

C0. Introduction

C0.1

(C0.1) Give a general description and introduction to your organization.

PTT Global Chemical Public Company Limited or "GC" is a fully Thai-owned company founded on 19th October 2011 by the amalgamation between PTT Chemical Public Company Limited (PTTCH) and PTT Aromatics and Refining Public Company Limited (PTTAR). Our headquarters is located at the Energy Complex Building, Chatuchak, Bangkok, Thailand.

In 2021, GC, as a Chemical Flagship of PTT Group with a combined chemical and petrochemical capacity of 13.95 million tons per year and crude oil and condensate distillation capacity of 280,000 barrels per day. GC consists of 3 business groups (Base business, Derivative & bio chemicals, and performance chemical) and has other businesses and services which GC invested for supporting 5 business groups. The key 8 business unit are: Olefins, Aromatics, Refinery and Shared Facilities, Polymers, EO-Based Performance, Green Chemicals, Performance Materials and Chemicals, and Phenol.

<Website: <https://www.pttgcgroup.com/en/about-gc/our-company/business-structure>>

GC prepared a GHG inventory that takes account of the international standards based on international GHG estimation standards such as, ISO 14064-1:2018, Greenhouse Gas Protocol (developed by WBCSD/WRI, 2004), Compendium of Greenhouse Gas Emission Methodologies for the Oil and Natural Gas Industry (developed by API, 2009), IPCC Guidelines for National Greenhouse Gas Inventories (developed by IPCC, 2006) and Thailand Greenhouse Gas Management Organization (Public Organization).

GC consists of a number of companies with differentiated business activities. Therefore, there is need in a standardized and systematic procedure for compiling GHG emission data for the GC group that can be sustained over the long term and that will improve data quality for the group. GC Greenhouse Gas Emission Accounting and Reporting Manual is an all- encompassing organizational GHG accounting manual for reference by all facilities under GC corporate GHG management program.

GC makes a public GHG reporting claiming conformance to ISO 14064-1, the organization shall make available to the public a GHG report prepared in accordance with ISO 14064-1, or an independent third-party verification statement related to the GHG reporting. In addition, GHG report and assurance statement with third party verification (LRQA) followed ISO 14064-1.

C0.2

(C0.2) State the start and end date of the year for which you are reporting data.

	Start date	End date	Indicate if you are providing emissions data for past reporting years	Select the number of past reporting years you will be providing emissions data for
Reporting year	January 1 2021	December 31 2021	No	<Not Applicable>

C0.3

(C0.3) Select the countries/areas in which you operate.

Thailand

C0.4

(C0.4) Select the currency used for all financial information disclosed throughout your response.

THB

C0.5

(C0.5) Select the option that describes the reporting boundary for which climate-related impacts on your business are being reported. Note that this option should align with your chosen approach for consolidating your GHG inventory.

Operational control

C-CH0.7

(C-CH0.7) Which part of the chemicals value chain does your organization operate in?

Row 1

Bulk organic chemicals

- Lower olefins (cracking)
- Aromatics
- Ethylene oxide & Ethylene glycol
- Polymers

Bulk inorganic chemicals

Other chemicals

- Specialty chemicals
- Other, please specify (Green Chemicals and Phenol)

C-OG0.7

(C-OG0.7) Which part of the oil and gas value chain and other areas does your organization operate in?

Row 1

Oil and gas value chain

Please select

Other divisions

C0.8

(C0.8) Does your organization have an ISIN code or another unique identifier (e.g., Ticker, CUSIP, etc.)?

Indicate whether you are able to provide a unique identifier for your organization	Provide your unique identifier
Yes, an ISIN code	Local TH1074010006 Foreign TH1074010014

C1. Governance

C1.1

(C1.1) Is there board-level oversight of climate-related issues within your organization?

Yes

C1.1a

(C1.1a) Identify the position(s) (do not include any names) of the individual(s) on the board with responsibility for climate-related issues.

Position of individual(s)	Please explain
Board Chair	<p>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.</p> <p>Board Chair ensures that our business has a clear picture of its exposure to climate related risks such as low carbon technology, law and regulations, R&D and customer behavior changed those related to the transition to a low-carbon economy and associated with the physical impacts of climate change and opportunity for an organization, such as resource efficiency, the development of new products and services, access to new markets.</p> <p>Board chair oversee and govern as the supervisor of Corporate Governance and Sustainability Committee (CGS) and Risk Management Committee (RMC) decision on climate strategy.</p> <p>In 2021, Board of Director (BOD) has been engaged and approved multiple initiative relating to GC's Climate actions/decision i.e. GHG emission reduction targets (scope 1+2) for 2021, 2030, & 2050, target and action plan for scope 3 baseline assessment and suppliers/customers engagement, renewable energy projects, and internal carbon pricing and marginal abatement costs curve.</p>
Board-level committee	<p>Climate Change issues are included under the direct responsibility of the Corporate Governance and Sustainability Committee and Risk Management Committee (RMC), which are appointed by the board of directors. Each committee consists of four members from the board of directors and an independent Chairman.</p> <p>Climate related issues such as Climate Change related laws and regulations that affect the whole company are evaluated and reviewed by the Corporate Governance Committee. This includes monitoring of relevant issues (including energy efficiency, alternative raw material sourcing, GHG mitigation and GHG reduction target).</p> <p>Currently, climate change risk is one of the corporate risk factors which has been managed and monitored by the RMC on quarterly basis. The RMC would ensure that corporate objectives are effectively achieved and our key risks including Climate-change related risks are managed.</p>
Chief Executive Officer (CEO)	<p>The Chief Executive Officer (CEO), director and secretary to the board of directors, sits at the pinnacle of our corporate hierarchy and is appointed from one of the Directors in conformity with the Articles of Association. He is tasked with managing the company according to established policies, plans and budgets under the authority granted by the board of directors. CEO is a member of Risk Management Committee and a chairperson of Management Committee. He shall provide strategies to deal with climate related risks and opportunities, and ensure sufficient resources climate related risk treatment.</p>

C1.1b

(C1.1b) Provide further details on the board's oversight of climate-related issues.

Frequency with which climate-related issues are a scheduled agenda item	Governance mechanisms into which climate-related issues are integrated	Scope of board-level oversight	Please explain
Scheduled – all meetings	Reviewing and guiding strategy Reviewing and guiding major plans of action Reviewing and guiding business plans Setting performance objectives Monitoring implementation and performance of objectives Monitoring and overseeing progress against goals and targets for addressing climate-related issues	<Not Applicable>	Corporate Governance and Sustainability Committee which is appointed by the board of directors, is responsible for sustainability management which climate-related issues such as GHG reduction target setting, strategy action plans, energy efficiency, renewable energy and alternative raw material sourcing endorsement are parts of meeting agendas. Quarterly monitoring and overseeing progress against goals and targets for addressing climate-related issues are taken care by the Corporate Governance and Sustainability Committee.
Scheduled – all meetings	Reviewing and guiding risk management policies Overseeing major capital expenditures, acquisitions and divestitures	<Not Applicable>	Risk Management Committee (RMC) which is appointed by the board of directors, sets the policy and give guideline of risk management which are reviewed quarterly to be consistent with the business context and internal/external factor changes may impact to company's objective and goal. RMC has considered and included the environment risk including the climate change related issue as one of significant risks in doing business in Risk management policy. This makes clear that business unit or risk owner shall put interest in proper management of the environment risk and mitigate if needed. RMC is responsible to monitor the risk management performance on quarterly basis to ensure all key risks in corporate level are well assessed and mitigated properly and timely to assure that company's objective and goal can be achieved.

C1.1d

(C1.1d) Does your organization have at least one board member with competence on climate-related issues?

	Board member(s) have competence on climate-related issues	Criteria used to assess competence of board member(s) on climate-related issues	Primary reason for no board-level competence on climate-related issues	Explain why your organization does not have at least one board member with competence on climate-related issues and any plans to address board-level competence in the future
Row 1	Yes	GC Board of Directors comprises of members who possess a wide range of knowledge, skills, expertise, and experience that would correspond with the Company's business strategies and sustainability goals. With Climate change considered as one of the most materials issues for the company, GC considered board who have experiences related to energy and petroleum or sustainability: corporate governance, social and environmental responsibility to oversee and advice company strategies and actions on climate-related issues. Specifically, GC's board have experiences in assessing risk related to chemical and petrochemical commodity business, reviewing laws and rules concerning the environment, procuring green feedstock, and developing social innovation and environmental stewardship based on circular economy concept. As of May 2021, GC have 10 experience board members on energy and petroleum and 12 members on sustainability: corporate governance, social and environmental responsibility.	<Not Applicable>	<Not Applicable>

C1.2

(C1.2) Provide the highest management-level position(s) or committee(s) with responsibility for climate-related issues.

Name of the position(s) and/or committee(s)	Reporting line	Responsibility	Coverage of responsibility	Frequency of reporting to the board on climate-related issues
Chief Executive Officer (CEO)	<Not Applicable>	Managing climate-related risks and opportunities	<Not Applicable>	More frequently than quarterly
Other C-Suite Officer, please specify (Chief Operating Officer - Center of Excellence)	<Not Applicable>	Managing climate-related risks and opportunities	<Not Applicable>	More frequently than quarterly
Other, please specify (Enterprise Risk Management Committee)	<Not Applicable>	Both assessing and managing climate-related risks and opportunities	<Not Applicable>	More frequently than quarterly
Sustainability committee	<Not Applicable>	Both assessing and managing climate-related risks and opportunities	<Not Applicable>	More frequently than quarterly

C1.2a

(C1.2a) Describe where in the organizational structure this/these position(s) and/or committees lie, what their associated responsibilities are, and how climate-related issues are monitored (do not include the names of individuals).

Sustainable Development Committee (SDC) chaired by Executive Vice President of Corporate Sustainability prepares climate change related issues, for instance, studying the impact of regulations and standards, as well as establishing targets and strategies. SDC also considers the refinement of project investment plans by emphasizing on reducing greenhouse gas emissions, enhancing the efficiency of energy consumption, and seeking an approach to use alternative energy in both GC's production processes and offices. SDC's members are comprised of the highest-level Executive Officers of business units and support functions. SDC shall report to Management Committee (MC) with Chief Executive Officer (CEO) as the chairman. Other members of the MC included of President (PSD), Chief Operating Officer – Value Added Products business, Chief Operating Officer of Base and Intermediate Chemicals business, Chief Operating Officer of the Center of Excellence (COE), Chief Operating Officer – International Business, and highest level Executive who in member of Management of Committee.

GC Operational Excellence Committee (GC OpEx) chaired by Chief Operating Officer of the Center of Excellence (COE) implements and monitors climate action plans endorsed by MC.

The responsibilities for climate-related issues have been assigned to MC as the committee shall report climate action implementation progress to Corporate Governance and Sustainability Committee which is appointed by the board of directors, is responsible for sustainability management which climate-related issues such as GHG reduction target setting, strategy action plans, energy efficiency and alternative raw material sourcing endorsement.

Enterprise Risk Management Committee (ERMC) at management level, chaired by Executive Vice President of Corporate Strategy, and members are comprised of Executive Officers from Business Units with mainly responsible for risk governance implementation, risk enforcement and company-wide management and ensure that risk management policy and framework are carried out and executed in a day-to-day for all business as well as subsidiaries accordance with risk appetite and risk tolerance approved by Risk Management Committee (RMC) at board level. ERMC is closely monitor our risk management performance every month, including risk profile, risk indicator, mitigation plan progress, and report to Management Committee (MC) chaired by CEO, RMC and the Board every quarter. Currently, climate change risk has been included in GC's corporate risk profile, therefore the risk assessment and mitigation progress will be reported to management and board level at least on quarterly basis.

The responsibilities for climate-related issues have been assigned to ERMC to act as management level to monitors our risk management performance every month and will report Management Committee (MC) chaired by CEO in quarterly which is comprise of top executive management to consider the performance of climate related risk/opportunity management and give recommendations whether the risk/opportunity needed further strategy or action plan. The MC will escalate the risk management report to the RMC respectively every quarter. If there is an investment of low carbon projects required, CEO as chairman of Investment Committee will make decision through this committee.

C1.3

(C1.3) Do you provide incentives for the management of climate-related issues, including the attainment of targets?

	Provide incentives for the management of climate-related issues	Comment
Row 1	Yes	

C1.3a

(C1.3a) Provide further details on the incentives provided for the management of climate-related issues (do not include the names of individuals).

Entitled to incentive	Type of incentive	Activity incentivized	Comment
Chief Executive Officer (CEO)	Monetary reward	Emissions reduction target	<p>GC sets Corporate KPIs that reflected our CEO, executive and employee compensation. GC Corporate KPIs relating to Energy & Climate Strategy consist of Energy Efficiency (energy reduction & GHG emissions reduction). We set this KPI as a part of Operational Excellence Benchmarking. We define criteria to achieve Corporate KPIs to 5-level. Compensation & bonus will be allocated to relevant executives & employees when KPI is succeeded at level 3 or above i.e.</p> <p>1) The individual KPI of management level is ranked on the Dow Jones Sustainability Indices (DJSI) and targeted at Top 5 in DJSI, which requires Climate Strategy and GHG Management strategies. The score on DJSI & CDP also relates to the Corporate KPI. In 2021, GHG emission target has been set as Corporate KPI and related to individual KPI for the management level.</p> <p>2) In climate strategy part, We have the set target to :</p> <ul style="list-style-type: none"> - achieve Net zero emissions for scope 1 and 2 and reduce greenhouse gas emissions by 50 percent for scope 3 by 2050 - reduce greenhouse gas emissions (scope 1&2) by 20%, within 2030 - reduce 50% of scope 3 by 2050 based on Science Based Targets Initiative compared to base year 2020. <p>Monetary reward: Achievement of Individual KPIs will relate to their performance bonus. If the base target is achieved, generally a six month of bonus is awarded (depending on Company performance), and if the stretched target is achieved, more than five months bonus will be awarded to the individual.</p>
Corporate executive team	Monetary reward	Emissions reduction project	<p>GC sets Corporate KPIs that reflected our CEO, executive and employee compensation. GC Corporate KPIs relating to Energy & Climate Strategy consist of Energy Efficiency (energy reduction & GHG emissions reduction). We set this KPI as a part of Operational Excellence Benchmarking. We define criteria to achieve Corporate KPIs to 5-level. Compensation & bonus will be allocated to relevant executives & employees when KPI is succeeded at level 3 or above i.e.</p> <p>1) The individual KPI of management level is ranked on the Dow Jones Sustainability Indices (DJSI) and targeted at Top 5 in DJSI , which requires Climate Strategy and GHG Management strategies. The score on DJSI & CDP also relates to the Corporate KPI. In 2021, GHG emission target has been set as Corporate KPI and related to individual KPI for the management level.</p> <p>2) In climate strategy part, We have the set target:</p> <ul style="list-style-type: none"> - achieve Net zero emissions for scope 1 and 2 and reduce greenhouse gas emissions by 50 percent for scope 3 by 2050 - reduce greenhouse gas emissions (scope 1&2) by 20%, within 2030. - reduce 50% of scope 3 by 2050 based on Science Based Targets Initiative compared to base year 2020 <p>Monetary reward: Achievement of Individual KPIs will relate to their performance bonus. If the base target is achieved, generally a six month of bonus is awarded (depending on Company performance), and if the stretched target is achieved, more than five months bonus will be awarded to the individual.</p>
All employees	Monetary reward	Emissions reduction target	<p>GC sets Corporate KPIs that reflected our CEO, executive and employee compensation. GC Corporate KPIs relating to Energy & Climate Strategy consist of Energy Efficiency (energy reduction & GHG emissions reduction). We set this KPI as a part of Operational Excellence Benchmarking. We define criteria to achieve Corporate KPIs to 5-level. Compensation & bonus will be allocated to relevant executives & employees when KPI is succeeded at level 3 or above i.e.</p> <p>1) The individual KPI of management level is ranked on the Dow Jones Sustainability Index (DJSI) and targeted at Top 5 in DJSI, which requires Climate Strategy and GHG Management strategies. DJSI also references the CDP, and our score on DJSI & CDP relates to our Corporate KPI.</p> <p>2) In climate strategy part, we have the set target to reduce greenhouse gas emissions (scope 1 and 2) by 20 percent, within 2030 compared to base year (2020)</p> <p>Monetary reward: Achievement of Individual KPIs will relate to their performance bonus. If the base target is achieved, generally a six month of bonus is awarded (depending on Company performance), and if the stretched target is achieved, more than five months bonus will be awarded to the individual.</p>

C2. Risks and opportunities

C2.1

(C2.1) Does your organization have a process for identifying, assessing, and responding to climate-related risks and opportunities?

Yes

C2.1a

(C2.1a) How does your organization define short-, medium- and long-term time horizons?

	From (years)	To (years)	Comment
Short-term	1	2	Formally included in corporate risk and opportunities management.
Medium-term	2	5	Formally included in corporate risk and opportunities management.
Long-term	5		Formally included in corporate risk and opportunities management.

C2.1b

(C2.1b) How does your organization define substantive financial or strategic impact on your business?

GC uses scenario analysis to identify and assess climate related risks and opportunities. With collaborations among risk management team, strategy development team, environmental management team and sustainability management team so called Climate Strategy Taskforce team, Since 2018, GC has been exploring scenario analysis as a tool to understand potential impacts to our strategy from a low carbon economy transition.

The analysis incorporates model setup and running simulations in many scenarios, including a 2°C or lower scenario as RCP2.6, with RCP4.5 and RCP8.5. Based on the findings, a set of practical mitigation measures and adaptation strategies is proposed for implementation to fit the impact type and level. We also have analyzed the potential impacts of the transition risks to our business using bespoke scenarios from Base Case (the Nationally Determined Contribution (NDC) pathway), Accelerated Energy Transition (AET 2C) and ACCS (1.5C) scenarios. The base case was based on business as usual assumptions leading to global warming of 2.6°C. AET was based on a low carbon economy transition leading to global warming of 2C. In addition to these two scenarios, in July 2022, GC plan to perform an analysis for Accelerated Carbon Capture and Storage (ACCS) scenario which is in line with 1.5C pathway. Assessment of transition risk based on potential scenarios for legislation, technological development or market conditions, and physical risks into both scenarios' events, assessing and identifying risk severity along the years 2020 – 2050.

Opportunities and risks which are deviated from set targets and planned/forecast EBITDA or net income above 2% would consider substantive. Short-term and medium-term risks deviated from planned/forecast EBITDA or net income will be further assessed. All opportunities and risks are then analyzed and prioritized by the Enterprise Risk Management Coordinator.

The risks and opportunities, according to the quantitative result occurring in short term (1 year calendar), can be located in one of the four regions in the risk matrix: – green = should be followed-up /monitored within a business unit (risk classified as low); – yellow (affect GC's EBITDA by 0.5-2%) = must have an action plan and implement all of the actions identified (risk classified as medium); – orange (affect GC's EBITDA by 2-5%) = must have risk mitigation plan and report mitigation progress to Enterprise Risk Management Committee monthly (risk classified as high); – red (affect GC's EBITDA by 5%) = must have risk mitigation plan, a special risk mitigation team and report mitigation progress to Enterprise Risk Management Committee monthly (risk classified as extreme).

C2.2

(C2.2) Describe your process(es) for identifying, assessing and responding to climate-related risks and opportunities.

Value chain stage(s) covered

Direct operations
Upstream
Downstream

Risk management process

Integrated into multi-disciplinary company-wide risk management process

Frequency of assessment

More than once a year

Time horizon(s) covered

Short-term
Medium-term
Long-term

Description of process

GC has developed an Enterprise Risk Management system according to the international standard of The Committee of Sponsoring Organizations of the Treadway Commission (COSO) and the International Organization for Standardization's ISO 31000.

(1) Identification Process

Objective of risk identification is to determine situations or scenarios that could interrupt along value chain operations, affect the reasonable expectation of achieving the company's strategy and business objectives or materially impact the license to operate (including reputation issues).

(a) Responsibility: The heads of Business Units (BU) and Support Functions (SF) responsible for the identification and assessment of opportunities and risks. A Risk Coordinator (RC) in each unit will aggregating the risks from the dedicated Risk Owners in the SFs and BUs: Climate-related risks are identified (and assessed) in different departments: Technology and innovation, Strategy, Markets/Business, Legal, Investor relations, and stakeholders expectation.

For example, The strategy department develops company's corporate strategy and considers megatrends like climate related products and markets, and low-carbon economies. This department identifies and reports a risk that hinder the company's objectives and strategy to become a low carbon company.

(b) Process: At business units, for instance, the availability of products, markets, raw materials, energies and water, the sustainability and the competitiveness are evaluated. At supporting functions, community expectations, reputation, legal and regulation are evaluated. The Risk Coordinators discuss the findings with their heads of department and submit the information to the Enterprise Risk Management Coordinator.

(2) Assessment Process

Short-, medium- and long-term opportunities and risks are assessed more than once a year for forecasting and budgeting/planning by Risk owners at BU and SF. Opportunities and risks which are deviated from set targets and planned/forecast EBITDA or net income above 2% would consider as substantive. Short-term and medium-term risks deviated from planned/forecast EBITDA or net income will be further assessed. All opportunities and risks are then analyzed and prioritized by Enterprise Risk Management Coordinator. Enterprise Risk Management Coordinator compiles the top risks and opportunities (in terms of the expected financial impact as well as the non-financial impact) together with the measures.

In addition to our traditional risk assessment processes, GC has also developed a climate-related scenario analysis process in line with TCFD recommendations. This scenario analysis process will be integrated into long-term risk processes, evaluating potential impacts to the company in 10-30 years time. This process is separated from our traditional Enterprise Management Risk process due to the high uncertainty of identified risks in the 10-30 time frame. Together with signposts, we will monitor the low carbon trajectory of the world. The signposts help identify what scenario the world is headed in and the potential impacts in that scenario based on the results of the scenario analysis. GC expects that potential impacts as monitored by scenario analysis could materialize in 5-10 years time.

(3) Process is applied to Physical risk/opportunity, a case study

At asset level, for instance, physical risks and opportunities from natural disasters which can be managed at Business and Support Functional Units level are monitored and managed continuously by the respective units. Risk owners are responsible for monitoring the risks and opportunities and reporting the responding results to Risk Coordinators on a monthly basis.

