

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 2022, GC, as a Chemical Flagship of PTT Group with a combined chemical and petrochemical capacity of 14.23 million tons per year and crude oil and condensate distillation capacity of 280,000 barrels per day. GC consists of 5 core business groups (Upstream, Intermediates, Polymers and chemicals, Bio and Circularity, and Performance chemicals) and has other businesses and services which GC invested for supporting 5 business groups. The key 12 business unit are: Refinery and Shared Facilities, Aromatics, Olefins, Ethylene Oxide and Derivatives, Phenols, Others Intermediates, Polymers, Chemicals, Bioplastics and Biochemicals, Post-consumer Recycled, Value Added Oleochemicals, and Value Added Oleochemicals. <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 comprises a number of companies with differentiated business activities. Therefore, there is need for a standardized and systematic GHG emission data compiling procedure for the GC group, that can be sustained over the long-term, to improve data quality for the group. The 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 and indicate whether you will be providing emissions data for past reporting years.

Reporting year

Start date

January 1 2022

End date

December 31 2022

Indicate if you are providing emissions data for past reporting years

No

Select the number of past reporting years you will be providing Scope 1 emissions data for

<Not Applicable>

Select the number of past reporting years you will be providing Scope 2 emissions data for

<Not Applicable>

Select the number of past reporting years you will be providing Scope 3 emissions data for

<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 or committee	Responsibilities for climate-related issues
Board Chair	<p>The Board Chair holds the most power and authority on the board of directors (BoD) and is responsible for ensuring that the business has a clear picture of its exposure to climate-related risks and opportunities associated with the transition towards a low carbon economy (e.g. low carbon technologies, law and regulations, R&D, and customer behavior changes) and the physical impacts of climate change on the organization (e.g. resource efficiency, the development of new products and services, and access to new markets). This is reflected through GC's vision, missions, directions, and operational strategies which is endorsed by the board. The Board Chair is also responsible for reviewing the performance of executives under an efficient performance monitoring and evaluation system.</p> <p>The Board chair oversees the Corporate Governance and Sustainability Committee (CGS) and the Risk Management Committee (RMC) and governs the decision-making on climate-related issues.</p> <p>In 2022, 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 2022, 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>At the board-level, the Corporate Governance and Sustainability Committee (CGS) and the Risk Management Committee (RMC) each comprises five members from the BoD and an independent Chairman.</p> <p>The CGS reports directly to the BoD in accordance with the duties and responsibilities assigned to them. Climate-related issues that affect the whole company, including energy efficiency, alternative raw material sourcing, GHG mitigation, and GHG reduction targets, are evaluated and reviewed by the CGS.</p> <p>The RMC is responsible for defining the direction of risk management guided by the risk appetite, risk policy, and five risk management frameworks: corporate, foreign exchange, price-and spread, subsidiaries, and investment. It is also tasked with monitoring and providing recommendations on the management of risks towards the achievement of GC's strategic and business goals. BoD's responsibility is to oversee corporate risk management by monitoring progress and RMC's performance at least quarterly, and to report results to shareholders through GC Annual Report.</p> <p>The RMC is responsible for defining comprehensive key risk management policies and practices, which include climate-related risks. The RMC assesses and reviews risks, considering both internal and external factors, which may affect the achievement of our goals in order to ensure that appropriate measures to tackle climate change, which are also in line with our business context, have been put in place.</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	<p>Reviewing and guiding annual budgets</p> <p>Overseeing and guiding employee incentives</p> <p>Reviewing and guiding strategy</p> <p>Overseeing and guiding the development of a transition plan</p> <p>Monitoring the implementation of a transition plan</p> <p>Overseeing the setting of corporate targets</p> <p>Monitoring progress towards corporate targets</p>	<Not Applicable>	<p>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, incentives provided for the management of climate-related issues, transition plans and implementations, annual budgets for related activities, energy efficiency, renewable energy and alternative raw material sourcing endorsement are parts of meeting agendas.</p> <p>Quarterly monitoring and overseeing progress against goals and targets for addressing climate-related issues are taken care by the Corporate Governance and Sustainability Committee.</p>
Scheduled – all meetings	<p>Overseeing major capital expenditures</p> <p>Overseeing acquisitions, mergers, and divestitures</p> <p>Reviewing and guiding the risk management process</p>	<Not Applicable>	<p>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.</p>

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	<p>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.</p> <p>As of January 2023, GC has 10 board members with industry experience on energy and petroleum and 12 members with experience on sustainability-related areas including corporate governance, social and environmental responsibility. For more detail on board metric skills, refer to ISR 2022, PDF page 130-131.</p>	<Not Applicable>	<Not Applicable>

C1.2

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

Position or committee

Chief Executive Officer (CEO)

Climate-related responsibilities of this position

Managing annual budgets for climate mitigation activities
 Monitoring progress against climate-related corporate targets
 Managing climate-related risks and opportunities

Coverage of responsibilities

<Not Applicable>

Reporting line

Reports to the board directly

Frequency of reporting to the board on climate-related issues via this reporting line

More frequently than quarterly

Please explain

The Chief Executive Officer (CEO) chairs the Management Committee (MC) overlooks the Sustainability Development Committee (SDC) and Enterprise Risk Management Committee (ERMC). The SDC and ERMC are management level committees. The MC reports to the Corporate Governance and Sustainability Committee and Risk Management Committee (RMC) which are board level committees.

The SDC updates the MC with progress on climate-related actions approved by the Corporate Governance and Sustainability Committee (e.g. studying the impacts of emerging regulations and standards, developing and implementing GC's climate strategy, and setting climate targets, etc.). The MC then reports climate action implementation progress to the Corporate Governance and Sustainability Committee on a quarterly basis.

Performance and management of climate-related risks and opportunities are reported by the ERMC to the MC for consideration and the MC is responsible for providing recommendations on whether further strategy or action plans are required for the risks and opportunities identified by the ERMC. The MC will also provide updates on the performance and management of climate-related risk and opportunities to the RMC on a quarterly basis.

The CEO is also chairman of the Investment Committee and is responsible for making decisions regarding investments in low carbon projects through the MC.

Overview of GC's climate change management structure is available at: <https://sustainability.pttggroup.com/th/net-zero/decarbonization-governance/climate-change-management-structure>.

Position or committee

Other C-Suite Officer, please specify (Chief Operating Officer - Center of Excellence)

Climate-related responsibilities of this position

Managing climate-related risks and opportunities

Coverage of responsibilities

<Not Applicable>

Reporting line

CEO reporting line

Frequency of reporting to the board on climate-related issues via this reporting line

More frequently than quarterly

Please explain

The Chief Operating Officer of the Center of Excellence (COE) chairs the GC Operational Excellence Committee (GC OpEx) and is responsible for implementing and monitoring climate action plans endorsed by the MC including issues such as GHG reduction target setting, strategy action plans, energy efficiency and alternative raw material sourcing endorsement.

Position or committee

Other, please specify (Enterprise Risk Management Committee)

Climate-related responsibilities of this position

Assessing climate-related risks and opportunities

Managing climate-related risks and opportunities

Coverage of responsibilities

<Not Applicable>

Reporting line

CEO reporting line

Frequency of reporting to the board on climate-related issues via this reporting line

More frequently than quarterly

Please explain

The Enterprise Risk Management Committee (ERMC) is a management level committee that is chaired by the Executive Vice President of Corporate Strategy and comprises Executive Officers across business units. The ERMC reports to the MC and is responsible for risk governance implementation, risk enforcement, and company-wide risk management. The ERMC also ensures that the risk management policy and frameworks are carried out and executed daily for all businesses and subsidiaries in accordance with the risk appetite and risk tolerance approved by the board through the RMC. The ERMC closely monitors performance on risk management (including risk profile, risk indicator, and mitigation plan progress) monthly. Currently, climate change risks are included in GC's corporate risk profile. Therefore, it is required for climate change risk assessment and mitigation progress to be updated to the MC at management level and the RMC at board level at least once every quarter.

Position or committee

Sustainability committee

Climate-related responsibilities of this position

Developing a climate transition plan

Monitoring progress against climate-related corporate targets

Assessing climate-related risks and opportunities

Managing climate-related risks and opportunities

Coverage of responsibilities

<Not Applicable>

Reporting line

CEO reporting line

Frequency of reporting to the board on climate-related issues via this reporting line

More frequently than quarterly

Please explain

The Sustainable Development Committee (SDC) is a management level committee that is chaired by the Executive Vice President of Corporate Sustainability with members comprising the highest-level Executive Officers of business units and support functions. The SDC shall report to the MC which is chaired by the CEO.

The SDC prepares and acts on climate change related issues such as studying the impact of regulations and standards, setting targets, establishing GC's climate transition plan, monitoring sustainability performance, and implementing climate strategies. The SDC also considers the refinement of project investment plans with emphasis 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.

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**

Chief Executive Officer (CEO)

Type of incentive

Monetary reward

Incentive(s)

Bonus – set figure

Performance indicator(s)

Achievement of climate transition plan KPI

Progress towards a climate-related target

Reduction in absolute emissions

Incentive plan(s) this incentive is linked to

Long-Term Incentive Plan

Further details of incentive(s)

CEO, executive, and employee compensation are reflective of performance against set Corporate KPIs. As part of our Operational Excellence Benchmarking, GC sets Corporate KPIs complimentary to our Energy & Climate Strategy and focuses on the area of Energy Efficiency (i.e. energy reduction & GHG emissions reduction).

The criteria used to assess performance is divided into 5 levels and compensation and bonuses will be allocated to relevant executives and employees when KPIs are met at level 3 or above. Specifically, individual KPIs for management-level employees are measured based on performance against the Dow Jones Sustainability Indices (DJSI) where the Company must rank within the Top 5 DJSI companies in the chemical sector. To achieve this, performance against set climate and GHG management strategies are required. DJSI and CDP scores are also related to Corporate KPIs. Starting in 2021, GHG emission targets have been set as a Corporate KPI and is an individual KPI for relevant executives and employees. For example, GHG (Scope 1&2) emissions reduction as 2022 Climate Change KPI was set align with long-term roadmap and target in 2030. CEO, relevant executives, and employees in related functions have GHG (Scope 1&2) emissions KPIs is absolute GHG reduction target attached to their performance reviews.

Monetary reward:

Achievement of individual KPIs is directly related to the performance bonus for management-level employees. 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 six months bonus will be awarded to the individual.

Explain how this incentive contributes to the implementation of your organization's climate commitments and/or climate transition plan

This incentive contributes to the implementation of GC's climate commitments and climate strategy as performance against set KPIs (i.e. energy reduction & GHG emissions reduction) determines the compensation and bonuses of relevant executives and employees.

As part of our climate strategy, GC has set the following GHG reduction targets:

- 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

These targets are determined using baseline emissions from 2020. Target GHG reductions are disclosed in our response to the DJSI and CDP questionnaires. Our achievements and progress of these targets are reflected in our DJSI and CDP scores which are related to Corporate KPIs and individual KPIs for relevant executives and employees. Therefore, the monetary award (i.e. compensation and bonuses), determined by performance against KPIs, is considered an incentive that contributes to the implementation of our climate commitments.

Entitled to incentive

Corporate executive team

Type of incentive

Monetary reward

Incentive(s)

Bonus – set figure

Performance indicator(s)

Progress towards a climate-related target
Reduction in absolute emissions

Incentive plan(s) this incentive is linked to

Long-Term Incentive Plan

Further details of incentive(s)

CEO, executive, and employee compensation are reflective of performance against set Corporate KPIs. As part of our Operational Excellence Benchmarking, GC sets Corporate KPIs complimentary to our Energy & Climate Strategy and focuses on the area of Energy Efficiency (i.e. energy reduction & GHG emissions reduction).

