plant

Abnormal climate can lead to lack of water resources in the world. [Taiwan is listed as the 18th country at risk of water scarcity in the world.](#) · CGPC's main plant and CGPCP's Linyuan plant have planned to establish the recovery and reuse of recycled water.



Condition before improvement	Before installing the system, the centrifuge wastewater and plant wastewater are treated by the sand filter system and then discharged to the sewage treatment plant.
Benefits after improvement	In 2023, the second phase of the HBF project was launched, and the daily recycling consumption is expected to increase by another 100 tonnes. The water saving in 2023 was as follows: Water Reclaimed Volume of CGPC: 139.5 million liters/year, Water Recycled Volume of CGPCP: 457.9 million liters/year Total: 597.4 million liters/year
Program Description	A biological treatment system and a COD adsorption system are set up to treat the separated original liquid that cannot undergo the complete recycling process and after the liquid is treated by the newly installed centrifuge to reduce the chemical oxygen demand (COD) and suspended solids (SS), it is resupplied to the cooling water tower to reduce the amount of tap water used and wastewater discharged. In 2023, a filter tank and a pre-treatment device were added to the HBF system, which is expected to increase the reused water consumption by 35 million liters.
Completion date	CGPC: The expansion was completed in April 2018 and by the end of 2023. CGPCP: In July 2018.

5.3.1 Water management ▶ (GRI 303-1 ~ 305-5)

In response to the risk of water shortage potentially caused by climate change, the water source used by CGPC (Main plant) is supplied by Yongheshan Reservoir and the water used by TVCM and CGPCP (Linyuan plant) is supplied by the Fengshan Reservoir, which is put into the process. In order to save water, the three companies have added processed water recycling systems and various water-conserving devices, promoted other related measures, and continued to pay attention to the internal and external water supply and demand status and reinforce the implementation of water risk management.

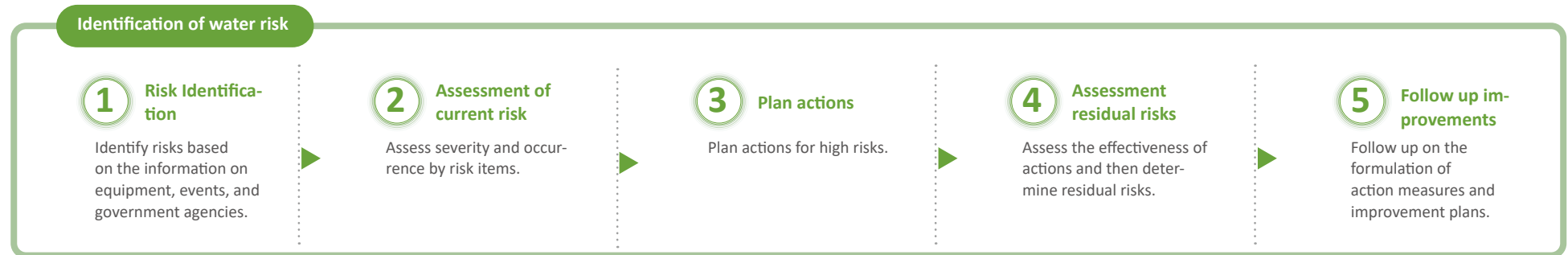
▶ Risk management of water resources

To ensure stable operation and sustainable development, the risk of water shortage resulting from climate change was addressed in December 2020 through the approval of the “[Risk Management Policies and Procedures](#)” by the Audit Committee and the Board of Directors, aiming to establish a comprehensive risk management system. To effectively implement the company’s risk management mechanism, the Board of Directors, Audit Committee, General Manager, Audit Department, various risk management units, and subsidiaries collaborate in its promotion. Pay attention to the development of international and domestic risk management systems at all time, review and optimize the risk management methods to improve the effectiveness of the Company’s risk management implementation.

▶ Distribution of water stress

The companies refer to the [water stress map](#) drawn up by the World Resources Institute (WRI), enabling us to understand the water stress felt by countries around the world. Each company is verified to be located in the low to high stress areas.

Item/Company	CGPC (Main plant)	TVCM (Linyuan plant)	CGPCP (Linyuan plant)
Regions with water stress.	Low to moderate water stress zone	Low to moderate water stress zone	Low to moderate water stress zone
Water stress	10 ~ 20%	10 ~ 20%	10 ~ 20%



▶ Assessment of water risks and implementation

CGPC Main plant plans to introduce ISO 46001 water resources management system and ISO 14046 water footprint in 2022 to understand the potential impact of water risks on operations (inventory of the 2021 information), and refer to the [Taiwan Climate Change Projection and Information Platform](#) and [Taiwan-wide disaster risk map](#) to estimate the impact of future changes in average rainfall on water resources. Water footprint, recycling of water resources, and wastewater treatment are used to formulate response strategies. Identified that the Company’s operating locations (Main plant in Miaoli is in a low to moderate stress area, and Linyuan plant in Kaohsiung is in a moderate to high stress area) are not in high water stress areas and there is no significant impact on water use.