For example, GC's plants may suffer drought, which normally requires GC to use fresh water from public reservoirs, which are the water for agricultural and municipal consumption and are filled up with storm water only (no connection to any river). In 2005, GC's plants in Rayong, Thailand faced severe drought, forcing us to buy water from landlords who have water reservoirs. 99% of GC sale revenue come from GC's production of refinery, aromatics, olefins and polymers in Rayong, which need water for cooling towers and steam cracker. In the worst case, GC may have to stop the plants operation.

(4) Process is applied to Transition risk/opportunity, a case study

Risks that associated with corporate strategy such as legal and market risks are brought to attention of Enterprise Risk Management Committee (ERMC) on a monthly basis, then, Management Committee (MC) chaired by CEO before being brought to Risks Management Committee (RMC) for acknowledgment or approval, on a quarterly basis.

RMC, appointed by the Board of Directors, is responsible for setting the policy and risk management framework, as well as monitoring and providing recommendations on risk management.

ERMC chaired by Executive Vice President (EVP) - with members of the highest-level Executive Officers of all relevant functions, has the responsibility of risk governance, enforcement and risk management throughout the organization, as well as monitoring the Key Risk Indicators (KRI), and the progress of risk mitigation measures.

Example 1: Thailand starts the process of developing the foundations for a national carbon price using World Bank funds that will culminate in a mandatory emissions trading scheme. To increase management capacity and reduce greenhouse gases in the organization, GC in Rayong, Thailand, included climate change regulatory into the corporate risk assessment process. Operational cost in term of emission reduction and carbon credit cost may arise, if GC cannot cap CO2 within our allocated quota.

Example 2: Consumers have become more aware of long-term environmental impacts, leading to a decline in single-use plastic consumption and an increase in purchase of products made from renewable raw materials or recycled plastic. We estimated capacity of recycling production of PET products and HDPE products to be 30,000 and 15,000 tonnes per year, respectively. The potential financial impact is calculated from rPET and rHDPE pallet sale price which are 36 THB/kg and 31 THB/kg.

Example 3: As part of the climate related scenario analysis process, we can see potential impacts to GC materializing around after 2030. Through our Climate-related Financial Driver Analysis we comprehensively analysed the potential financial impact from changes in demand, pricing and carbon pricing. From 2030-2050, if GC does not make changes to its portfolio, under a low carbon scenario there could be significant impacts to GC's profitability. These impacts are compensated by our efforts to expand into recycled plastics and use renewable energy.

C2.2a

(C2.2a) Which risk types are considered in your organization's climate-related risk assessments?

	Relevance & Inclusion	Please explain
Current regulation	Relevant, always included	At the moment, there are no current regulations regarding climate change or GHG affecting GC as these are undergoing drafting process. The severity of climate change due to global warming has intensified, leading to various risks, for example, severe natural disasters, drought, etc. Many countries have issued policies, regulations, and laws to expedite a solution for global warming in response to COP26. As GC operates high-carbon intensive operations such as refinery, aromatics and olefins in Thailand, we have established our goals in alignment with national targets, which the reduction of greenhouse gas emissions scope 1 and 2 by 20% within 2030, based on Business As Usual scenario. Even though the greenhouse gas reduction target is not mandated to GC directly, PTT (GC's mother company) as the national oil company is mandated by government directly so GC shall follow this target too. We monitor and assess any risks that affect our target monthly. Our operational cost increasing cannot be avoidable.
Emerging regulation	Relevant, always included	GC as an energy- and emissions-intensive company is directly affected by current and emerging regulation targeting energy use and efficiency as well as reduction of emissions. An example of emerging regulation Thailand starts the process of developing the foundations for a national carbon price using World Bank funds, a climate official said, a process which will culminate in a mandatory emissions trading scheme. To navigate GHG regulation, GC (> 90% operation sites) as a partner of Thailand Greenhouse Gas Management Organization (TGO), has joined the Thailand Voluntary Emission Trading Scheme (Thailand V-ETS) pilot project since 2016 to define appropriate greenhouse gas reduction approaches for petrochemical sector using the carbon market mechanism in Thailand. To increase management capacity and reduce greenhouse gases in the organization, GC also included climate change regulatory as one of GC's corporate risk factor in corporate risk assessment process by Enterprise Risk Management Committee. Our operational cost in term of emission reduction and carbon credit cost may arise, in case we cannot cap CO2 within our allocated quota.
Technology	Relevant, always included	To achieve GHG reduction targets as we committed, energy efficiency process technology must be taken into account. Because GC (at Rayong, Thailand) has refinery, olefins and aromatics plants which are high carbon intensive plants, GC (at Rayong, Thailand) is studying technological improvements or innovations that support the transition to a lower-carbon, energy-efficient economic system such as solar roofs, steam turbine motors, steam expanders, high efficiency motors, fuel oil to gas shifted and CO2 based chemicals & materials. These technologies will support our GHG reduction target in alignment with national targets but Installation of equipment or improvement of production process to reduce GHG emissions may result in higher operating cost. GC included climate change related technology as one of GC's corporate risk factor in corporate risk assessment process by Enterprise Risk Management Committee. Our operational cost will be increasing because of research and development cost on studying CO2 based chemical, investment in renewable energy and other energy-efficiency technologies.
Legal	Relevant, always included	GC's legal department is monitoring and evaluating the current laws and regulations such as carbon tax or carbon trading scheme in every country we have operations. Any risk comes up from laws and litigation are raised up to management level and Enterprise Risk Management Committee (ERMC). Once this issue active, updated laws and regulations are sent to employees via e-mail. Moreover, employees can access Legal-online system to check new laws and regulations too. Example: In 2022 Thailand will announce National Climate Change Acts which relevant to carbon tax, carbon markets and inclusive climate change risks in investment projects. Neglect of including carbon price as a criterion for new investment project may result lawsuit.
Market	Relevant, sometimes included	At present, environmental awareness of circular economy has become a growing trend at both national and international levels. Thai and Asian consumers have, thus, become more aware of long-term environmental impacts, leading to a decline in single-use plastic consumption and an increase in purchase of products made from renewable raw materials or recycled plastic. Decrease in single-use plastic consumption and growing trend to modify the components of environmentally friendly products by entrepreneurs have lowered the demand for plastic pellets in the period of two to three years, affecting GC's revenue directly. GC Thailand included climate change related market trends as one of GC's corporate risk factor in corporate risk assessment process by Enterprise Risk Management Committee. During 2020 - 2030, Thailand, China and other Asian countries aim to achieve a reduction in single-use plastic. In case GC cannot adapt to this change, we may lose some revenue.
Reputation	Relevant, always included	Reputation is always included as one of GC's corporate risk factor in corporate risk assessment process by Enterprise Risk Management Committee. We realized that public concerns of single-use plastic ban are coming together with low-carbon economy. GC Thailand as a leading petrochemical company in South East Asia cannot avoid public expectations on moving forward to low-carbon economy. If we fail to convince that GC is following an emission reduction pathway towards low-carbon industry we will experience difficulties to retain young shareholders.
Acute physical	Relevant, sometimes included	Climate change may lead to water shortage. Without an efficient water management plan, GC's business operations may be affected and disrupted. GC Thailand (>90% operation sites) uses water from reservoirs not from river basins which are the same water sources for municipal use. Climate change may affect precipitation patterns resulting to water stress. Water shortage in the production process or deteriorating raw water quality leads to production process disruption, which may decrease GC's revenue and increasing procedures for implementation of new measures and laws, e.g. permission request, water allocation, legal responsibility, etc.
Chronic physical	Relevant, sometimes included	Changing climate patterns in longer-term shifts is one of the basic characteristics of climate change. Increasing number of cyclones may cause disruptions of crude transportation by sea freight. That can influence our supply chain stability, if alternative methods are not thoroughly planned. GC Rayong, Thailand refinery plant is running with crude most from West Africa and North America. Any disruptions of crude transportation in Indian ocean may cause the delay of feedstocks delivery.

C2.3

(C2.3) Have you identified any inherent climate-related risks with the potential to have a substantive financial or strategic impact on your business?

Yes

C2.3a

(C2.3a) Provide details of risks identified with the potential to have a substantive financial or strategic impact on your business.

Identifier

Risk 1

Where in the value chain does the risk driver occur?

Direct operations

Risk type & Primary climate-related risk driver

Emerging regulation	Carbon pricing mechanisms
---------------------	---------------------------

Primary potential financial impact

Increased indirect (operating) costs

Climate risk type mapped to traditional financial services industry risk classification

<Not Applicable>

Company-specific description

Emerging regulation in Thailand is in the process of developing the foundations for a national carbon price using World Bank funds, a climate official said, a process which will culminate in a mandatory emissions trading scheme. There is some possibility that Thailand could issues new Thailand acts related to climate change in the near future. As an energy and the emissions-intensive company, with about 151.3 million GJ energy consumption and about 84.7% are from non-renewable energy consumption in 2021. Therefore, GC is directly affected by current and emerging regulations which having direction to optimize energy use and maximize energy efficiency as well as reduction of emissions. With this impact, it is expected that GC's operating costs will be significantly increased within 2030, and the amount of the mentioned cost will be reached to critical point in 2050. However, GC also aims to convert this risk into opportunities by investing in low carbon products and businesses.

Time horizon

Long-term

Likelihood

Likely

Magnitude of impact

High

Are you able to provide a potential financial impact figure?

Yes, a single figure estimate

Potential financial impact figure (currency)

16931000000

Potential financial impact figure – minimum (currency)

<Not Applicable>

Potential financial impact figure – maximum (currency)

<Not Applicable>

Explanation of financial impact figure

GC operational cost in term of mission reduction and carbon credit cost may arise, in case we cannot cap CO2 within our allocated quota. This situation of related carbon regulatory leading to change in market demand of fossil-base product and disruption from low carbon technologies, so based on the financial impact study on transition risk in Accelerated Energy Transition (AET 2C) scenario is initially applied to fit properly to the financial implications to our existing products in 2050 as follows;

a) Refined products • Increased operating cost due to carbon cost approximately 120 million THB • Margin erosion approximately 949 million THB • Volume impact by demand approximately 1,994 million THB

b) Polyolefin products • Increased operating cost due to carbon cost approximately 464 million THB • Margin erosion approximately 4,578 million THB • Volume impact by demand approximately 8,826 million THB .

The total financial impact is 120,000,000 + 949,000,000 + 1,994,000,000 + 464,000,000 + 4,578,000,000 + 8,826,000,000 = 16,931,000,000

Cost of response to risk

32500000000

Description of response and explanation of cost calculation

Situation:

Potential emerging regulations related to GHG emissions has been included as one of GC's corporate risk factor in corporate risk assessment process by Enterprise Risk Management Committee and GC has been engaged with related stakeholders for many years.

Objective:

It is crucial to ensure that GC's GHG emissions will not exceed emissions allocation in the long-term view, therefore GC has set a Net Zero target scope 1 and 2 and 50% reduction of scope 3 by 2050.

Actions:

To mitigate these risks, GC has set the Decarbonization Pathways to reach the Net Zero goal through 3 approaches which include Efficiency-Driven, Portfolio-Driven, and Compensation-Driven. The summary of the programs are; (1) Investment in carbon reduction programs and carbon capture technology (2) Initiating the Maptaphut Integration (MTPi) eco-friendly program to reduce loss in the process and lower greenhouse gas emissions (3) Investment in low-carbon process technology (4) Investment in capacity for green products such as bio-fuel, and bio plastic (5) Investment in recycled products, high-performance products, low carbon products, and upcycled products.

Results:

In 2021, GC has carried out numerous projects to reduce greenhouse gas emissions and enhance energy efficiency. Highlight projects include the Installation of Gas Turbine Generator and Heat Recovery Steam Generator at Utilities Plant, Enhancement on Energy Efficiency of Steam Production, and the Installation of Solar Cells on the rooftop of the Operations Buildings. Total investment is about 3,028 million THB, reduce 63,333 tons CO2 equivalent per year, and reduce cost of about 337 million THB per year.

Measures and breakdown of cost:

Estimated total investment during 2021 – 2050 is 945 billion THB therefore investment per year is 32.5 billion;

a) 175 billion THB will be invested in GHG emission reduction initiatives e.g., (1) Efficiency-driven: investment in technology for energy efficiency improvement and low carbon power and heat/renewable (2) Compensation: invest in nature-based solutions and carbon capture and storage. Therefore, about 6.03 billion will be invest.

b) 770 billion THB will be invested in business portfolio evolution towards low carbon business (1) Green products such as bio-fuel, bio plastic (2) Recycled and upcycled products. Therefore, about 26.55 billion will be invest.

The total cost of response to risk is 6.03 billion + 26.55 billion = 32,500,000,000 THB

Comment

C2.4

(C2.4) Have you identified any climate-related opportunities with the potential to have a substantive financial or strategic impact on your business?

Yes

C2.4a

(C2.4a) Provide details of opportunities identified with the potential to have a substantive financial or strategic impact on your business.

Identifier

Opp1

Where in the value chain does the opportunity occur?

Downstream

Opportunity type

Products and services

Primary climate-related opportunity driver

Development and/or expansion of low emission goods and services

Primary potential financial impact

Increased revenues resulting from increased demand for products and services

Company-specific description

With consumer being more environmentally conscious and aware of circular economy, since 2018, customers have reduced demand for virgin plastic and high carbon products and they have preferred to use recycle plastic and bio-fuel instead. 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 bio-products include bio-fuel, bio-plastic, recycled product, high performance product, low carbon products, and upcycled products. 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. GC targets to increase high-performance and green products to 35% of the products portfolio by 2030, in order to enable continuous business growth with lower greenhouse gas emissions rate.

Time horizon

Long-term

Likelihood

Likely

Magnitude of impact

Medium

Are you able to provide a potential financial impact figure?

Yes, a single figure estimate

Potential financial impact figure (currency)

58840000000

Potential financial impact figure – minimum (currency)

<Not Applicable>

Potential financial impact figure – maximum (currency)

<Not Applicable>

Explanation of financial impact figure

The opportunity that is raised from the transition risk is to motivate and enhance the environmental aspects of our existing green products. GC expects to capture this opportunity and move toward our Net Zero strategy, so GC plans to increase investment in the development of green products and sustainability-driven solutions that provides sustainability value-added to users.

GC has assessed potentials and impact of environmental-friendly products in the future. GC has forecasted that GC would have total EBITDA for 143.5 billion THB in 2030. The environmental-friendly products that are performance material & chemical products, and green chemicals & bioplastic will have EBITDA for 35% and 6% of total EBITDA, which equivalent to 50.23 and 8.61 billion THB, respectively. Therefore, GC has potential to gain EBITDA in 2030 of such products for $50.23 + 8.61 = 58.84$ billion THB.

Cost to realize opportunity

770000000000

Strategy to realize opportunity and explanation of cost calculation

Situation:

At present, environmental awareness of circular economy and environmental impact had become a growing trend, leading to a decline in single-use plastic consumption and an increase in purchase of products made from renewable raw materials or recycled plastic. This have lowered the demand for plastic pellets in the period of two to three years, affecting GC's revenue directly.

Objective:

Aligning with GC's Net Zero target by 2050, GC has a long-term plan to shift our portfolio towards low-carbon business by adjusting the management process and investing in high value business (HVB), green chemicals, and recycled products. GC targets to increase high-performance and green products to 35% of the products portfolio by 2030, in order to continue our business with low environment impact.

Actions:

GC plans to increase investment in the development of low carbon products, sustainability-driven solutions, and technology that provides sustainability value-added to users. These bio-products include bio-fuel, bio-plastics, recycled products, high-performance products, low carbon products, and upcycled products. We collaborate with experts, customers, partners, and other sectors through the Customer Solution Center (CSC) using the Eco-Design Guideline, the Life Cycle Assessment (LCA) and the Circular Economy principles.

Results:

In 2021, GC generated revenue of 18,982 million THB from green chemicals & bioplastics, 68,721 million THB from performance material & chemical products, and 17.8 million THB from upcycled products. The certification of products as low carbon is expected to grow every year. In addition, GC is able to brought 300 tons/year of plastic back into the recycling system.

Measures and breakdown of cost:

Estimated total investment of 22.2 billion USD or 770 billion THB (1 USD = 35 THB), from 2021 – 2050, which will be focusing on Business portfolio transition towards low carbon business;

In 5 year plan investment (end at year 2027), there will be investment in high performance and green product of total 171.5 billion THB. From 2028 - 2050 total investment 598.5 billion THB (75% performance chemical (448.87 billion THB) and 25% Low carbon and recycle products (149.62 billion THB)).

Therefore, the cost to realize is 171.5 billion THB + 598.5 billion THB = 770 billion THB.

Comment

C3. Business Strategy

C3.1

(C3.1) Does your organization’s strategy include a transition plan that aligns with a 1.5°C world?

Row 1

Transition plan

Yes, we have a transition plan which aligns with a 1.5°C world

Publicly available transition plan

Yes

Mechanism by which feedback is collected from shareholders on your transition plan

Our transition plan is voted on at AGMs and we also have an additional feedback mechanism in place

Description of feedback mechanism

GC Annual General Meeting will usually hold at the beginning of each year. In 2021, GC released net zero target on October, which is the period after AGM. As GC highly prioritize communication with stakeholders, GC has held a separate follow up meeting with all shareholders to inform and received comments regarding Net zero target and transition plan. In the year 2022, GC AGM has included the update of business plan and portfolio according to our Net Zero target along with the business performance for shareholders to vote and cast opinions. In the meeting, after each agenda, a short Q&A session is available to clarify any point of discussion followed with the online voting system for any supportive or disagreement. At the end of the meeting, another Q&A session is also available as the final agenda to gather all questions from shareholders.

In addition, GC also regularly received and engaged with shareholders and investors regarding net zero strategy and low carbon initiatives through Investor relation communication function, responding to any questions or suggestions. Moreover, GC also hold Analyst meeting with key stakeholders quarterly for business update. Documents and MoM from the meeting are available in GC’s public website (<https://www.pttggroup.com/en/investor-relations/document/presentations>)

Frequency of feedback collection

More frequently than annually

Attach any relevant documents which detail your transition plan (optional)

- PTT GC_TCFD 2022 (New).pdf
- GC AGM Slide 2022.pdf
- PTTGC_Decarbonization Pathway.pdf
- GC AGM Slide 2022.pdf

Explain why your organization does not have a transition plan that aligns with a 1.5°C world and any plans to develop one in the future

<Not Applicable>

Explain why climate-related risks and opportunities have not influenced your strategy

<Not Applicable>

C3.2

(C3.2) Does your organization use climate-related scenario analysis to inform its strategy?

	Use of climate-related scenario analysis to inform strategy	Primary reason why your organization does not use climate-related scenario analysis to inform its strategy	Explain why your organization does not use climate-related scenario analysis to inform its strategy and any plans to use it in the future
Row 1	Yes, qualitative and quantitative	<Not Applicable>	<Not Applicable>

C3.2a

(C3.2a) Provide details of your organization’s use of climate-related scenario analysis.

Climate-related scenario	Scenario analysis coverage	Temperature alignment of scenario	Parameters, assumptions, analytical choices		
<table border="1"> <tr> <td>Transition scenarios</td> <td>Bespoke transition scenario</td> </tr> </table>	Transition scenarios	Bespoke transition scenario	Company-wide	2.1°C - 3°C	<p>Parameters: Climate Financial Driver analysis covered; Consumer Demand, access to Low carbon technology, Carbon policy and carbon price. The boundary of analysis was Refinery and Polyolefins businesses where the polyolefins operations represents our downstream businesses.</p> <p>Assumptions: The base case was based on business as usual assumptions leading to global warming of 2.9°C. In this scenario, maintain global temperature at 2C by 2050 is not possible.</p> <p>1) Consumer demand; increase for EV and recycle plastic products 2) Low carbon technology; Low access to technology and high cost 3) Carbon policy; The bottom-up modelling effort in this scenario requires a lot of detail at the sectoral level, including pricing policies, efficiency standards and schemes, electrification programs as well as specific infrastructure projects.</p> <p>Analytical choices: Timeframe; 2030 - 2050 Conducted both quantitative and qualitative analysis Data sources; IHS Markit’s Rivalry Scenario for feedstock prices, product prices, demand and carbon pricing, Nationally Determined Contributions under the Paris Agreement</p>
Transition scenarios	Bespoke transition scenario				

Climate-related scenario		Scenario analysis coverage	Temperature alignment of scenario	Parameters, assumptions, analytical choices
Transition scenarios	IEA 2DS	Company-wide	<Not Applicable>	<p>Parameters: Climate Financial Driver analysis covered; Consumer Demand, access to Low carbon technology, Carbon policy and carbon price. The boundary of analysis was Refinery and Polyolefins businesses where the polyolefins operations represents our downstream businesses.</p> <p>Assumptions: AET was based on low carbon economy transition leading to global warming of 2°C. In this scenario, maintain global temperature at 2C by 2050 is possible. 1) Consumer demand; increase for EV and recycle plastic products 2) Low carbon technology; medium level of access to technology with medium cost 3) Carbon policy; strictly applying regulation with medium rate charge</p> <p>Analytical choices: Timeframe; 2030 - 2050 Conducted both quantitative and qualitative analysis Data sources; Accelerated Energy Transition (AET) scenarios that based on IHS Markit's Autonomy Scenario for feedstock prices, product prices, demand and carbon pricing</p>
Transition scenarios	IEA B2DS	Company-wide	<Not Applicable>	<p>Parameters: Climate Financial Driver analysis covered; Consumer Demand, access to Low carbon technology, Carbon policy and carbon price. The boundary of analysis was Refinery and Polyolefins businesses where the polyolefins operations represents our downstream businesses.</p> <p>Assumptions: GC's Sustainable Development Scenario (SDS) & Accelerated Carbon Capture and Sequestration (AACCs) are consistency with IEA B2DS was based on low carbon economy transition leading to global warming of below 2°C. SDS = focus on policy aspect ACCs = focus on technology aspect</p> <p>Analytical choices Timeframe: 2030 - 2050 quantitative and qualitative analysis</p>
Physical climate scenarios	RCP 2.6	Company-wide	<Not Applicable>	<p>Parameters: Rainfall (Standard Precipitation Index (SPI)) and Wind speed (frequency of tropical cyclone categories 1-5). The assessment covered specific geographical locations where GC plants and suppliers operate in Rayong and Chonburi provinces, and its major client operation in Samutprakarn and Samutsakorn provinces.</p> <p>Assumptions: Mean Radiative forcing at earth surface is 2.6 W/m²; High effort on the implementation of decarbonization making maintain global temperature at 2C by 2050 is possible. Medium intensity & low frequency in extreme weather.</p> <p>Analytical choices: Timeframe: 2030 - 2050 Conducted both quantitative and qualitative analysis Data sources: Aqueduct, The climate explorer, Research gate, ScienceDirect, The projection of rainfall data by climate model CMIP 5</p>
Physical climate scenarios	RCP 4.5	Company-wide	<Not Applicable>	<p>Parameters: Rainfall (Standard Precipitation Index (SPI)) and Wind speed (frequency of tropical cyclone categories 1-5). The assessment covered specific geographical locations where GC plants and suppliers operate in Rayong and Chonburi provinces, and its major client operation in Samutprakarn and Samutsakorn provinces.</p> <p>Assumptions Mean Radiative forcing at earth surface is 4.5 W/m²; Medium effort on the implementation of decarbonisation making maintain global temperature at 2C by 2050 is Possible, with high uncertainty Medium intensity & medium frequency in extreme weather</p> <p>Analytical choices: Timeframe: 2030 - 2050 Conducted both quantitative and qualitative analysis Aqueduct, The climate explorer, Research gate, ScienceDirect, The projection of rainfall data by climate model CMIP 5</p>
Physical climate scenarios	RCP 8.5	Company-wide	<Not Applicable>	<p>Parameters: Rainfall (Standard Precipitation Index (SPI)) and Wind speed (frequency of tropical cyclone categories 1-5). The assessment covered specific geographical locations where GC plants and suppliers operate in Rayong and Chonburi provinces, and its major client operation in Samutprakarn and Samutsakorn provinces.</p> <p>Assumptions: Mean Radiative forcing at earth surface is 8.5 W/m²; Low effort on the implementation of decarbonization making maintain global temperature at 2C by 2050 is not possible. High intensity & high frequency in extreme weather</p> <p>Analytical choices: Timeframe: 2030 - 2050 Conducted both quantitative and qualitative analysis Aqueduct, The climate explorer, Research gate, ScienceDirect, The projection of rainfall data by climate model CMIP 5</p>

C3.2b

(C3.2b) Provide details of the focal questions your organization seeks to address by using climate-related scenario analysis, and summarize the results with respect to these questions.

