Task Force on Climate-related Financial Disclosures (TCFD) 2021

Disclosure in the alignment with TCFD

Section	Items	Disclosure Sources
Governance	The organization governance around climate-related risks and opportunities.	■ Page 3-4 ■ https://sustainability.pttgcgroup.com/en/environment/climate-strategy/climate-change-governance ■ https://www.pttgcgroup.com/storage/download/sustainability/reporting-center/isr/pttgc-isr2020.pdf, Page 156-157
Risk Management	Climate-related risk identification, assessment, and management process. ■ Climate-related risk and opportunity identification process ■ Climate-related risk and opportunity assessment process ■ Implementation of the process to physical risk and opportunity ■ Implementation of the process to transition risk and opportunity	■ Page 4-5 ■ https://sustainability.pttgcgroup.com/en/environment/climate-strategy/climate-change-risks-and-opportunities ■ https://www.pttgcgroup.com/storage/download/sustainability/reporting-center/isr/pttgc-isr2020.pdf, Page 158-159
Strategy	Implication of climate-related risks and opportunities on GC's business, operation, strategy, and financial performance. ■ Climate scenarios analysis on physical risk, including RCP 4.5 and RCP 8.5 scenario ■ Risk validation and qualification ■ Impact assessment on climate-related risks and opportunities on the business operation, strategy and financial performance ■ Mitigation and adaptation plan for climate-related risks and opportunities	■ Page 6-11 ■ https://sustainability.pttgcgroup.com/en/environment/climate-strategy/climate-change-strategy-and-target ■ https://www.pttgcgroup.com/storage/download/sustainability/reporting-center/isr/pttgc-isr2020.pdf, Page 157
Metrics and Targets	Presents the scope 1, 2 and 3 emissions to date and the proposed target of those emissions moving forward.	■ Page 12-13 ■ https://sustainability.pttgcgroup.com/en/environment/climate-strategy/climate-change-strategy-and-target ■ https://www.pttgcgroup.com/storage/download/sustainability/reporting-center/isr/pttgc-isr2020.pdf, Page 161-165 ■ GC GHG report 2020, https://sustainability.pttgcgroup.com/storage/document/climate-change-strategy-and-target/20210624-gc-gas-report-2020.pdf, Page 11-13, 16-17

1. INTRODUCTION

PTT Global Chemical, is devoted to exploring new and effective sustainable pathway to continue our journey forward and contributing to the environment where possible. We pledge to aggressively establish the company's target as per our Climate Strategy and Climate-related Performance. In this light, GC has initiated ambitious GHG emissions reduction target and other indirect targets to monitor and improve GC's performance and keep track of our progress directed at the global climate objective. These takes into consideration the Sustainable Development Goal 7 (Affordable and Clean Energy) and 13 (Climate Action). To further enhance GC's operational excellence in leading towards the aforementioned target, GC has assigned its governance body to oversee the climate-related risk, opportunity and strategic directions. We have also analysed internal and external risk factors, which could influence the business operation as well as observing the emerging Risks to identify climate change risks that may cause significant impacts on GC and take precautionary measures to address them appropriately. Our approach include developing scenario-based climate analysis for both physical and transition risks.

Ultimately, we have enforced robust risk and crisis management approaches to manage unfavourable risk and minimize to the extent that is acceptable in response to GC's Climate Change Strategy. We intends to initiate Net Zero Target to strengthen our climate strategy.

As part of GC disclosure action, the company has conducted this with conformance to TCFD recommendations and thus improving their robustness and uniformity. With evidence that will be presented in this report, GC has demonstrated to be a supporter of the TCFD recommendations and has, to the best of their ability, adopt the four aforementioned core elements of the climate-related financial disclosures recommendation.

The disclosure recommendations are structured around four core elements of organizational operation: governance, strategy, risk management and metrics and targets.

2. IMPLEMENTATION OF TCFD RECOMMENDATIONS

2.1. Governance

Governance is a key component as investors, lenders, insurance underwriters, and other users of climate-related financial disclosures are keen to understand where the organization's board stands and what role or action they will be responsible for in overseeing climate-related issue. This extends to their accountability for assessing and managing those issues.