By company	Water stress Assessment Result	Impacts caused by extreme weather
CGPC Main plant	Low to moderate water stress zone	In the second half of 2020, the rainfall continued to be lower than expected. The water supply situation in Hsinchu and Miaoli areas was particularly dire. The Toufen Industrial Park Management Center has required a weekly water saving of 7% starting from January 7, 2023, 11% starting from February 19, 2023, and 17% starting from May 12, 2021, and the weekly water intake reported and the water meter data needed to be checked to verify whether the water conservation standards have been met. Statistics show that as of the end of July 2023, the average water conservation performance of the Main plant has reached more than 15%, that of TVCM Linyuan plant has reached 11%, and that of CGPCP has reached 20%. No material impact in 2023.
TVCM Linyuan plant	Low to moderate water stress zone	
CGPCP Linyuan plant	Low to moderate water stress zone	
Identification of water risk (Frequency of occurrence)	The risks of operational sites are evaluated based on factors such as water usage, seasonal variations, droughts, floods, and declining groundwater levels.	
Management actions	<p>A. Conservation of process water:</p> <ol style="list-style-type: none"> (1) Start water conservation measures to increase the conductivity of the water replenished to the cooling water tower. (2) Increase the concentration ratio of the cooling water tower and reduce the frequency of water replacement in the scrubber tower. (3) Discharge the cooling water and recycle it as the water used in the scrubber. <p>B. Conservation of water used in daily life</p> <ol style="list-style-type: none"> (1) Decompressed water supply. (2) Place water bottles and install water savers to squat toilets to achieve water conservation. (3) Continue to advocate water conservation to employees. (4) Improve on-site patrol inspections and send personnel to handle any water leaks immediately. <p>C. Improve the recycling water treatment operation and the recycling rate and actively plan rainwater recycling.</p> <p>D. Purchased water and active the use of underground in the Main plant.</p> <p>E. Continue to maintain contact with government agencies to obtain water information.</p> <p>F. CGPC plans to continue to issue ISO 46001 and ISO 14046 certificates in 2023.</p> <p>G. Conduct monthly plant review meetings, exchange opinions with other plants from time to time, and keep track of climate and reservoir information.</p> <p>H. One new 500-ton PE storage tank (20 pieces) and 1,500-ton tap water storage tank.</p>	
Water conservation results	<ol style="list-style-type: none"> 1. Install centrifuge dryer wastewater recovery systems (HBF) for CGPC Main plant and CGPCP Linyuan plant. 2. In 2023, water reuse accounted for the total water withdrawn: 49.2% from CGPC, 24.4% from TVCM, and 70.3% from CGPCP. The total water reuse was 1,314.1 million liters. <p>Note: CGPC's recycled water includes HBF process recycled water system, steam condensate, and coal boiler sedimentation tank uses effluent water instead.</p>	

CGPC's building materials factory – Rainwater recycling and re-use



Solution: Rainwater recycling and reuse

Description:

CGPC has been established for 59 years. The building materials plant uses the plastic pipes produced by the Company to build a green environment which can be used by employees during their break and for environmental protection purposes. We strive to harness the power of our team and give our utmost efforts to contribute to environmental protection.

- ◆ **Rainwater Storage Tank Volume:**
(12-inch pipe X 2M X 6) about 3 tons + 1 ton buckets (2), which can store about 5 tons of rainwater.
- ◆ **Application situation:**
Rainwater in the rainwater recovery tank can be used for watering plants and flushing toilets.
- ◆ **Benefits:**
Green and keep the environment clean and it can also keep water bills low and add to conservation.

We spare no efforts in conducting internal and external coordination and communicating with government agencies and have implemented adding the use of HBF recycled water, increasing the concentration ratio of the cooling water tower and reduce the water replenishment and other water conservation measures. Because the water data is inconsistent with the actual water volume we should be receiving, which results in great challenges to our operations, we will continue to observe the process and take action at any time.

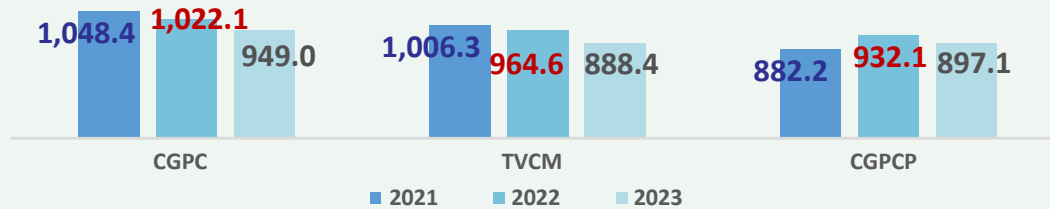
Water withdrawal by each plant in the last 3 years

(Unit: million liters)

By company	Source	2021	2022	2023
CGPC (Main plant)	Tap water	1,022.9	1,021.5	949.0
	Groundwater	25.5	0.6	-
	Total	1,048.4	1,022.1	949.0
TVCM (Linyuan plant)	Tap water	968.4	1,079.2	884.1
	Party from third-party (Note 2)	37.9	(114.6)	4.3
	Total	1,006.3	964.6	888.4
CGPCP (Linyuan plant)	Tap water	701.8	680.5	751.4
	Party from third-party (Note 2)	180.5	251.6	145.7
	Total	882.3	932.1	897.1
三廠	Total water withdrawal	2,937.0	2,918.8	2,734.5

Note 1: HBF (process water recycling system) has been set up in CGPC main plant and CGPCP Linyuan plant, which diverts the recycled water into the cooling water tower for use, in order to reduce the consumption of tap water.

Note 2: Third-party water includes: CGPCP provides tap water to TVCM to produce pure water, and TVCM also provides pure water for CGPCP to use.



Water reuse rate in the past three years (R2) Statistics

(Unit: million liters)

By company	Reclaimed %	2021	2022	2023
CGPC (Main plant)	Reuse water consumption	552.6	520.8	467.1
	Recycling water volume	94,225.8	94,556.8	84,959.2
TVCM (Linyuan plant)	Reuse water consumption	218.2	236.3	216.5
	Recycling water volume	95,802.0	95,802.0	95,802.0
CGPCP (Linyuan plant)	Reuse water consumption	627.6	594.8	630.5
	Recycling water volume	46,428.0	46,428.0	46,603.7
Total Reclaimed water of the three factories		1,398.5	1,351.9	1,314.1
Reclaimed water ratio of the three factories		70.7%	70.7%	71.9%
R2 reclaimed target of the three factories		-	-	71.0%

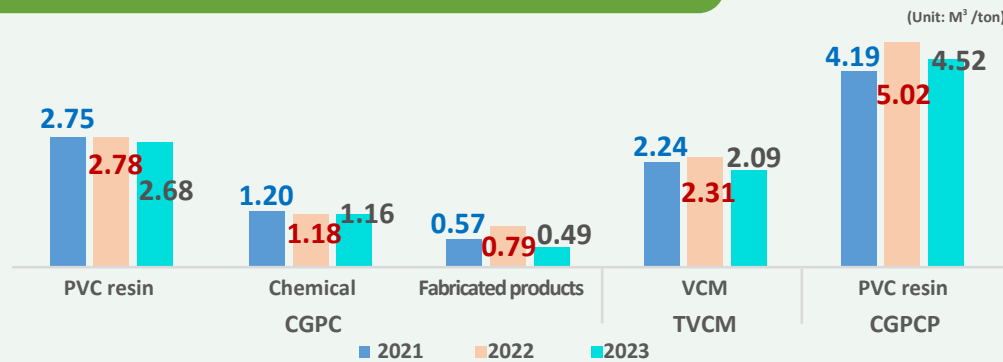
Note

1: Starting in 2023, the water recycling ratio is calculated using the R2 method, and the water recycling ratio is increased by 1% every year.