Row 1

Focal questions

How would climate-related transition risks of changing demand, prices and carbon prices affect GC business? Are GC's current actions sufficient to mitigate the risk? What actions/strategies should be developed?

Rationale for selecting the scenarios:

Result of GC climate risk assessment showed that climate related transition risks impose highest risk to GC business i.e. impact of changing demand and carbon price. Therefore, GC has selected the following climate scenario for transition risk assessment; IHS Markit, Base Case and Accelerated Energy Transition (AET) (consistent with IEA 2DS) and Accelerated Carbon Capture and Storage (ACCS) (consistent with IEA B2DS) scenarios.

Results of the climate-related scenario analysis with respect to the focal questions

Scenario analysis and results

To identify the impact, GC analyzed the potential impacts to business using scenarios from IHS Markit, Base Case and Accelerated Energy Transition (AET) and Accelerated Carbon Capture and Storage (ACCS) scenarios. The base, AET and ACCS cases was based on assumptions leading to global warming of 2.6°C, 2°C and 1.5°C, respectively. The analysis were focused on the impact of changing demand, prices and carbon prices on the main products which are refined products and polyolefins (PE).

The results show that future regulations related to GHG emissions may result in higher operating costs e.g. carbon price & lower demand of single-use plastic and refinery products. This impact will directly affect polyolefins and refinery business, by which estimate impact to EBITDA by 48.5% (using AET scenario) in 2050. In addition, GC also identified opportunity from the situation, transitioning portfolio to low carbon business will aim to reach EBITDA by 58.8 billion THB in 2030.

Thus, GC developed 2 Internal Carbon Pricing models which are 1) carbon price 2) carbon fee to align with decarbonization pathway.

Example of how scenario analysis influence business strategy and action

According to the result of the analysis, GC has establish the Low-carbon Transition Framework to response to the scenario analysis and aim for net zero target. The Framework embrace 3 pillars

- 1) Efficiency-Driven: Maximizing efficiency across all assets and implementing new breakthrough technologies. Carbon fee will be use to accelerate asset's decarbonization & support new abatement initiatives
- 2) Portfolio-Driven: Portfolio adjustment to increase quality of earning, while adopting integrated circular economy concept. GC implement Carbon Pricing, using Shadow Price (15-48 USD/tCO_{2e}) & adopted MACC to analyze/plan the investment worthiness of new GHG reduction projects
- 3) Compensation-Driven: Capture & offset residual carbon emissions using multiple approaches and technologies. For example, GC has established cooperation with its partner network, and plan to invest in CCUS start-ups through Corporate Venture Capital (CVC) to explore new technology with higher efficiency and less costs.

C3.3

(C3.3) Describe where and how climate-related risks and opportunities have influenced your strategy.

	Have climate-related risks and opportunities influenced your strategy in this area?	Description of influence
Products and services	Yes	<p>Due to the changes of consumer trends toward low carbon society, since 2018 customers have reduced demand for virgin plastic and high carbon fuel, and they have preferred to use recycle plastic and bio-fuel instead. In this regard, climate-related risks and opportunities have influenced GC's commitment to be a part to promote a sustainable measure and create value in accordance with "Circular Economy" principle.</p> <p>As part of Net zero strategy, GC has defined a "portfolio-driven" pillar focusing on 1. Adjusting our portfolio towards low-carbon business and Circular Economy by steering investment to high value business (HVB), bioplastic, and recycled plastic, 2. Creating low carbon products, 3. Creating complete product circularity for efficient recycling process, and 4. Investing in technology</p> <p>In 2021, GC products (out of 132 products) are certified with Carbon Footprint of Product (CFP) and Carbon Footprint Reduction (CFR) by 100% and 64%, respectively. Another example of GC's actions toward "circular economy" principle is the YOUTURN project, which is an end-to-end used plastic management system which collecting used plastic for recycling and manufacturing. Physical drop points and digital drop points have been established to collect used plastic bottles from more than 150 key locations in government agencies, communities, and educational institutions. The link continues through the transportation of the plastic bottles to ENVICCO, GC's international standard plastic recycling plant, or other standardized recycling partners. In 2021, the project collected about 343,148 kg of hard plastic, and 96,744 kg of stretchy plastic. Reduce the GHG emission by 1,034 ton CO2e.</p>
Supply chain and/or value chain	Yes	<p>Climate change causes droughts and higher demand for water from all sectors in the Eastern, Thailand region where our >90% productions are there, making it harder to access adequate fresh water, increase water sourcing cost, and may cause conflict with neighbouring communities.</p> <p>In addition, GC regularly conducts water risk assessments (using tools such as, Environmental Impact Assessment and Life Cycle Assessment to identify suppliers with high water risk i.e. PTT Gas Separation Plant, GPSC and GLOW.</p> <p>GC has conducted physical risk assessments using IPCC's RCP 2.6, 4.5, and 8.5 scenarios within 2030-2050 timeframe. The analysis covered all GC operations, its suppliers and major client operations (32 GC's plants, 1 Critical 1st tire feedstock supplier, and 2 major clients). The result showing that main impact are located in only GC operations, covering a wide range of financial impact from 10.5 million THB (water treatment cost) to 536 million baht (plant shutdown).</p> <p>GC strategy "One water strategy" comprise of</p> <ol style="list-style-type: none"> 1) Governance: Managing water through the Water Management Taskforce to drive implementation of integrated water management as well as define the 10 year Water Management Strategy with the target to reduce dependence on current water sources by at least 50 percent 2) Water stewardship: building water efficiency, supply chain corporation i.e. knowledge sharing with key suppliers, and investment in technology i.e. Sea Water Reverse Osmosis (SWRO) and Wastewater Reverse Osmosis (WWRO) to reduce freshwater withdrawal 3) Resilience: Building network with the public, private and industrial sectors, playing key role and taking part in planning and water management locally and nationally to drive sustainable water management
Investment in R&D	Yes	<p>According to the result of transition risks and opportunities assessment, low carbon technology is identified as the main opportunity for GC. GC has aligned its innovation strategy with its business directions and action plans by focusing on process efficiency enhancement, product value creation, and create new business through R&D networks.</p> <p>As part of portfolio-driven strategy to Net zero target by 2050, GC focuses its research and investments in innovation through tech startups and venture capitals (VC) worldwide with focus in four areas of innovation: 1. Clean Technology, 2. Advance Materials, 3. Digital Platforms, and 4. Biotech & Life Science. Further, GC explores opportunities to create new business from direct and indirect Corporate Venture Capital (CVC) investments.</p> <p>GC works on innovation development to improve process efficiency and creating high quality, healthy, and eco-friendly products by focusing on 3 type of innovation development.</p> <ol style="list-style-type: none"> 1) Open innovation; building product R&D networks through direct and indirect investment in innovation i.e. startups. For example, in 2021, GC invested 2.5 million USD to Phase Change Energy Solutions (PCES), Develop bio-materials to reduce CO2 emissions in the supply chain of biopharmaceutical cold chain logistics 2) Product innovation; researched and developed products based on customer sentiments and supports net zero emissions businesses. In 2021, product innovations to highlight include Post-Consumer Recycled (PCR) Resin and Development of High Flow Rotational Molding Grade Plastic. 3) Process innovation; Aim to achieve maximum potential by focusing on energy reduction, waste utilization, modification of chemical use and application of tools to accommodate the creation of diverse products. In 2021, highlight process innovations include Yellow Oil Value Added and Online Chemical Cleaning for Convection Coil of Fired Heaters.
Operations	Yes	<p>According to GC scenario analysis, various impacts from physical risks (drought, and flood), and transition opportunities and risks (changing of consumer demand and carbon price) are effecting the business throughout our operation and value chain. GC has realized the important of addressing the climate related issues and recently announce its Net zero target by 2050 (scope 1 & 2). GC roadmap to net zero covers 3 key pillars, one of them is "Efficiency-driven" focused on improving a) efficiency of resources and energy, and b) low carbon energy in our operation.</p> <p>For example, GC Efficiency Improvement Projects covered energy conservation, steam reduction, digitalization (using Advance Process Control (APC), light gas utilization, and flare reduction. In 2021, GC has conducted 82 energy conservation projects, focusing on enhancing energy efficiency and optimization. Since 2012-2021, GC has accumulatively reduced greenhouse gas emissions from Energy Conservation Projects by 838,899 tons CO2e. In terms of renewable energy, the total of 6 million baht is invested on solar rooftop project, resulting in the total capacity of 480 kilowatt-hours/day and estimate 47 ton CO2e of GHG emission reduction. In addition, GC also adopted internal carbon price (a shadow price of USD 15-48 per tons CO2) and marginal abatement costs curve to support investment decisions in Greenhouse gas emission reduction projects.</p>

C3.4

(C3.4) Describe where and how climate-related risks and opportunities have influenced your financial planning.

	Financial planning elements that have been influenced	Description of influence
Row 1	Revenues Capital expenditures Capital allocation	<p>Capital allocation – Case Study//</p> <p>With the severity of climate change due to global warming has intensified, leading to various risks such as severe natural disasters, drought, etc. GC has defined and applied internal carbon price as a shadow price to estimate greenhouse gas emissions costs to serve as a decision-making and planning tool for new project investments. GC set a target to have greenhouse gas emission scope 1 and 2 reduced by 20% within 2030, compared to base year 2020, and Net zero target by 2050 (2020 base year). GC will allocate capital to downstream and performance products, which emit less GHG based on internal carbon price difference proportion in downstream and upstream businesses being approximately 25/75. It is estimated that about 945 billion THB will be invested in GHG emission reduction and transition of portfolio to low carbon business initiatives, by 2050.</p> <p>Revenues – Case Study//</p> <p>According to the Roadmap on Plastic Waste Management 2018-2030, Thailand will phase out single-use plastics by the end of 2022. Environmental awareness has become a growing trend at both national and international levels. Consumers have, thus, become more aware of long-term environmental impacts, leading to a decline in single-use plastic consumption and an increase in purchase of products made from renewable raw materials and recycled plastic products. With GC's current emission intensive based products, therefore, GC aims to adjust its portfolio to integrated circular economy concept and increase its earning as part of low carbon transition framework to Net Zero target. It is estimate that total of 770 billion THB will be invested towards low carbon business by 2050. GC will use renewable raw materials such as corn, palm oil, cassava and sugarcane to generate green products such as fatty alcohol, glycerin, Polylactic Acid (PLA) and Polybutylene Succinate. Additionally, to serve demand of recycled plastics, ENVICCO Limited is a new joint venture established in a partnership involving GC and ALPLA, produces two high-performance polymers, rPET and rHDPE, with cutting-edge technology that meets international standards. These low carbon products are expected to generate approximately 87 million THB per year, in the short-term. As a result, GC is able to create rPET and rHDPE pellets with a production capacity of 30,000 tons per annum and 15,000 tons per annum, respectively. The revenue received from upcycling product in 2021 is 18 million baht.</p> <p>Capital expenditure – Case Study//</p> <p>As GC has high-carbon intensive operations with the most sale revenue 67% in 2020 from Refinery, Aromatics, Olefins, Green Chemical, and Polymer, we have established our goals in alignment with national targets, which the reduction of greenhouse gas emissions scope 1 and 2 by 20% within 2030 and Net zero target of scope 1 & 2 by 2050. We studied how to reduce GHG with optimum return on investment focusing on low carbon process technology, energy efficiency and renewable energy. Investments in low-carbon process technology such as high-quality insulation jackets, steam recovery technology and premium efficiency motors. Additionally, we are improving our existing plants with energy efficiency programs such as heat recovery, process optimization. Furthermore, we are installing solar panels on our building rooftops. By 2050, about 175 billion THB will be invest in energy efficiency and low carbon energy, including nature based solution, and carbon capture and storage. Currently, the total investment in solar rooftop project is 6 million baht, with total GHG emission reduction of 47 tons CO₂e per year, and reduction of energy purchased costs of 492,234 baht per year</p>

C3.5

(C3.5) In your organization's financial accounting, do you identify spending/revenue that is aligned with your organization's transition to a 1.5°C world?

Yes

C3.5a

(C3.5a) Quantify the percentage share of your spending/revenue that is aligned with your organization's transition to a 1.5°C world.

Financial Metric

Other, please specify (CAPEX and OPEX)

Percentage share of selected financial metric aligned with a 1.5°C world in the reporting year (%)

3.3

Percentage share of selected financial metric planned to align with a 1.5°C world in 2025 (%)

16.7

Percentage share of selected financial metric planned to align with a 1.5°C world in 2030 (%)

33.3

Describe the methodology used to identify spending/revenue that is aligned with a 1.5°C world

GC plans to increase investment Estimated total investment of 22.2 billion USD or 770 billion THB (1 USD = 35 THB), from 2021 – 2050, which will be focusing on Business portfolio transition towards low carbon business;

In 5 year plan investment (end at year 2027), there will be investment in high performance and green product of total 171.5 billion THB. From 2028 - 2050 total investment 598.5 billion THB (75% performance chemical (448.87 billion THB) and 25% Low carbon and recycle products (149.62 billion THB)).

Therefore, the cost to realize is 171.5 billion THB + 598.5 billion THB = 770 billion THB.

This plan is align with GC goal to reach Net zero by 2050. The bio-products include bio-fuel, bio-plastic, recycled products, high-performance products, low carbon products, and upcycled products.

C4. Targets and performance

C4.1

(C4.1) Did you have an emissions target that was active in the reporting year?

Absolute target

C4.1a

(C4.1a) Provide details of your absolute emissions target(s) and progress made against those targets.

Target reference number

Abs 1

Year target was set

2021

Target coverage

Company-wide

Scope(s)

Scope 1

Scope 2

Scope 2 accounting method

Market-based

Scope 3 category(ies)

<Not Applicable>

Base year

2020

Base year Scope 1 emissions covered by target (metric tons CO2e)

5787067

Base year Scope 2 emissions covered by target (metric tons CO2e)

1975210

Base year Scope 3 emissions covered by target (metric tons CO2e)

<Not Applicable>

Total base year emissions covered by target in all selected Scopes (metric tons CO2e)

7762277

Base year Scope 1 emissions covered by target as % of total base year emissions in Scope 1

100

Base year Scope 2 emissions covered by target as % of total base year emissions in Scope 2

100

Base year Scope 3 emissions covered by target as % of total base year emissions in Scope 3 (in all Scope 3 categories)

<Not Applicable>

Base year emissions covered by target in all selected Scopes as % of total base year emissions in all selected Scopes

100

Target year

2030

Targeted reduction from base year (%)

20

Total emissions in target year covered by target in all selected Scopes (metric tons CO2e) [auto-calculated]

6209821.6

Scope 1 emissions in reporting year covered by target (metric tons CO2e)

6737595

Scope 2 emissions in reporting year covered by target (metric tons CO2e)

2222649

Scope 3 emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Total emissions in reporting year covered by target in all selected scopes (metric tons CO2e)

8960244

% of target achieved relative to base year [auto-calculated]

-77.1659527223777

Target status in reporting year

New

Is this a science-based target?

No, but we anticipate setting one in the next 2 years

Target ambition

<Not Applicable>

Please explain target coverage and identify any exclusions

This target is company-wide and covers 100% of both our Scope 1 and 2 emissions, with covers the operation performance of the companies under GC Group in Thailand that GC holds greater than or equal to 50 percent of the total shares.

Plan for achieving target, and progress made to the end of the reporting year

In 2021, GC has a total GHG emission scope 1 and 2 of 8,960,244 ton CO2e, which is higher than the total GHG emission in 2020, 7,779,764 ton CO2e, as baseline. Meaning that GC has not achieved annual target of absolute emission reduction due to current expanding of GC's business. GC will continue to seek new business opportunities with outstanding technologies and innovations to strengthen our ability to compete in the market in a long-run. After GC has reached to the peak year of emission (estimate 2025), the absolute emission is expected to be exponentially decreased. All plants and operation sites will reach to its most optimized condition where all

of functions will fully and efficiently operate. Consequently, overall performance of entire corporate will potentially maximize.

GC has committed to achieve the Net Zero target for scope 1&2 within 2050, with a framework of the three pillars of transition to Net Zero Company i.e., Efficiency-Driven, Portfolio-Driven, and Compensation-Driven. Focusing on Efficiency-Driven and Portfolio-Driven pillar, GC has implemented many emission reduction initiatives to reduce overall GHG emission generated within the organization. In 2021, key initiatives that contribute most to the emission reduction progress is optimization of energy efficiency in production processes and Machine/equipment replacement, which contributed to reduce for 49,579 and 21,670 tons CO2 equivalent, respectively.

GC has operated the business towards achieving net zero target. GC is continuously improving energy efficiency for entire organization. In 2021, GC has conducted 82 energy conservation projects, reducing emission around 63,333 tons CO2 equivalent per year. Despite the expansion of business, GC will continue to focus on improving energy efficiency in the production process for all current and upcoming sites, which proven to be highly contribute to GC's reduction of emission.

List the emissions reduction initiatives which contributed most to achieving this target

<Not Applicable>

Target reference number

Abs 2

Year target was set

2021

Target coverage

Company-wide

Scope(s)

Scope 1

Scope 2

Scope 2 accounting method

Market-based

Scope 3 category(ies)

<Not Applicable>

Base year

2020

Base year Scope 1 emissions covered by target (metric tons CO2e)

5787067

Base year Scope 2 emissions covered by target (metric tons CO2e)

1975210

Base year Scope 3 emissions covered by target (metric tons CO2e)

<Not Applicable>

Total base year emissions covered by target in all selected Scopes (metric tons CO2e)

7762277

Base year Scope 1 emissions covered by target as % of total base year emissions in Scope 1

100

Base year Scope 2 emissions covered by target as % of total base year emissions in Scope 2

100

Base year Scope 3 emissions covered by target as % of total base year emissions in Scope 3 (in all Scope 3 categories)

<Not Applicable>

Base year emissions covered by target in all selected Scopes as % of total base year emissions in all selected Scopes

100

Target year

2050

Targeted reduction from base year (%)

100

Total emissions in target year covered by target in all selected Scopes (metric tons CO2e) [auto-calculated]

0

Scope 1 emissions in reporting year covered by target (metric tons CO2e)

6737595

Scope 2 emissions in reporting year covered by target (metric tons CO2e)

2222649

Scope 3 emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Total emissions in reporting year covered by target in all selected scopes (metric tons CO2e)

8960244

% of target achieved relative to base year [auto-calculated]

-15.4331905444755

Target status in reporting year

New

Is this a science-based target?

No, but we anticipate setting one in the next 2 years

Target ambition

<Not Applicable>

Please explain target coverage and identify any exclusions

This target is company-wide and covers 100% of both our Scope 1 and 2 emissions, with covers the operation performance of the companies under GC Group in Thailand that GC holds greater than or equal to 50 percent of the total shares.

Plan for achieving target, and progress made to the end of the reporting year

In 2021, GC has a total GHG emission scope 1 and 2 of 8,960,244 ton CO2e, which is higher than the total GHG emission in 2020, 7,779,764 ton CO2e, as baseline. Meaning that GC has not achieved annual target of absolute emission reduction due to current expanding of GC's business. GC will continue to seek new business opportunities with outstanding technologies and innovations to strengthen our ability to compete in the market in a long-run. After GC has reached to the peak year of emission (estimate 2025), the absolute emission is expected to be exponentially decreased. All plants and operation sites will reach to its most optimized condition where all of functions will fully and efficiently operate. Consequently, overall performance of entire corporate will potentially maximize.