The criteria used to assess performance is divided into 5 levels and compensation and bonuses will be allocated to relevant executives and employees when KPIs are met at level 3 or above. Specifically, individual KPIs for management-level employees are measured based on performance against the Dow Jones Sustainability Indices (DJSI) where the Company must rank within the Top 5 DJSI companies in the chemical sector. To achieve this, performance against set climate and GHG management strategies are required. DJSI and CDP scores are also related to Corporate KPIs. Starting in 2021, GHG emission targets have been set as a Corporate KPI and is an individual KPI for relevant executives and employees. For example, GHG (Scope 1&2) emissions reduction as 2022 Climate Change KPI was set align with long-term roadmap and target in 2030. CEO, relevant executives, and employees in related functions have GHG (Scope 1&2) emissions KPIs is absolute GHG reduction target attached to their performance reviews.

Monetary reward:

Achievement of individual KPIs is directly related to the performance bonus for management-level employees. 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 six months bonus will be awarded to the individual.

Explain how this incentive contributes to the implementation of your organization's climate commitments and/or climate transition plan

This incentive contributes to the implementation of GC's climate commitments and climate strategy as performance against set KPIs (i.e. energy reduction & GHG emissions reduction) determines the compensation and bonuses of relevant executives and employees.

As part of our climate strategy, GC has set the following GHG reduction targets:

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These targets are determined using baseline emissions from 2020. Target GHG reductions are disclosed in our response to the DJSI and CDP questionnaires. Our achievements and progress of these targets are reflected in our DJSI and CDP scores which are related to Corporate KPIs and individual KPIs for relevant executives and employees. Therefore, the monetary award (i.e. compensation and bonuses), determined by performance against KPIs, is considered an incentive that contributes to the implementation of our climate commitments.

Entitled to incentive

All employees

Type of incentive

Monetary reward

Incentive(s)

Bonus – set figure

Performance indicator(s)

Progress towards a climate-related target

Reduction in absolute emissions

Incentive plan(s) this incentive is linked to

Long-Term Incentive Plan

Further details of incentive(s)

CEO, executive, and employee compensation are reflective of performance against set Corporate KPIs. As part of our Operational Excellence Benchmarking, GC sets Corporate KPIs complimentary to our Energy & Climate Strategy and focuses on the area of Energy Efficiency (i.e. energy reduction & GHG emissions reduction).

The criteria used to assess performance is divided into 5 levels and compensation and bonuses will be allocated to relevant executives and employees when KPIs are met at level 3 or above. Specifically, individual KPIs for management-level employees are measured based on performance against the Dow Jones Sustainability Indices (DJSI) where the Company must rank within the Top 5 DJSI companies in the chemical sector. To achieve this, performance against set climate and GHG management strategies are required. DJSI and CDP scores are also related to Corporate KPIs. Starting in 2021, GHG emission targets have been set as a Corporate KPI and is an individual KPI for relevant executives and employees. For example, GHG (Scope 1&2) emissions reduction as 2022 Climate Change KPI was set align with long-term roadmap and target in 2030. CEO, relevant executives, and employees in related functions have GHG (Scope 1&2) emissions KPIs is absolute GHG reduction target attached to their performance reviews.

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Achievement of individual KPIs is directly related to the performance bonus for management-level employees. 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 six months bonus will be awarded to the individual.

Explain how this incentive contributes to the implementation of your organization's climate commitments and/or climate transition plan

This incentive contributes to the implementation of GC's climate commitments and climate strategy as performance against set KPIs (i.e. energy reduction & GHG emissions reduction) determines the compensation and bonuses of relevant executives and employees.

As part of our climate strategy, GC has set the following GHG reduction targets:

- 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

These targets are determined using baseline emissions from 2020. Target GHG reductions are disclosed in our response to the DJSI and CDP questionnaires. Our achievements and progress of these targets are reflected in our DJSI and CDP scores which are related to Corporate KPIs and individual KPIs for relevant executives and employees. Therefore, the monetary award (i.e. compensation and bonuses), determined by performance against KPIs, is considered an incentive that contributes to the implementation of our climate commitments.

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 transitioning towards a low carbon economy using the IEA Stated Policies (STEPS) and IEA Net Zero Emissions 2050 (NZE) scenarios. The STEPS scenario represents an above 2C which is based on current policies and targets that governments have announced including the Nationally Determined Contributions (NDC) while the NZE represents a 'well below 2C' scenario where net zero commitments are achieved by 2050. Assessment of transition risks cover regulatory, market, technology, legal, and reputational drivers. Risk severity of both transition and physical risks are assessed and identified 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 as substantive impact. 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 hinders 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 timeframe. This process is separated from our traditional Enterprise Management Risk process due to the high uncertainty of identified risks in the 10-30 years timeframe. 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 timeframe.

(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 45,000 and 15,000 tons 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 analyzed 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) 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 still under the drafting process. The severity of climate change due to global warming has intensified, leading to various risks, for example, severe natural disasters, droughts, etc. Many countries have issued policies, regulations, and laws to expedite a solution for global warming in response to COP27. As GC's operations, including refinery, aromatics and olefins in Thailand are carbon-intensive operations, we have established our climate goals in alignment with national targets. By 2030, GC aims to reduce scope 1 and 2 GHG emissions by 20%, based on a Business-as-usual scenario. Even though the GHG reduction target is not mandated to GC directly, PTT (GC's mother company) as the national oil company is mandated by government directly. Therefore, GC shall also follow this target. To manage our progress against this target, GC monitors and assesses all risk factors that may impact our performance monthly.
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. As an example of an emerging regulation, Thailand is in the process of developing the foundations for the implementation of a national carbon price, using World Bank funds, which will lead to the development of a mandatory emissions trading scheme. To prepare for this emerging 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 GHG reduction approaches for the petrochemical sector using the carbon market mechanism in Thailand. To increase management capacity and reduce GHG emissions in the organization, GC also included climate change regulations as one of GC's risk factors in the corporate risk assessment process conducted by the Enterprise Risk Management Committee. In the case where we cannot limit CO2 emissions within our allocated quota, our operational cost, reflected in emissions reduction and carbon credit costs, will increase.
Technology	Relevant, always included	Energy efficiency process technologies play a crucial role in our progress towards achieving our climate commitments and GHG reduction targets. Because GC (at Rayong, Thailand) has refinery, olefins and aromatics plants which are carbon-intensive operations, GC (at Rayong, Thailand) is studying technological improvements or innovations that support the transition to a lower-carbon and 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. However, installation of equipment or improvement of production process to reduce GHG emissions may result in higher operating cost. GC included climate change related technologies as one of GC's risk factors in the corporate risk assessment process conducted by the Enterprise Risk Management Committee. Our operational costs will increase due to research and development costs associated with the studying of CO2 based chemicals, investments in renewable energy, and investments in other energy-efficiency technologies.
Legal	Relevant, always included	GC's legal department is monitoring and evaluating the current climate-related laws and regulations, such as carbon tax or carbon trading scheme, in every country we operate in. Identified legal risks, including laws and liabilities, are raised up to the management level and the Enterprise Risk Management Committee. Once the issue is active, updated laws and regulations are sent to employees via e-mail. Employees can also access the Legal-online system to check new laws and regulations. Example: By 2023, Thailand will announce National Climate Change Acts which will cover topics such as 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 in a 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 the long-term environmental impacts of single-use plastics, 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 risk factors in the corporate risk assessment process conducted by the Enterprise Risk Management Committee. During 2020 - 2030, Thailand, China and other Asian countries aim to achieve a reduction in single-use plastics. If GC cannot adapt to this change, our revenue will be directly impacts.
Reputation	Relevant, always included	Reputation is always included as one of GC's risk factors in the corporate risk assessment process conducted by the Enterprise Risk Management Committee. We realized that as we transition towards a low-carbon economy, awareness on single-use plastics and the eventual expectation to limit or ban their use will be inevitable. GC Thailand, as a leading petrochemical company in South East Asia, will be expected to drive this transition and failure to meet climate commitments and emissions reductions will impact our ability to retain 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. This will impact 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
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Primary potential financial impact

Increased indirect (operating) costs

Climate risk type mapped to traditional financial services industry risk classification

<Not Applicable>

Company-specific description

GC included climate change regulations as one of GC's corporate risk factors in the corporate risk assessment process conducted by the Enterprise Risk Management Committee. Thailand is currently in the process of developing regulations on national carbon price which will eventually culminate in a mandatory emissions trading scheme. In 2022, energy consumption was approximately 115.5 million GJ with 87.6% being energy from a non-renewable source. Therefore, the additional costs arising from the implementation of carbon pricing regulations are expected to be significant given GC's operations are energy intensive. Hence, we plan to minimize the impacts associated with this risk through optimizing energy use to maximize energy efficiency and reduce GHG remissions. We have also set an internal carbon price and applied it in the consideration of our investments and GHG reduction projects.

Time horizon

Long-term

Likelihood

Likely

Magnitude of impact

High

Are you able to provide a potential financial impact figure?

Yes, an estimated range

Potential financial impact figure (currency)

<Not Applicable>

Potential financial impact figure – minimum (currency)

15838000000

Potential financial impact figure – maximum (currency)

110791000000

Explanation of financial impact figure

In our transition scenario analysis, we quantified the potential impacts from the implementation of a carbon pricing regulation under the IEA's Stated Policies (STEPS) scenario and Net Zero Emissions 2050 (NZE) scenario.

As part of our assessment, we have quantified the potential financial impacts from the implementation of a carbon pricing regulation by applying the projected carbon costs under the STEPS and NZE 2050 scenarios on GC's projected GHG emissions under a business-as-usual scenario to obtain the potential carbon tax costs (i.e. the costs arising from the carbon pricing regulation that must be shouldered by GC should the regulation be implemented). We have used carbon tax forecast from the IEA World Energy Outlook 2022 dataset to inform our assessment.

The results of our transition scenario analysis indicated the least impacts from the implementation of a carbon pricing regulation under the STEPS scenario in 2030 and the largest impacts under the NZE scenario in 2050. In 2030, carbon tax costs were 15,838 million THB (minimum impact) under the STEPS scenario and 30,457 million THB under the NZE scenario. In 2050, the carbon tax costs were 32,622 million THB under the STEPS scenario and 110,791 million THB (maximum impact) under the NZE scenario. Therefore, we determined the potential financial impacts as a range between 15,838 million THB and 110,791 million THB which reflects the minimum and maximum impacts that may occur from the implementation of a carbon pricing regulation.

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 2022, GC has carried out numerous projects to reduce greenhouse gas emissions and enhance energy efficiency. Highlight projects include energy conservation projects, Propane Dehydrogenation (PDH) Optimization Model, Floating Solar, Reduce Water Injection at Oxidation Unit, and Wastewater Reverse Osmosis (WWRO). Total investment is about 261 million THB, reduce 59,903 tons CO2 equivalent per year, and reduce cost of about 471.6 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 THB;

- 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 invested per year.
- 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 per year.

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

Since 2018, consumers have become environmentally conscious and aware of circular economy principles with customers having preference for recycled plastics and biofuel products and reduced demands for virgin plastic and high carbon products. GC has taken the management actions and direction into account to minimize transition risk impacts and capture arising opportunities 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 increasing accessibility of renewable energy which may affect our petroleum products and business. Therefore, GC aims to seize the opportunity by expanding the Polymer product portfolio. GC targets to increase high-performance and green products to 35% of the products portfolio by 2030 to enable continuous business growth while lowering GHG emissions.

Time horizon

Long-term

Likelihood

Likely

Magnitude of impact

Medium

Are you able to provide a potential financial impact figure?