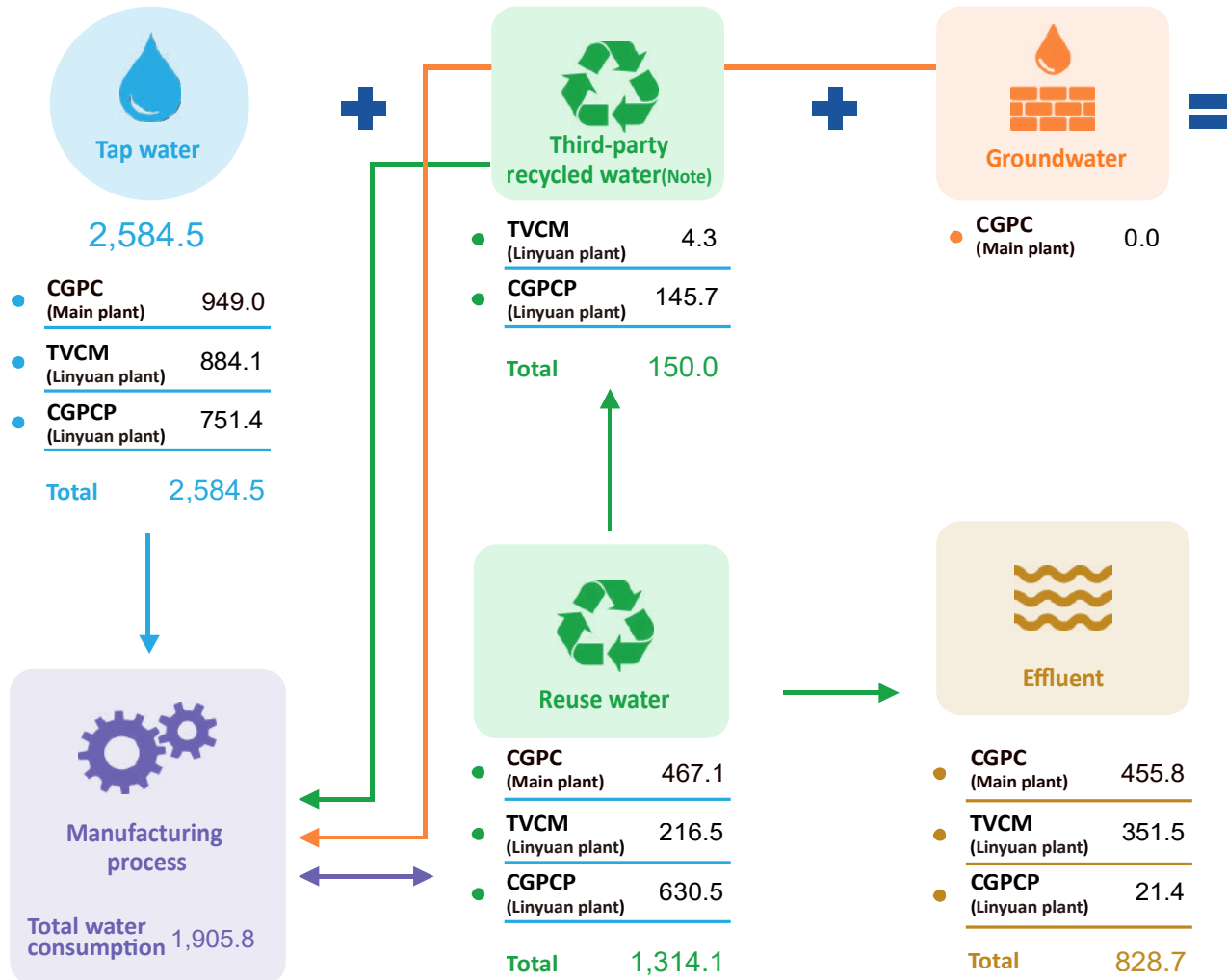
2: Calculated based on the water consumption rate R2 for water reuse.

3: The volumes of reuse water and recycled water are estimated statistics.

Water consumption per product by each of the plant in the past three years



Water Resource Statistics Table ▶ 2023 Water Balance Chart (Unit: million liters)



Company	Reservoir	Percentage of water intake to reservoir water outflow
CGPC (Main plant)	Yongheshan	1.88%
TVCM (Linyuan plant)	Fengshan Reservoir	0.55%
CGPCP (Linyuan plant)	Fengshan Reservoir	0.47%
Total water withdrawal (Unit: million liters)		2,734.5

Percentage of local reservoir water usage at the plant site (Unit: million liters)

By company	Year	Water intake volumes	Reservoir outflow volume	Percentage
CGPC (Main plant)	2021	1,022.9	40,517	2.52%
	2022	1,021.5	52,454	1.95%
	2023	949.0	50,589	1.88%
TVCM (Linyuan plant)	2021	968.4	160,600	0.60%
	2022	1,079.2	160,600	0.67%
	2023	884.1	160,600	0.55%
CGPCP (Linyuan plant)	2021	701.8	160,600	0.44%
	2022	680.5	160,600	0.42%
	2023	751.4	160,600	0.47%