GC has committed to achieve the Net Zero target for scope 1&2 within 2050, with a framework of the three pillars of transition to Net Zero Company i.e., Efficiency-Driven, Portfolio-Driven, and Compensation-Driven. Focusing on Efficiency-Driven and Portfolio-Driven pillar, GC has implemented many emission reduction initiatives to reduce overall GHG emission generated within the organization. In 2021, key initiatives that contribute most to the emission reduction progress is optimization of energy efficiency in production processes and Machine/equipment replacement, which contributed to reduce for 49,579 and 21,670 tons CO2 equivalent, respectively.

GC has operated the business towards achieving net zero target. GC is continuously improving energy efficiency for entire organization. In 2021, GC has conducted 82 energy conservation projects, reducing emission around 63,333 tons CO2 equivalent per year. Despite the expansion of business, GC will continue to focus on improving energy efficiency in the production process for all current and upcoming sites, which proven to be highly contribute to GC's reduction of emission.

List the emissions reduction initiatives which contributed most to achieving this target

<Not Applicable>

Target reference number

Abs 3

Year target was set

2021

Target coverage

Company-wide

Scope(s)

Scope 3

Scope 2 accounting method

<Not Applicable>

Scope 3 category(ies)

Category 1: Purchased goods and services

Category 2: Capital goods

Category 3: Fuel-and-energy-related activities (not included in Scopes 1 or 2)

Category 4: Upstream transportation and distribution

Category 9: Downstream transportation and distribution

Category 10: Processing of sold products

Category 11: Use of sold products

Category 12: End-of-life treatment of sold products

Category 15: Investments

Base year

2020

Base year Scope 1 emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 2 emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3 emissions covered by target (metric tons CO2e)

38705046

Total base year emissions covered by target in all selected Scopes (metric tons CO2e)

38705046

Base year Scope 1 emissions covered by target as % of total base year emissions in Scope 1

<Not Applicable>

Base year Scope 2 emissions covered by target as % of total base year emissions in Scope 2

<Not Applicable>

Base year Scope 3 emissions covered by target as % of total base year emissions in Scope 3 (in all Scope 3 categories)

99.9

Base year emissions covered by target in all selected Scopes as % of total base year emissions in all selected Scopes

100

Target year

2050

Targeted reduction from base year (%)

50

Total emissions in target year covered by target in all selected Scopes (metric tons CO2e) [auto-calculated]

19352523

Scope 1 emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 2 emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3 emissions in reporting year covered by target (metric tons CO2e)

36923799

Total emissions in reporting year covered by target in all selected scopes (metric tons CO2e)

36923799

% of target achieved relative to base year [auto-calculated]

9.20421073779372

Target status in reporting year

New

Is this a science-based target?

No, but we anticipate setting one in the next 2 years

Target ambition

<Not Applicable>

Please explain target coverage and identify any exclusions

This target is company-wide and covers 100% of major scope 3 relevant to GC's business. The exclusion of relevant categories covering those with very minor emission of category 5 waste generate in operation, category 6 business travel, and category 7 employee commuting, which covering only 0.14% of total scope 3 emission in FY2021. The coverage of emission data covers the operation performance of the companies under GC Group in Thailand that GC holds greater than or equal to 50 percent of the total shares.

Plan for achieving target, and progress made to the end of the reporting year

In 2021, GC has total GHG emission scope 3 of 36,923,799 ton CO2e lower than the total GHG emission in 2020 of 38,705,046 ton CO2e, as baseline. We have achieved reduction of scope 3 emission as a result of the continuity of COVID-19 pandemic that caused many countries to implement lockdown measures and social distancing. For example, Europe has announced travel restrictions that consequently resulted in a slowdown in crude oil demand causing the GC to reduce oil fuel production, such as Jet fuel & Diesel. The reduction in fuel production has also reduced GHG emission on upstream emissions of the purchased fuel as the extraction, production and transportation of fuel used. Scope 3, Category 3. fuel and energy-related activities (not included in Scope 1 or 2) in FY2021 have reduced GHG emissions by approximately 10% from Y2020. To achieve further reductions, we plan to keep developing our low-carbon products to be highly efficient in the use phase, and improving on transportation of both upstream and downstream. Alongside this we will continue to increase our sourcing of zero-carbon electricity. The progress curve is likely to be exponential.

In 2021, GC's implementation to reduce GHG emission in scope 3 are 1) Categories 15 - to systematically assess and adjust business portfolio to invest on potential low-carbon businesses, which contributed to about 0.80 million tCO2e 2) Categories 11 – to change from production of fossil-based fuel to biofuel production (e.g. jet fuel to bio-jet), and reducing use phase emission 3) Categories 3 – to shift from utilization of high carbon-intensive fuel to lower carbon-tensive fuel e.g. use LNG, natural gas, or local off-gas within the operational boundary, which contributed about 0.12 million tCO2e.

GC has expanded the scope of our operations and joined forces with stakeholders throughout the value chain to response target of achieving halve Scope 3 GHG emissions by 2050. To move towards the low-carbon business, GC will rely on our partnership with various sectors to gain access to technology and assess business feasibility for instance, increasing the proportion of renewable energy consumption and investing in Carbon Capture Utilization and Storage (CCUS), etc. GC is now in the progress of transforming its portfolio to low carbon business through low carbon business investment, development of low carbon product, and sourcing of low carbon energy.

List the emissions reduction initiatives which contributed most to achieving this target

<Not Applicable>

C4.2

(C4.2) Did you have any other climate-related targets that were active in the reporting year?

Net-zero target(s)

C4.2c

(C4.2c) Provide details of your net-zero target(s).

Target reference number

NZ1

Target coverage

Company-wide

Absolute/intensity emission target(s) linked to this net-zero target

Abs2

Target year for achieving net zero

2050

Is this a science-based target?

No, but we anticipate setting one in the next 2 years

Please explain target coverage and identify any exclusions

GC has set decarbonization goals and pathways. The goal is to attain net zero emissions for scope 1 and 2 and reduce greenhouse gas emissions by 50 percent for scope 3 by 2050.

Do you intend to neutralize any unabated emissions with permanent carbon removals at the target year?

Yes

Planned milestones and/or near-term investments for neutralization at target year

We actively scout for new technology and identify new investment opportunities for GC, and invest through GC's CVC arms: GC Ventures and GC Ventures America. Leveraging the breadth of GC's resources and business footprint, we help our portfolio companies scale – bringing breakthrough innovations to market. We are keen to partner with technology startups and venture capital funds worldwide. We are especially interested in the areas of advanced materials, digital platform, biotech and life science, and clean and green technology.

Carbon offsets are another important driving force in the management of residual greenhouse gases after implementing business activities align with efficiency-driven and portfolio-driven approaches. GC employs technology-based solutions for carbon sequestration, such as carbon capture and storage (CCS) technology and offsets through nature-based solutions, such as reforestation and forest restoration.

Planned actions to mitigate emissions beyond your value chain (optional)

C-OG4.2d

(C-OG4.2d) Indicate which targets reported in C4.1a/b incorporate methane emissions, or if you do not have a methane-specific emissions reduction target for your oil and gas activities, please explain why not and forecast how your methane emissions will change over the next five years.

C4.3

(C4.3) Did you have emissions reduction initiatives that were active within the reporting year? Note that this can include those in the planning and/or implementation phases.

Yes

C4.3a

(C4.3a) Identify the total number of initiatives at each stage of development, and for those in the implementation stages, the estimated CO2e savings.

	Number of initiatives	Total estimated annual CO2e savings in metric tonnes CO2e (only for rows marked *)
Under investigation	0	0
To be implemented*	151	170000
Implementation commenced*	142	40000
Implemented*	88	83439
Not to be implemented	0	0

C4.3b

(C4.3b) Provide details on the initiatives implemented in the reporting year in the table below.

Initiative category & Initiative type

Energy efficiency in buildings	Lighting
--------------------------------	----------

Estimated annual CO2e savings (metric tonnes CO2e)

219

Scope(s) or Scope 3 category(ies) where emissions savings occur

Scope 2 (location-based)

Voluntary/Mandatory

Voluntary

Annual monetary savings (unit currency – as specified in C0.4)

4640000

Investment required (unit currency – as specified in C0.4)

21120000

Payback period

4-10 years

Estimated lifetime of the initiative

6-10 years

Comment

Installing of LED lighting and reinforcing system to increase energy efficiency. We have energy saving approximately 773 MWh, GHG emission reduction 219 ton CO2e. The total investment cost of these programs was 21 million Baht, resulting in cost savings of 5 million Baht.

Initiative category & Initiative type

Energy efficiency in production processes	Waste heat recovery
---	---------------------

Estimated annual CO2e savings (metric tonnes CO2e)

7035

Scope(s) or Scope 3 category(ies) where emissions savings occur

Scope 1

Scope 2 (location-based)

Scope 2 (market-based)

Voluntary/Mandatory

Voluntary

Annual monetary savings (unit currency – as specified in C0.4)

32080000

Investment required (unit currency – as specified in C0.4)

0

Payback period

No payback

Estimated lifetime of the initiative

6-10 years

Comment

GC had launched 1 energy saving projects (Waste heat recovery), which saved approximately 24,787 MWh, GHG emission reduction 7,035 ton CO2e . The total investment cost of these programs was 0 million Baht, resulting in cost savings of 32 million Baht.

Initiative category & Initiative type

Energy efficiency in production processes	Process optimization
---	----------------------

Estimated annual CO2e savings (metric tonnes CO2e)

49579

Scope(s) or Scope 3 category(ies) where emissions savings occur

Scope 1

Scope 2 (location-based)

Scope 2 (market-based)

Voluntary/Mandatory

Voluntary

Annual monetary savings (unit currency – as specified in C0.4)

265790000

Investment required (unit currency – as specified in C0.4)

28000000

Payback period

4-10 years

Estimated lifetime of the initiative

16-20 years

Comment

GC had launched 53 energy saving projects (Process optimization), which saved approximately 174,686 MWh, GHG emission reduction 49,579 ton CO2e . The total investment cost of these programs was 28 million Baht, resulting in cost savings of 266 million Baht.

Initiative category & Initiative type

Energy efficiency in production processes	Machine/equipment replacement
---	-------------------------------

Estimated annual CO2e savings (metric tonnes CO2e)

21670

Scope(s) or Scope 3 category(ies) where emissions savings occur

Scope 1

Scope 2 (location-based)

Scope 2 (market-based)

Voluntary/Mandatory

Voluntary

Annual monetary savings (unit currency – as specified in C0.4)

63350000

Investment required (unit currency – as specified in C0.4)

3004000000

Payback period

>25 years

Estimated lifetime of the initiative

16-20 years

Comment

GC had launched 3 energy saving projects (Machine/equipment replacement), which saved approximately 76,351 MWh, GHG emission reduction 21,670 ton CO2e. The total investment cost of these programs was 3,004 million Baht, resulting in cost savings of 63 million Baht.

Initiative category & Initiative type

Energy efficiency in production processes	Smart control system
---	----------------------

Estimated annual CO2e savings (metric tonnes CO2e)

3418

Scope(s) or Scope 3 category(ies) where emissions savings occur

Scope 1

Scope 2 (location-based)

Scope 2 (market-based)

Voluntary/Mandatory

Voluntary

Annual monetary savings (unit currency – as specified in C0.4)

13220000

Investment required (unit currency – as specified in C0.4)

4200000

Payback period

<1 year

Estimated lifetime of the initiative

3-5 years

Comment

GC had launched 11 energy saving projects (Smart control system), which saved approximately 12,042 MWh, GHG emission reduction 3,418 ton CO2e . The total investment cost of these programs was 13 million Baht, resulting in cost savings of 4 million Baht.

Initiative category & Initiative type

Energy efficiency in production processes	Motors and drives
---	-------------------

Estimated annual CO2e savings (metric tonnes CO2e)

1518

Scope(s) or Scope 3 category(ies) where emissions savings occur

Scope 1

Scope 2 (location-based)

Scope 2 (market-based)

Voluntary/Mandatory

Voluntary

Annual monetary savings (unit currency – as specified in C0.4)

8020000

Investment required (unit currency – as specified in C0.4)

90000

Payback period

<1 year

Estimated lifetime of the initiative

6-10 years

Comment

GC had launched 13 energy saving projects (Motor and drives), which saved approximately 5,350 MWh, GHG emission reduction 1,518 ton CO2e . The total investment cost of these programs was 8 million Baht, resulting in cost savings of 0 million Baht.

C4.3c

(C4.3c) What methods do you use to drive investment in emissions reduction activities?

Method	Comment
Dedicated budget for energy efficiency	GC focuses on energy efficiency enhancement and investment in energy saving technologies and Alternative Energy projects.
Dedicated budget for low-carbon product R&D	Low carbon product R&D innovation is part of Innovation Management for the Future roadmap, because GC takes into account the value of natural resources and environmental impact throughout the product life cycle. Therefore, GC has emphasized on the research to improve its production process, develops low carbon products that use resources efficiently and minimized environmental impact.
Dedicated budget for other emissions reduction activities	GC focuses on reducing the impact of air pollutions, especially the reduction of diffusion and leakage of Volatile Organic Compounds (VOCs) from the production process, Examples; 1) We had installed the cover at Activated Sludge Basin to control and reduce VOCs emission.
Internal incentives/recognition programs	Emissions Reduction Activities are driven by our Company goal which is related to our emissions performance (see description on management incentives and cascading KPI in Section 2 Strategy), and departments and individuals have KPIs related to GHG management.

C4.5

(C4.5) Do you classify any of your existing goods and/or services as low-carbon products?

Yes

C4.5a

(C4.5a) Provide details of your products and/or services that you classify as low-carbon products.

Level of aggregation

Group of products or services

Taxonomy used to classify product(s) or service(s) as low-carbon

Low-Carbon Investment (LCI) Registry Taxonomy

Type of product(s) or service(s)

Chemicals and plastics	Other, please specify (Olefins, Aromatics, Polymers, EO-Based Performance, Green Chemicals, Performance Materials and Chemicals and Phenol)
------------------------	---

Description of product(s) or service(s)

TGO has developed the CFP certification and registration scheme for Thai producers in accordance with ISO 14067: 2018 Greenhouse gases – Carbon footprint of products – Requirements and guidelines for quantification, and also developed a third party verification system to increase the credibility and reliability of the Thai CFP scheme to meet the International Standardization.

In 2021, 132 GC's products completed product Life-cycle assessment (LCA) and certified for Carbon Footprint of Products (CFP), by which 84 of products grades were certified of the Carbon Footprint Reduction (CFR) by Thailand Greenhouse Gas Organization (TGO). These CFR certified products is knew to reduce its GHG emissions in cradle to gate stages, by at least 2% from previous production process (CFP certified baseline) or The certified CFP of its present year is equal to or less than the product category benchmarking threshold and not more than its base year certified value. We compared these data from available databases i.e. TGO emission factors or SimaPro's database to complete our emission reduction assessment.

Have you estimated the avoided emissions of this low-carbon product(s) or service(s)

Yes

Methodology used to calculate avoided emissions

Other, please specify (Carbon Footprint of Reduction (CFR) by Thailand Greenhouse Gas Organization (TGO))

Life cycle stage(s) covered for the low-carbon product(s) or services(s)

Cradle-to-gate

Functional unit used

1 tonne of product

Reference product/service or baseline scenario used

CFP certified products in the disclosure year compared to certified CFP products base year

Life cycle stage(s) covered for the reference product/service or baseline scenario

Cradle-to-gate

Estimated avoided emissions (metric tons CO2e per functional unit) compared to reference product/service or baseline scenario

0.505426

Explain your calculation of avoided emissions, including any assumptions

TGO has developed the reference benchmarking threshold of each product category for targeted producers to be used for their CFR certification and registration. For the methodology of estimated total avoided emissions per year, emission factors from TGO and SimaPro's database were used. With the scope of cradle to gate, GC use consequential estimation approach; (products emission in base year – products emission in disclosure year)/ total product produced (kg), to estimate avoided emission. In summary, total avoided emission for CFR products is 9,000,761 metric tonCO2e and total CFR products in FY21 was = 17,808,280.5 tonne, therefore the estimate avoided emissions per functional unit is 9,000,761/17,808,280.50 = 0.505426 metric tonCO2e/tonne CFR products.

Revenue generated from low-carbon product(s) or service(s) as % of total revenue in the reporting year

65.2

C-OG4.6

(C-OG4.6) Describe your organization's efforts to reduce methane emissions from your activities.

C-OG4.7

(C-OG4.7) Does your organization conduct leak detection and repair (LDAR) or use other methods to find and fix fugitive methane emissions from oil and gas production activities?

Please select

C-OG4.8

(C-OG4.8) If flaring is relevant to your oil and gas production activities, describe your organization's efforts to reduce flaring, including any flaring reduction targets.

C5. Emissions methodology

C5.1

(C5.1) Is this your first year of reporting emissions data to CDP?

No

C5.1a

(C5.1a) Has your organization undergone any structural changes in the reporting year, or are any previous structural changes being accounted for in this disclosure of emissions data?

Row 1

Has there been a structural change?

No

Name of organization(s) acquired, divested from, or merged with

<Not Applicable>

Details of structural change(s), including completion dates

<Not Applicable>

C5.1b

(C5.1b) Has your emissions accounting methodology, boundary, and/or reporting year definition changed in the reporting year?

	Change(s) in methodology, boundary, and/or reporting year definition?	Details of methodology, boundary, and/or reporting year definition change(s)
Row 1	No	<Not Applicable>

C5.2

(C5.2) Provide your base year and base year emissions.

Scope 1

Base year start

January 1 2020

Base year end

December 31 2020

Base year emissions (metric tons CO2e)

5787067

Comment

Scope 2 (location-based)

Base year start

January 1 2020

Base year end

December 31 2020

Base year emissions (metric tons CO2e)

17487

Comment

Scope 2 (market-based)

Base year start

January 1 2020

Base year end

December 31 2020

Base year emissions (metric tons CO2e)

1975210

Comment

Scope 3 category 1: Purchased goods and services

Base year start

January 1 2020

Base year end

December 31 2020

Base year emissions (metric tons CO2e)

5707398

Comment

Scope 3 category 2: Capital goods

Base year start

January 1 2021

Base year end

December 31 2021

Base year emissions (metric tons CO2e)

258236

Comment

GC will update its Category 2 base year in 2020 to align with other categories next year. The estimate different of emission between 2020 and 2021 is insignificant.

Scope 3 category 3: Fuel-and-energy-related activities (not included in Scope 1 or 2)

Base year start

January 1 2020

Base year end

December 31 2020

Base year emissions (metric tons CO2e)

1149540

Comment

Scope 3 category 4: Upstream transportation and distribution

Base year start

January 1 2020

Base year end

December 31 2020

Base year emissions (metric tons CO2e)

588896

Comment

Scope 3 category 5: Waste generated in operations

Base year start

January 1 2020

Base year end

December 31 2020

Base year emissions (metric tons CO2e)

33111

Comment

Scope 3 category 6: Business travel

Base year start

January 1 2020

Base year end

December 31 2020

Base year emissions (metric tons CO2e)

866

Comment

Scope 3 category 7: Employee commuting

Base year start

January 1 2020

Base year end

December 31 2020

Base year emissions (metric tons CO2e)

5772

Comment

Scope 3 category 8: Upstream leased assets

Base year start

Base year end

Base year emissions (metric tons CO2e)

0

Comment

GC do not have Upstream leased assets

Scope 3 category 9: Downstream transportation and distribution

Base year start

January 1 2020

Base year end

December 31 2020

Base year emissions (metric tons CO2e)

31904

Comment

Scope 3 category 10: Processing of sold products

Base year start

January 1 2020

Base year end

December 31 2020

Base year emissions (metric tons CO2e)

2404437

Comment

Scope 3 category 11: Use of sold products

Base year start

January 1 2020

Base year end

December 31 2020

Base year emissions (metric tons CO2e)

25069677

Comment

Scope 3 category 12: End of life treatment of sold products

Base year start

January 1 2020

Base year end

December 31 2020

Base year emissions (metric tons CO2e)

589289

Comment

Scope 3 category 13: Downstream leased assets

Base year start

Base year end

Base year emissions (metric tons CO2e)

0

Comment

GC do not have Downstream leased assets

Scope 3 category 14: Franchises

Base year start

Base year end

Base year emissions (metric tons CO2e)

0

Comment

GC do not have Franchises

Scope 3 category 15: Investments

Base year start

January 1 2020

Base year end

December 31 2020

Base year emissions (metric tons CO2e)

2905669

Comment

Scope 3: Other (upstream)

Base year start

Base year end

Base year emissions (metric tons CO2e)

0

Comment

GC do not have Other (upstream)

Scope 3: Other (downstream)

Base year start

Base year end

Base year emissions (metric tons CO2e)

0

Comment

GC do not have Other (downstream)

C5.3

(C5.3) Select the name of the standard, protocol, or methodology you have used to collect activity data and calculate emissions.

IPCC Guidelines for National Greenhouse Gas Inventories, 2006

ISO 14064-1

Thailand Greenhouse Gas Management Organization: The National Guideline Carbon Footprint for organization

The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (Revised Edition)

The Greenhouse Gas Protocol: Scope 2 Guidance

C6. Emissions data

C6.1

(C6.1) What were your organization's gross global Scope 1 emissions in metric tons CO2e?

Reporting year

Gross global Scope 1 emissions (metric tons CO2e)

6737595

Start date

<Not Applicable>

End date

<Not Applicable>

Comment

C6.2

(C6.2) Describe your organization's approach to reporting Scope 2 emissions.

Row 1

Scope 2, location-based

We are reporting a Scope 2, location-based figure

Scope 2, market-based

We are reporting a Scope 2, market-based figure

Comment

C6.3

(C6.3) What were your organization's gross global Scope 2 emissions in metric tons CO₂e?

Reporting year

Scope 2, location-based

15953

Scope 2, market-based (if applicable)

2222649

Start date

<Not Applicable>

End date

<Not Applicable>

Comment

C6.4

(C6.4) Are there any sources (e.g. facilities, specific GHGs, activities, geographies, etc.) of Scope 1 and Scope 2 emissions that are within your selected reporting boundary which are not included in your disclosure?

No

C6.5

(C6.5) Account for your organization's gross global Scope 3 emissions, disclosing and explaining any exclusions.