The governance role is to provide oversight of and support on the climate-related risks and opportunities. GC has assigned the Board of Directors to be in charge of planning strategies, management approaches, and response measures for climate-related risks and opportunities in order to achieve maximum operational efficiency. GC's governance body comprises of the following position individuals.

Governing Body	Roles and Responsibilities	Meeting Frequency
Board Chair	The Board Chair holds the most power and authority on the board of directors who provide visions, missions, directions, and operational strategies with an efficient performance monitoring and evaluation system in place, which is independent from the management, to review the operation of Executives. Board chair will also act as a person who resolves conflict on climate-change related matter between Corporate Governance Committee and Risk Management Committee (RMC)	As needed
Corporate Governance Committee	The Corporate Governance Committee is responsible for developing strategies associated with climate change, which is a part of GC Group's meeting agenda on planning and performance related to sustainable development.	Quarterly
Risk Management Committee (RMC)	The RMC is responsible for defining comprehensive key risk management policies and practices, which include climate-related risks. The RMC assesses and reviews risks, taking into account both internal and external factors which may affect the achievement of our goals in order to ensure that appropriate measures to tackle climate change, which are also in line with our business context, have been put in place.	Quarterly
Chief Executive Officer	The CEO is tasked to manage the company according to the established and agreed policies, plans and budget under the authority granted by the board of directors. The CEO also falls under the Risk Management Committee and a chairperson of Management Committee. In regards to Climate Change, he has the responsibility of strategic movement to manage climate related risk and opportunities, and ensure sufficient resources are allocated for mitigating climate related risk.	Quarterly

2.2. Risk Management

As part of the risk management and internal process, GC has developed an Enterprise Risk Management according to the international standard of the Committee of Sponsoring Organizations of the Treadway Commission (COSO), the International Organization for Standardization's ISO 31000. The objective of the risk management framework and guidelines that GC has established is to systematically manage risks associated with climate change throughout the organization. This management scheme is also integrated into GC's policies, rules, and standards related to governance, risk management and internal control, and compliance, to incorporate climate-related risk management into GC's internal management so as to protect and create sustainable value for the organization. Such initiatives is extended to GC's subsidiaries and suppliers through conducting executive workshops, and communicated with employees to build a risk management culture.

Our risk management process consists of four main steps, which are:

Identification process

The heads of Business Units (BU) and Support Functions (SF) bear the responsibility for the identification and assessment of climate-related risks and opportunities across GC assets to determine situations or scenarios that could interrupt along value chain operations, impacting the company's strategy and operation objectives

Assessment process

Risks and opportunities assessment are conducted on a yearly basis in order to forecast and budget the process. All risk and opportunities are analysed and prioritized by Enterprise Risk Management Coordinator whom will compile the top risks and opportunities together with the appropriate measures;

Process applied to physical risks and opportunities

A case study at asset level for physical risks and opportunities from natural disasters which are monitored and managed continuously by the responsible units and departments, and a Business and Support Function Units level. This risk and opportunity are communicated to Risk Coordinators on a monthly basis;

Process applied to transition risks and opportunities

Risk that requires to be addressed will be assigned to the Enterprise Risk Management Committee (ERMC), then, Management Committee (MC) before reaching the Risks Management Committee (RMC) for acknowledgement or approval. RMC will then be responsible for the policy and risk management framework establishment as well as monitoring and providing recommendations on the risk management .

With these steps, a responsible person is assigned to take charge and ensure the process are in progress effectively.

2.3. Strategy, and Metrics and Targets

2.3.1. Scenario Analysis on Physical Risk

Scenario analysis is a tool to enhance strategic thinking, through exploration of alternatives in the world of uncertainty. Representative Concentration Pathways (RCP) scenarios show how temperature and other climate characteristics may change depending on different CO_2 concentrations in the atmosphere.