Note: Water consumption = Water intake - Discharge

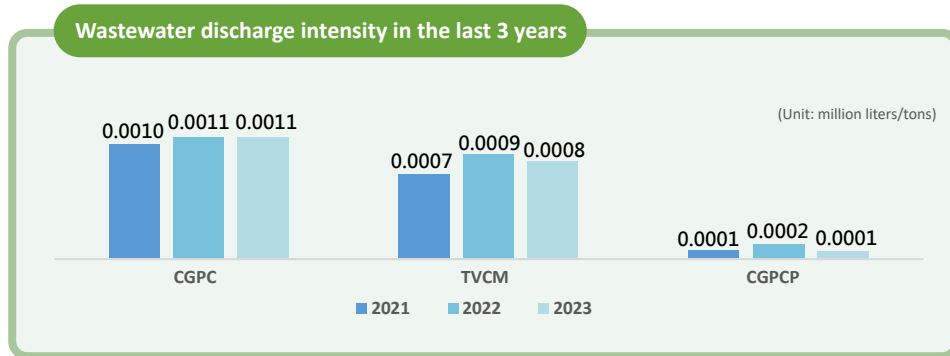
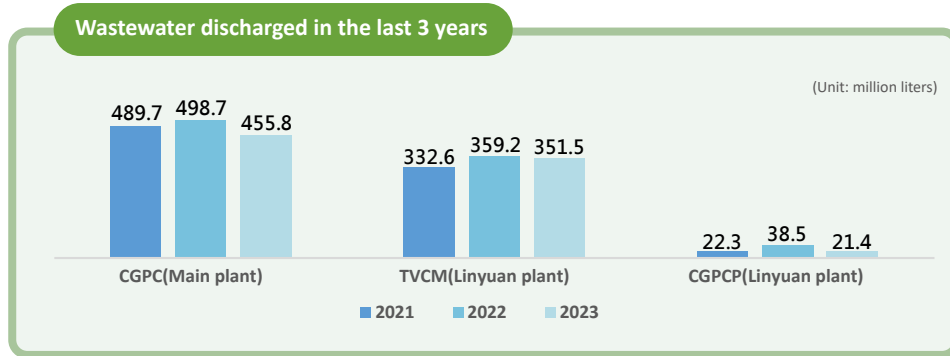
All plants adopt standards stricter than regulatory requirements for their treatment and discharge of wastewater. Outsourcing steam and CGPCP provides tap water to TVCM to produce pure water.

5.3.2 Wastewater discharge management ▶ (GRI 303-4)

CGPC's plants adopt standards stricter than regulatory requirements for their treatment and discharge of wastewater. The destinations of each plant's effluent are as follows:

By company	CGPC (Main plant)	TVCM (Linyuan plant)	CGPCP (Linyuan plant)
Effluents' Destination	Jhonggang River	Ocean discharge in Dalinpu (Note)	

Note: The wastewater of each plant in Linyuan Industrial Park is treated and then discharged to the sewage treatment plant in Linyuan and then transported to the Kaohsiung Linhai Linyuan and Dafa Industrial Parks Combined Wastewater Treatment Plant of the Industrial Development Bureau, Ministry of Economic Affairs, before being discharged to the open sea of the industrial park and the water quality has to meet the discharge standards.



Description:
 1. The amount of effluents of TVCM and CGPCP's Linyuan factories is far less than the consumption of tap water.
 2. Since the process wastewater is almost completely recovered to be used as water replenishment of the cooling water tower, the volume of discharged water is greatly reduced.

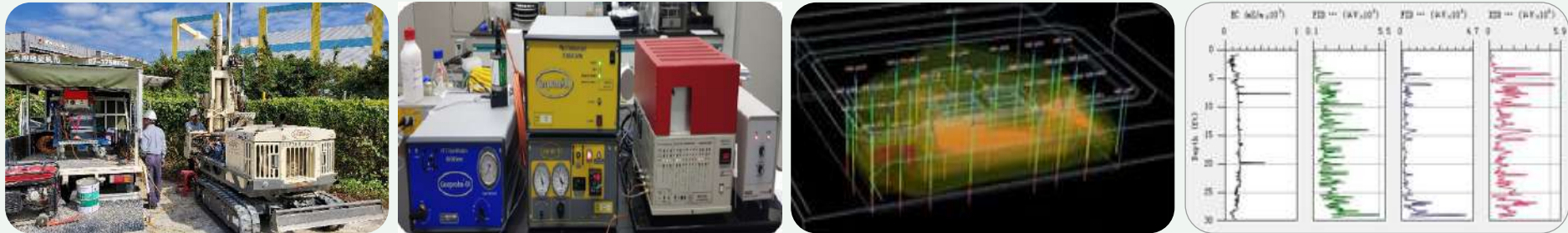
5.3.3 Wastewater quality testing ▶ (GRI 303-2)

The main water quality testing items include suspended solids, grease, chemical oxygen demand, etc., and are regularly tested and reported. In the last 3 years, they have all been lower than the effluent water standard or below the detection limit value. (Unit: mg/L)

By company	Test items	2021 average value	2022 average value	2023 average value	Emissions Standard	Internal control value
CGPC (Main plant)	pH	7.6	7.7	7.7	6~9	7~8
	(SS) Suspended solids (mg/L)	13.5	14.4	12.9	30	<25
	(COD) Chemical oxygen demand (mg/L)	32.0	32.5	31.1	100	<80
TVCM (Linyuan plant)	pH	7.9	7.8	8.0	6~9	7~8
	(SS) Suspended solids (mg/L)	17.3	15.0	4.9	25	<25
	(COD) Chemical oxygen demand (mg/L)	42.0	33.5	19.7	90	<90
CGPCP (Linyuan plant)	pH	7.4	7.8	7.8	6~9	7~8
	(SS) Suspended solids (mg/L)	1.2	1.1	17.2	25	<25
	(COD) Chemical oxygen demand (mg/L)	6.7	12.7	64.1	90	<90

Source: Average of annual inspections (CGPC, four times/year; TVCM and Taiwan Highpolymer, twice/year)