Purchased goods and services

Evaluation status

Relevant, calculated

Emissions in reporting year (metric tons CO₂e)

6087267

Emissions calculation methodology

Supplier-specific method

Hybrid method

Percentage of emissions calculated using data obtained from suppliers or value chain partners

100

Please explain

Emission from production of capital goods purchased (main raw material). This emission is 13.26% of total emission by scope 3.

(i) Methodology: Greenhouse Gas Protocol's Corporate Value Chain (Scope 3) Accounting and Reporting Standard and ISO14064-1:2018 Specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals. (ii) Activity data: Quantity and monetary the capital good from main raw material. (iii) Emissions factors: Emission factor from Ecoinvent 2.2 IPCC 2022 GWP 100a, Thailand Greenhouse Gas Organization and Supplier. (iv) GWP values: GWP AR6 IPCC 2022 100 years.

Capital goods

Evaluation status

Relevant, calculated

Emissions in reporting year (metric tons CO₂e)

258236

Emissions calculation methodology

Average spend-based method

Percentage of emissions calculated using data obtained from suppliers or value chain partners

100

Please explain

Indirect GHG Emissions from products used by organization. This emission is 0.56% of total emission by scope 3.

(i) Methodology: Greenhouse Gas Protocol's Corporate Value Chain (Scope 3) Accounting and Reporting Standard and ISO14064-1:2018 Specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals. (ii) Emissions factors: Emission factor of 0.498 kgCO₂/kg waste from Ecoinvent 2.2, IPCC 2022 GWP 100a: Disposal, municipal solid waste, 22.9% water, to sanitary landfill/CH S, Emission factor of 2.42 kgCO₂/kg waste from Ecoinvent 2.2, IPCC 2022 GWP 100a: Disposal, hazardous waste, 25% water, to hazardous waste incineration/CH. (iii) GWP values: GWP AR6 IPCC 2022 100 years.

Fuel-and-energy-related activities (not included in Scope 1 or 2)

Evaluation status

Relevant, calculated

Emissions in reporting year (metric tons CO₂e)

1031907

Emissions calculation methodology

Supplier-specific method
Average data method

Percentage of emissions calculated using data obtained from suppliers or value chain partners

100

Please explain

Emission from Electricity Transmission and Distribution Loss (not included in Scope 1 or 2). This emission is 2.25 % of total emission by scope 3.

Transmission and Distribution Losses (i) Methodology: Methodology: P32, 2016, API, Estimating petroleum industry value chain (Scope 3) Greenhouse Gas Emissions and ISO14064-1:2018 Specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals. (ii) Activity data: Quantity and monetary the electric power transmission and heat & steam distribution Losses. (iii) Emissions factors: Electric power transmission and distribution losses from world bank and District heat & steam distribution losses from 2016, UK Government GHG Conversion Factors for Company Reporting (iv) GWP values: GWP AR6 IPCC 2022 100 years.

Upstream transportation and distribution

Evaluation status

Relevant, calculated

Emissions in reporting year (metric tons CO₂e)

560586

Emissions calculation methodology

Distance-based method

Percentage of emissions calculated using data obtained from suppliers or value chain partners

100

Please explain

GHG emissions from pipeline transportation of main feedstock were calculated. Only a GHG emission for pipeline transportation was reported, other upstream and distribution emissions were not yet calculated and reported. This emission is 1.22 % of total emission by scope 3.

(i) Methodology: Greenhouse Gas Protocol's Corporate Value Chain (Scope 3) Accounting and Reporting Standard and ISO14064-1:2018 Specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals. (ii) Activity data: Quantity and monetary the purchased goods and services from water supply purchased. (iii) Emissions factors: Emission factor from our water supplier East Water. (iv) GWP values: GWP values: GWP AR6 IPCC 2022 100 years.

Waste generated in operations

Evaluation status

Relevant, calculated

Emissions in reporting year (metric tons CO₂e)

44993

Emissions calculation methodology

Waste-type-specific method

Percentage of emissions calculated using data obtained from suppliers or value chain partners

100

Please explain

This emission is 0.1217% of total emission by scope 3.

(i) Methodology: Greenhouse Gas Protocol's Corporate Value Chain (Scope 3) Accounting and Reporting Standard and ISO14064-1:2018 Specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals. (ii) Activity data: Quantity and monetary the waste generated in operations from waste to landfill, incineration and wastewater. (iii) Emissions factors: Emission factor of 0.498 kgCO₂/kg waste from Ecoinvent 2.2, IPCC 2022 GWP 100a: Disposal, municipal solid waste, 22.9% water, to sanitary landfill/CH S, Emission factor of 2.42 kgCO₂/kg waste from Ecoinvent 2.2, IPCC 2022 GWP 100a: Disposal, hazardous waste, 25% water, to hazardous waste incineration/CH, Emission factor of 0.0001315 kgCO₂/liter Wastewater Treatment from Thailand Greenhouse Gas Organization CFP EF, Thai National LCI Database/MTEC. (iv) GWP values: GWP AR6 IPCC 2022 100 years.

Business travel

Evaluation status

Relevant, calculated

Emissions in reporting year (metric tons CO₂e)

181

Emissions calculation methodology

Distance-based method

Percentage of emissions calculated using data obtained from suppliers or value chain partners

100

Please explain

This emission is 0.0005% of total emission by scope 3.

(i) Methodology: Greenhouse Gas Protocol's Corporate Value Chain (Scope 3) Accounting and Reporting Standard and ISO14064-1:2018 Specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals. (ii) Activity data: Quantity and monetary the purchased goods and services from water supply purchased. (iii) Emissions factors: Emission factor from our water supplier East Water. (iv) GWP values: GWP AR6 IPCC 2022 100 years.

Employee commuting

Evaluation status

Relevant, calculated

Emissions in reporting year (metric tons CO₂e)

7976

Emissions calculation methodology

Distance-based method

Percentage of emissions calculated using data obtained from suppliers or value chain partners

100

Please explain

This emission is 0.0216% of total emission by scope 3.

(i) Methodology: Greenhouse Gas Protocol's Corporate Value Chain (Scope 3) Accounting and Reporting Standard and ISO14064-1:2018 Specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals. (ii) Activity data: Quantity of cars registered and number of employees travelled by public transport. (iii) Emissions factors: Emission factor from IPCC 2022 and Defra. (iv) GWP values: GWP AR6 IPCC 2022 100 years

Upstream leased assets

Evaluation status

Not relevant, calculated

Emissions in reporting year (metric tons CO₂e)

0

Emissions calculation methodology

Site-specific method

Percentage of emissions calculated using data obtained from suppliers or value chain partners

100

Please explain

We have no upstream leased assets, therefore we have zero emissions from this category.

Downstream transportation and distribution

Evaluation status

Relevant, calculated

Emissions in reporting year (metric tons CO₂e)

40138

Emissions calculation methodology

Distance-based method

Percentage of emissions calculated using data obtained from suppliers or value chain partners

100

Please explain

GHG emissions from polymer products transportation to customer. This emission is 0.09% of total emission by scope 3.

(i) Methodology: Greenhouse Gas Protocol's Corporate Value Chain (Scope 3) Accounting and Reporting Standard and ISO14064-1:2018 Specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals. (ii) Activity data: Quantity and monetary the downstream transportation and distribution from polymer products. (iii) Emissions factors: Emission factor from API GHG Compendium 2009 Table 4-13 Default Fuel Economy Factors for Different Types of Mobile Sources. (iv) GWP values: GWP AR6 IPCC 2022 100 years.

Processing of sold products

Evaluation status

Relevant, calculated

Emissions in reporting year (metric tons CO₂e)

2501051

Emissions calculation methodology

Average data method

Percentage of emissions calculated using data obtained from suppliers or value chain partners

100

Please explain

GHG emissions from processing of polymer production. This emission is 5.45% of total emission by scope 3

(i) Methodology: Greenhouse Gas Protocol's Corporate Value Chain (Scope 3) Accounting and Reporting Standard and ISO14064-1:2018 Specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals. (ii) Activity data: Quantity and monetary the processing of sold products from polymer products. (iii) Emissions factors: Emission factor from Ecoinvent 2.2 IPCC 2018 GWP 100a and Thailand Greenhouse Gas Organization. (iv) GWP values: GWP AR6 IPCC 2022 100 years.

Use of sold products

Evaluation status

Relevant, calculated

Emissions in reporting year (metric tons CO₂e)

24266496

Emissions calculation methodology

Methodology for direct use phase emissions, please specify (Products that directly consume energy (fuels or electricity) during use)

Percentage of emissions calculated using data obtained from suppliers or value chain partners

100

Please explain

GHG emissions on the use of all Diesel, LPG, Jet Fuel, Marine Fuel oil, Kerosene, Propane, Butane) and bio-diesel fuel sold are included. This emission is 52.87% of total emission by scope 3

(i) Methodology: Greenhouse Gas Protocol's Corporate Value Chain (Scope 3) Accounting and Reporting Standard and ISO14064-1:2018 Specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals. (ii) Activity data: Quantity and monetary the use of sold products (iii) GWP values: GWP AR6 IPCC 2022 100 years.

End of life treatment of sold products

Evaluation status

Relevant, calculated

Emissions in reporting year (metric tons CO₂e)

604053

Emissions calculation methodology

Waste-type-specific method

Percentage of emissions calculated using data obtained from suppliers or value chain partners

100

Please explain

GHG emissions from end of life of polymer products (recycle rate 87%). This emission is 1.32% of total emission by scope 3

(i) Methodology: Greenhouse Gas Protocol's Corporate Value Chain (Scope 3) Accounting and Reporting Standard and ISO14064-1:2018 Specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals. (ii) Activity data: Quantity and monetary the end of life treatment of sold polymer products. (iii) Emissions factors: Emission factor from Thailand Greenhouse Gas Organization (recycle rate 87%). (iv) GWP values: GWP AR6 IPCC 2022 100 years

Downstream leased assets

Evaluation status

Not relevant, calculated

Emissions in reporting year (metric tons CO₂e)

0

Emissions calculation methodology

Site-specific method

Percentage of emissions calculated using data obtained from suppliers or value chain partners

100

Please explain

We have no downstream leased assets, Therefore we have zero emissions from this category.

Franchises

Evaluation status

Not relevant, calculated

Emissions in reporting year (metric tons CO2e)

0

Emissions calculation methodology

Site-specific method

Percentage of emissions calculated using data obtained from suppliers or value chain partners

100

Please explain

We have no franchise., therefore we have zero emissions from this category.

Investments

Evaluation status

Relevant, calculated

Emissions in reporting year (metric tons CO2e)

1574065

Emissions calculation methodology

Average data method
Investment-specific method

Percentage of emissions calculated using data obtained from suppliers or value chain partners

100

Please explain

A reporting company's scope 3 emissions from investments are the scope 1 and scope 2 emissions of investees. This emission is 3.43% of total emission by scope 3.

(i) Methodology: Greenhouse Gas Protocol's Corporate Value Chain (Scope 3) Accounting and Reporting Standard and ISO14064-1:2018 Specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals. (ii) Activity data: Quantity and monetary the investment. (iii) Emissions factors: Emission factor from Ecoinvent 2.2 IPCC 2022 GWP 100a and Thailand Greenhouse Gas Organization. (iv) GWP values: GWP AR6 IPCC 2022 100 years.

Other (upstream)

Evaluation status

Not relevant, calculated

Emissions in reporting year (metric tons CO2e)

0

Emissions calculation methodology

Site-specific method

Percentage of emissions calculated using data obtained from suppliers or value chain partners

100

Please explain

We have no additional upstream activities

Other (downstream)

Evaluation status

Not relevant, calculated

Emissions in reporting year (metric tons CO2e)

0

Emissions calculation methodology

Site-specific method

Percentage of emissions calculated using data obtained from suppliers or value chain partners

100

Please explain

We have no additional downstream activities

C6.7

(C6.7) Are carbon dioxide emissions from biogenic carbon relevant to your organization?

Yes

C6.7a

(C6.7a) Provide the emissions from biogenic carbon relevant to your organization in metric tons CO2.

	CO2 emissions from biogenic carbon (metric tons CO2)	Comment
Row 1	82.87	We have used biofuel for vehicle and calculated the CO2 emissions from mobile combustion of biofuel. We used the emissions calculation methodology, based on the GHG Protocol Corporate Accounting and Reporting Standard.

C6.10

(C6.10) Describe your gross global combined Scope 1 and 2 emissions for the reporting year in metric tons CO2e per unit currency total revenue and provide any additional intensity metrics that are appropriate to your business operations.

Intensity figure

0.000019264

Metric numerator (Gross global combined Scope 1 and 2 emissions, metric tons CO2e)

8960244

Metric denominator

unit total revenue

Metric denominator: Unit total

465128000000

Scope 2 figure used

Market-based

% change from previous year

20.05

Direction of change

Decreased

Reason for change

Overall intensity is decreased due to greater increase in total revenue comparing to emissions that less increased. Revenue increased due to by products prices significantly increased according to global economic recovery after ease of lockdown restriction of COVID-19 , and increase in global vaccination rate that led to increase of demand for products. Additionally, tightening supply during some periods of the year also had a positive impact to products price. The slight increase in GHG emission is because of GC starts to operate new four plants, which are OLE 4, GC-M PTA, GCO, and GCP. However, GC has continually pursued efforts to reduce GHG emissions through implementation of several projects, including Energy Conservation projects, and Pollution Reduction Projects. In 2021, GC has supported projects addressing climate change, such as Installation of Gas Turbine Generator and Heat Recovery Steam Generator at Utilities Plant, and Enhancement on Energy Efficiency of Steam Production.

Intensity figure

0.41974

Metric numerator (Gross global combined Scope 1 and 2 emissions, metric tons CO2e)

8960244

Metric denominator

metric ton of product

Metric denominator: Unit total

21347170

Scope 2 figure used

Market-based

% change from previous year

10.56

Direction of change

Increased

Reason for change

Intensity increased due to the GHG emissions in 2021 was higher than in 2020 because of an expansion of downstream business. In 2021, GC starts to operate new four plants, which are OLE 4, GC-M PTA, GCO, and GCP leading to increase of the GHG emissions approximately 15% from existing business production. The products increased by 4% in 2021 compared with 2020.

We have production efficiency improvement and MTPi project (MTPi project are organization's efficiency enhancement and improvement such as improvement and resources optimization, energy efficiency, utilities efficiency in GC Group). Moreover, GC has continually pursued efforts to reduce GHG emissions through implementation of several projects, including Energy Conservation projects, and Pollution Reduction Projects. In 2021, GC has supported projects addressing climate change, such as Installation of Gas Turbine Generator and Heat Recovery Steam Generator at Utilities Plant, and Enhancement on Energy Efficiency of Steam Production.

C-OG6.12

(C-OG6.12) Provide the intensity figures for Scope 1 emissions (metric tons CO2e) per unit of hydrocarbon category.

C-OG6.13

(C-OG6.13) Report your methane emissions as percentages of natural gas and hydrocarbon production or throughput.

C7. Emissions breakdowns

C7.1

(C7.1) Does your organization break down its Scope 1 emissions by greenhouse gas type?

Yes

C7.1a

(C7.1a) Break down your total gross global Scope 1 emissions by greenhouse gas type and provide the source of each used greenhouse warming potential (GWP).

Greenhouse gas	Scope 1 emissions (metric tons of CO2e)	GWP Reference
CO2	6352484.44	IPCC Sixth Assessment Report (AR6 - 100 year)
CH4	379967.08	IPCC Sixth Assessment Report (AR6 - 100 year)
N2O	211.65	IPCC Sixth Assessment Report (AR6 - 100 year)
HFCs	0	IPCC Sixth Assessment Report (AR6 - 100 year)
PFCs	4932.08	IPCC Sixth Assessment Report (AR6 - 100 year)
SF6	0	IPCC Sixth Assessment Report (AR6 - 100 year)

C-OG7.1b

(C-OG7.1b) Break down your total gross global Scope 1 emissions from oil and gas value chain production activities by greenhouse gas type.

C7.2

(C7.2) Break down your total gross global Scope 1 emissions by country/region.

Country/Region	Scope 1 emissions (metric tons CO2e)
Thailand	6737595

C7.3

(C7.3) Indicate which gross global Scope 1 emissions breakdowns you are able to provide.

By business division

By facility

C7.3a

(C7.3a) Break down your total gross global Scope 1 emissions by business division.

Business division	Scope 1 emissions (metric ton CO2e)
Olefins	2501582
Aromatics	964696
Refinery	937897
Polymers	221024
EO-Based Performance	89326
Green Chemicals	27087
Performance Materials and Chemicals	310477
Phenol	11503
Shared Facilities (Utilities & Tank farm & Logistics)	1667951
Others (Building)	6052

C7.3b

(C7.3b) Break down your total gross global Scope 1 emissions by business facility.

Facility	Scope 1 emissions (metric tons CO2e)	Latitude	Longitude
GC 1 (RO)	1691	12.71759	101.19519
GC 2 (I-1)	321208	12.70302	101.13918
GC 2 (UT)	1643907	12.70302	101.13918
GC 2 (HDPE)	85	12.70302	101.13918
GC 2 (ORP)	435326	12.70302	101.13918
GC 2 (HGP)	1058	12.70302	101.13918
GC 3 (I-4)	886491	12.6963	101.14495
GC 4 (Aromatics I)	259264	12.68975	101.14487
GC 5 (Aromatics II)	705432	12.75314	101.1657
GC 6 (Refinery)	937897	12.67767	101.15804
GC 7 (Jetty&BTF)	1759	12.68099	101.12966
GC 8 (ATF)	17289	12.69479	101.14927
GC 9 (Lab Center)	23	12.69299	101.1894
GC 11 (PE)	857500	12.68653	101.12293
GC 11 (LDPE)	8993	12.68711	101.12773
GC 11 (LLDPE)	13529	12.68343	101.13147
GC 12 (BPE)	737	12.69357	101.13642
GC Glycol (EO/EG)	89326	12.69913	101.12759
GC Glycol (EA)	0	12.69699	101.12943
GGC (Plant I)	177	12.69552	101.1269
TTT	2878	12.66578	101.13473
GCME	801	12.6892	101.1188
NPC S&E	134	12.68948	101.11907
GCS	3222	12.68921	101.1326
ENCO (Head Office)	0	13.81969	100.55725
GCPC (Phenol I&II)	11503	12.69463	101.1282
GCPC (BPA)	0	12.69399	101.1275
GC Logistics Solution (GCL)	2118	12.68292	101.1228
GC 13 (INNO)	0	12.69579	101.26332
GC Corporate (Scope1)	3402	12.71759	101.19519
GC 14 (Maintenance)	0	12.68433	101.11803
GC-M PTA	171032	12.69959	101.11992
TPRC	23426	12.70257	101.1136
GGC (Plant II)	26910	13.07481	101.3866
GCO (GC Oxirane)	303214	12.70996	101.13097
GCP (GC Polyols)	7262	12.70255	101.12943
GC Estate	0	12.70389	101.10598

C-CE7.4/C-CH7.4/C-CO7.4/C-EU7.4/C-MM7.4/C-OG7.4/C-ST7.4/C-TO7.4/C-TS7.4

(C-CE7.4/C-CH7.4/C-CO7.4/C-EU7.4/C-MM7.4/C-OG7.4/C-ST7.4/C-TO7.4/C-TS7.4) Break down your organization's total gross global Scope 1 emissions by sector production activity in metric tons CO2e.

	Gross Scope 1 emissions, metric tons CO2e	Net Scope 1 emissions, metric tons CO2e	Comment
Cement production activities	<Not Applicable>	<Not Applicable>	<Not Applicable>
Chemicals production activities	4125696	<Not Applicable>	GHG emissions from chemicals production activities are Olefins, Aromatics, Polymers, EO-Based Performance, Green Chemicals, Performance Materials and Chemicals and Phenol (exclude Shared Facilities). This emission is 61.2% of total emission by scope 1 emission by sector production.
Coal production activities	<Not Applicable>	<Not Applicable>	<Not Applicable>
Electric utility activities	<Not Applicable>	<Not Applicable>	<Not Applicable>
Metals and mining production activities	<Not Applicable>	<Not Applicable>	<Not Applicable>
Oil and gas production activities (upstream)	0	<Not Applicable>	-
Oil and gas production activities (midstream)	0	<Not Applicable>	-
Oil and gas production activities (downstream)	0	<Not Applicable>	-
Steel production activities	<Not Applicable>	<Not Applicable>	<Not Applicable>
Transport OEM activities	<Not Applicable>	<Not Applicable>	<Not Applicable>
Transport services activities	<Not Applicable>	<Not Applicable>	<Not Applicable>

C7.5

(C7.5) Break down your total gross global Scope 2 emissions by country/region.

Country/Region	Scope 2, location-based (metric tons CO2e)	Scope 2, market-based (metric tons CO2e)
Thailand	15953	2222649

C7.6

(C7.6) Indicate which gross global Scope 2 emissions breakdowns you are able to provide.

- By business division
- By facility

C7.6a

(C7.6a) Break down your total gross global Scope 2 emissions by business division.

Business division	Scope 2, location-based (metric tons CO2e)	Scope 2, market-based (metric tons CO2e)
Olefins	0	384313
Aromatics	0	634821
Refinery	2240	0
Polymers	0	355355
EO-Based Performance	0	84299
Green Chemicals	7376	57950
Performance Materials and Chemicals	0	179120
Phenol	0	474147
Shared Facilities (Utilities & Tank farm & Logistics)	761	49790
Others (Building)	5574	2850

C7.6b

(C7.6b) Break down your total gross global Scope 2 emissions by business facility.