Yes, an estimated range

Potential financial impact figure (currency)

<Not Applicable>

Potential financial impact figure – minimum (currency)

17639000000

Potential financial impact figure – maximum (currency)

18489000000

Explanation of financial impact figure

GC expects to capture this opportunity raised through motivating and enhancing the environmental aspects of our existing green products while moving toward achieving Net Zero emissions. Therefore, GC plans to increase investments in the development of green products and sustainability-driven solutions that provides sustainability value-added to users.

In our transition scenario analysis, we quantified the potential opportunities ("impacts") from the expected growth in the demand for green products, specifically biofuels, under the IEA's STEPS and NZE scenarios. As part of our assessment, we have applied the projected growth in biofuel demand provided in the IEA World Energy Outlook 2022 dataset under the STEPS and NZE 2050 scenarios on GC's biofuel production and estimated the resulting revenue that would arise. The results indicated the least impacts under the NZE scenario in 2050 and the largest impacts under the NZE scenario in 2030. In 2030, forecasted revenue from biofuels were 17,916 million THB under the STEPS scenario and 18,489 million THB (maximum impact) in the NZE scenario. In 2050, the forecasted revenue from biofuels were 18,270 million THB under the STEPS scenario and 17,639 million THB (minimum impact) in the NZE scenario. Therefore, we determined the potential financial impacts as a range between 17,639 million THB and 18,489 million THB which reflects the minimum and maximum impacts that may occur from the change in biofuel demand. In addition, the total initial financial opportunity from green products is at least 87 billion THB per year.

Cost to realize opportunity

77000000000

Strategy to realize opportunity and explanation of cost calculation

Situation:

At present, environmental awareness of circular economy and environmental impact is a growing trend that is contributing to the decline in single-use plastic consumption and an increase in that purchase of products made from renewable raw materials or recycled plastic. This has resulted in lower demands for plastic pellets, in the period of two to three years, which affected GC's revenue directly.

Objective:

Aligning with GC's Net Zero target by 2050, GC has a long-term plan to shift our business in line with the low-carbon economy 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 to continue our business while lowering environment impacts.

Actions:

GC plans to increase investments in the development of low carbon products, sustainability-driven solutions, and technologies that provide 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 2022, GC generated revenue of 22,250 million THB from green chemicals & bioplastics, 118,201 million THB from performance material & chemical products, and 22.5 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 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 climate transition plan that aligns with a 1.5°C world?

Row 1

Climate transition plan

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

Publicly available climate transition plan

Yes

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

Our climate 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 October 2021, we released our net zero target, 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.pttgcgroup.com/en/investor-relations/document/presentations>)

Frequency of feedback collection

More frequently than annually

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

PTT GC_TCFD 2023 (New).pdf
GC AGM 2022 Slide.pdf
PTTGC_Decarbonization Pathway.pdf
GC AGM 2023 Slide (New).pdf

Explain why your organization does not have a climate 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
Transition scenarios	IEA NZE 2050	Company-wide	<Not Applicable>	<p>Parameters: The transition scenario analysis focused on carbon pricing regulations as an emerging risk that may have significant impacts on GC’s businesses and the change in biofuel demands.</p> <p>Assumptions: The IEA Net Zero Emissions 2050 (NZE) scenario reflects a pathway for the global energy sector to achieve net zero emissions and limit global warming to 1.5 °C in 2100. Under this scenario, advanced economies are expected to reach net zero emissions ahead of other economies. The uptake of all available technologies and emissions reduction options is dictated by the costs, technology maturity, policy preferences, and market and country conditions.</p> <ol style="list-style-type: none"> 1. Carbon price – Change in carbon price increase over time with change being increasingly rapid. 2. Biofuel demand – Increase in biofuel demand/consumption with a peak at around 2030. However, there will be gradual decline as consumers shift away from biofuels to electrification. <p>Analytical choices: Timeframe: 2030 - 2050 Conducted both quantitative and qualitative analysis Data sources: IEA World Energy Outlook 2022 – cost of carbon, biofuel consumption</p>
Transition scenarios	IEA STEPS (previously IEA NPS)	Company-wide	<Not Applicable>	<p>Parameters: The transition scenario analysis focused on carbon pricing regulations as an emerging risk that may have significant impacts on GC’s businesses and the change in biofuel demands.</p> <p>Assumptions: The IEA STEPS scenario reflects efforts to reduce emissions which are driven by current regulations and policies including Nationally Determined Contributions under the Paris Agreement. Policies are not expected to strengthen or weaken in the future. Therefore, there is no major additional steer from policy makers. In this scenario, global temperatures are limited at 2.6°C in 2100.</p> <ol style="list-style-type: none"> 1. Carbon price – carbon price mechanisms will be implemented but much less strict compared to estimated carbon prices under the NZE scenario 2. Biofuel demand – Increase in biofuel demand/consumption but significantly slower relative to the increase in NZE. In STEPS, biofuel demand/consumption does not peak but continue to increase through 2050. <p>Analytical choices: Timeframe: 2030 - 2050 Conducted both quantitative and qualitative analysis Data sources: IEA World Energy Outlook 2022 – cost of carbon, biofuel consumption</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: Aqeduct, 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 Aqeduct, 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 Aqeduct, 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; IEA Stated Policies (STEPS) and IEA Net Zero Emissions 2050 (NZE).

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 the IEA, including the Stated Policies (STEPS) and Net Zero Emissions 2050 (NZE) scenarios. The STEPS and NZE cases was based on assumptions leading to global warming of 1.5°C and 2.6°C by 2100, respectively. The assessment focused on the impacts of carbon pricing regulations and changes in biofuel demand on GC's business.

Results indicate that additional costs arising from the implementation of carbon pricing regulations may be significant by impacting net profit by -18% under the STEPS scenario and -61% under the NZE scenario in 2050. We also quantified the financial opportunity that may arise from the growth in demand for green products as clean energy sources, including biofuels, are crucial resources in the transition towards a low-carbon economy. The initial financial opportunity from green products is at least 87 billion THB per year. In the short-term (i.e. 2030), the expected revenue growth from biofuel products is 17,916 million THB under the STEPS scenario and 18,489 million THB in the NZE scenario.

To minimize risks and maximize opportunities from the transition towards a low carbon economy, 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 (14-113 USD/tCO2e) & 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 2022, GC products (out of 156 products) are certified with Carbon Footprint of Product (CFP) and Carbon Footprint Reduction (CFR) by 100% and 55%, respectively.</p> <p>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 2022, the project has collected a cumulative 600 tons of PET/HDPE bottles since the start of the project and contributed to the reduction of over 1,400 tCO2e of GHG emissions.</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" comprises</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, growth in demand for low carbon products (including biofuels) was identified as an opportunity for GC. Therefore, we have aligned our innovation strategy with our business directions and action plans by focusing on process efficiency enhancement, product value creation, and create new businesses 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 2022, 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 2022, product innovations to highlight include Post-Consumer Recycled (PCR) Resin, Development of High Flow Rotational Molding Grade Plastic, HDPE for Truck-bed liner. 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 2022, highlight process innovations include Furnace Management Program (FMP) and Byproduct Upgrading.
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 2022, GC has conducted 94 energy conservation projects, focusing on enhancing energy efficiency and optimization. Since 2012-2022, GC has accumulatively reduced greenhouse gas emissions from Energy Conservation Projects by 898,802 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 1.12 million units of electricity per year and GHG remissions reduction by 564 tons CO2e per year. 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>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 billion THB per year, in the short-term. As a result, GC is able to create rPET and rHDPE pellets with a production capacity of 45,000 tons per annum and 15,000 tons per annum, respectively. The revenue received from upcycling product in 2022 is 22.5 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 THB, with total GHG emission reduction of 564 tons CO2e per year and reduction of energy purchased costs of approximately 400,000 THB 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 climate transition?

	Identification of spending/revenue that is aligned with your organization's climate transition	Indicate the level at which you identify the alignment of your spending/revenue with a sustainable finance taxonomy
Row 1	Yes, we identify alignment with our climate transition plan	<Not Applicable>

C3.5a

(C3.5a) Quantify the percentage share of your spending/revenue that is aligned with your organization's climate transition.

Financial Metric

CAPEX

Type of alignment being reported for this financial metric

Alignment with our climate transition plan

Taxonomy under which information is being reported

<Not Applicable>

Objective under which alignment is being reported

<Not Applicable>

Amount of selected financial metric that is aligned in the reporting year (unit currency as selected in C0.4)

384362489.37

Percentage share of selected financial metric aligned in the reporting year (%)

1.8

Percentage share of selected financial metric planned to align in 2025 (%)

22.52

Percentage share of selected financial metric planned to align in 2030 (%)

24.21

Describe the methodology used to identify spending/revenue that is aligned

Identify by all project benefit that reduce company GHG emissions.

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

Is this a science-based target?

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

Target ambition

<Not Applicable>

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)

1961434

Base year Scope 3, Category 1: Purchased goods and services emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 2: Capital goods emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 3: Fuel-and-energy-related activities (not included in Scopes 1 or 2) emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 4: Upstream transportation and distribution emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 5: Waste generated in operations emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 6: Business travel emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 7: Employee commuting emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 8: Upstream leased assets emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 9: Downstream transportation and distribution emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 10: Processing of sold products emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 11: Use of sold products emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 12: End-of-life treatment of sold products emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 13: Downstream leased assets emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 14: Franchises emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 15: Investments emissions covered by target (metric tons CO2e)

<Not Applicable>

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

<Not Applicable>

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

<Not Applicable>

Base year total 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)

7748501

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, Category 1: Purchased goods and services emissions covered by target as % of total base year emissions in Scope 3, Category 1:

Purchased goods and services (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 2: Capital goods emissions covered by target as % of total base year emissions in Scope 3, Category 2: Capital goods (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 3: Fuel-and-energy-related activities (not included in Scopes 1 or 2) emissions covered by target as % of total base year emissions in Scope 3, Category 3: Fuel-and-energy-related activities (not included in Scopes 1 or 2) (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 4: Upstream transportation and distribution covered by target as % of total base year emissions in Scope 3, Category 4: Upstream transportation and distribution (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 5: Waste generated in operations emissions covered by target as % of total base year emissions in Scope 3, Category 5: Waste generated in operations (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 6: Business travel emissions covered by target as % of total base year emissions in Scope 3, Category 6: Business travel (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 7: Employee commuting covered by target as % of total base year emissions in Scope 3, Category 7: Employee commuting (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 8: Upstream leased assets emissions covered by target as % of total base year emissions in Scope 3, Category 8: Upstream leased assets (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 9: Downstream transportation and distribution emissions covered by target as % of total base year emissions in Scope 3, Category 9: Downstream transportation and distribution (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 10: Processing of sold products emissions covered by target as % of total base year emissions in Scope 3, Category 10: Processing of sold products (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 11: Use of sold products emissions covered by target as % of total base year emissions in Scope 3, Category 11: Use of sold products (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 12: End-of-life treatment of sold products emissions covered by target as % of total base year emissions in Scope 3, Category 12: End-of-life treatment of sold products (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 13: Downstream leased assets emissions covered by target as % of total base year emissions in Scope 3, Category 13: Downstream leased assets (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 14: Franchises emissions covered by target as % of total base year emissions in Scope 3, Category 14: Franchises (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 15: Investments emissions covered by target as % of total base year emissions in Scope 3, Category 15: Investments (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Other (upstream) emissions covered by target as % of total base year emissions in Scope 3, Other (upstream) (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Other (downstream) emissions covered by target as % of total base year emissions in Scope 3, Other (downstream) (metric tons CO2e)

<Not Applicable>

Base year total 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]

6198800.8

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

6148622

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

2112327

Scope 3, Category 1: Purchased goods and services emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 2: Capital goods emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 3: Fuel-and-energy-related activities (not included in Scopes 1 or 2) emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 4: Upstream transportation and distribution emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 5: Waste generated in operations emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 6: Business travel emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 7: Employee commuting emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 8: Upstream leased assets emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 9: Downstream transportation and distribution emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 10: Processing of sold products emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 11: Use of sold products emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 12: End-of-life treatment of sold products emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 13: Downstream leased assets emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 14: Franchises emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 15: Investments emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

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

<Not Applicable>

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

<Not Applicable>

Total 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)

8260949

Does this target cover any land-related emissions?