The initial stage is referred to as the Portfolio Screening / Hot Spot Analysis, which will consist of a high level estimation of risk caused by natural hazards. This is generally done based on both the spatial data available in analysis model and business specific information analysed at a corporate level.

We selected the following scenarios to conduct analysis against geographical locations where GC, its suppliers and major clients operate (which includes the 32 GC's plants in Rayong and Chonburi, 1 Critical 1st tire feedstock supplier in Rayong, and 2 major clients in Samutprakan and Samutsakorn):

- RCP 8.5 (Business as Usual) corresponds to 3.7 degree Celsius rise by end of the century due to low or no effort to reduce emissions; and
- RCP 4.5 (Middle Path) corresponds to 1.8 degree Celsius rise by end of the century due to moderate efforts to reduce emissions.

GC can screen the outcomes of 9 different natural hazard variables using the result of multi-model-mean of CMIP5 data. These 9 aspects include temperature, storm surge, water supply and demand, precipitation, hurricane/cyclone/typhoon, sea level rise, drought, floods, and landslides. However, within GC's region of operation, these are further screened down to 5 categories that are relevant to the company. The natural hazards are classified based on the following factors;

Natural Hazard Categorization

Water Stress	Flooding	Wind and Cyclones	Sea Level Risk	Extreme Heat
				
■ *The water stress analysis is based on ratio of total water withdrawal to available renewable water resources (surface and groundwater).*	■ *Flooding assessment is conducted using WRI-Aqueduct Flood tool by determining depth of inundation (i.e. flooding).*	■ *Cyclone categories rely on potential damage as classified by Saffir-Simpson Scale.* ■ *Wind speed is categorized under the Beaufort's Scale.*	■ *Sea level risk assessment utilises WRI-Aqueduct Flood tool by determining the depth of inundation (i.e. flooding).*	■ *Hazard level reflects expected frequency of extreme heat conditions, using simulations of long-term variations in temperature and expert guidance. Extreme heat is assessed using a widely accepted heat stress indicator, the Wet Bulb Globe Temperature (°C).*

Further physical risk assessment is conducted where the result is shown below.

Baseline

Sr. No.	Asset	Water Stress	Riverine Flood	Landslide Precipitation	Extreme Heat	Wind Speed (Average)	Wind Speed (Maximum)	Cyclone	Coastal Flood
1	Rayong: GC Operation and Supplier	2	2	0	2	1	3	0	0
2	Chonburi: GC Operation	1	0	0	2	1	3	0	0
3	Bangkok: GC Head Office	2	2	0	3	1	3	0	0
4	Samut Sakhon Client 1	2	2	0	3	1	3	0	3
5	Samut Prakan Client 2 MMS	2	2	0	3	1	3	0	2

RCP 4.5

Sr. No.	Asset	Water Stress			Riverine Flood[1]			Landslide Precipitation			Extreme Heat			Wind Speed (Average)[2]			Wind Speed (Maximum)[2]			Cyclone[3]			Coastal Flood		
		BSL	2030	2050	BSL	2030	2050	BSL	2030	2050	BSL	2030	2050	BSL	2030	2050	BSL	2030	2050	BSL	2030	2050	BSL	2030	2050
1	Rayong: GC Operation and Supplier	2	2	2	2	3	2	0	0	0	2	3	3	1	1	1	3	3	3	0	1	1	0	0	0
2	Chonburi: GC Operation	1	1	1	0	0	0	0	0	0	2	3	3	1	1	1	3	3	3	0	1	1	0	0	0
3	Bangkok: GC Head Office	2	2	2	2	2	3	0	0	0	3	3	3	1	1	1	3	3	3	0	1	1	0	0	0
4	Samut Sakhon Client 1	2	2	2	2	2	3	0	0	0	3	3	3	1	1	1	3	3	3	0	1	1	3	3	3
5	Samut Prakan Client 2 MMS	2	2	2	2	2	3	0	0	0	3	3	3	1	1	1	3	3	3	0	1	1	2	2	2