5.3.4 Soil and groundwater remediation technology



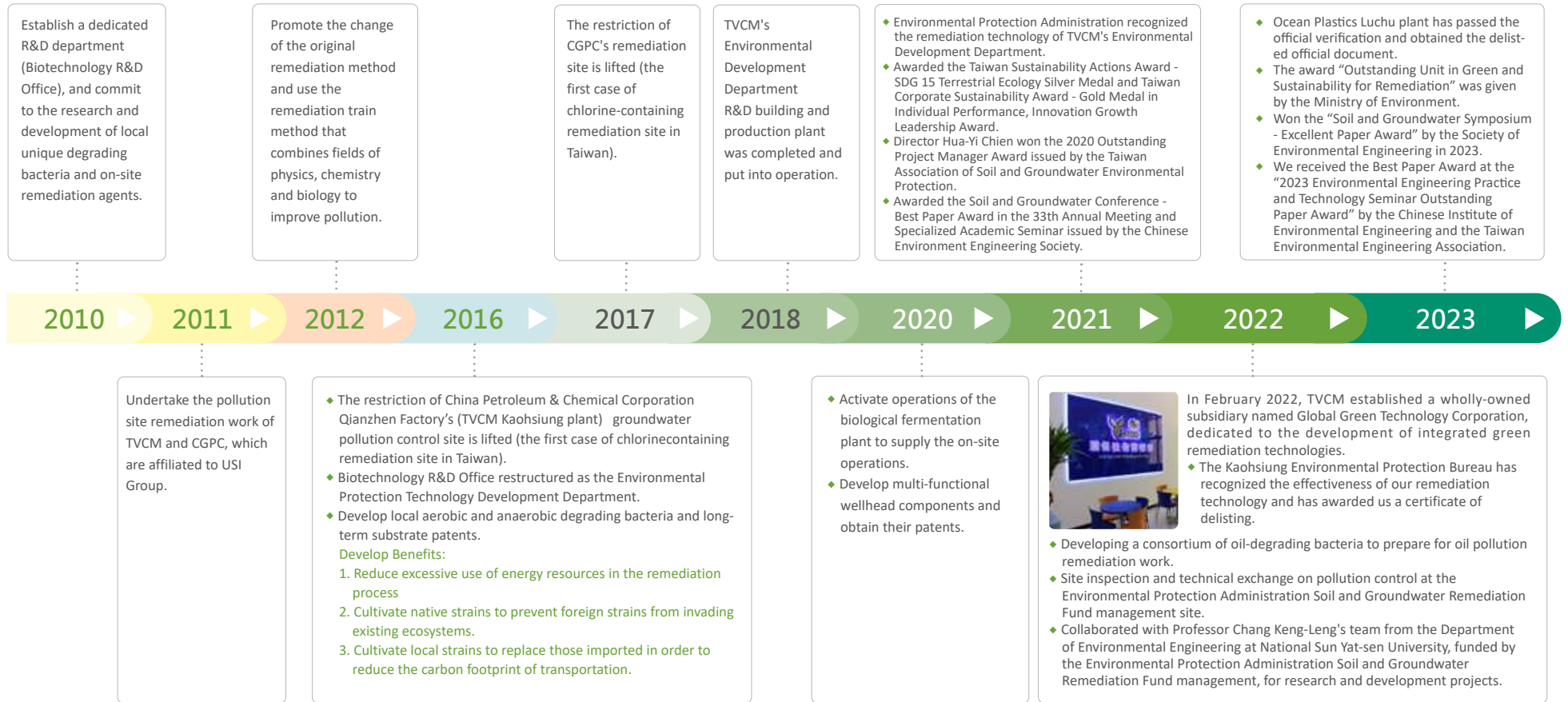
Development background

Global Green Technology Corporation (hereinafter referred to as “GGTC Company”) is one of the green energy and environmental protection business groups in USI Group's affiliated enterprises, a spin-off of the Environmental Protection Technology Development Department. It is a 100% invested company of TVCM (a subsidiary of CGPC).

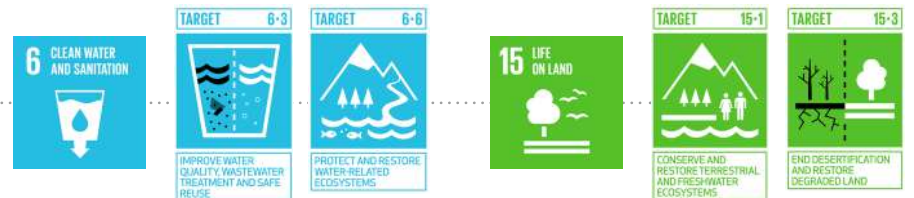
The team was originally formed because our own industry was affected by the soil and groundwater pollution and had entrusted an external environmental protection company to make improvements for many years without success. As we realized that the remediation work was arduous, especially the chlorine-containing pollutants that are difficult to handle and pose a risk to human health are difficult to be solved by traditional physical techniques or single chemical treatment methods. Therefore, we have invested in research and development work force and related precision equipment committed to the development of local biological remediation technology, hoping to solve the problem of soil and water pollution by chlorinated organic compounds through scientific engineering methods. At the same time, we sought for academia-industry collaborations (such as, National Sun Yat-sen University, Kaohsiung University, National Chung Cheng University, Kaohsiung University of Science and Technology, Fu-Yin University of Science and Technology, etc.) to research related issues, accumulate experience in the application of results, and provide more pollution remediation solutions. In April 2016 and February 2017, the remediation of TVCM's Kaohsiung plant (Sinopec's Qianzhen plant) and CGPC Main plant were completed, respectively, and obtained a delisting letter from the competent authority. In 2021, the Company was awarded the first certificate (the first case for delisting as a chlorine-containing site) nationwide by the Ministry of Environment for the “Contaminated Site Remediation Technology Delisted Certificate” and the “Contaminated Site Remediation Technology Certification” issued by the Environmental Protection Bureau of the Kaohsiung City Government in 2022 as the first two cases in the history of remediation of large chlorine-containing factories in Taiwan.

Since the establishment of GGTC Company in 2022, in addition to pollutant analysis and testing, biological agents and materials research and development, we have further refined our survey technology. We have introduced high-resolution on-site pollution survey technology to construct a conceptual model of underground pollution to provide more accurate remediation planning and execution. In 2023, the team once again completed the groundwater treatment of the Luchu plant of Taoyuan Ocean Plastics Co., Ltd, and obtained the delisting performance. In recent years, we have proactively expanded into areas such as corporate social responsibility and sustainable operations (ESG), environmental protection and industry-academia collaboration, and land reuse for contaminated sites. The pollution-degrading microorganism recovery technology developed by our own, through technology integration and cross-fields collaborations, is regarded as a powerful tool for green remediation development. Our team produces remediation materials and technologies domestically, reducing the need for imports. We prioritize the use of indigenous bacteria over international samples. Our approach focuses on five core elements: “reducing energy consumption”, “lowering atmospheric emissions”, “minimizing water resource impacts”, “reducing materials and waste”, and “mitigating soil and ecosystem impacts”. On the social front, we prioritize “human health and safety” and “social justice” as our core elements. In terms of the economy, we strive for “cost-effectiveness” and “economic impact”, aligning with the principles of Green and Sustainable Remediation (GSR) promoted by the Environmental Protection Administration. In 2023, we have won recognition from the Ministry of Environment with the “Green and Sustainable Remediation Outstanding Unit” award. In the future, with the ability and experience of the R&D team, we will continue to develop new technologies, and be committed to the improvement and prevention of environmental pollution to achieve sustainable development of the environment.