No, it does not cover any land-related emissions (e.g. non-FLAG SBT)

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

-33.0675571959015

Target status in reporting year

Underway

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 2022, GC has a total GHG emission scope 1 and 2 of 8,260,949 ton CO2e, which is higher than the total GHG emission in 2020, 7,748,501 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 2022, 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 51,653 and 29,042 tons CO2 equivalent, respectively.

GC has operated the business towards achieving net zero target. GC is continuously improving energy efficiency for entire organization. In 2022, GC has conducted 94 energy conservation projects, reducing emission around 59,903 tons CO2 equivalent per year. Despite the expansion of businesses, GC will continue to focus on improving energy efficiency in the production process for all current and upcoming sites, which has been significant to GC's emission reductions.

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

<Not Applicable>

Target reference number

Abs 2

Is this a science-based target?

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

Target ambition

<Not Applicable>

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)

1961434

Base year Scope 3, Category 1: Purchased goods and services emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 2: Capital goods emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 3: Fuel-and-energy-related activities (not included in Scopes 1 or 2) emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 4: Upstream transportation and distribution emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 5: Waste generated in operations emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 6: Business travel emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 7: Employee commuting emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 8: Upstream leased assets emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 9: Downstream transportation and distribution emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 10: Processing of sold products emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 11: Use of sold products emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 12: End-of-life treatment of sold products emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 13: Downstream leased assets emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 14: Franchises emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 15: Investments emissions covered by target (metric tons CO2e)

<Not Applicable>

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

<Not Applicable>

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

<Not Applicable>

Base year total 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)

7748501

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, Category 1: Purchased goods and services emissions covered by target as % of total base year emissions in Scope 3, Category 1:

Purchased goods and services (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 2: Capital goods emissions covered by target as % of total base year emissions in Scope 3, Category 2: Capital goods (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 3: Fuel-and-energy-related activities (not included in Scopes 1 or 2) emissions covered by target as % of total base year emissions in Scope 3, Category 3: Fuel-and-energy-related activities (not included in Scopes 1 or 2) (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 4: Upstream transportation and distribution covered by target as % of total base year emissions in Scope 3, Category 4: Upstream transportation and distribution (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 5: Waste generated in operations emissions covered by target as % of total base year emissions in Scope 3, Category 5: Waste generated in operations (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 6: Business travel emissions covered by target as % of total base year emissions in Scope 3, Category 6: Business travel (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 7: Employee commuting covered by target as % of total base year emissions in Scope 3, Category 7: Employee commuting (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 8: Upstream leased assets emissions covered by target as % of total base year emissions in Scope 3, Category 8: Upstream leased assets (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 9: Downstream transportation and distribution emissions covered by target as % of total base year emissions in Scope 3, Category 9: Downstream transportation and distribution (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 10: Processing of sold products emissions covered by target as % of total base year emissions in Scope 3, Category 10: Processing of sold products (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 11: Use of sold products emissions covered by target as % of total base year emissions in Scope 3, Category 11: Use of sold products (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 12: End-of-life treatment of sold products emissions covered by target as % of total base year emissions in Scope 3, Category 12: End-of-life treatment of sold products (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 13: Downstream leased assets emissions covered by target as % of total base year emissions in Scope 3, Category 13: Downstream leased assets (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 14: Franchises emissions covered by target as % of total base year emissions in Scope 3, Category 14: Franchises (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 15: Investments emissions covered by target as % of total base year emissions in Scope 3, Category 15: Investments (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Other (upstream) emissions covered by target as % of total base year emissions in Scope 3, Other (upstream) (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Other (downstream) emissions covered by target as % of total base year emissions in Scope 3, Other (downstream) (metric tons CO2e)

<Not Applicable>

Base year total 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)

6148622

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

2112327

Scope 3, Category 1: Purchased goods and services emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 2: Capital goods emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 3: Fuel-and-energy-related activities (not included in Scopes 1 or 2) emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 4: Upstream transportation and distribution emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 5: Waste generated in operations emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 6: Business travel emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 7: Employee commuting emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 8: Upstream leased assets emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 9: Downstream transportation and distribution emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 10: Processing of sold products emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 11: Use of sold products emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 12: End-of-life treatment of sold products emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 13: Downstream leased assets emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 14: Franchises emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 15: Investments emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

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

<Not Applicable>

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

<Not Applicable>

Total 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)

8260949

Does this target cover any land-related emissions?

No, it does not cover any land-related emissions (e.g. non-FLAG SBT)

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

-6.6135114391803

Target status in reporting year

Underway

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 2022, GC has a total GHG emission scope 1 and 2 of 8,260,949 ton CO2e, which is higher than the total GHG emission in 2020, 7,748,501 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 2022, 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 51,653 and 29,042 tons CO2 equivalent, respectively.

GC has operated the business towards achieving net zero target. GC is continuously improving energy efficiency for entire organization. In 2022, GC has conducted 94 energy conservation projects, reducing emission around 59,903 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

Is this a science-based target?

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

Target ambition

<Not Applicable>

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, Category 1: Purchased goods and services emissions covered by target (metric tons CO2e)

5707398

Base year Scope 3, Category 2: Capital goods emissions covered by target (metric tons CO2e)

258236

Base year Scope 3, Category 3: Fuel-and-energy-related activities (not included in Scopes 1 or 2) emissions covered by target (metric tons CO2e)

1148852

Base year Scope 3, Category 4: Upstream transportation and distribution emissions covered by target (metric tons CO2e)

588896

Base year Scope 3, Category 5: Waste generated in operations emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 6: Business travel emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 7: Employee commuting emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 8: Upstream leased assets emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 9: Downstream transportation and distribution emissions covered by target (metric tons CO2e)

31904

Base year Scope 3, Category 10: Processing of sold products emissions covered by target (metric tons CO2e)

2404437

Base year Scope 3, Category 11: Use of sold products emissions covered by target (metric tons CO2e)

25069677

Base year Scope 3, Category 12: End-of-life treatment of sold products emissions covered by target (metric tons CO2e)

589289

Base year Scope 3, Category 13: Downstream leased assets emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 14: Franchises emissions covered by target (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 15: Investments emissions covered by target (metric tons CO2e)

2905669

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

<Not Applicable>

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

<Not Applicable>

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

38704358

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

38704358

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, Category 1: Purchased goods and services emissions covered by target as % of total base year emissions in Scope 3, Category 1:

Purchased goods and services (metric tons CO2e)

100

Base year Scope 3, Category 2: Capital goods emissions covered by target as % of total base year emissions in Scope 3, Category 2: Capital goods (metric tons CO2e)

100

Base year Scope 3, Category 3: Fuel-and-energy-related activities (not included in Scopes 1 or 2) emissions covered by target as % of total base year emissions in Scope 3, Category 3: Fuel-and-energy-related activities (not included in Scopes 1 or 2) (metric tons CO2e)

100

Base year Scope 3, Category 4: Upstream transportation and distribution covered by target as % of total base year emissions in Scope 3, Category 4: Upstream transportation and distribution (metric tons CO2e)

100

Base year Scope 3, Category 5: Waste generated in operations emissions covered by target as % of total base year emissions in Scope 3, Category 5: Waste generated in operations (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 6: Business travel emissions covered by target as % of total base year emissions in Scope 3, Category 6: Business travel (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 7: Employee commuting covered by target as % of total base year emissions in Scope 3, Category 7: Employee commuting (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 8: Upstream leased assets emissions covered by target as % of total base year emissions in Scope 3, Category 8: Upstream leased assets (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 9: Downstream transportation and distribution emissions covered by target as % of total base year emissions in Scope 3, Category 9: Downstream transportation and distribution (metric tons CO2e)

100

Base year Scope 3, Category 10: Processing of sold products emissions covered by target as % of total base year emissions in Scope 3, Category 10: Processing of sold products (metric tons CO2e)

100

Base year Scope 3, Category 11: Use of sold products emissions covered by target as % of total base year emissions in Scope 3, Category 11: Use of sold products (metric tons CO2e)

100

Base year Scope 3, Category 12: End-of-life treatment of sold products emissions covered by target as % of total base year emissions in Scope 3, Category 12: End-of-life treatment of sold products (metric tons CO2e)

100

Base year Scope 3, Category 13: Downstream leased assets emissions covered by target as % of total base year emissions in Scope 3, Category 13: Downstream leased assets (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 14: Franchises emissions covered by target as % of total base year emissions in Scope 3, Category 14: Franchises (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Category 15: Investments emissions covered by target as % of total base year emissions in Scope 3, Category 15: Investments (metric tons CO2e)

100

Base year Scope 3, Other (upstream) emissions covered by target as % of total base year emissions in Scope 3, Other (upstream) (metric tons CO2e)

<Not Applicable>

Base year Scope 3, Other (downstream) emissions covered by target as % of total base year emissions in Scope 3, Other (downstream) (metric tons CO2e)

<Not Applicable>

Base year total 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

99.9

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]

19352179

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, Category 1: Purchased goods and services emissions in reporting year covered by target (metric tons CO2e)

5642268

Scope 3, Category 2: Capital goods emissions in reporting year covered by target (metric tons CO2e)

46032

Scope 3, Category 3: Fuel-and-energy-related activities (not included in Scopes 1 or 2) emissions in reporting year covered by target (metric tons CO2e)

978957

Scope 3, Category 4: Upstream transportation and distribution emissions in reporting year covered by target (metric tons CO2e)

540983

Scope 3, Category 5: Waste generated in operations emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 6: Business travel emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 7: Employee commuting emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 8: Upstream leased assets emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 9: Downstream transportation and distribution emissions in reporting year covered by target (metric tons CO2e)

22314

Scope 3, Category 10: Processing of sold products emissions in reporting year covered by target (metric tons CO2e)

2475156

Scope 3, Category 11: Use of sold products emissions in reporting year covered by target (metric tons CO2e)

22798563

Scope 3, Category 12: End-of-life treatment of sold products emissions in reporting year covered by target (metric tons CO2e)

990880

Scope 3, Category 13: Downstream leased assets emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 14: Franchises emissions in reporting year covered by target (metric tons CO2e)

<Not Applicable>

Scope 3, Category 15: Investments emissions in reporting year covered by target (metric tons CO2e)

1808187

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

<Not Applicable>

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

<Not Applicable>

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

35303340

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

35303340

Does this target cover any land-related emissions?