RCP 8.5

Sr. No.	Asset	Water Stress			Riverine Flood[1]			Landslide Precipitation			Extreme Heat			Wind Speed (Average)[2]			Wind Speed (Maximum)[2]			Cyclone[3]			Coastal Flood		
		BSL	2030	2050	BSL	2030	2050	BSL	2030	2050	BSL	2030	2050	BSL	2030	2050	BSL	2030	2050	BSL	2030	2050	BSL	2030	2050
1	Rayong: GC Operation and Supplier	2	2	2	2	3	3	0	0	0	2	3	3	1	1	1	3	3	3	0	1	1	0	0	0
2	Chonburi: GC Operation	1	1	1	0	0	0	0	0	0	2	3	3	1	1	1	3	3	3	0	1	1	0	0	0
3	Bangkok: GC Head Office	2	2	2	2	2	3	0	0	0	3	3	3	1	1	1	3	3	3	0	1	1	0	0	0
4	Samut Sakhon Client 1	2	2	2	2	2	3	0	0	0	3	3	3	1	1	1	3	3	3	0	1	1	3	3	3
5	Samut Prakan Client 2 MMS	2	3	2	2	2	3	0	0	0	3	3	3	1	1	1	3	3	3	0	1	1	2	2	3

	- No Hazard		- Low Hazard		- Medium Hazard		- High Hazard

The above result of the different physical climate-related risks identified under scenario RCP 4.5 and 8.5 for 2030 and 2050, can be summarized as follows:

- RCP 4.5 in 2030
  - GC operations is assessed in high hazard for Riverine Flood, Extreme Heat and Wind Speed
  - GC Value Chain is assessed in high hazard for Extreme Heat, Wind Speed and Costal Flood
- RCP 8.5 in 2030
  - GC operations is assessed in high hazard for Riverine Flood, Extreme Heat and Wind Speed
  - GC Value Chain is assessed in high hazard for Water Stress, Extreme Heat, Wind Speed and Costal Flood
- RCP 4.5 in 2050
  - GC operations is assessed in high hazard for Riverine Flood, Extreme Heat and Wind Speed
  - GC Value Chain is assessed in high hazard for Riverine Flood, Extreme Heat, Wind Speed and Costal Flood

- RCP 8.5 in 2050
  - GC operations is assessed in high hazard for Riverine Flood, Extreme Heat and Wind Speed
  - GC Value Chain is assessed in high hazard for Riverine Flood, Extreme Heat, Wind Speed and Costal Flood

Natural Hazard Implication to GC Business

By conducting the asset specific risk validation at detailed site level, potential significant risk and potential opportunities for GC to benefit, and high level financial implications can be outlined as follows;

	Water Stress	Flooding	Wind and Cyclones	Sea Level Risk	Extreme Heat
Natural Hazard					
Implication to GC Business	Water stress may result in unavailability of adequate fresh water. This may lead to disruption of production, and utilities. Additionally, it may also increase the water sourcing cost as plant requires to adopt more expensive alternate technologies.	Disruption of GC's operation resulted in revenue loss. GC's critical 1st tier feedstock supplier may delay delivery raw material but there is no significant impact to GC.	GC's design standard with design margin 10% can cope maximum wind speed in Thailand. No significant impact on GC assets.	No GC assets located in sea level risk. No significant impact on GC assets.	No significant impact on GC assets.
Financial Implication	404 – 536 MTHB	17 MTHB	-	-	-

2.3.2. Practical Adaptation for Physical Risk

In this phase, impact assessment and adaptation are performed, in detailed, at the site and asset level that incorporates models setup and running simulations. Based on the findings, a set of practical mitigation measures and adaptation strategies is proposed for implementation to fit for the impact type and level.

Operation Initiatives

Key operation initiatives to highlight the adaptation measure are presented below:

Water Stress Measures

Water Resilience

GC launches the tangible water management practices within GC Group to ensure long-term sustainability of water supply, including water consumption plans based on 3Rs principle (Reduce, Reuse, Recycle) and increase in production capacity of the Wastewater Reverse Osmosis (WWRO) system.