► Promotion of development (2010~2023)



CGPC's soil and groundwater remediation technology restores the original land through biological remediation technology, which also reduces the harm to groundwater sources and pollutants that harm ecosystems and it is also linked to SDGs 6 Clean water and sanitation and SDGs 15 Protect terrestrial ecosystems. Remediation requires years of actual performance before it can be affirmed by government agencies.



Remediation requires years of actual performance before it can be affirmed by government agencies

► Remediation performance – CDPC plant in Qianzhen District



◆ Lifted the status as a restricted site in 2016

In October 2006, the factory was announced as a groundwater pollution control site by the Environmental Protection Bureau Kaohsiung City Government as the concentration of chlorine-containing organic compounds in groundwater exceeded the control standard, and the controlled area was about 16.8 hectares. Since October 2009, the TVCM Remediation Team has been implementing the groundwater pollution control plan at the site. The plan lasted for approximately six years and was delisted in April 2016, making it the first controlled site with chlorinated organic compound pollution to be delisted in Taiwan. The successful experience made it a good example for promoting improvement of sites with dense non-aqueous phase liquid (DNAPL).

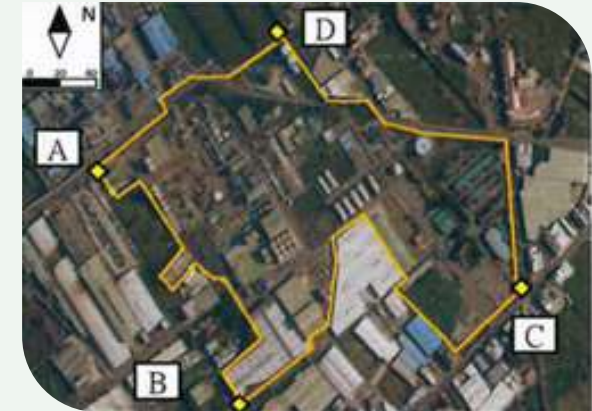
► Remediation performance – CGPC Main plant



◆ Lifted the status as a restricted site in 2017

Listed as an underground pollution remediation site by the Environmental Protection Agency of the County Government of Miaoli in 2011, and the main pollutant was only vinyl chloride. In 2013, an environmental consulting company was commissioned to carry out the improvement plan, which was not completed. In 2015, the TVCM team took over and implemented an extended remediation plan. After over a year of remediation, long-term monitoring has been able to maintain compliance with regulatory standards. The pollution improvement work at the site was completed ahead of schedule by the end of 2016. In February and March, 2017, the Company obtained official letters from the Ministry of Environment and the Environment Protection Bureau, Miaoli County Government, respectively, announcing the lifting of restrictions on the remediation and controlled site, becoming the first chlorine-containing organic pollution site to be lifted from the controlled list in Taiwan.

► Remediation Performance- Ocean Plastics Taoyuan plant



◆ Lifted the status as a restricted site in 2023

Ocean Plastic listed as an underground pollution remediation site by the Environmental Protection Agency of the Taoyuan City Government in 2011, and the main pollutant was vinyl chloride. In 2017, the environmental development department of TVCM/ GGTC Company team was commissioned to implement the extension of the remediation plan. After about 5 years of remediation, verification was conducted by the Taoyuan City Government Environmental Protection Bureau on the improvement outcomes of the soil and underground water pollution in March 2023, and that the detected concentration was lower than the groundwater pollution (category 2) control standard. In April, the Taoyuan City Government issued to the Company the official document on the delisting of the groundwater pollution control site.

◆ Obtained the second delist certificate in 2022.

The Environmental Protection Bureau of the Kaohsiung City Government recognized the remediation technology of the TVCM - Environmental Development Department (a subsidiary of CGPC) - Sinopec Qianzhen plant.



◆ Obtained the first delist certificate in 2021.

The Ministry of Environment recognized the remediation technology of TVCM's Environmental Development Department (a subsidiary of CGPC) - CGPC Main plant.



2020~2021 development key points



Construction of a bio-fermentation plant

The automatic production control of fermentation technology can cultivate and obtain inoculum stable in quality and large and quantity in a short period of time for practical application. The original laboratory can only produce a capacity of only 20 liters per week, it can now be scaled up to 1,000 liters or more for on-site remediation.



Develop multi-functional wellhead components

The device can be switch to multiple functions according to different remediation methods, and can be combined with air pressure for injection, which increases the distance of drug transmission and overcomes the existing technical shortcomings. It can save about 5 times the operating time and has been awarded a utility patent in 2020.

Developed oil-degrading microbial strains in 2022



After laboratory acclimation of soil at oil-contaminated sites, microbial strains with degradation capabilities were screened. Through fermentation and cultivation, genes for the degradation of toluene and naphthalene were detected, and the strains demonstrated the ability to degrade benzene, toluene, and diesel, making them suitable for on-site remediation purposes.

Slow-release biospheres were newly developed in 2023

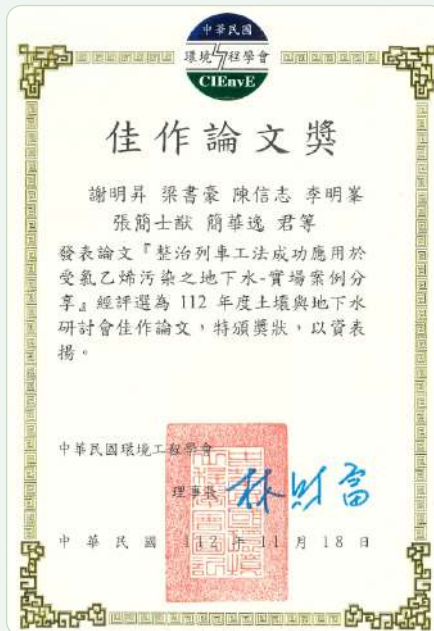


Geodes are naturally decomposable materials. They are used to coat specific functional bacteria or biological matrices and slowly release them in the groundwater environment to continuously decompose pollutants and provide a nutrient source for biological growth for a long time. It is very suitable for groundwater flow variation for the remediation and use of high-risk sites.