No, it does not cover any land-related emissions (e.g. non-FLAG SBT)

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

17.5743413700338

Target status in reporting year

Underway

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 other relevant categories, including Category 5 Waste Generated in Operations, Category 6 Business Travel, and Category 7 Employee Commuting resulted in the exclusion of 0.14% of GC's total scope 3 emissions. Additionally, for Category 2 Capital goods in this year, GC used an estimated value from FY2021, which was verified by external party instead, due to GC has no data in 2020, and we will update the value of base year (2020) in the next year to align with other categories. However, the estimated difference of emissions is insignificant. As

these sources of emissions combined do not reach the significant threshold of 5% as defined by the Greenhouse Gas Protocol, they were excluded from our scope 3 target. 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 2022, GC's total GHG emission scope 3 was 35,303,340 ton CO₂e which was lower than the total GHG emission in 2020 of 38,446,123 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 social distancing measures. For example, China continued its stringent zero-COVID policy resulting in a slowdown in crude oil demand causing the GC to reduce oil fuel production. Also, another factor was the Russia-Ukraine conflict which caused a decline in global oil demand. 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 FY2022 have reduced GHG emissions by approximately 15% from Y2020. Also, we plan to keep developing our low-carbon products to be highly efficient in the use phase, improving on transportation of both upstream and downstream, and continuing to increase our sourcing of zero-carbon electricity. The progress curve is likely to be exponential.

In 2022, GC's implementation to reduce GHG emission in scope 3 are 1) Category 15 - to adjust business portfolio by investing on potential low-carbon businesses such as selling Global Power Synergy PCL common shares to reduce power generation business and acquiring specialty chemical supplier Allnex 2) Category 11 - to decrease the production of fossil-based fuel to reduce use phase emission 3) Categories 3 - to shift from utilization of high carbon-intensive fuel to lower carbon-intensive fuel e.g. use LNG and natural gas. As a result, the total GHG emission in scope 3 of these categories has been reduced around 3.54 million tCO₂e comparing to base year. 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 two 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	222	6210028
To be implemented*	90	36737
Implementation commenced*	0	0
Implemented*	97	101424
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)

100

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)

926725

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

5895000

Payback period

4-10 years

Estimated lifetime of the initiative

6-10 years

Comment

GC had launched 4 energy saving projects by Installing of LED lighting and reinforcing system to increase energy efficiency. We have energy saving approximately 339.73 MWh, GHG emission reduction 100.03 ton CO2e. The total investment cost of these programs was 5.9 million Baht, resulting in cost savings of 0.9 million Baht.

Initiative category & Initiative type

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

Estimated annual CO2e savings (metric tonnes CO2e)

7781

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)

22028147

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

44339000

Payback period

1-3 years

Estimated lifetime of the initiative

6-10 years

Comment

GC had launched 4 energy saving projects (Waste heat recovery), which saved approximately 16,936.61 MWh, GHG emission reduction 7,780.79 ton CO2e. The total investment cost of these programs was 44.3 million Baht, resulting in cost savings of 22.0 million Baht.

Initiative category & Initiative type

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

Estimated annual CO2e savings (metric tonnes CO2e)

51653

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)

176042217

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

7940000

Payback period

<1 year

Estimated lifetime of the initiative

16-20 years

Comment

GC had launched 66 energy saving projects (Process optimization), which saved approximately 171,450.20 MWh, GHG emission reduction 51,652.94 ton CO2e. The total investment cost of these programs was 7.9 million Baht, resulting in cost savings of 176.0 million Baht.

Initiative category & Initiative type

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

Estimated annual CO2e savings (metric tonnes CO2e)

29042

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)

153180000

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

198950000

Payback period

1-3 years

Estimated lifetime of the initiative

16-20 years

Comment

GC had launched 5 energy saving projects (Machine/equipment replacement), which saved approximately 141,397.93 MWh, GHG emission reduction 29,042.48 ton CO2e. The total investment cost of these programs was 199.0 million Baht, resulting in cost savings of 153.2 million Baht.

Initiative category & Initiative type

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

Estimated annual CO2e savings (metric tonnes CO2e)

11466

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)

32045401

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

9610000

Payback period

<1 year

Estimated lifetime of the initiative

3-5 years

Comment

GC had launched 10 energy saving projects (Smart control system), which saved approximately 55,630.94 MWh, GHG emission reduction 11,465.84 ton CO2e. The total investment cost of these programs was 9.6 million Baht, resulting in cost savings of 32.0 million Baht.

Initiative category & Initiative type

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

Estimated annual CO2e savings (metric tonnes CO2e)

294

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)

140000

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

1400000

Payback period

4-10 years

Estimated lifetime of the initiative

6-10 years

Comment

GC had launched 5 energy saving projects (Motor and drives), which saved approximately 1,940.40 MWh, GHG emission reduction 294.10 ton CO2e . The total investment cost of these programs was 1.4 million Baht, resulting in cost savings of 0.1 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 2022, 156 GC's products completed product Life-cycle assessment (LCA) and certified for Carbon Footprint of Products (CFP), by which 86 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

0.163

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 722,789 metric tonCO2e and total CFR products in FY22 was = 4,431,689 tonne, therefore the estimate avoided emissions per functional unit is $722,789 / 4,431,689 = 0.1630$ metric tonCO2e/tonne CFR products.

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

88

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	Yes, a change in methodology	GHG recalculation of the base year of 2020 and year 2021 has been recalculated as follows: 1) Quantification methodologies updated, change the heating value of steam method, then calculation approach updated for GC 11 (LDPE), GC 11 (LLDPE), GC 18 (Phenol) in both 2020 and 2021. 2) Quantification methodologies updated. Stationary fuel has changed to carbon content method, then calculation approach updated for GC2 (OLE4) in 2021. 3) Any error and omission of data for Stationary Fuel Combustion has been addressed for GC 19 (GCO) in 2021. 4) Quantification methodologies updated; new operating sites such as GC Estate, and Envicco is added in 2022.

C5.1c

(C5.1c) Have your organization's base year emissions and past years' emissions been recalculated as a result of any changes or errors reported in C5.1a and/or C5.1b?

	Base year recalculation	Scope(s) recalculated	Base year emissions recalculation policy, including significance threshold	Past years' recalculation
Row 1	Yes	Scope 2, market-based Scope 3	GC has developed a base year emissions recalculation policy in accordance with ISO14064-1. GC's recalculation policy outlines methodology of appropriate recalculation practices that includes significant threshold of conducting recalculation, reasons for the recalculation, and guideline of reporting of the emissions restating. Reasons for the recalculation includes 1) structural change, in which there is merger, acquisition, or divestment in the business 2) a change in calculation methodologies or emission factors or 3) the discovery of an error or a number of cumulative errors that are collectively substantial. GC has defined significant threshold as if there is a change contributed to increase/decrease in emissions of greater than 5% for each operating plants.	No

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

GC's GHG emission data was verified by External party.

Scope 2 (location-based)

Base year start

January 1 2020

Base year end

December 31 2020

Base year emissions (metric tons CO2e)

17487

Comment

GC's GHG emission data was verified by External party.

Scope 2 (market-based)

Base year start

January 1 2020

Base year end

December 31 2020

Base year emissions (metric tons CO2e)

1961434

Comment

GC's GHG emission data was verified by External party.

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

GC's GHG emission data was verified by External party.

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 is insignificant. GC not data in Y2020, We are using estimate from Y2021 not verify by External party.

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)

1148852

Comment

GC's GHG emission data was verified by External party.

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

GC's GHG emission data was verified by External party.

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

GC does not verify by External party.

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

GC does not verify by External party.

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

GC does not verify by External party.

Scope 3 category 8: Upstream leased assets

Base year start

Base year end

Base year emissions (metric tons CO2e)

0

Comment

GC does 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

GC's GHG emission data was verified by External party.

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

GC's GHG emission data was verified by External party.

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

GC's GHG emission data was verified by External party.

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

GC's GHG emission data was verified by External party.

Scope 3 category 13: Downstream leased assets

Base year start

Base year end

Base year emissions (metric tons CO2e)

0

Comment

GC does 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 does 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

GC's GHG emission data was verified by External party.

Scope 3: Other (upstream)

Base year start

Base year end

Base year emissions (metric tons CO2e)

0

Comment

GC does not have Other (upstream)

Scope 3: Other (downstream)

Base year start

Base year end

Base year emissions (metric tons CO2e)

0

Comment

GC does not have Other (downstream)

(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
The Greenhouse Gas Protocol: Corporate Value Chain (Scope 3) Standard

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)

6148622

Start date

<Not Applicable>

End date

<Not Applicable>

Comment

In 2022, 92.6% of scope1 emission were from fuel combustion activities, 0.2% from fugitive emissions, and 7.3% from aggregation of CO2 separation, ethylene production, and other process and vented activities.

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

16783

Scope 2, market-based (if applicable)

2112327

Start date

<Not Applicable>

End date

<Not Applicable>

Comment

The majority of GC's indirect energy purchased in the form of electricity and steam are purchased directly from our main suppliers (Co-generation plants), GLOW and GPSC (99% of Scope 2 emission). The remaining electricity and steam are self-generated at our utility plants on site and emissions reported under scope 1. The remaining electricity is purchased from the grid on a need basis.

C6.4

(C6.4) Are there any sources (e.g. facilities, specific GHGs, activities, geographies, etc.) of Scope 1, Scope 2 or Scope 3 emissions that are within your selected reporting boundary which are not included in your disclosure?

No

(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)

5642268

Emissions calculation methodology

Supplier-specific method

Hybrid method

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

100

Please explain

Emissions from purchased goods and services. Emissions from this category account for 15.95% of total scope 3 emissions.

(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 factors from Ecoinvent 3.0, IPCC 2013 GWP 100a, and Thailand Greenhouse Gas Organization

(iii) GWP values: GWP AR6 IPCC 2021 100 years.

(iv) Activity data: Quantity and monetary the capital good from Raw material, Chemical, Catalyst, and Packaging.

Capital goods**Evaluation status**

Relevant, calculated

Emissions in reporting year (metric tons CO₂e)

46032

Emissions calculation methodology

Average spend-based method

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

100

Please explain

Emissions from capital goods purchased (main raw materials, chemicals, catalysts, and packaging). This emission is 0.13% of total scope 3 emissions.

(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.

(v) Emissions factors: Emission factors from Ecoinvent 3.0, IPCC 2013 GWP 100a, and Thailand Greenhouse Gas Organization

(ii) GWP values: GWP AR6 IPCC 2021 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)

978957

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

Emissions from fuel- and energy-related activities (not included in Scope 1 or 2). Specifically, electric power transmission and heat & steam distribution losses. Emissions from this category account for 2.77% of total scope 3 emissions.

(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 factors from Ecoinvent 3.0, IPCC 2013 GWP 100a, and Thailand Greenhouse Gas Organization

(iii) GWP values: GWP AR6 IPCC 2021 100 years.

(iv) Activity data: Quantity and monetary the electric power transmission and heat & steam distribution Losses.

Upstream transportation and distribution

Evaluation status

Relevant, calculated

Emissions in reporting year (metric tons CO₂e)

540983

Emissions calculation methodology

Distance-based method

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

100

Please explain

Emissions from pipeline transportation of main feedstock. Other upstream and distribution emissions are not calculated and reported. Emissions from this category account for 1.53% of total scope 3 emissions.

(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 factors from Ecoinvent 3.0, IPCC 2013 GWP 100a, and Thailand Greenhouse Gas Organization

(iii) GWP values: GWP AR6 IPCC 2021 100 years.

Waste generated in operations

Evaluation status

Relevant, calculated

Emissions in reporting year (metric tons CO₂e)

65046

Emissions calculation methodology

Waste-type-specific method

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

100

Please explain

Emissions from waste generated. Emissions from this category account for 0.18% of total scope 3 emissions and is not considered a significant source of emissions.

Emissions reported in this category has not been third-party verified.

(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 factors from Ecoinvent 3.0, IPCC 2013 GWP 100a, and Thailand Greenhouse Gas Organization

(iii) GWP values: GWP AR6 IPCC 2021 100 years.

(iv) Activity data: Quantity and monetary the waste generated in operations from waste to landfill, incineration and wastewater.