It also includes the plans to produce fresh water instead of withdrawal fresh water from natural sources. These can be done through the installation of the Sea Water Reverse Osmosis (SWRO) unit at Refinery Plant with a capital investment approximately 300 million THB, and the installation of pipeline system from WWRO to our Refinery plant that comes up with the investment and operating costs around 66 million THB.

Flooding Measure

Flooding Prevention and Mitigation Measures

GC preventive measures include taking actions in sewer system survey and maintenance prior to the raining season. These also include site monitoring during heavy rain, feasibility study on plan design and the construction of flood wall that can cope with the flood from the historical data for raining rate at 130 mm. The measures, such as preparation and installation of mobile pumps and sandbag flood barrier are also in place to mitigate the occurrence of flooding. The estimated total investment cost is approximately 20 million THB.

Supply Chain Initiatives

GC conducts water risk assessment (using tools such as, Environmental Impact Assessment and Life Cycle Assessment) to identify relevant suppliers with high water-related risks, which founds to be PTT Gas Separation Plant, GPSC and GLOW. As GC is the leader for PTT Group Water Management Team, we have developed a knowledge sharing sessions for suppliers and PTTEP group to synergize water consumptions and reduction goals that is the external water management, water reduction application and water discharge regulations. These synergy (which includes, engagement with the suppliers and training sessions, reporting and disclosure of suppliers' water consumption) are then focused towards the high-risk ranking group.

Additionally, GC prepares mitigation actions and shredding ranking guideline to minimize water consumption by 10-70% to alleviate impacts on business. These actions will be conducted internally and externally along supply chain under the support of the management team.

2.3.3. Scenario Analysis on Transition Risk

TCFD recommends organizations should describe how resilient their strategies are to climate-related risk and opportunities, taking into consideration a transition to a lower-carbon economy (where the above scenario analysis will enhance the deep dive of the strategies performance). Where this low-carbon economy is consistent with a 2°C or lower scenario and, where relevant to the organization, scenarios consistent with increased physical climate-related risks. This could lead to transition risk associated with increased operating costs due to laws and regulations on greenhouse gas reduction, as well as higher demand for carbon technology investment.

Since 2018, GC has been exploring scenario analysis as a tool to understand potential impacts to our strategy from a low carbon economy transition. In 2021 we have analyzed the potential impacts to our business using bespoke scenarios from IHS Markit, Base Case and Accelerated Energy Transition

(AET) scenarios (base case was based on IHS Markit's Rivalry Scenario, AET was based on IHS Markit's Autonomy Scenario). The base case was based on business as usual assumptions leading to global warming of 2.9°C. AET was based on low carbon economy transition leading to global warming of 2°C. In addition to scenarios from IHS Markit, GC also performed scenario analysis against IEA's Sustainable Development Scenario, which is based on assumptions of a transition to a 1.65°C world.

Based on the financial impact study of the transition risk for refined products, Polyolefins in scenario AET and SDS, the financial implications in 2030 and 2050 Our analysis focused on the impact of changing demand, prices and carbon prices on our main businesses. Overall, the results show that our downstream and green products businesses remain the most resilient, however all products groups are affected by a low carbon economy transition, especially in terms of pricing.

The estimated financial implications in 2030 and 2050 are shown below, note that these numbers are not forecasts, but instead hypothetical impacts to GC in the case that world shifts towards low carbon economy and in the case that GC does not have any mitigating actions to reduce financial impacts. In the real world situation, GC regularly monitors potential future impacts to its business, and therefore would be able to adapt its business for a low carbon world well ahead in time before any financial impacts occur. Note additionally that in the SDS scenario in South East Asia petrochemical business will still grow at 1.7% p.a. from 2019-2050, however oil demand will reduce by 0.6% per year. Therefore, in the case of low carbon economy transition, GC will need to speed up green chemical production and other efforts in line with consumer demand and local regulations.

Transition Risk Financial Implication to GC Business and Measures

	Financial Implication	
Business	**2030**	**2050**
Refinery	33%	79%
Polyolefins	30%	47%

Remark: The high-level estimation is based on scenario analysis study. Implication may depend on economic situation.