- ◆ GGTC sponsored the annual conference of the Chinese Institute of Environmental Engineering in 2022



- ◆ Won the “Best Paper Award and the Outstanding Paper Award” in 2023



- ◆ In 2023, the outstanding achievements of TVCM and GGTC Company in the remediation of groundwater were selected as “Outstanding Units for Green and Sustainable Remediation”



The Environmental Management Administration of the Ministry of Environment launched the “2023 Selection of Outstanding Units for Green and Sustainable Remediation” for the first time in Taiwan to encourage outstanding enterprises to adopt green sustainable remediation technologies. TVCM and GGTC Company jointly participated in the event (Note 1) and were awarded trophies and publicly commended as outstanding units through the recognition of the Ministry of the Environment and various experts and scholars.

By using the remediation train sequence technique and reviewing improvement strategies on a rolling basis, we have also adopted “green, energy-saving, low-carbon emission, and environment friendly” sustainable construction methods during the site improvement of the Toufen plant of TVCM. After years of hard work, the “Energy Storage and Green Power Planning” was selected as an “Outstanding Unit in Green and Sustainability Remediation” for its achievements in standing out of the crowd with quantitative indicators such as environmental, economic, and social indicators for the progress and effectiveness of improvements.

Note 1: The case of Toufen site processing commissioned by TVCM (a subsidiary of CGPC).



5.4 Air Pollution Control ▶ (GRI 2-4, 3-3)

Major air pollutants emitted by CGPC's factories from the manufacturing process include sulfur oxides (SOx), nitrogen oxides (NOx), volatile organic compounds (VOCs), and total suspended particulate matter (TSP). These are mainly generated from the boiler process. CGPC has installed a new [natural gas boiler](#) in 2023, gradually increasing the proportion of natural gas boilers and reduce the use of coal-fired boilers. [Activated carbon adsorption and desorption equipment](#) was installed and the discharge arm was used for VCM loading and unloading in 2022. The discharge pipeline of the loading operation has been sealed with leak-proof joints to reduce the proportion of VOCs emissions. Currently, all factories of CGPC are making persistent efforts to reduce air pollutants by continuously replacing old equipment with new ones, increasing the use of natural gas, replacing valves with ISO 15848-compliant valves, and using enclosed gas collection treatment for equipment prone to disseminate.



Material issue: Air pollution control and prevention



The Significance and Impact of CGPC

Reduce the impact of greenhouse gas emissions and air pollutants on the environment. Affected parties: employees, community residents, government agencies.



Develop Strategy

Switch to the use of low-polluting fuel (natural gas) to reduce sulfur oxides (SOx), nitrogen oxides (NOx) and volatile organic compounds (VOCs) emissions.



Policy Commitment

In addition to complying with environmental regulations and emission standards, the unit product emissions of sulfur oxides (SOx), nitrogen oxides (NOx) and organic volatile compounds (VOCs) are reduced year by year.



Grievance Unit

Environmental Protection Sector



SASB Indicator

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Promotion policy	Unit	2023 goal	2023 result	2024 goal	2025 goal	2030 goal
Continue to replace equipment and use low-polluting fuels	Reduce sulfur oxide emission intensity (ton/kt)	0.004	0.003	0.003	0.003	0.003
	Reduce NOx emission intensity (ton/kt)	0.227	0.174	0.226	0.225	0.220
	Reduce the emission intensity of volatile organic compounds (ton/kt)	1.414	1.142	1.408	1.403	1.375

1. Updated target based on production volume (chemicals in dry tons): Sox: Based on the fact that the actual performance in 2022 was the lowest on record for the 2023 target, the actual performance in 2023 has become the target for 2024-2030. Target adjustment for NOx and VOCs: Taking 2022 as the base year, reduce them by 0.4% per year.
 2. Please refer to the description of air pollutant emissions.



Air pollution emissions in the last three years

(Unit: tons/year)

By company	Pollutants	2021	2022	2023	2023 Percentage of pollutants in performance indicators of each plant
CGPC (Main plant)	Sulfur oxides (SOx)	4.500	1.400	0.882	88%
	Nitrogen oxides (NOx)	29.800	24.500	27.013	34%
	Volatile organic compounds (VOCs)	606.951	404.400	304.979	84%
TVCM (Linyuan plant)	Sulfur oxides (SOx)	0.130	0.118	0.117	12%
	Nitrogen oxides (NOx)	55.337	55.821	53.199	66%
	Volatile organic compounds (VOCs)	38.047	33.454	52.660	14%
CGPCP (Linyuan plant)	Volatile organic compounds (VOCs)	6.032	5.116	6.951	2%
	Total suspended particulate (TSP)	5.163	2.466	1.660	-

- Notes: 1. In 2021, due to the increase in production, the number of days in which the boiler is in operation also increased, resulting in an increase in NOx and VOCs emissions.
 2. Since 2020, CGPCP's TSP has reduced due to that clean water was added to the venturi scrubber to wash the particulates away, so the TSP emissions have been reduced.
 3. The construction of pollution prevention equipment at CGPC Main plant was completed in 2022, and a natural gas boiler was added in October 2023 to gradually reduce the use of coal-fired boilers.
 4. Due to the high emission intensity found by the flue test results of TVCM in 2023, the recent improvement of the storage tank (T6030 fixed tank instead of a pressure tank) is expected to reduce VOCs by 3-4 metric tonnes/year.
 5. In the third quarter of 2023, in response to regulatory updates, CGPCP needs to calculate the VCM emissions of individual species and the cost plus the increase in VOC emissions due to increased production capacity. The stripping tower and venturi scrubbers will be re-reviewed and improved later.