Business travel

Evaluation status

Relevant, calculated

Emissions in reporting year (metric tons CO₂e)

1017

Emissions calculation methodology

Distance-based method

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

100

Please explain

Emissions from business travel. Emissions from this category account for 0.003% of total scope 3 emissions and is not considered a significant source of emissions.

Emissions reported in this category has not been third-party verified.

(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 factors from Ecoinvent 3.0, IPCC 2013 GWP 100a, and Thailand Greenhouse Gas Organization

(iii) GWP values: GWP AR6 IPCC 2021 100 years.

(iv) Activity data: Quantity and monetary the Business travel.

Employee commuting

Evaluation status

Relevant, calculated

Emissions in reporting year (metric tons CO2e)

5522

Emissions calculation methodology

Distance-based method

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

100

Please explain

Emissions from employee commuting between their homes and workplace. Emissions from this category account for 0.02% of total scope 3 emissions and is not considered a significant source of emissions. Emissions reported in this category has not been third-party verified.

(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 factors from Ecoinvent 3.0, IPCC 2013 GWP 100a, and Thailand Greenhouse Gas Organization

(iii) GWP values: GWP AR6 IPCC 2021 100 years.

(iv) Activity data: Quantity of cars registered and number of employees travelled by public transport.

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)

22314

Emissions calculation methodology

Distance-based method

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

100

Please explain

Emissions from the transportation of polymer products to our customers. Emissions from this category account for 0.06% of total scope 3 emissions.

(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 factors from Ecoinvent 3.0, IPCC 2013 GWP 100a, and Thailand Greenhouse Gas Organization

(iii) GWP values: GWP AR6 IPCC 2021 100 years.

(iv) Activity data: Quantity and monetary the downstream transportation and distribution from polymer products.

Processing of sold products

Evaluation status

Relevant, calculated

Emissions in reporting year (metric tons CO2e)

2475156

Emissions calculation methodology

Average data method

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

100

Please explain

Emissions from processing of polymers during our production process. Emissions from this category account for 7.00% of total scope 3 emissions.

(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 factors from Ecoinvent 3.0, IPCC 2013 GWP 100a, and Thailand Greenhouse Gas Organization

(iii) GWP values: GWP AR6 IPCC 2021 100 years.

(iv) Activity data: Quantity and monetary the processing of sold products from polymer products.

Use of sold products

Evaluation status

Relevant, calculated

Emissions in reporting year (metric tons CO2e)

22798563

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

Emissions from the combustion of our diesel, LPG, jet fuel, marine fuel oil, kerosene, propane, butane, and bio-diesel products sold to our customers. Emissions from this category account for 64.45% of total scope 3 emissions.

(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 factors from Ecoinvent 3.0, IPCC 2013 GWP 100a, and Thailand Greenhouse Gas Organization

(iii) GWP values: GWP AR6 IPCC 2021 100 years.

(iv) Activity data: Quantity and monetary the use of sold products

End of life treatment of sold products

Evaluation status

Relevant, calculated

Emissions in reporting year (metric tons CO2e)

990880

Emissions calculation methodology

Waste-type-specific method

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

100

Please explain

Emissions from the end-of-life stage of polymer products sold to our customers. Our polymer products have a recycle rate of 87%. Emissions from this category account for 2.80% of total scope 3 emissions.

(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 factors from Ecoinvent 3.0, IPCC 2013 GWP 100a, and Thailand Greenhouse Gas Organization

(iii) GWP values: GWP AR6 IPCC 2021 100 years.

(iv) Activity data: Quantity and monetary the end of life treatment of sold polymer products.

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 franchises. Therefore, we have zero emissions from this category.

Investments

Evaluation status

Relevant, calculated

Emissions in reporting year (metric tons CO2e)

1808187

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

Emissions from the direct operations of our investees (i.e. scope 1 and scope 2 emissions of our investees). Emissions from this category account for 5.11% of total scope 3 emissions.

(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 factors from Ecoinvent 3.0, IPCC 2013 GWP 100a, and Thailand Greenhouse Gas Organization

(iii) GWP values: GWP AR6 IPCC 2021 100 years.

(iv) Activity data: Quantity and monetary the investment.

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	150	We used biofuels for our vehicles and calculated the CO2 emissions from the mobile combustion of biofuels. 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

0.000012204

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

8277731

Metric denominator

unit total revenue

Metric denominator: Unit total

678267000000

Scope 2 figure used

Market-based

% change from previous year

35.32

Direction of change

Decreased

Reason(s) for change

Other emissions reduction activities

Acquisitions

Change in revenue

Please explain

In 2022, GC had higher sales revenue of 678,267 million THB than in 2021 mainly due to the increase in petroleum products price in the Upstream business, and the Performance Chemicals business increased from the consolidation of allnex's financial performance in 2022, which led to higher revenue of the Performance Chemicals in 2022. Fixed overhead and SG&A (Selling, General and Administrative) expenses went up from 2021 due to the consolidation of allnex's expenses and maintenance expenses from the planned maintenance shutdown.

Moreover, GC puts tremendous effort to continually improve operational efficiency that potentially reduce GHG emissions in 2022 through several projects e.g., Energy Conservation projects, PDH (Propane Dehydrogenation) Optimization Model, Floating Solar, Reduce Water Injection at Oxidation Unit, and Wastewater Reverse Osmosis (WWRO). As a result, these projects were leading to the GHG reduction of 59,903 tons CO2 equivalent.

Intensity figure

0.419976209

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

8277731

Metric denominator

metric ton of product

Metric denominator: Unit total

19710000

Scope 2 figure used

Market-based

% change from previous year

3.51

Direction of change

Increased

Reason(s) for change

Change in output

Please explain

In 2022, The GHG emissions (Scope 1&2) was lower than in 2021 because of shutdown/turnaround activities, which are Refinery, Aromatics1, Olefins3, Phenol, Bisphenol-A, Glycol reduces the amount of GHG emissions approximately 5.7% and reduces production approximately 7.9%, leading to increase of the GHG emission intensity approximately 3.5%.

However, GC has continually pursued efforts to reduce GHG emissions through the implementation of several projects, including Energy Conservation projects, and Pollution Reduction Projects. In 2022, GC supported various projects addressing climate change, such as energy conservation projects with GHG emission reduction 59,903 ton CO2 equivalent per year, Process Optimization, Floating Solar, and Reduce Wate Injection at Oxidation Unit.

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	5817526	IPCC Sixth Assessment Report (AR6 - 100 year)
CH4	320958	IPCC Sixth Assessment Report (AR6 - 100 year)
N2O	235	IPCC Sixth Assessment Report (AR6 - 100 year)
HFCs	9903	IPCC Sixth Assessment Report (AR6 - 100 year)
PFCs	0	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/area/region.

Country/area/region	Scope 1 emissions (metric tons CO2e)
Thailand	6148622

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	2313708
Aromatics	883775
Refinery	876829
Polymers	278302
EO-Based Performance	114635
Green Chemicals	25613
Performance Materials and Chemicals	0
Phenol	13558
Shared Facilities (Utilities & Tank farm & Logistics)	1634826
Others (Building)	7376

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)	1279	12.71759	101.19519
GC 2 (I-1)	244145	12.70302	101.13918
GC 2 (UT)	1628614	12.70302	101.13918
GC 2 (HDPE)	4660	12.70302	101.13918
GC 2 (ORP)	549781	12.70302	101.13918
GC 2 (HGP)	1003	12.70302	101.13918
GC 3 (I-4)	858513	12.6963	101.14495
GC 4 (Aromatics I)	230225	12.68975	101.14487
GC 5 (Aromatics II)	653549	12.75314	101.1657
GC 6 (Refinery)	876829	12.67767	101.15804
GC 7 (Jetty&BTF)	1796	12.68099	101.12966
GC 8 (ATF)	865	12.69479	101.14927
GC 9 (Lab Center)	9	12.69299	101.1894
GC 11 (PE)	660266	12.68653	101.12293
GC 11 (LDPE)	10007	12.68711	101.12773
GC 11 (LLDPE)	18384	12.68343	101.13147
GC 12 (BPE)	579	12.69357	101.13642
GC Glycol (EO/EG)	33343	12.69913	101.12759
GC Glycol (EA)	0	12.69699	101.12943
GGC (Plant I)	190	12.69552	101.1269
TTT	1840	12.66578	101.13473
GCME	978	12.6892	101.1188
NPC S&E	714	12.68948	101.11907
GCS	2826	12.68921	101.1326
ENCO (Head Office)	0	13.81969	100.55725
GCPC (Phenol I&II)	13036	12.69463	101.1282
GCPC (BPA)	522	12.69399	101.1275
GC Logistics Solution (GCL)	1712	12.68292	101.1228
GC 13 (INNO)	0	12.69579	101.26332
GC Corporate (Scope1)	4395	12.71759	101.19519
GC 14 (Maintenance)	0	12.68433	101.11803
GC-M PTA	204706	12.69959	101.11992
TPRC	29288	12.70257	101.1136
GGC (Plant II)	25423	13.07481	101.3866
GCO (GC Oxirane)	81292	12.70996	101.13097
GCP (GC Polyols)	7853	12.70255	101.12943
GC Estate	1	12.70389	101.10598
Envicco	0	12.70462	101.1011

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	3629591	<Not Applicable>	GHG emissions from chemicals production activities are Olefins, Aromatics, Polymers, EO-Based Performance, Green Chemicals, and Phenol (exclude Shared Facilities). Emissions from chemical production activities account for 59.0% of total scope 1 emissions.
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/area/region.

Country/area/region	Scope 2, location-based (metric tons CO2e)	Scope 2, market-based (metric tons CO2e)
Thailand	16782	2112324

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	355520
Aromatics	0	601407
Refinery	3034	0
Polymers	19	364181
EO-Based Performance	0	257412
Green Chemicals	7097	63757
Phenol	0	439531
Shared Facilities (Utilities & Tank farm & Logistics)	741	27721
Others (Building)	5892	2798
Performance Materials and Chemicals	0	0

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)	4006	0
GC 2 (I-1)	0	0
GC 2 (UT)	314	13507
GC 2 (HDPE)	0	0
GC 2 (ORP)	0	0
GC 2 (HGP)	0	0
GC 3 (I-4)	0	195903
GC 4 (Aromatics I)	0	293030
GC 5 (Aromatics II)	0	308377
GC 6 (Refinery)	3034	0
GC 7 (Jetty&BTF)	0	0
GC 8 (ATF)	0	5590
GC 9 (Lab Center)	0	2798
GC 11 (PE)	0	159617
GC 11 (LDPE)	0	109013
GC 11 (LLDPE)	0	103585
GC 12 (BPE)	19	15110
GC Glycol (EO/EG)	0	111508
GC Glycol (EA)	0	16612
GGC (Plant I)	0	63757
TTT	0	0
GCME (PTTME)	559	0
NPC S&E	383	0
GCS	0	0
ENCO (Head Office)	215	0
GCPC (Phenol I&II)	0	329445
GCPC (BPA)	0	110086
GC Logistics Solution (GCL)	427	8624
GC 13 (INNO)	180	0
GC Corporate (Scope 1)	0	0
GC 14 (Maintenance)	180	0
GC-M PTA	0	104450
TPRC	0	16724
GGC (Plant II)	7097	0
GCO (GC Oxirane)	0	129921
GCP (GC Polyols)	0	11345
GC Estate	369	0
Envicco	0	3953

C7.7

(C7.7) Is your organization able to break down your emissions data for any of the subsidiaries included in your CDP response?

Yes

C7.7a

(C7.7a) Break down your gross Scope 1 and Scope 2 emissions by subsidiary.