Facility	Scope 2, location-based (metric tons CO2e)	Scope 2, market-based (metric tons CO2e)
GC 1 (RO)	3849	0
GC 2 (I-1)	0	0
GC 2 (UT)	43	35280
GC 2 (HDPE)	0	0
GC 2 (ORP)	0	0
GC 2 (HGP)	0	0
GC 3 (I-4)	0	216964
GC 4 (Aromatics I)	0	336776
GC 5 (Aromatics II)	0	298046
GC 6 (Refinery)	2241	0
GC 7 (Jetty&BTF)	0	0
GC 8 (ATF)	0	6092
GC 9 (Lab Center)	0	2851
GC 11 (PE)	0	167350
GC 11 (LDPE)	0	108569
GC 11 (LLDPE)	0	102163
GC 12 (BPE)	0	18993
GC Glycol (EO/EG)	0	66764
GC Glycol (EA)	0	17536
GGC (Plant I)	0	57950
TTT	0	0
GCME (PTTME)	519	0
NPC S&E	290	0
GCS	0	0
ENCO (Head Office)	225	0
GCPC (Phenol I&II)	0	332844
GCPC (BPA)	0	141304
GC Logistics Solution (GCL)	718	8418
GC 13 (INNO)	179	0
GC Corporate (Scope 1)	0	0
GC 14 (Maintenance)	179	0
GC-M PTA	0	111000
TPRC	0	14631
GGC (Plant II)	7377	0
GCO (GC Oxirane)	0	167887
GCP (GC Polyols)	0	11233
GC Estate	344	0

C-CE7.7/C-CH7.7/C-CO7.7/C-MM7.7/C-OG7.7/C-ST7.7/C-TO7.7/C-TS7.7

(C-CE7.7/C-CH7.7/C-CO7.7/C-MM7.7/C-OG7.7/C-ST7.7/C-TO7.7/C-TS7.7) Break down your organization’s total gross global Scope 2 emissions by sector production activity in metric tons CO2e.

	Scope 2, location-based, metric tons CO2e	Scope 2, market-based (if applicable), metric tons CO2e	Comment
Cement production activities	<Not Applicable>	<Not Applicable>	<Not Applicable>
Chemicals production activities	7377	2170008	GHG emissions from chemicals production activities are Olefins, Aromatics, Polymers, EO-Based Performance, Green Chemicals, Performance Materials and Chemicals and Phenol (exclude Shared Facilities). This emission is 97.3% of total company wide scope 2 emission
Coal production activities	<Not Applicable>	<Not Applicable>	<Not Applicable>
Metals and mining production activities	<Not Applicable>	<Not Applicable>	<Not Applicable>
Oil and gas production activities (upstream)	0	0	-
Oil and gas production activities (midstream)	0	0	-
Oil and gas production activities (downstream)	0	0	-
Steel production activities	<Not Applicable>	<Not Applicable>	<Not Applicable>
Transport OEM activities	<Not Applicable>	<Not Applicable>	<Not Applicable>
Transport services activities	<Not Applicable>	<Not Applicable>	<Not Applicable>

(C-CH7.8) Disclose the percentage of your organization's Scope 3, Category 1 emissions by purchased chemical feedstock.

Purchased feedstock	Percentage of Scope 3, Category 1 tCO2e from purchased feedstock	Explain calculation methodology
Ethane	26.25	(i) Methodology: Greenhouse Gas Protocol's Corporate Value Chain (Scope 3) Accounting and Reporting Standard and ISO14064-1:2018 Specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals. (ii) Activity data: Quantity of purchased ethane feedstock. (iii) Emissions factors: Emission factor from Ethane's supplier. (iv) GWP values: GWP AR6 IPCC 2022 100 years. This GHG emission from purchased Ethane feedstock is 26.25% of total emission by scope 3, Categories 1- Purchased good and services: emissions of main raw material.
Propane gas	3.01	(i) Methodology: Greenhouse Gas Protocol's Corporate Value Chain (Scope 3) Accounting and Reporting Standard and ISO14064-1:2018 Specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals. (ii) Activity data: Quantity of purchased Propane gas. (iii) Emissions factors: Emission factor from Propane gas 's supplier. (iv) GWP values: GWP AR6 IPCC 2022 100 years. This GHG emission from purchased Propane gas feedstock is 3.01% of total emission by scope 3, Categories 1- Purchased good and services: emissions of main raw material.
Naphtha	5.77	(i) Methodology: Greenhouse Gas Protocol's Corporate Value Chain (Scope 3) Accounting and Reporting Standard and ISO14064-1:2018 Specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals. (ii) Activity data: Quantity of purchased Naphtha feedstock. (iii) Emissions factors: Emission factor from TGO database. (iv) GWP values: IPCC 2013 GWP 100a V1.03. This GHG emission from purchased Naphtha feedstock is 5.77% of total emission by scope 3, Categories 1- Purchased good and services: emissions of main raw material.
LPG	7.67	(i) Methodology: Greenhouse Gas Protocol's Corporate Value Chain (Scope 3) Accounting and Reporting Standard and ISO14064-1:2018 Specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals. (ii) Activity data: Quantity of purchased LPG feedstock. (iii) Emissions factors: Emission factor from LPG's supplier and TGO. (iv) GWP values: IPCC 2013 GWP 100a V1.03. This GHG emission from purchased LPG feedstock is 7.67% of total emission by scope 3, Categories 1- Purchased good and services: emissions of main raw material.
Other (please specify) (Butene-1)	0.68	(i) Methodology: Greenhouse Gas Protocol's Corporate Value Chain (Scope 3) Accounting and Reporting Standard and ISO14064-1:2018 Specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals. (ii) Activity data: Quantity of purchased Butene-1 feedstock. (iii) Emissions factors: Emission factor from JEMAI Pro database. (iv) GWP values: GWP AR6 IPCC 2022 100 years. This GHG emission from purchased Butene-1 feedstock is 0.68% of total emission by scope 3, Categories 1- Purchased good and services: emissions of main raw material.
Other (please specify) (Hexane)	0.18	(i) Methodology: Greenhouse Gas Protocol's Corporate Value Chain (Scope 3) Accounting and Reporting Standard and ISO14064-1:2018 Specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals. (ii) Activity data: Quantity of purchased Hexane feedstock. (iii) Emissions factors: Emission factor from Ecoinvent 2.2 (iv) GWP values: IPCC 2007 GWP 100a years. This GHG emission from purchased Hexane feedstock is 0.18% of total emission by scope 3, Categories 1- Purchased good and services: emissions of main raw material.
Other (please specify) (Full Range Condensate (FRC))	3.92	(i) Methodology: Greenhouse Gas Protocol's Corporate Value Chain (Scope 3) Accounting and Reporting Standard and ISO14064-1:2018 Specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals. (ii) Activity data: Quantity of purchased FRC feedstock. (iii) Emissions factors: Emission factor from Ecoinvent 3.0. (iv) GWP values: IPCC 2007 GWP 100a years. This GHG emission from purchased Full Range Condensate (FRC) feedstock is 3.92% of total emission by scope 3, Categories 1- Purchased good and services: emissions of main raw material.
Other (please specify) (Oxygen , NH3)	0.25	(i) Methodology: Greenhouse Gas Protocol's Corporate Value Chain (Scope 3) Accounting and Reporting Standard and ISO14064-1:2018 Specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals. (ii) Activity data: Quantity of purchased Oxygen , NH3 feedstock. (iii) Emissions factors: Emission factor from TGO. (iv) GWP values: IPCC 2007 GWP 100a V1.03. This GHG emission from purchased Oxygen and NH3 feedstock is 0.25% of total emission by scope 3, Categories 1- Purchased good and services: emissions of main raw material.
Other (please specify) (Biodiesel feed)	6.97	(i) Methodology: Greenhouse Gas Protocol's Corporate Value Chain (Scope 3) Accounting and Reporting Standard and ISO14064-1:2018 Specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals. (ii) Activity data: Quantity of purchased Biodiesel feedstock. (iii) Emissions factors: Emission factor from TGO. (iv) GWP values: IPCC 2013 GWP 100a V1.03. This GHG emission from purchased Biodiesel feed feedstock is 6.97% of total emission by scope 3, Categories 1- Purchased good and services: emissions of main raw material.
Other (please specify) (NGL)	4.42	(i) Methodology: Greenhouse Gas Protocol's Corporate Value Chain (Scope 3) Accounting and Reporting Standard and ISO14064-1:2018 Specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals. (ii) Activity data: Quantity of purchased NGL feedstock. (iii) Emissions factors: Emission factor from TGO. (iv) GWP values: IPCC 2013 GWP 100a V1.03. This GHG emission from purchased NGL feedstock is 4.42% of total emission by scope 3, Categories 1- Purchased good and services: emissions of main raw material.
Other (please specify) (Styrene Monomer, Rubber)	3.05	(i) Methodology: Greenhouse Gas Protocol's Corporate Value Chain (Scope 3) Accounting and Reporting Standard and ISO14064-1:2018 Specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals. (ii) Activity data: Quantity of purchased Styrene Monomer, Rubber feedstock. (iii) Emissions factors: Emission factor from Styrene Monomer, Rubber 's supplier. (iv) GWP values: IPCC 2013 GWP 100a V1.03. This GHG emission from purchased Styrene Monomer and Rubber feedstock is 3.05% of total emission by scope 3, Categories 1- Purchased good and services: emissions of main raw material.
Other (please specify) (Import reformate)	7.91	(i) Methodology: Greenhouse Gas Protocol's Corporate Value Chain (Scope 3) Accounting and Reporting Standard and ISO14064-1:2018 Specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals. (ii) Activity data: Quantity of purchased Import reformate feedstock. (iii) Emissions factors: Emission factor from GC's database. (iv) GWP values: GWP AR6 IPCC 2022 100 years. This GHG emission from purchased Import reformate feedstock is 7.91% of total emission by scope 3, Categories 1- Purchased good and services: emissions of main raw material.
Other (please specify) (Acetic Acid)	2.02	(i) Methodology: Greenhouse Gas Protocol's Corporate Value Chain (Scope 3) Accounting and Reporting Standard and ISO14064-1:2018 Specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals. (ii) Activity data: Quantity of purchased Acetic Acid feedstock. (iii) Emissions factors: Emission factor from TGO. (iv) GWP values: IPCC 2007 GWP 100a. This GHG emission from purchased Acetic Acid feedstock is 2.02% of total emission by scope 3, Categories 1- Purchased good and services: emissions of main raw material.
Other (please specify) (Propylene Oxide)	2.33	(i) Methodology: Greenhouse Gas Protocol's Corporate Value Chain (Scope 3) Accounting and Reporting Standard and ISO14064-1:2018 Specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals. (ii) Activity data: Quantity of purchased Propylene Oxide feedstock. (iii) Emissions factors: Emission factor from TGO. (iv) GWP values: IPCC 2013 GWP 100a V1.03. This GHG emission from purchased Propylene Oxide feedstock is 2.33% of total emission by scope 3, Categories 1- Purchased good and services: emissions of main raw material.
Other (please specify) (PTA : Purified Terephthalic Acid)	2.14	(i) Methodology: Greenhouse Gas Protocol's Corporate Value Chain (Scope 3) Accounting and Reporting Standard and ISO14064-1:2018 Specification with guidance at the organizational level for quantification and reporting of greenhouse gas emissions and removals. (ii) Activity data: Quantity of purchased PTA (Purified Terephthalic Acid) feedstock. (iii) Emissions factors: Emission factor from GC's database. (iv) GWP values: GWP AR6 IPCC 2022 100 years. This GHG emission from purchased PTA (Purified Terephthalic Acid) feedstock is 2.14% of total emission by scope 3, Categories 1- Purchased good and services: emissions of main raw material.

(C-CH7.8a) Disclose sales of products that are greenhouse gases.

	Sales, metric tons	Comment
Carbon dioxide (CO2)	81569	We have initiated the Raw CO2 Trading Project with the entrepreneur using carbon dioxide as a raw material in the production of Sodium Carbonate, in order to reduce greenhouse gas emissions. This project is accordance with the Circular Economy Concept, in which carbon dioxide emission from the manufacturing process is being used as a new raw material in other industry.
Methane (CH4)	0	We have not sold it.
Nitrous oxide (N2O)	0	We have not sold it.
Hydrofluorocarbons (HFC)	0	We have not sold it.
Perfluorocarbons (PFC)	0	We have not sold it.
Sulphur hexafluoride (SF6)	0	We have not sold it.
Nitrogen trifluoride (NF3)	0	We have not sold it.

C7.9

(C7.9) How do your gross global emissions (Scope 1 and 2 combined) for the reporting year compare to those of the previous reporting year?

Increased

C7.9a

(C7.9a) Identify the reasons for any change in your gross global emissions (Scope 1 and 2 combined), and for each of them specify how your emissions compare to the previous year.

	Change in emissions (metric tons CO2e)	Direction of change	Emissions value (percentage)	Please explain calculation
Change in renewable energy consumption	551	Decreased	0.007	In 2021, GC's installation plan a solar rooftop to promote alternative energy use within the organization. The produced electricity will be used for warehouse, workshop and street lighting. Our total S1 and S2 emissions in the previous year was 7,779,764 tCO2e, therefore we arrived at 0.007% through $(551/7,779,764) \times 100 = 0.007\%$.
Other emissions reduction activities	171155	Decreased	2.2	We emphasize reducing GHG emission, enhancing the efficiency of energy consumption and seeking approach to use alternative energy. We continuously enhance our plant asset reliability and integrity management measures and energy efficiency projects. In 2021, GC has launched 82 energy saving projects, to save 1.07 million GJ which was equivalent to GHG emissions reductions of 63,333 ton CO2e. GC's indirect energy purchased from supplier's utilities (GLOW and GPSC), which our using natural gas, combined cycle gas turbine and Combined Heat and Power (cogeneration) for electricity and steam produced, being less carbon intensity. Additionally, the emission factor of steam in 2021 was lower than its in 2020 by 2.4%, which was equivalent to GHG emissions reductions of 107,822 ton CO2e in 2022. Our total S1 and S2 emissions in the previous year was 7,779,764 tCO2e, therefore we arrived at 2.20% through $((63,333+107,822)/7,779,764) \times 100 = 2.20\%$.
Divestment	0	No change	0	In 2021, GC had no changes that occur as a result of selling off certain aspects of the businesses.
Acquisitions	0	No change	0	In 2021, GC had no changes that occur as a result of purchasing or obtaining another facility.
Mergers	0	No change	0	In 2021, GC had no changes that occur as a result of business mergers.
Change in output	1368139	Increased	17.59	In 2021, GC starts to operate new four plants, which are OLE 4, GC-M PTA, GCO, and GCP leading to increase of the GHG emissions 1,368,139 tCO2e and our total S1 and S2 emissions in the previous year was 7,779,764 tCO2e, therefore we arrived at 17.59% through $(1,368,139/7,779,764) \times 100 = 17.59\%$.
Change in methodology	0	No change	0	In 2021, GC had no changes that occur due to modifications in the way that the inventory is calculated.
Change in boundary	0	No change	0	In 2021, GC had no changes in the boundary used for your inventory calculation.
Change in physical operating conditions	0	No change	0	In 2021, GC had no changes in weather that have a significant influence on how the company operates.
Unidentified	0	No change	0	GC does not have any unidentified changes.
Other	0	No change	0	GC does not have any other changes.

C7.9b

(C7.9b) Are your emissions performance calculations in C7.9 and C7.9a based on a location-based Scope 2 emissions figure or a market-based emissions figure?

Market-based

C8. Energy

C8.1

(C8.1) What percentage of your total operational spend in the reporting year was on energy?

More than 5% but less than or equal to 10%

C8.2

(C8.2) Select which energy-related activities your organization has undertaken.

	Indicate whether your organization undertook this energy-related activity in the reporting year
Consumption of fuel (excluding feedstocks)	Yes
Consumption of purchased or acquired electricity	Yes
Consumption of purchased or acquired heat	No
Consumption of purchased or acquired steam	Yes
Consumption of purchased or acquired cooling	No
Generation of electricity, heat, steam, or cooling	Yes

C8.2a

(C8.2a) Report your organization's energy consumption totals (excluding feedstocks) in MWh.

	Heating value	MWh from renewable sources	MWh from non-renewable sources	Total (renewable and non-renewable) MWh
Consumption of fuel (excluding feedstock)	LHV (lower heating value)	0	36733772.08	36733772.08
Consumption of purchased or acquired electricity	<Not Applicable>	1249.49	1515561.64	1516811.13
Consumption of purchased or acquired heat	<Not Applicable>	<Not Applicable>	<Not Applicable>	<Not Applicable>
Consumption of purchased or acquired steam	<Not Applicable>	0	4983165.47	4983165.47
Consumption of purchased or acquired cooling	<Not Applicable>	<Not Applicable>	<Not Applicable>	<Not Applicable>
Consumption of self-generated non-fuel renewable energy	<Not Applicable>	0	<Not Applicable>	0
Total energy consumption	<Not Applicable>	1249.49	43232499.19	43233748.68

C-CH8.2a

(C-CH8.2a) Report your organization's energy consumption totals (excluding feedstocks) for chemical production activities in MWh.

Consumption of fuel (excluding feedstocks)

Heating value

LHV (lower heating value)

MWh consumed from renewable sources inside chemical sector boundary

0

MWh consumed from non-renewable sources inside chemical sector boundary (excluding recovered waste heat/gases)

14908220.47

MWh consumed from waste heat/gases recovered from processes using fuel feedstocks inside chemical sector boundary

16997101.15

Total MWh (renewable + non-renewable + MWh from recovered waste heat/gases) consumed inside chemical sector boundary

31905321.62

Consumption of purchased or acquired electricity

Heating value

<Not Applicable>

MWh consumed from renewable sources inside chemical sector boundary

1249.49

MWh consumed from non-renewable sources inside chemical sector boundary (excluding recovered waste heat/gases)

1493055.19

MWh consumed from waste heat/gases recovered from processes using fuel feedstocks inside chemical sector boundary

0

Total MWh (renewable + non-renewable + MWh from recovered waste heat/gases) consumed inside chemical sector boundary

1494304.68

Consumption of purchased or acquired steam

Heating value

<Not Applicable>

MWh consumed from renewable sources inside chemical sector boundary

0

MWh consumed from non-renewable sources inside chemical sector boundary (excluding recovered waste heat/gases)

4983165.46

MWh consumed from waste heat/gases recovered from processes using fuel feedstocks inside chemical sector boundary

0

Total MWh (renewable + non-renewable + MWh from recovered waste heat/gases) consumed inside chemical sector boundary

4983165.46

Consumption of self-generated non-fuel renewable energy

Heating value

<Not Applicable>

MWh consumed from renewable sources inside chemical sector boundary

0

MWh consumed from non-renewable sources inside chemical sector boundary (excluding recovered waste heat/gases)

0

MWh consumed from waste heat/gases recovered from processes using fuel feedstocks inside chemical sector boundary

0

Total MWh (renewable + non-renewable + MWh from recovered waste heat/gases) consumed inside chemical sector boundary

0

Total energy consumption

Heating value

<Not Applicable>

MWh consumed from renewable sources inside chemical sector boundary

1249.49

MWh consumed from non-renewable sources inside chemical sector boundary (excluding recovered waste heat/gases)

21384441.12

MWh consumed from waste heat/gases recovered from processes using fuel feedstocks inside chemical sector boundary

16997101.15

Total MWh (renewable + non-renewable + MWh from recovered waste heat/gases) consumed inside chemical sector boundary

38382791.76

C8.2b

(C8.2b) Select the applications of your organization's consumption of fuel.

	Indicate whether your organization undertakes this fuel application
Consumption of fuel for the generation of electricity	No
Consumption of fuel for the generation of heat	Yes
Consumption of fuel for the generation of steam	No
Consumption of fuel for the generation of cooling	No
Consumption of fuel for co-generation or tri-generation	Yes

C8.2c

(C8.2c) State how much fuel in MWh your organization has consumed (excluding feedstocks) by fuel type.

Sustainable biomass

Heating value

Unable to confirm heating value

Total fuel MWh consumed by the organization

0

MWh fuel consumed for self-generation of electricity

<Not Applicable>

MWh fuel consumed for self-generation of heat

0

MWh fuel consumed for self-generation of steam

<Not Applicable>

MWh fuel consumed for self-generation of cooling

<Not Applicable>

MWh fuel consumed for self- cogeneration or self-trigeneration

0

Comment

We don't consume sustainable biomass as fuel.

Other biomass

Heating value

Unable to confirm heating value

Total fuel MWh consumed by the organization

0

MWh fuel consumed for self-generation of electricity

<Not Applicable>

MWh fuel consumed for self-generation of heat

0

MWh fuel consumed for self-generation of steam

<Not Applicable>

MWh fuel consumed for self-generation of cooling

<Not Applicable>

MWh fuel consumed for self- cogeneration or self-trigeneration

0

Comment

We don't consume other biomass as fuel.

Other renewable fuels (e.g. renewable hydrogen)

Heating value

Unable to confirm heating value

Total fuel MWh consumed by the organization

0

MWh fuel consumed for self-generation of electricity

<Not Applicable>

MWh fuel consumed for self-generation of heat

0

MWh fuel consumed for self-generation of steam

<Not Applicable>

MWh fuel consumed for self-generation of cooling

<Not Applicable>

MWh fuel consumed for self- cogeneration or self-trigeneration

0

Comment

We don't consume other renewable fuels (e.g. renewable hydrogen) as fuel.

Coal

Heating value

Unable to confirm heating value

Total fuel MWh consumed by the organization

0

MWh fuel consumed for self-generation of electricity

<Not Applicable>

MWh fuel consumed for self-generation of heat

0

MWh fuel consumed for self-generation of steam

<Not Applicable>

MWh fuel consumed for self-generation of cooling

<Not Applicable>

MWh fuel consumed for self- cogeneration or self-trigeneration

0

Comment

We don't consume coal as fuel.