However, GC has taken the management actions and direction into account in order to minimize the impact of transition risk and capture the climate-related opportunities. This can be done through differentiating the green product portfolio to serve the increasing demand in the market. GC plans to increase investment in the development of green products and sustainability-driven solutions that provides sustainability value-added to users. These products include bio-fuel, bio plastic, recycle product, high performance product, low carbon product and upcycling product. Additionally, GC is well aware of the lower demand and price of fossil fuel due to renewable energy trend, which may affect our petroleum products and business. Therefore, GC aims to seize the opportunity by increasing the Polymer product portfolio. The total estimated investment cost of management actions is 37,453 million THB by 2030, with the estimation of a financial benefit approximately 4,095 million THB per annum.

GC will continue do regular scenario analysis to update the situation regard low carbon economy transition. If the global situation becomes closer to AET and SDS case, GC will adjust its strategy and portfolio accordingly to avoid financial impacts to the company. GC leverages their position as an environmentally-friendly business by striving to become the leading manufacturer of low-carbon products through our Long Range Climate Strategy Plan. It focuses on reducing negative environmental impacts and mitigate climate change risks and potential opportunities for GC to benefit from.

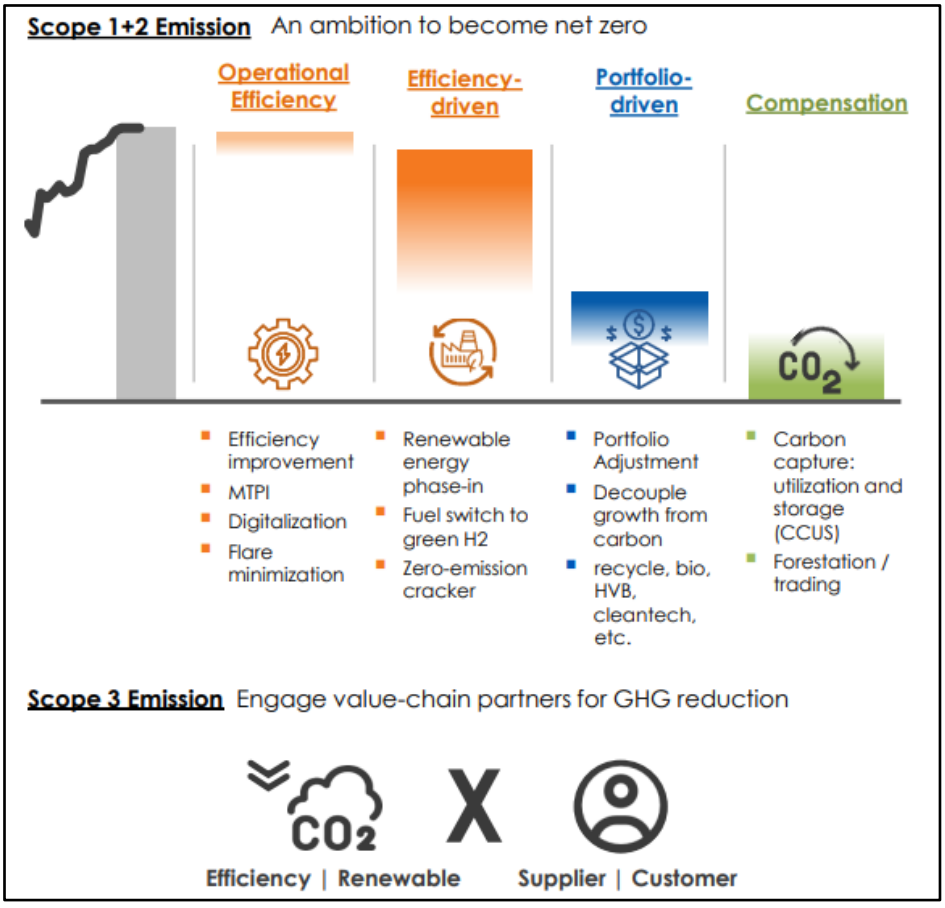
Climate Strategy

As part of GC's climate strategy, the company has established both short-term and long-term strategies for energy management and climate change in accordance to the TCFD recommendations. The objective of this plan is to focus on shaping the directions of the climate change plan, investment in advanced technology to enhance process efficiency, alternative energy utilization, and Internal Carbon Pricing.