Subsidiary name

Global Green Chemical Public Company Limited

Primary activity

Agricultural chemicals

Select the unique identifier(s) you are able to provide for this subsidiary

ISIN code – bond

ISIN code – bond

TH7920010Z10

ISIN code – equity

<Not Applicable>

CUSIP number

<Not Applicable>

Ticker symbol

<Not Applicable>

SEDOL code

<Not Applicable>

LEI number

<Not Applicable>

Other unique identifier

<Not Applicable>

Scope 1 emissions (metric tons CO2e)

25612.84

Scope 2, location-based emissions (metric tons CO2e)

7096.96

Scope 2, market-based emissions (metric tons CO2e)

63757.46

Comment

-

Subsidiary name

Thai Tank Terminal Limited (TTT)

Primary activity

Oil & gas pipelines & storage

Select the unique identifier(s) you are able to provide for this subsidiary

Please select

ISIN code – bond

<Not Applicable>

ISIN code – equity

<Not Applicable>

CUSIP number

<Not Applicable>

Ticker symbol

<Not Applicable>

SEDOL code

<Not Applicable>

LEI number

<Not Applicable>

Other unique identifier

<Not Applicable>

Scope 1 emissions (metric tons CO2e)

1839.72

Scope 2, location-based emissions (metric tons CO2e)

0

Scope 2, market-based emissions (metric tons CO2e)

0

Comment

Noted: Purchased energy from GC' Utilities plant, We had GHG report in scope 1.

Subsidiary name

GC Maintenance and Engineering Co., Ltd. (GCME)

Primary activity

Industrial services

Select the unique identifier(s) you are able to provide for this subsidiary

Please select

ISIN code – bond

<Not Applicable>

ISIN code – equity

<Not Applicable>

CUSIP number

<Not Applicable>

Ticker symbol

<Not Applicable>

SEDOL code

<Not Applicable>

LEI number

<Not Applicable>

Other unique identifier

<Not Applicable>

Scope 1 emissions (metric tons CO2e)

978.33

Scope 2, location-based emissions (metric tons CO2e)

558.67

Scope 2, market-based emissions (metric tons CO2e)

0

Comment

-

Subsidiary name

NPC Safety and Environmental Service Co., Ltd. (NPC)

Primary activity

Engineering services

Select the unique identifier(s) you are able to provide for this subsidiary

Please select

ISIN code – bond

<Not Applicable>

ISIN code – equity

<Not Applicable>

CUSIP number

<Not Applicable>

Ticker symbol

<Not Applicable>

SEDOL code

<Not Applicable>

LEI number

<Not Applicable>

Other unique identifier

<Not Applicable>

Scope 1 emissions (metric tons CO2e)

713.58

Scope 2, location-based emissions (metric tons CO2e)

382.64

Scope 2, market-based emissions (metric tons CO2e)

0

Comment

-

Subsidiary name

PTT Phenol Company Limited (GCPC)

Primary activity

Other base chemicals

Select the unique identifier(s) you are able to provide for this subsidiary

Please select

ISIN code – bond

<Not Applicable>

ISIN code – equity

<Not Applicable>

CUSIP number

<Not Applicable>

Ticker symbol

<Not Applicable>

SEDOL code

<Not Applicable>

LEI number

<Not Applicable>

Other unique identifier

<Not Applicable>

Scope 1 emissions (metric tons CO2e)

13558.13

Scope 2, location-based emissions (metric tons CO2e)

0

Scope 2, market-based emissions (metric tons CO2e)

439530.97

Comment

-

Subsidiary name

GC Logistics Solutions Co., Ltd. (GCL)

Primary activity

Logistics - transport

Select the unique identifier(s) you are able to provide for this subsidiary

Please select

ISIN code – bond

<Not Applicable>

ISIN code – equity

<Not Applicable>

CUSIP number

<Not Applicable>

Ticker symbol

<Not Applicable>

SEDOL code

<Not Applicable>

LEI number

<Not Applicable>

Other unique identifier

<Not Applicable>

Scope 1 emissions (metric tons CO2e)

1711.65

Scope 2, location-based emissions (metric tons CO2e)

426.96

Scope 2, market-based emissions (metric tons CO2e)

8623.67

Comment

-

Subsidiary name

GC-M PTA Company Limited

Primary activity

Other base chemicals

Select the unique identifier(s) you are able to provide for this subsidiary

Please select

ISIN code – bond

<Not Applicable>

ISIN code – equity

<Not Applicable>

CUSIP number

<Not Applicable>

Ticker symbol

<Not Applicable>

SEDOL code

<Not Applicable>

LEI number

<Not Applicable>

Other unique identifier

<Not Applicable>

Scope 1 emissions (metric tons CO2e)

204705.92

Scope 2, location-based emissions (metric tons CO2e)

0

Scope 2, market-based emissions (metric tons CO2e)

104450.11

Comment

-

Subsidiary name

Thai PET Resin Company Limited (TPRC)

Primary activity

Basic plastics

Select the unique identifier(s) you are able to provide for this subsidiary

Please select

ISIN code – bond

<Not Applicable>

ISIN code – equity

<Not Applicable>

CUSIP number

<Not Applicable>

Ticker symbol

<Not Applicable>

SEDOL code

<Not Applicable>

LEI number

<Not Applicable>

Other unique identifier

<Not Applicable>

Scope 1 emissions (metric tons CO2e)

29287.76

Scope 2, location-based emissions (metric tons CO2e)

0

Scope 2, market-based emissions (metric tons CO2e)

16723.87

Comment

-

Subsidiary name

GC Oxirane Company Limited (GCO)

Primary activity

Specialty chemicals

Select the unique identifier(s) you are able to provide for this subsidiary

Please select

ISIN code – bond

<Not Applicable>

ISIN code – equity

<Not Applicable>

CUSIP number

<Not Applicable>

Ticker symbol

<Not Applicable>

SEDOL code

<Not Applicable>

LEI number

<Not Applicable>

Other unique identifier

<Not Applicable>

Scope 1 emissions (metric tons CO2e)

81292.03

Scope 2, location-based emissions (metric tons CO2e)

0

Scope 2, market-based emissions (metric tons CO2e)

129291.4

Comment

-

Subsidiary name

GC Polyols Company Limited (GCP)

Primary activity

Specialty chemicals

Select the unique identifier(s) you are able to provide for this subsidiary

Please select

ISIN code – bond

<Not Applicable>

ISIN code – equity

<Not Applicable>

CUSIP number

<Not Applicable>

Ticker symbol

<Not Applicable>

SEDOL code

<Not Applicable>

LEI number

<Not Applicable>

Other unique identifier

<Not Applicable>

Scope 1 emissions (metric tons CO2e)

7853.09

Scope 2, location-based emissions (metric tons CO2e)

0

Scope 2, market-based emissions (metric tons CO2e)

11344.75

Comment

-

Subsidiary name

GC Estate Company Limited

Primary activity

Infrastructure upkeep & management

Select the unique identifier(s) you are able to provide for this subsidiary

Please select

ISIN code – bond

<Not Applicable>

ISIN code – equity

<Not Applicable>

CUSIP number

<Not Applicable>

Ticker symbol

<Not Applicable>

SEDOL code

<Not Applicable>

LEI number

<Not Applicable>

Other unique identifier

<Not Applicable>

Scope 1 emissions (metric tons CO2e)

1.18

Scope 2, location-based emissions (metric tons CO2e)

369.28

Scope 2, market-based emissions (metric tons CO2e)

0

Comment

-

Subsidiary name

ENVICCO Limited

Primary activity

Basic plastics

Select the unique identifier(s) you are able to provide for this subsidiary

Please select

ISIN code – bond

<Not Applicable>

ISIN code – equity

<Not Applicable>

CUSIP number

<Not Applicable>

Ticker symbol

<Not Applicable>

SEDOL code

<Not Applicable>

LEI number

<Not Applicable>

Other unique identifier

<Not Applicable>

Scope 1 emissions (metric tons CO2e)

0

Scope 2, location-based emissions (metric tons CO2e)

0

Scope 2, market-based emissions (metric tons CO2e)

3953.49

Comment

-

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	7116	2081805	GHG emission from chemicals production activities are Olefins, Aromatics, Polymers, EO-Based Performance, Green Chemicals, and Phenol (exclude Shared Facilities). This emission is 98.1% of total company-wide scope 2 emissions.
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

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

	Sales, metric tons	Comment
Carbon dioxide (CO2)	61515	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?

Decreased

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 in emissions	Emissions value (percentage)	Please explain calculation
Change in renewable energy consumption	45	Decreased	0.001	In 2022, 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 8,776,321 tCO2e, therefore we arrived at 0.001% through $(45/8,776,321) \times 100 = 0.001\%$.
Other emissions reduction activities	59903	Decreased	0.68	We emphasize reducing GHG emission, enhancing the efficiency of energy consumption and seeking approach to use alternative energy. We have continuous enhancement of plant asset reliability and integrity management measures and energy efficiency projects. In 2022, GC's launched 70 energy saving projects, to saved 471.6 million GJ which was equivalent to GHG emissions reductions of 59,903 ton CO2e in 2022. Our total S1 and S2 emissions in the previous year was 8,776,321 tCO2e, therefore we arrived at 0.68% through $(59,903/8,776,321) \times 100 = 0.68\%$.
Divestment	0	No change	0	In 2022, GC had no changes that occur as a result of selling off certain aspects of the businesses.
Acquisitions	0	No change	0	In 2022, GC had no changes that occur as a result of purchasing or obtaining another facility.
Mergers	0	No change	0	In 2022, GC had no changes that occur as a result of business mergers.
Change in output	438642	Decreased	5	In 2022 our emissions decreased by 438,642 tCO2e for two main reasons. Firstly, our electricity supplier's emissions intensity decreased, therefore decreasing our Scope 2 emissions. Secondly, we had a turnaround this year which also contributed to less emissions (reduce fuel consumption). To compare year on year emissions decrease we used total S1 and S2 emissions in the previous year 438,642 tCO2e, therefore we arrived at 5.0% through $(438,642 / 8,776,321) \times 100 = 5.0\%$.
Change in methodology	0	No change	0	In 2022, 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 2022, GC had no changes in the boundary used for your inventory calculation.
Change in physical operating conditions	0	No change	0	In 2022, GC had no changes in the boundary used for your inventory calculation.
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 Scope 2 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	32092372	32092372
Consumption of purchased or acquired electricity	<Not Applicable>	1339	885549	886889
Consumption of purchased or acquired heat	<Not Applicable>	<Not Applicable>	<Not Applicable>	<Not Applicable>
Consumption of purchased or acquired steam	<Not Applicable>	0	3906287	3906287
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>	1339	36884208	36885547

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)

12305906

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

15169281

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

27475187

Consumption of purchased or acquired electricity

Heating value

<Not Applicable>

MWh consumed from renewable sources inside chemical sector boundary

1339

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

867220

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

868559

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)

3906287

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

3906287

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

1339

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

17079413

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

15169281

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

32250033

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

207821

MWh fuel consumed for self-generation of electricity

<Not Applicable>

MWh fuel consumed for self-generation of heat

207821

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, Foul Hexane, and Diesel

Gas**Heating value**

LHV

Total fuel MWh consumed by the organization

31884550

MWh fuel consumed for self-generation of electricity

<Not Applicable>

MWh fuel consumed for self-generation of heat

25542927

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

6341623

Comment

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

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

32092372

MWh fuel consumed for self-generation of electricity

<Not Applicable>

MWh fuel consumed for self-generation of heat

25750748

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

6341623

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	886889	885549	1339	1339
Heat	0	0	0	0
Steam	3906287	3906287	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)

886889

Generation that is consumed inside chemicals sector boundary (MWh)

885549

Generation from renewable sources inside chemical sector boundary (MWh)

1339

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

1339

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)

3906287

Generation that is consumed inside chemicals sector boundary (MWh)

3906287

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.