Oil

Heating value

LHV

Total fuel MWh consumed by the organization

193893.63

MWh fuel consumed for self-generation of electricity

<Not Applicable>

MWh fuel consumed for self-generation of heat

193893.63

MWh fuel consumed for self-generation of steam

<Not Applicable>

MWh fuel consumed for self-generation of cooling

<Not Applicable>

MWh fuel consumed for self- cogeneration or self-trigeneration

0

Comment

The fuels covered Fuel Oil Number 1, Pyrolysis Gas Oil, and Oligomer

Gas**Heating value**

LHV

Total fuel MWh consumed by the organization

36539878.45

MWh fuel consumed for self-generation of electricity

<Not Applicable>

MWh fuel consumed for self-generation of heat

28633013.29

MWh fuel consumed for self-generation of steam

<Not Applicable>

MWh fuel consumed for self-generation of cooling

<Not Applicable>

MWh fuel consumed for self- cogeneration or self-trigeneration

7906865.16

Comment

The fuels cover Natural gas, Liquefied Petroleum Gas, Fuel Gas, and Recovered Volatile

Other non-renewable fuels (e.g. non-renewable hydrogen)**Heating value**

Unable to confirm heating value

Total fuel MWh consumed by the organization

0

MWh fuel consumed for self-generation of electricity

<Not Applicable>

MWh fuel consumed for self-generation of heat

0

MWh fuel consumed for self-generation of steam

<Not Applicable>

MWh fuel consumed for self-generation of cooling

<Not Applicable>

MWh fuel consumed for self- cogeneration or self-trigeneration

0

Comment

We don't consume other non-renewable fuels (e.g. non-renewable hydrogen)as fuel.

Total fuel**Heating value**

LHV

Total fuel MWh consumed by the organization

36733772.08

MWh fuel consumed for self-generation of electricity

<Not Applicable>

MWh fuel consumed for self-generation of heat

28826906.92

MWh fuel consumed for self-generation of steam

<Not Applicable>

MWh fuel consumed for self-generation of cooling

<Not Applicable>

MWh fuel consumed for self- cogeneration or self-trigeneration

7906865.16

Comment**C8.2d****(C8.2d) Provide details on the electricity, heat, steam, and cooling your organization has generated and consumed in the reporting year.**

	Total Gross generation (MWh)	Generation that is consumed by the organization (MWh)	Gross generation from renewable sources (MWh)	Generation from renewable sources that is consumed by the organization (MWh)
Electricity	1516811.13	1515561.64	1249.49	1249.49
Heat	0	0	0	0
Steam	3578010.73	3578010.73	0	0
Cooling	0	0	0	0

C-CH8.2d

(C-CH8.2d) Provide details on electricity, heat, steam, and cooling your organization has generated and consumed for chemical production activities.

Electricity

Total gross generation inside chemicals sector boundary (MWh)

1516811.13

Generation that is consumed inside chemicals sector boundary (MWh)

1493055.19

Generation from renewable sources inside chemical sector boundary (MWh)

1249.49

Generation from waste heat/gases recovered from processes using fuel feedstocks inside chemical sector boundary (MWh)

0

Heat

Total gross generation inside chemicals sector boundary (MWh)

0

Generation that is consumed inside chemicals sector boundary (MWh)

0

Generation from renewable sources inside chemical sector boundary (MWh)

0

Generation from waste heat/gases recovered from processes using fuel feedstocks inside chemical sector boundary (MWh)

0

Steam

Total gross generation inside chemicals sector boundary (MWh)

3578010.73

Generation that is consumed inside chemicals sector boundary (MWh)

3578010.73

Generation from renewable sources inside chemical sector boundary (MWh)

0

Generation from waste heat/gases recovered from processes using fuel feedstocks inside chemical sector boundary (MWh)

0

Cooling

Total gross generation inside chemicals sector boundary (MWh)

0

Generation that is consumed inside chemicals sector boundary (MWh)

0

Generation from renewable sources inside chemical sector boundary (MWh)

0

Generation from waste heat/gases recovered from processes using fuel feedstocks inside chemical sector boundary (MWh)

0

C8.2e

(C8.2e) Provide details on the electricity, heat, steam, and/or cooling amounts that were accounted for at a zero or near-zero emission factor in the market-based Scope 2 figure reported in C6.3.

Sourcing method

Purchase from an on-site installation owned by a third party

Energy carrier

Electricity

Low-carbon technology type

Solar

Country/area of low-carbon energy consumption

Thailand

Tracking instrument used

Contract

Low-carbon energy consumed via selected sourcing method in the reporting year (MWh)

1249.49

Country/area of origin (generation) of the low-carbon energy or energy attribute

Thailand

Commissioning year of the energy generation facility (e.g. date of first commercial operation or repowering)

2020

Comment

Our operations in Thailand have Power purchase agreement (PPA) with on-site generator owned by a third party with no grid transfers (direct line), purchased grid mix of renewable electricity to cover part of the electricity consumption during the period approximately 0.02% of total indirect energy purchased. The majority of GC's indirect energy purchased from supplier's utilities (GLOW and GPSC), which our using natural gas, combined cycle gas turbine and Combined Heat and Power (cogeneration) for electricity and steam produced, being less carbon intensive than other means of electricity production from coal and fuel oil. This GHG emission from the market-based Scope 2 is 99% of Scope 2 emission.

C8.2g

(C8.2g) Provide a breakdown of your non-fuel energy consumption by country.

Country/area

Thailand

Consumption of electricity (MWh)

3516319.28

Consumption of heat, steam, and cooling (MWh)

8814668.85

Total non-fuel energy consumption (MWh) [Auto-calculated]

12330988.13

Is this consumption excluded from your RE100 commitment?

<Not Applicable>

C-CH8.3

(C-CH8.3) Does your organization consume fuels as feedstocks for chemical production activities?

Yes

C-CH8.3a

(C-CH8.3a) Disclose details on your organization's consumption of fuels as feedstocks for chemical production activities.

Fuels used as feedstocks

Ethane

Total consumption

2230210

Total consumption unit

metric tons

Inherent carbon dioxide emission factor of feedstock, metric tons CO2 per consumption unit

0.91

Heating value of feedstock, MWh per consumption unit

12.89

Heating value

LHV

Comment

(i) Emissions factors of feedstock use: Emission factor from Ethane's supplier (PTTGSP). (ii) Heating value of feedstock: Heating value from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, V2, Ch1. This database contains Net Calorific Values (NCVs) or LHV

Fuels used as feedstocks

Propane gas

Total consumption

625692.96

Total consumption unit

metric tons

Inherent carbon dioxide emission factor of feedstock, metric tons CO2 per consumption unit

0.71

Heating value of feedstock, MWh per consumption unit

12.88

Heating value

LHV

Comment

(i) Emissions factors of feedstock use: Emission factor from Propane's supplier (PTTGSP). (ii) Heating value of feedstock: Heating value from API Compendium of Greenhouse Gas Emissions Estimation Methodologies for the Oil and Natural Gas Industry (API 2009), table 3-8 and using Lower Heating Value.

Fuels used as feedstocks

Naphtha

Total consumption

1424741.46

Total consumption unit

metric tons

Inherent carbon dioxide emission factor of feedstock, metric tons CO2 per consumption unit

0.3

Heating value of feedstock, MWh per consumption unit

12.36

Heating value

LHV

Comment

(i) Emissions factors of feedstock use: Emission factor from TGO database. (ii) Heating value of feedstock: Heating value from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, V2, Ch1. This database contains Net Calorific Values (NCVs) or LHV

Fuels used as feedstocks

LPG

Total consumption

939802.78

Total consumption unit

metric tons

Inherent carbon dioxide emission factor of feedstock, metric tons CO2 per consumption unit

0.69

Heating value of feedstock, MWh per consumption unit

13.14

Heating value

LHV

Comment

(i) Emissions factors of feedstock use: Emission factor from LPG's supplier (PTTGSP) and EF of TGO. (ii) Heating value of feedstock: Heating value from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, V2, Ch1. This database contains Net Calorific Values (NCVs) or LHV

Fuels used as feedstocks

Other, please specify (Butene-1)

Total consumption

48193.04

Total consumption unit

metric tons

Inherent carbon dioxide emission factor of feedstock, metric tons CO2 per consumption unit

1.56

Heating value of feedstock, MWh per consumption unit

12.59

Heating value

LHV

Comment

(i) Emissions factors of feedstock use: Emission factor from JEMAI Pro database. (ii) Heating value of feedstock: Heating value from API Compendium of Greenhouse Gas Emissions Estimation Methodologies for the Oil and Natural Gas Industry (API 2009) and using Lower Heating Value.

Fuels used as feedstocks

Other, please specify (Full Range Condensate (FRC))

Total consumption

4499200.31

Total consumption unit

metric tons

Inherent carbon dioxide emission factor of feedstock, metric tons CO2 per consumption unit

0.05

Heating value of feedstock, MWh per consumption unit

11.75

Heating value

LHV

Comment

(i) Emissions factors of feedstock use: Emission factor from Ecoinvent 3.0, IPCC 2007 GWP 100a: Crude oil, at production offshore/NL S. (ii) Heating value of feedstock: Heating value using Crude oil from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, V2, Ch1. This database contains Net Calorific Values (NCVs) or LHV.

Fuels used as feedstocks

Other, please specify (NH3)

Total consumption

7482

Total consumption unit

metric tons

Inherent carbon dioxide emission factor of feedstock, metric tons CO2 per consumption unit

0.51

Heating value of feedstock, MWh per consumption unit

6.25

Heating value

LHV

Comment

(i) Emissions factors of feedstock use: Emission factor from TGO database. (ii) Heating value of feedstock: Heating value from https://en.wikipedia.org/wiki/Heat_of_combustion#Lower_heating_value and using Lower Heating Value.

Fuels used as feedstocks

Other, please specify (Biodiesel feed)

Total consumption

280552.54

Total consumption unit

metric tons

Inherent carbon dioxide emission factor of feedstock, metric tons CO2 per consumption unit

1.4

Heating value of feedstock, MWh per consumption unit

7.5

Heating value

LHV

Comment

(i) Emissions factors of feedstock use: Emission factor from TGO. (ii) Heating value of feedstock: Heating value from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, V2, Ch1. This database contains Net Calorific Values (NCVs) or LHV.

Fuels used as feedstocks

Other, please specify (Styrene Monomer)

Total consumption

78308.63

Total consumption unit

metric tons

Inherent carbon dioxide emission factor of feedstock, metric tons CO2 per consumption unit

2.37

Heating value of feedstock, MWh per consumption unit

8.72

Heating value

LHV

Comment

(i) Emissions factors of feedstock use: Emission factor from TGO database. (ii) Heating value of feedstock: Heating value from <https://www.sciencedirect.com/science/article/abs/pii/S0304389497001295#:~:text=The%20heat%20values%20of%20tires%20range%20from%20about,what%20cannot%20be%20decomposed%20easily%20in%20long%20term.>

C-CH8.3b

(C-CH8.3b) State the percentage, by mass, of primary resource from which your chemical feedstocks derive.

	Percentage of total chemical feedstock (%)
Oil	71
Natural Gas	0
Coal	0
Biomass	2
Waste (non-biomass)	0
Fossil fuel (where coal, gas, oil cannot be distinguished)	27
Unknown source or unable to disaggregate	0

C9. Additional metrics

C9.1

(C9.1) Provide any additional climate-related metrics relevant to your business.

Description

Waste

Metric value

48787

Metric numerator

metric tons

Metric denominator (intensity metric only)

-

% change from previous year

50.56

Direction of change

Increased

Please explain

Total Hazardous waste from routine operations in 2021 (48,787 ton) is higher than that in 2020 (32,403 ton) or increase by 50.56% due to the operation of new four plants, which are OLE4, GC-M PTA, GCO, and GCP. Moreover, GC has performed turnaround/shutdown for many plants in this year, which resulted in higher hazardous substance generation according to the maintenance. To address this issue, GC has conducted Green Turnaround project to promote the efficient use of resources and heighten recycling potentials. These have contributed to the reduction of disposal of waste and wastewater by 4,410 tons, or equivalent to a cost reduction of waste disposal for 14.6 million baht.

Description

Other, please specify (Water usage)

Metric value

55510000

Metric numerator

m3

Metric denominator (intensity metric only)

-

% change from previous year

10

Direction of change

Increased

Please explain

Total water consumption in 2021 (55.51 million cubic meter) was more than it was in 2020 (49.77 million cubic meter) or increase by 10%, due to the operation of new four plants, which are OLE4, GC-M PTA, GCO, and GCP leading to increase of the fresh water consumption intensity approximately 8% from existing business production. This is because at the beginning phase, the environmental performance of each plant is still in the improvement and optimization processes. It is planned these new plants will improve the reduction of water consumption based on Reduce, Reuse and Recycle (3Rs).

Description

Other, please specify (VOCs Emission)

Metric value

816

Metric numerator

metric tons

Metric denominator (intensity metric only)

-

% change from previous year

4.16

Direction of change

Decreased

Please explain

Total VOCs emission in 2021 (816 ton) is lower than that in 2020 (850 ton) or decreased by 4.16% due to the implementation of several projects to control and reduce VOCs in our productions. For instance, we implemented optimization of Vapor Recovery Unit (VRU) project, installation a Bio-filter to reduce and control the VOCs from the wastewater treatment system instead of using existing Activated Carbon Treatment System, and installation new flare to control VOC at Tank Farm of Jetty. These projects enable GC to control VOCs more effectively, more environmentally friendly and reduce impacts to the communities. Additionally, these systems are able to control odor that help to reduce an impact to the communities

C-CH9.3a

(C-CH9.3a) Provide details on your organization's chemical products.

Output product

High Value Chemicals (Steam cracking)

Production (metric tons)

3507029

Capacity (metric tons)

3738000

Direct emissions intensity (metric tons CO2e per metric ton of product)

0.71

Electricity intensity (MWh per metric ton of product)

0.43

Steam intensity (MWh per metric ton of product)

1.43

Steam/ heat recovered (MWh per metric ton of product)

1.43

Comment

Total main products of High Value Chemicals (Steam cracking), include Olefins, 1,3 Butadiene and Butene-1.

Output product

Aromatics extraction

Production (metric tons)

2642068

Capacity (metric tons)

2419000

Direct emissions intensity (metric tons CO2e per metric ton of product)

0.37

Electricity intensity (MWh per metric ton of product)

0.2

Steam intensity (MWh per metric ton of product)

0.54

Steam/ heat recovered (MWh per metric ton of product)

0.54

Comment

Total main products of Aromatics extraction, include Benzene, Cyclohexane, Mixed Xylenes, Ortho Xylenes and Para Xylenes.

Output product

Polymers

Production (metric tons)

3582578

Capacity (metric tons)

4524000

Direct emissions intensity (metric tons CO2e per metric ton of product)

0.06

Electricity intensity (MWh per metric ton of product)

0.26

Steam intensity (MWh per metric ton of product)

0.12

Steam/ heat recovered (MWh per metric ton of product)

0.12

Comment

Total main products of Polymers, include HDPE, LDPE, LLDPE, Hexene-1, PP and PS.

Output product

Specialty chemicals

Production (metric tons)

321213

Capacity (metric tons)

380000

Direct emissions intensity (metric tons CO2e per metric ton of product)

0.97

Electricity intensity (MWh per metric ton of product)

0.59

Steam intensity (MWh per metric ton of product)

0

Steam/ heat recovered (MWh per metric ton of product)

0

Comment

Total main products of Specialty chemicals, include Acrylonitrile, Methyl Methacrylate, others

Output product

Other, please specify (EO-Based Performance)

Production (metric tons)

611373

Capacity (metric tons)

473000

Direct emissions intensity (metric tons CO2e per metric ton of product)

0.15

Electricity intensity (MWh per metric ton of product)

0.23

Steam intensity (MWh per metric ton of product)

0.26

Steam/ heat recovered (MWh per metric ton of product)

0.26

Comment

Total main products of EO-Based Performance, include MEG and EA.

Output product

Other, please specify (Green Chemicals)

Production (metric tons)

550203

Capacity (metric tons)

775000

Direct emissions intensity (metric tons CO2e per metric ton of product)

0.05

Electricity intensity (MWh per metric ton of product)

0.06

Steam intensity (MWh per metric ton of product)

0.44

Steam/ heat recovered (MWh per metric ton of product)

0.44

Comment

Total main products of Green Chemicals, include Methyl Ester, Glycerin, Fatty Alcohol and Polybutylene Succinate.

Output product

Other, please specify (Phenol & BPA)

Production (metric tons)

1079767

Capacity (metric tons)

954000

Direct emissions intensity (metric tons CO2e per metric ton of product)

0.01

Electricity intensity (MWh per metric ton of product)

0.22

Steam intensity (MWh per metric ton of product)

1.55

Steam/ heat recovered (MWh per metric ton of product)

1.55

Comment

Total main products of Phenol&BPA include Phenol, Acetone and Bis Phenol A

C-CE9.6/C-CG9.6/C-CH9.6/C-CN9.6/C-CO9.6/C-EU9.6/C-MM9.6/C-OG9.6/C-RE9.6/C-ST9.6/C-TO9.6/C-TS9.6

(C-CE9.6/C-CG9.6/C-CH9.6/C-CN9.6/C-CO9.6/C-EU9.6/C-MM9.6/C-OG9.6/C-RE9.6/C-ST9.6/C-TO9.6/C-TS9.6) Does your organization invest in research and development (R&D) of low-carbon products or services related to your sector activities?

	Investment in low-carbon R&D	Comment
Row 1	Yes	

C-CH9.6a

(C-CH9.6a) Provide details of your organization's investments in low-carbon R&D for chemical production activities over the last three years.

Technology area	Stage of development in the reporting year	Average % of total R&D investment over the last 3 years	R&D investment figure in the reporting year (optional)	Comment
Product redesign	Full/commercial-scale demonstration	81 - 100%	59153102	GC has placed the top priority on research and innovation development with environmental and social care as well as realizing the need to reduce the capital of customers, due to raw materials tend to be depleted and risen higher prices. GC has invested in various technology areas to improve our chemical products i.e. GC and Magnolia Quality Development Corporation collaboration to develop "Epoxy for Composite Rebar" and High Heat Resistant PLA for Biodegradable Cutlery. In addition, GC has set short term target for its Innovation strategy: 1) Increase percentage of EBITDA uplift proportion from R&D to 5 percent by 2025 and 10 percent by 2030 2) Expand investment proportion in R&D to at least 2 percent of GC's petrochemical products revenue by 2030 Total R&D investment for chemical production in 2021 was 67,225,541 THB, of which 88% (59,153,102 THB) are investment for low carbon transition.

C-CO9.6a/C-EU9.6a/C-OG9.6a

(C-CO9.6a/C-EU9.6a/C-OG9.6a) Provide details of your organization's investments in low-carbon R&D for your sector activities over the last three years.

Technology area	Stage of development in the reporting year	Average % of total R&D investment over the last 3 years	R&D investment figure in the reporting year (optional)	Comment
Smart systems	Please select	Please select		

C10. Verification

C10.1

(C10.1) Indicate the verification/assurance status that applies to your reported emissions.

	Verification/assurance status
Scope 1	Third-party verification or assurance process in place
Scope 2 (location-based or market-based)	Third-party verification or assurance process in place
Scope 3	Third-party verification or assurance process in place

C10.1a

(C10.1a) Provide further details of the verification/assurance undertaken for your Scope 1 emissions, and attach the relevant statements.

Verification or assurance cycle in place

Annual process

Status in the current reporting year

Complete

Type of verification or assurance

Limited assurance

Attach the statement

GC Greenhouse gas report 2021.pdf

Assurance statement related to GHG report 2021.pdf

Page/ section reference

Assurance statement related to GHG report 2021, page 1-3, GC Greenhouse gas report 2021, page 3-19

Relevant standard

ISO14064-3

Proportion of reported emissions verified (%)

100

C10.1b

(C10.1b) Provide further details of the verification/assurance undertaken for your Scope 2 emissions and attach the relevant statements.

Scope 2 approach

Scope 2 location-based

Verification or assurance cycle in place

Annual process

Status in the current reporting year

Complete

Type of verification or assurance

Limited assurance

Attach the statement

GC Greenhouse gas report 2021.pdf

Assurance statement related to GHG report 2021.pdf

Page/ section reference

Assurance statement related to GHG report 2021, page 1-3, GC Greenhouse gas report 2021, page 3-19

Relevant standard

ISO14064-3

Proportion of reported emissions verified (%)

100

C10.1c

(C10.1c) Provide further details of the verification/assurance undertaken for your Scope 3 emissions and attach the relevant statements.

Scope 3 category

Scope 3: Purchased goods and services

Scope 3: Capital goods

Scope 3: Fuel and energy-related activities (not included in Scopes 1 or 2)

Scope 3: Upstream transportation and distribution

Scope 3: Investments

Scope 3: Downstream transportation and distribution

Scope 3: Processing of sold products

Scope 3: Use of sold products

Scope 3: End-of-life treatment of sold products

Verification or assurance cycle in place

Annual process

Status in the current reporting year

Complete

Type of verification or assurance

Limited assurance

Attach the statement

GC Greenhouse gas report 2021.pdf

Assurance statement related to GHG report 2021.pdf

Page/section reference

Assurance statement related to GHG report 2021, page 1-3, GC Greenhouse gas report 2021, page 3-19

Relevant standard

ISO14064-3

Proportion of reported emissions verified (%)

100

C10.2

(C10.2) Do you verify any climate-related information reported in your CDP disclosure other than the emissions figures reported in C6.1, C6.3, and C6.5?

Yes

C10.2a

(C10.2a) Which data points within your CDP disclosure have been verified, and which verification standards were used?

Disclosure module verification relates to	Data verified	Verification standard	Please explain
C8. Energy	Year on year emissions intensity figure	It is in accordance with ISAE 3000 and uses the following principles of - inclusivity, materiality, responsiveness and reliability of performance data.	The Report is in accordance with the: - GRI Standard; core option - GRI Oil and Gas Sector Supplement Evaluating the reliability of data and information for selected specific standard disclosures (PDF page 274) Evaluating the reliability of data and information for selected specific standard disclosures: Energy consumption within the organization (GRI 302-1); Total energy consumption outside the organization (GRI 302-2); Energy intensity (GRI 302-3); Water withdrawal, discharge – included COD load and consumptions (GRI 303-3 to 5); SOx, NOx and other significant air emissions (GRI 305-7); Waste generated, diverted from disposal and directed to disposal (GRI 306-3 to 5) – 2020 edition; Type of injury and rates of injury as LTIFR, occupational diseases, lost days and total number of work-related fatalities (GRI 403-9 and 10), Number of process event safety (OGSS OG13), Community investment (GRI 201- 1) and Ratio of basic salary and remuneration of women to men (GRI 405-2). pttgc-isr2021.pdf

C11. Carbon pricing

C11.1

(C11.1) Are any of your operations or activities regulated by a carbon pricing system (i.e. ETS, Cap & Trade or Carbon Tax)?