5.5 Waste Management (GRI 3-3、306-1~3 : 2020)

SDGs



The Company adheres to the philosophy of green environmental protection for pollution control work. In addition to the abovementioned water and air pollution control, it reduces waste pollution in various aspects to fulfill its operational responsibilities. CGPC's factories sell leftover materials, auction off unqualified products and recycle and remanufacture offcuts, so there is little waste from the process. The waste is classified into general industrial waste and hazardous industrial waste. The removal and disposal are handled by organizations with a qualified license, and comply with the Waste Disposal Act.

- Each plant has designated waste personnel to manage, monitor, and inspect waste disposal vendors, and the designated personnel perform in-plant inspections (waste labeling, storage) from time to time and check whether or not the waste cleaning plan and reporting data are abnormal in order to ensure that the plant management complies with the laws and regulations.
- Hazardous industrial waste shall be stored and labeled in accordance with the Methods and Facilities Standards for the Storage, Clearance and Disposal of Industrial Waste and the disposal and treatment shall be tracked by using the Industrial Waste Reporting and Management System.

Material issue: Waste management

	The Significance and Impact of CGPC	Comply with environmental protection regulations, legally clean and transport, improve resource reuse rate, and pursue sustainable resource utilization. Affected objects: employees, community residents, government agencies.
	Develop Strategy	Continue to promote waste classification and improve resource reuse rate.
	Policy Commitment	Reduce waste per unit of output year by year.
	Grievance Unit	Environmental Protection Sector
	SASB Indicator	RT-CH-150a.1

Promotion policy	Unit	2023 goal	2023 result	2024 goal	2025 goal	2030 goal
Promote circular economy to reduce waste and increase reuse rate	Decreasing unit production waste generation (tons/tons)	0.0060	0.0053	0.0060	0.0050	0.0045
	Recycling rate %	80.0	77.9	80.0	85.0	90.0
	Landfill rate %	20.0	22.1	20.0	15.0	10.0

Detailed remarks on the amount of waste generated in the last three years.



Amount of waste generated in the last three years

(Unit: ton)

	By company	Final disposal	2021	2022	2023	
General industrial waste	CGPC (Main plant)	Recycled and reused	2,423.37	1,521.67	2,612.84	
		Preparation for reuse	617.69	402.03	772.01	
		Landfill	91.23	95.14	190.57	
	Total general industrial waste of CGPC			3,132.29	2,018.84	3,575.42
	% of general industrial waste recycled by CGPC			97.1%	95.3%	94.7%
	TVCM (Linyuan plant)	Recycled and reused	445.12	569.96	409.98	
		Landfill	367.24	556.56	635.19	
	Total general industrial waste of TVCM			812.36	1,216.52	1,045.17
	% of general industrial waste recycled by TVCM			54.8%	50.6%	39.2%
	CGPCP (Linyuan plant)	Recycled and reused	39.52	28.16	42.68	
		Landfill	58.30	54.47	62.66	
	Total general industrial waste of CGPCP			97.82	82.63	105.34
% of general industrial waste recycled by CGPCP			40.4%	34.1%	40.5%	
Total amount of general industrial waste			4,042.47	3,227.99	4,725.93	
% of total general industrial waste recycled			87.2%	78.1%	81.2%	
Hazardous industrial waste	CGPC (Main plant)	Recycled and reused	3.35	1.62	114.08	
		Preparation for reuse	-	-	24.00	
		Landfill	0.01	6.70	21.82	
	Total hazardous industrial waste			3.36	8.32	159.90
	% of hazardous industrial waste recycled by CGPC			99.7%	19.5%	86.4%
	TVCM (Linyuan plant)	Landfill	38.30	38.23	38.05	
		Total hazardous industrial waste of TVCM		38.30	38.23	38.05
	% of hazardous industrial waste recycled by TVCM			0.0%	0.0%	0.0%
Total amount of hazardous industrial waste			41.66	46.55	197.95	
% of total hazardous industrial waste recycled			8.0%	3.5%	69.8%	
General + hazardous_total			4,084.13	3,274.54	4,923.88	
General industrial waste as a percentage			99.0%	98.6%	96.0%	
Percentage of hazardous industrial waste (%)			1.0%	1.4%	4.0%	

- Note: 1. All recyclable resources from CGPC's factories are given to legal vendors for recycling off-site.
 2. Our environmental safety and health units regularly inspect waste disposal vendors' management and disposal monitoring, and the general affairs units work with waste treatment organizations to formulate contracts. GPS real-time tracking systems are used to confirm the transportation routes and flows, and the delivery receipt is signed by all three parties, ensuring that the waste is transported and treated in accordance with regulations. In 2023, the disposal and treatment agencies did not have any breach of contract.
 3. In 2023, the reason for the increase in the amount of industrial waste of CGPC was that the amount of scrap iron increased as a result of the demolition of the plant in the Fabric I Section.
 4. The increase in hazardous waste at CGPC in 2023 was attributed to the chemical waste from the rubber production plant.
 5. The increase in the amount of industrial waste in landfills in 2023 was mainly due to the increase in waste from packaging bags. After communicating with the clearance contractor, recycling outside the plant in future can reduce the amount of waste being sent to landfills.
 6. Due to some omissions in the previous statistics of the three factories, the data for 2021-2022 was updated.

► Life cycle management for waste

The hazardous waste generated by CGPC and TVCM in 2023 was 197.95 tonnes. Without proper management and effective treatment, random disposal can pollute the environment (air, soil, and water), further affecting the ecosystems and harming human health. Therefore, we have adopted the following management measures:

1. Review vendors' qualifications: they need to be qualified waste removal and treatment organizations.
2. Use the GPS real-time tracking system to confirm the transportation route and flow.



On September 29, 2022, an activated carbon fluidized bed control equipment was installed, primarily for the recovery of Methyl Ethyl Ketone (MEK), accounting for approximately 84% of the total waste liquid volume.

The pollution control equipment has been continuously operating for two months in the plant, using a Flame Ionization Detector (FID) for self-monitoring. The FID detects the average concentration of Volatile Organic Compounds (VOCs) emitted from 2 to 4 production lines. The average removal efficiency is over 93%, significantly reducing environmental emissions and pollution.