GC has set a voluntary goal of a 20% reduction in GHG emissions (scope 1 and 2) by 2030, based on business-as-usual scenarios from 2012 base-year emissions. Ultimately, this should enable GC to reduce their GHG emissions by 724,185 tons of carbon dioxide equivalents. These actions will contribute to the bigger picture of the Climate Uplifting that is the Thailand commitments for the 20% of GHG emissions reduction by 2030. By mid-century, GC aims to collectively reduce 52% GHG intensity from 2012 base-year emissions for scope 1 and 2.

Ultimately, GC's aspiration is to achieve 'Net Zero'. To achieve Net Zero, we have established 4 boundaries in which GC business will focus on, these are 1) operational efficiency, 2) efficiency-driven, 3) portfolio-driven, and 4) compensation. As for scope 3 emission, GC is determined to engage and collaborate with value-chain partners (suppliers and customers) and induce efficiency and renewable energy framework.

This also coincides with the Paris Agreement (at global level) of limit global warming to well below 2°C and pre-industrial levels and pursuing efforts to limit warming to 1.5°C by achieving global Net Zero by 2050.



2.4. Metrics and Targets

GC aspires to be the leading international chemical company that harnesses innovation and environmentally friendly technology in striving towards becoming the role model organization that develops and sustainably grows with determined responsibility to the environment, society and economy in which we are present. Through operational excellence, transparency and continuous innovation development, we are committed to building trust with the stakeholders by reporting climate-related metrics and targets below.

2.4.1. Climate-related metric

GC asset that for the period 1st January to 31st December 2020, the total GHG emissions by scope, within our organizational boundary are as follows:

Scope (as defined within ISO 14064-1:2006)	GHG emissions (tons CO_2 equivalent)				
	2012 (recalculated)	**2017 (recalculated)**	**2018 (recalculated)**	**2019 (recalculated)**	**2020**
Direct GHG Emissions ($MtCO_2$ equivalent)	5.74	6.37	6.08	6.10	5.88
Market-based energy indirect (scope 2) GHG emissions ($MtCO_2$ equivalent)	2.72	2.02	1.92	2.14	1.98
Location based energy indirect (scope 2) GHG emissions ($MtCO_2$ equivalent)	0.03	0.01	0.01	0.013	0.02
Other relevant indirect GHG emission (scope 3)* ($MtCO_2$ equivalent)	2.68	11	10	11	11.03

Remark: GHG scope 3 covers 8 categories, including Purchased goods and service, Upstream transportation and distribution, Waste generated in operations, Business travel, Downstream transportation and distribution, Processing of sold products, Use of sold product and End-of-life treatment of sold product.

In addition, GC leverages their position as an environmentally-friendly business by striving to become the leading manufacturer of low-carbon products through our Long Range Climate Strategy Plan. It focuses on reducing negative environmental impacts.

Direct target

Climate Strategy:
Reduce GHG emissions (scope 1 and 2) by 20%, based on BAUs by 2030.

Climate Strategy:
Reduce GHG emissions intensity (scope 1 and 2) by 52% according to Science Based Targets initiative (SBTi), by 2050 compared to base year (2012).

Climate Strategy:
Reduce scope 3 GHG emissions intensity, and initiate two projects on scope 3 GHG management across the value chain.

Indirect target

Sustainable Product and Services:
Expand high performance products and Bio & Green Chemical product portfolio for 30% of all products by 2030.

Energy Management:
Energy efficiency performance of plants under GC Group to achieve Top Quartile Performance in Benchmarking.

Energy Management:
Reduce accumulative energy consumption by 16.95 million GJ by 2030.