No, but we anticipate being regulated in the next three years

C11.1d

(C11.1d) What is your strategy for complying with the systems you are regulated by or anticipate being regulated by?

After completing participation with Thailand Voluntary Emission Trading Scheme (Thailand V-ETS) 2nd trading period from 2017-2019; with the main purpose for setting Measuring, Reporting and Verification (MRV) criteria and emissions caps for the petrochemical sector, GC has successfully set the CO2 reduction target for refinery plants and has been participated in a program jointly provided by the Thailand Greenhouse Gas Management Organization (TGO) and private companies on the setting and internal implementation of Internal Carbon Pricing into our financial processes, preparing GC for future regulation on carbon pricing.

Moreover, in order to continuously support Thailand's Nationally Determined Contribution (NDC) target for climate change, GC has been actively engaged and partnered with policy makers e.g. The Federation of Thai Industries and The Joint Standing Committee on Commerce, Industry and Banking (composing of Board of Trade of Thailand, The Thai Bankers Association, and The Federation of Thai Industries), providing climate-related technical experiences and academic research as input for climate-related policy planning and disclosing. We anticipate regulated carbon market in Thailand is likely to be in place by year 2025 to 2030.

In addition, the company has prepared the GHG Reporting, GHG Database System and MRV process of all factories, for reporting to government agencies. We expect Thailand's Climate Change Act to be announce by 2023.

C11.2

(C11.2) Has your organization originated or purchased any project-based carbon credits within the reporting period?

No

C11.3

(C11.3) Does your organization use an internal price on carbon?

Yes

C11.3a

(C11.3a) Provide details of how your organization uses an internal price on carbon.

Objective for implementing an internal carbon price

- Navigate GHG regulations
- Stakeholder expectations
- Change internal behavior
- Drive energy efficiency
- Drive low-carbon investment
- Stress test investments
- Identify and seize low-carbon opportunities
- Supplier engagement

GHG Scope

- Scope 1
- Scope 2
- Scope 3

Application

GC has initially stated criteria for long-term investment into investment management process;

- 1) Project prioritization: Carbon intensity was added as one of the investment process criteria to prioritize investment in the low carbon business as company direction.
- 2) Project evaluation: GC has applied Internal Carbon Price (ICP) for scope 1,2,3 into project's additional expenses which impact to project return. These expenses will be the cost of carbon abatement which uses for seeking technology or the other acceptable carbon management method. ICP calculated on regional basic of project to reflect the implementation with home base regulation for Asia, Europe, and America. Therefore, the ICP impact will also be informed to MC and BOD committee for further considerations and decision making.
- 3) Carbon neutral-growth investment: GC initially set direction to control carbon from new investment in long term by giving guideline of carbon neutral growth investment.

Actual price(s) used (Currency /metric ton)

1435

Variance of price(s) used

We have variance of price used by static pricing.

Type of internal carbon price

- Shadow price
- Internal fee

Impact & implication

GC developed two Internal Carbon Pricing models, which are 1) Shadow Price (average number at 41 USD/tCO_{2e} and range between 15-48 USD/tCO_{2e}) to incorporate assumptions on full cost of future emissions into business decisions, and 2) Carbon Fee to accelerate asset's decarbonization & support new abatement initiatives.

GC has applied the Internal Carbon Price mechanism as a tool to help assess the impact of business projects from increasing or reducing the amount of greenhouse gas emissions, as well as drive new greenhouse gas reduction projects. Examples of important operations that have taken place include:

Example project :

Project return of improving Oleflex unit is reduced 0.2% from carbon price. This project modifies refrigerator, compressor and installs new burner of propylene production process which carbon emission increases about 6,000 ton. Investment CAPEX is 75.7 million USD.

Carbon impact (from both abatement and regulatory prices) on project return of Aromatic derivative projects (Green field) is less than 2% depend on energy usage. These projects are under study phase and will be approved for construction within next year.

Carbon emission is a criteria of project prioritization by seeking low carbon intensity project with high margin contribution. This methodology convinces that GC spends budget efficiently.

In addition, GC is developing Marginal Abatement Costs Curve (MACC) as such, to assist with identifying cost effective abatement actions as part of efforts to reduce their greenhouses gas emissions and to assess carbon pricing for consider the project investment."

C12. Engagement

C12.1

(C12.1) Do you engage with your value chain on climate-related issues?

- Yes, our suppliers
- Yes, our customers/clients
- Yes, other partners in the value chain

C12.1a

(C12.1a) Provide details of your climate-related supplier engagement strategy.

Type of engagement

Information collection (understanding supplier behavior)

Details of engagement

Collect climate change and carbon information at least annually from suppliers

% of suppliers by number

50

% total procurement spend (direct and indirect)

98

% of supplier-related Scope 3 emissions as reported in C6.5

0

Rationale for the coverage of your engagement

GC's suppliers are required to provide climate change and carbon information as a part of Life-cycle-assessment (LCA) in annually basis. 100% of our suppliers from PTT Group of companies are required to provide information based on GC requirement. A group of supplier was chosen in respect with spending. GC had engaged approximately 50% of major feedstock suppliers. The engaged companies include PTT and Gas plant separation, which accounted for 98% of our spending since we mainly supply from within PTT group to increase synergy. The assessment allows GC to identify hotspots and impacts in value chain in terms of sustainability. The following aspects were considered in the engagement: climate change, human toxicity, particulate matter formation, and fossil depletion. These suppliers are required to respond to us through the PTT group LCA platform.

Impact of engagement, including measures of success

Impact of engagement: GC has conducted a LCA to 50% of suppliers in 2021. The assessment allows GC to identify hotspots and impacts of Scope 1, 2 and 3 GHG emissions using specific emission factors from suppliers. The weighted average feedstock emission factor is 0.32 tonnes CO2/tonne compared to ethane, the major feedstock, with the emission factor of 0.77 tonnes CO2/tonne. To improve the reduction of the emission factors and Scope 3 GHG emission, GC has engaged the suppliers to drive the sustainable procurement policy and criteria of bidding. The suppliers have been categorized into 2 groups: long-term and non-long-term contract suppliers. The long-term contract suppliers have been advocated for Net Zero agenda and aligned and/or set joint climate objectives. For the non-long-term contract suppliers, GC has approached them with a standard qualification scheme which requests the suppliers to disclose the GHG emission data and reduction target in order to incentivize the outperformed climate performance suppliers. In addition, GC engaged with suppliers such as PTTEP, PTT GSP, and PTT Trading through PTT Group Working Team. During these engagements GC and other PTT group companies shared information about current best practices regarding energy efficiency and GHG reduction practices, as well as progress towards GHG targets.

Measure of Success: 100% engage with critical feedstock suppliers that contribute to GC scope 3 emission to develop their own initiative with GC on emission reduction. In future years, these suppliers are subject to annual performance review and the measures of success includes the following subjects: resources use and GHG reduction compared to baseline, extend KPIs to value chain, trend analysis, and stakeholder feedback.

Positive Outcome: GC achieved 100% engaged with critical feedstock suppliers. As a result, GC's suppliers is able to develop initiative e.g. project flare gas recovery unit which can reduce emission 5 – 10% and plant utilization hot oil from WHRS to LPG Recovery Column that save energy 500,000 GJ/year or reduce GHG emission 28,000 tCO2e/year.

Comment

C12.1b

(C12.1b) Give details of your climate-related engagement strategy with your customers.

Type of engagement & Details of engagement

Education/information sharing	Run an engagement campaign to educate customers about the climate change impacts of (using) your products, goods, and/or services
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% of customers by number

0

% of customer - related Scope 3 emissions as reported in C6.5

53

Please explain the rationale for selecting this group of customers and scope of engagement

We chose the group of customer and scope of engagement for the following reasons. Firstly, we tried reach as broad a group as possible to cover as many of customers, especially high value customers (those with requirement for high performance and low carbon products). GC engaged selected customer group by holding training events and advertising, for example. Currently, consumers have increased awareness of the dangers and consequences resulting from the use of unsafe or non-standard products and tend to consume goods and products that are safe for health and environmental-friendly. GC has a marketing and customer relationship management strategy that follows the company's core strategy. This strategy has been used to create valuable innovative products, maximize customer satisfaction in products and services, and empower its employees in customer relationship management in order to strengthen the competitiveness and support the expansion of customer base to new domestic and international markets.

Impact of engagement, including measures of success

Impact of engagement: GC's strengthens the relationship to the customer by demonstrating credibility and know-how on climate related topics as well as offering innovative solutions in this area. The buy-in of customers to GC's solutions contributes to avoiding emissions along the value chain. For more details of impact see below.

Measures of success: 1) Engaged customers are expected to have at least 1 emission reduction initiative with GC. 2) GC to achieved annual customer satisfaction score (%) of 91% in FY 2021.

Positive Outcome: As a result of the engagement, GC's key account customer, PTTOR were able to reduce downstream transportation by manage product delivery method to swap diesel transfer volume from Truck to Thappline by 10 MML/month which expect GHG reduction ~1000 tCO2e/year that challenge both companies strengthen planning process to optimize Thappline utilization and prevent Thappline interruption.

GC's efforts in collaboration projects with customers has set an expectation to keep customer satisfied with our business. The achievement of GC 2021 target in both domestic and international customer satisfaction surveys at 93% .

GC engaged with many customers such as KFC, Lion, Mistine, Ichitan, ThaiBev, Truecoffee, Sappe, Kodomo, etc. for collaborating project to reduce GHG scope 3 emission of GC and customer accounting. All projects were categorized in downgrading formulation, upcycling product, recycled plastic, bio-plastic and mono material. As summary, GC were able to reduce emission related to customer reduce by 3000 tCO2e in FY 2021

C12.1d

(C12.1d) Give details of your climate-related engagement strategy with other partners in the value chain.

GC has continuously executed the project in collaboration with other partners in the value chain. These partners include policy makers, entrepreneurs, and start-up businesses that have the potential to become customers and business partners. We chose this part of value chain to expand GC's low carbon business and to co-create low carbon products that align with GC's low carbon transition framework as well as creating value for the stakeholders.

Method of engagement includes; Policy maker: dialog in low-carbon conferences and forums. Entrepreneurs, and start-up businesses: investment in new business and technology through collaborative projects and consortium.

Success metric: Number of policy launches that indicated positive impact to GC's low carbon business. Providing funding Green tech investment of 280 million THB (8 million USD).

Positive outcome in 2021:

Policy makers; GC consistence engagement to policy makers on climate change has result in recent update of Food Act, on plastic packaging quality and standard, allowing recycled plastic to be use as input material for plastic food packaging.

Entrepreneurs, and start-up businesses; GC has been collaboration and investment in start-up company focus on clean technology e.g. Phase Change Energy Solution (PCES) and ESSinc. In addition, GC invest in technology funds on clean technology e.g. Emerald and GRC SinoGreen.

C12.2

(C12.2) Do your suppliers have to meet climate-related requirements as part of your organization's purchasing process?

Yes, suppliers have to meet climate-related requirements, but they are not included in our supplier contracts

C12.2a

(C12.2a) Provide details of the climate-related requirements that suppliers have to meet as part of your organization's purchasing process and the compliance mechanisms in place.

Climate-related requirement

Climate-related disclosure through a public platform

Description of this climate related requirement

GC regularly revisits on corporate's sustainable procurement framework that aims to procure or support the upstream business that operate with a good ESG approaches. Climate Change is included as one of the criteria of the procurement framework. GC has been communicating GC's Net zero roadmap, along with revised and updated procurement framework to corporate's suppliers and vendors through supplier conferences. The objective of the conferences is to build awareness and early request to the suppliers/vendors to prepare the relevant environmental information e.g., GHG emission for conducting assessment in procurement process. The suppliers who will be request to disclose their GHG emission performance would be those in the pilot categories (part of decarbonization strategy). The disclosed GHG emission data from the pilot categories would be used as the base information for further development of assessment criteria that allow GC to classify supplier/vendors in to tiers, for sourcing prioritization, and improve our GHG emission reduction performance. GC have just started to implement this strategy in 2021, therefore no suppliers are yet required to abide by our requirements, enforcement will be implemented in the future year.

% suppliers by procurement spend that have to comply with this climate-related requirement

0

% suppliers by procurement spend in compliance with this climate-related requirement

0

Mechanisms for monitoring compliance with this climate-related requirement

Supplier scorecard or rating

Response to supplier non-compliance with this climate-related requirement

Retain and engage

C12.3

(C12.3) Does your organization engage in activities that could either directly or indirectly influence policy, law, or regulation that may impact the climate?

Row 1

Direct or indirect engagement that could influence policy, law, or regulation that may impact the climate

Yes, we engage directly with policy makers

Yes, we engage indirectly through trade associations

Does your organization have a public commitment or position statement to conduct your engagement activities in line with the goals of the Paris Agreement?

Yes

Attach commitment or position statement(s)

GC Public Commitment on Engagement Activities (website).pdf

GC Public Commitment on Engagement Activities (Climate Strategy).pdf

Describe the process(es) your organization has in place to ensure that your engagement activities are consistent with your overall climate change strategy

GC highly values the importance of all stakeholder groups, and has continuously reviews stakeholder engagement activities and communication channels on annual basis. This is to ensure that stakeholders have opportunities to involve in the engagement and provide appropriate suggestions. GC has proactively engaged the government organizations to drive the country's Net Zero and climate change-related policies by exchanging views, strategies, and operation plans to support and enhance the effectiveness in the long run of climate change roadmap and action plan for both national and company levels. For example, GC has joined Thailand Carbon Neutral Network (TCNN), which is a Public Private Partnership to drive the Carbon Market or the carbon credit exchange market in Thailand which intends to support the private company to achieve GHG emission reduction target. TCNN was founded by Thailand Greenhouse Gas Management Organization (TGO), a Thailand public organization. Moreover, GC is also one of the founders of the Public Private Partnership for Sustainable Plastic and Waste Management (PPP Plastics) which aims to reduce the amount of plastic waste through sustainable waste management in line with the Circular Economy. At the same time, GC has continuously monitored the global climate change policies to ensure the national- and company-level targets are aligned with the global direction.

Primary reason for not engaging in activities that could directly or indirectly influence policy, law, or regulation that may impact the climate

<Not Applicable>

Explain why your organization does not engage in activities that could directly or indirectly influence policy, law, or regulation that may impact the climate

<Not Applicable>

C12.3a

(C12.3a) On what policy, law, or regulation that may impact the climate has your organization been engaging directly with policy makers in the reporting year?

Focus of policy, law, or regulation that may impact the climate

Emissions trading schemes

Specify the policy, law, or regulation on which your organization is engaging with policy makers

Thailand Nationally Determined Contributions (NDCs)

Policy, law, or regulation geographic coverage

National

Country/region the policy, law, or regulation applies to

Thailand

Your organization's position on the policy, law, or regulation

Support with no exceptions

Description of engagement with policy makers

GC is one of the main stakeholder to support and push forward the development of Voluntary Emission Trading Scheme in Thailand or "Thailand V-ETS" to encourage private and public sector to reduce domestic GHG emissions, help Thailand meet emission reduction target of Nationally Determined Contributions (NDCs) – Paris agreement, and paving way to more sustainable "Low Carbon Economy". GC has been provided our greenhouse gas data and petrochemical, Refinery and Plastic sectors knowledge for the pilot phase and projects of Thailand Voluntary Emission Trading Scheme (Thailand V-ETS) by collaborating with the Thailand Greenhouse Gas Management Organization (TGO), and The Federation of Thai Industries, in Thailand. The scheme was test through 15 pilot factories. The monitoring, reporting, and verification system (MRV) has been developed based on ISO 14064-1, 14064-3, and 14065 standards. In addition, GC also participate in the Thailand Voluntary Emission Reduction Program (T-VER) and drafting of the "White paper – carbon pricing" promoting carbon pricing to all sectors.

Details of exceptions (if applicable) and your organization's proposed alternative approach to the policy, law or regulation

<Not Applicable>

Have you evaluated whether your organization's engagement is aligned with the goals of the Paris Agreement?

Yes, we have evaluated, and it is aligned

C12.3b

(C12.3b) Provide details of the trade associations your organization engages with which are likely to take a position on any policy, law or regulation that may impact the climate.

Trade association

Other, please specify (Thailand Business Council for Sustainable Development (TBCSD), and Plastic Industry Club, the Federation of Thai Industries (FTI))

Is your organization's position on climate change consistent with theirs?

Consistent

Has your organization influenced, or is your organization attempting to influence their position?

We publicly promote their current position

State the trade association's position on climate change, explain where your organization's position differs, and how you are attempting to influence their position (if applicable)

Since 2020 GC's has been participating in PPP Plastics (Public Private Partnership for Sustainable Plastics and Waste Management) project, established by TBCSD and FTI, supporting partnership of over 33 government sectors and private sector organizations to sustainably manage plastic and waste through knowledge sharing, seminar, and training. PPP Plastics has the main goal of reducing Thailand Marine plastic waste at least 50% by 2027. For example, value creation from waste to treasure programme. This project support the National BCG economic Model, focusing on Bioeconomy and Circular economy, which is one of the key strategy for achieving Thailand Nationally Determined Contribution (NDC) as committed under the Paris Agreement.

GC participates as a leading Network Partners, supporting community waste management. Including, partnership with the government to draft a "Plastic waste management roadmap" for other organizations in the association and beyond to reach the goal of 50% marine plastic waste reduction in Thailand.

Funding figure your organization provided to this trade association in the reporting year, if applicable (currency as selected in C0.4) (optional)

0

Describe the aim of your organization's funding

<Not Applicable>

Have you evaluated whether your organization's engagement with this trade association is aligned with the goals of the Paris Agreement?

Yes, we have evaluated, and it is aligned

C12.4

(C12.4) Have you published information about your organization's response to climate change and GHG emissions performance for this reporting year in places other than in your CDP response? If so, please attach the publication(s).

Publication

In mainstream reports

Status

Complete

Attach the document

PTT_GC_TCFD 2022 (New).pdf
pttgc-isr2021.pdf

Page/Section reference

ISR 2021: Governance (Page 118 PDF), Strategy (Page 2, 116 PDF), Emission figures (Page 122 – 124/ 139 PDF) Emission targets (125 PDF)

TCFD 2022: Governance (pp10-15), Strategy (pp 16-20, 46), Risks & Opportunities (pp 21-45), Emission figures (p 59), Emission targets (pp 55-61), Other metrics (p 61)

Content elements

- Governance
- Strategy
- Risks & opportunities
- Emissions figures
- Emission targets
- Other metrics

Comment

GC disclosed our climate change response in Integrated Sustainability Management Report 2021 and TCFD report.

C15. Biodiversity

C15.1

(C15.1) Is there board-level oversight and/or executive management-level responsibility for biodiversity-related issues within your organization?

	Board-level oversight and/or executive management-level responsibility for biodiversity-related issues	Description of oversight and objectives relating to biodiversity	Scope of board-level oversight
Row 1	Yes, both board-level oversight and executive management-level responsibility	GC have ensure to select board member with skills and experiences to oversee any environmental and biodiversity related strategy. Specifically, the experiences covered; agricultural policies, forestry and environmental law, sustainability management, circular economy, innovation and digital transformation. Similar to climate change topic, biodiversity-related topics are included under the direct responsibility of the Corporate Governance and Sustainability Committee (CGS), which are appointed by the board of directors. The main objective is to review any related regulation and identified potential risks and opportunities. GC commitment and values of protecting biodiversity is covered in the corporate QSHEB policy. GC has recently release Biodiversity Statement (endorsed by CGS), which aim to achieved; biodiversity risk assessment and management integration, avoid biodiversity loss, no-net-loss of biodiversity values, No Net Deforestation' for our operation and tier-1 suppliers, and Avoid to operate in World Heritage areas and IUCN Category I-IV protected areas.	<Not Applicable>

C15.2

(C15.2) Has your organization made a public commitment and/or endorsed any initiatives related to biodiversity?

	Indicate whether your organization made a public commitment or endorsed any initiatives related to biodiversity	Biodiversity-related public commitments	Initiatives endorsed
Row 1	Yes, we have made public commitments only	Commitment to Net Positive Gain Commitment to No Net Loss Adoption of the mitigation hierarchy approach Commitment to not explore or develop in legally designated protected areas Commitment to respect legally designated protected areas Commitment to no conversion of High Conservation Value areas	<Not Applicable>

C15.3

(C15.3) Does your organization assess the impact of its value chain on biodiversity?

	Does your organization assess the impact of its value chain on biodiversity?	Portfolio
Row 1	No, but we plan to assess biodiversity-related impacts within the next two years	<Not Applicable>

C15.4

(C15.4) What actions has your organization taken in the reporting year to progress your biodiversity-related commitments?

	Have you taken any actions in the reporting period to progress your biodiversity-related commitments?	Type of action taken to progress biodiversity- related commitments
Row 1	Yes, we are taking actions to progress our biodiversity-related commitments	Land/water management Species management Education & awareness

C15.5

(C15.5) Does your organization use biodiversity indicators to monitor performance across its activities?

	Does your organization use indicators to monitor biodiversity performance?	Indicators used to monitor biodiversity performance
Row 1	No, we do not use indicators, but plan to within the next two years	Please select

C15.6

(C15.6) Have you published information about your organization’s response to biodiversity-related issues for this reporting year in places other than in your CDP response? If so, please attach the publication(s).

Report type	Content elements	Attach the document and indicate where in the document the relevant biodiversity information is located
No publications	<Not Applicable>	<Not Applicable>

C16. Signoff

C-FI

(C-FI) Use this field to provide any additional information or context that you feel is relevant to your organization's response. Please note that this field is optional and is not scored.

C16.1

(C16.1) Provide details for the person that has signed off (approved) your CDP climate change response.

	Job title	Corresponding job category
Row 1	President & Chief Executive Officer	Chief Executive Officer (CEO)

Submit your response

In which language are you submitting your response?

English

Please confirm how your response should be handled by CDP

	I understand that my response will be shared with all requesting stakeholders	Response permission
Please select your submission options	Yes	Public

Please confirm below

I have read and accept the applicable Terms