Country/area of low-carbon energy consumption

Thailand

Sourcing method

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

Energy carrier

Electricity

Low-carbon technology type

Solar

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

1339

Tracking instrument used

Contract

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

Thailand

Are you able to report the commissioning or re-powering year of the energy generation facility?

Yes

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 by country/area of your non-fuel energy consumption in the reporting year.

Country/area

Thailand

Consumption of purchased electricity (MWh)

2951980

Consumption of self-generated electricity (MWh)

1339

Is this electricity consumption excluded from your RE100 commitment?

<Not Applicable>

Consumption of purchased heat, steam, and cooling (MWh)

7114719

Consumption of self-generated heat, steam, and cooling (MWh)

0

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

10068038

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

1730838

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

673517

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

1474029

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

922063

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

128383

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

4288974

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

6843

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

569120

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

72082

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	100
Natural Gas	0
Coal	0
Biomass	0
Waste (non-biomass)	0
Fossil fuel (where coal, gas, oil cannot be distinguished)	0
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

Other, please specify (Hazardous waste generation)

Metric value

98651

Metric numerator

metric tons

Metric denominator (intensity metric only)

-

% change from previous year

10.12

Direction of change

Decreased

Please explain

Due to the fact that most hazardous waste is generated in turnaround activity, GC has established the Green Turnaround Management Approach by focusing on efficient use of resources and reduction of hazardous and non-hazardous wastes generation caused by maintenance activities, including reduction at source and waste utilization.

This was because we extend our intention to initiate a waste management project by using the 5Rs principle and the Circular Economy Concept to optimize the use of resources, reduce waste generation, and reduce impact on the environment, covering our product development, production, product used and waste management. As a result, GC has been able to lower expenses and create added value in a continuous manner.

Description

Other, please specify (Water usage)

Metric value

56620000

Metric numerator

m3

Metric denominator (intensity metric only)

-

% change from previous year

1.38

Direction of change

Decreased

Please explain

Total freshwater consumption in 2022 was lower than in 2021 because of increasing plant reliability of Refinery, Olefins 2, PTTAC etc.

This is done by saving water using innovation to reduce freshwater withdrawal, and evaluating water Footprint throughout the product life cycle.

Description

Other, please specify (VOCs Emission)

Metric value

754

Metric numerator

metric tons

Metric denominator (intensity metric only)

-

% change from previous year

10.34

Direction of change

Decreased

Please explain

Total VOCs emission in 2022 (754 ton) is lower than that in 2021 (841 ton) or decreased by 10.34% 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. Also, GC has implemented the Code of Practice, or CoP, in turnaround activities to regulate 1,3-Butadiene emissions into the atmosphere from such activities to the minimum and below legal standards. These projects enable GC to control VOCs more effectively, more environmentally friendly and reduce impacts to the communities. Additionally, these systems can control odor, helping to reduce impacts to local 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)

3368631.79

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)

0.12

Steam intensity (MWh per metric ton of product)

0.62

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

0.62

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)

2321282.28

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)

0.23

Steam intensity (MWh per metric ton of product)

0.61

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

0.61

Comment

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

Output product

Polymers

Production (metric tons)

4141531.06

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)

0.31

Steam intensity (MWh per metric ton of product)

0.05

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

0.05

Comment

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

Output product

Specialty chemicals

Production (metric tons)

474226.2

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)

0.52

Steam intensity (MWh per metric ton of product)

0.66

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

0.66

Comment

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

Output product

Other, please specify (EO-Based Performance)

Production (metric tons)

377613.28

Capacity (metric tons)

380000

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

0

Electricity intensity (MWh per metric ton of product)

0.35

Steam intensity (MWh per metric ton of product)

1.02

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

1.02

Comment

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

Output product

Other, please specify (Green Chemicals)

Production (metric tons)

550790.41

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)

0.09

Steam intensity (MWh per metric ton of product)

0.48

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

0.48

Comment

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

Output product

Other, please specify (Phenol & BPA)

Production (metric tons)

1078394.28

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 + Acetone.

C-OG9.5a/C-CO9.5a

(C-OG9.5a/C-CO9.5a) Break down, by fossil fuel expansion activity, your organization’s CAPEX in the reporting year and CAPEX planned over the next 5 years.

	CAPEX in the reporting year for this expansion activity (unit currency as selected in C0.4)	CAPEX in the reporting year for this expansion activity as % of total CAPEX in the reporting year	CAPEX planned over the next 5 years for this expansion activity as % of total CAPEX planned over the next 5 years	Explain your CAPEX calculations, including any assumptions
Exploration of new oil fields				
Exploration of new natural gas fields				
Expansion of existing oil fields				
Expansion of existing natural gas fields				
Development of new coal mines	<Not Applicable>	<Not Applicable>	<Not Applicable>	<Not Applicable>
Expansion of existing coal mines	<Not Applicable>	<Not Applicable>	<Not Applicable>	<Not Applicable>

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	GC targets to adjust long-term business portfolio by transferring 40 percent of the long-term adjusted EBITDA into low-carbon businesses by 2030. In 2022, GC’s combined production capacity for bio-based products (chemical & polymers) and plastic recycling (mechanical & chemical recycling) totaled to more than 1,500,000 tons. GC further targets to expand investment to support a production capacity of 2,500,000 tons by 2027. While aligning with GC’s Net Zero Target, such adjustment also helps the company to maintain our competitiveness and growth. At the same time, our customers can also benefit from low-carbon products. It also creates product circularity which reintroduces used plastics into recycling and upcycling systems.

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

Bio technology

Stage of development in the reporting year

Pilot demonstration

Average % of total R&D investment over the last 3 years

0.3

R&D investment figure in the reporting year (unit currency as selected in C0.4) (optional)

2138622

Average % of total R&D investment planned over the next 5 years

0.37

Explain how your R&D investment in this technology area is aligned with your climate commitments and/or climate transition plan

GC developed Three-Pillar Low Carbon Transition Framework, as company's climate transition plan, consisting of Efficiency-driven, Portfolio-driven, and Compensation-driven strategies to achieve significant 20 percent reduction in greenhouse gas emissions by 2030, and achieve net zero CO2 emissions by 2050.

GC also sets the target of adjusting long-term business portfolio by transferring 40 percent of the long-term adjusted EBITDA into low-carbon businesses by 2030, which is a part of implementation under Portfolio-driven pillar.

To support and promote the transition of business portfolio to be low-carbon, GC has developed many bio-technologies to enable to produce new innovation products that are environmental-friendly and have low-carbon intensity. Example of such technology is the second polylactic acid (PLA) biopolymer production facility for NatureWorks, operating under the Ingeo™ trade name. This facility will add value to Thai agricultural raw materials, meet the needs of an expanding market and is expected to begin commercial operations in 2024.

Technology area

Carbon capture, utilization, and storage (CCUS)

Stage of development in the reporting year

Applied research and development

Average % of total R&D investment over the last 3 years

0.14

R&D investment figure in the reporting year (unit currency as selected in C0.4) (optional)

2967893

Average % of total R&D investment planned over the next 5 years

0.17

Explain how your R&D investment in this technology area is aligned with your climate commitments and/or climate transition plan

GC developed Three-Pillar Low Carbon Transition Framework, as company's climate transition plan, consisting of Efficiency-driven, Portfolio-driven, and Compensation-driven strategies to achieve significant 20 percent reduction in greenhouse gas emissions by 2030, and achieve net zero CO2 emissions by 2050.

Under Compensation-driven pillar, GC aims to offsetting excess carbon using high-efficiency carbon capture technology and nature-based solutions. Accordingly, GC has signed a Memorandum of Understanding to conduct a feasibility study on the application of Carbon Capture and Storage (CCS) technology, or CCS Hub Model, in collaboration with PTT Group. The project is expected to commence its operations in 2029, initially capturing and storing up to 1.32 million tons of carbon dioxide per year.

Technology area

Product redesign

Stage of development in the reporting year

Small scale commercial deployment

Average % of total R&D investment over the last 3 years

2.43

R&D investment figure in the reporting year (unit currency as selected in C0.4) (optional)

28809618

Average % of total R&D investment planned over the next 5 years

3.04

Explain how your R&D investment in this technology area is aligned with your climate commitments and/or climate transition plan

GC developed Three-Pillar Low Carbon Transition Framework, as company's climate transition plan, consisting of Efficiency-driven, Portfolio-driven, and Compensation-driven strategies to achieve significant 20 percent reduction in greenhouse gas emissions by 2030, and achieve net zero CO2 emissions by 2050.

GC also sets the target of adjusting long-term business portfolio by transferring 40 percent of the long-term adjusted EBITDA into low-carbon businesses by 2030, which is a part of implementation under Portfolio-driven pillar.

GC places importance in achieving maximum resource efficiency while connecting such target to the GHG reduction in order to lessen impact on the environment and society throughout the product's value chain. As a result, GC Group's products continue to receive certifications such as Carbon Footprint of Products (CFP), Carbon Footprint Reduction (CFR), Carbon Footprint of Circular Economy Product (CE-CFP), Water Footprint (WF) from the Federation of Thai Industries, and Green for Life. These certifications indicated improvement of such products, which conducted via many mechanism e.g., product redesign, Eco-Design Guideline, etc. that its carbon footprint was potentially reduced.

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 (unit currency as selected in C0.4) (optional)	Average % of total R&D investment planned over the next 5 years	Explain how your R&D investment in this technology area is aligned with your climate commitments and/or climate transition plan
	<Not Applicable>				

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

ISO 14064 AS PTTGC_2022 released for client (final).pdf

GC GHG Report_Year 2022_for LRQA (final).pdf

Page/ section reference

Assurance statement related to GHG report 2022, page 1-3

GC GHG Report 2022, page 3-18

Relevant standard

ISO14064-1

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 market-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

ISO 14064 AS PTTGC_2022 released for client (final).pdf

GC GHG Report_Year 2022_for LRQA (final).pdf

Page/ section reference

Assurance statement related to GHG report 2022, page 1-3

GC GHG Report 2022, page 3-18

Relevant standard

ISO14064-1

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

ISO 14064 AS PTTGC_2022 released for client (final).pdf

GC GHG Report_Year 2022_for LRQA (final).pdf

Page/section reference

Assurance statement related to GHG report 2022, page 1-3

GC GHG Report 2022, page 3-18

Relevant standard

IS)14064-1

Proportion of reported emissions verified (%)

99.8

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	Energy consumption	Verification procedure is in accordance with ISAE 3000 (revised) and uses the following principles of - inclusivity, materiality, responsiveness and reliability of performance data.	The Report is in accordance with the: GRI 2021 Standards; GRI 11 Sector Standard for Oil and Gas Evaluating the reliability of data and information for selected specific standard disclosures (PDF page 238); Energy consumption within the organization (GRI 302-1); Total energy consumption outside the organization (GRI 302-2); Energy intensity (GRI 302-3). pttgc-isr2022 (New).pdf
C9. Additional metrics	Waste data	Verification procedure is in accordance with ISAE 3000 (revised) and uses the following principles of - inclusivity, materiality, responsiveness and reliability of performance data.	The Report is in accordance with the: GRI 2021 Standards; GRI 11 Sector Standard for Oil and Gas Evaluating the reliability of data and information for selected specific standard disclosures (PDF page 238); Waste generated, diverted from disposal and directed to disposal (GRI 306-3 to 5). pttgc-isr2022 (New).pdf
C9. Additional metrics	Other, please specify (Water consumption)	Verification procedure is in accordance with ISAE 3000 (revised) and uses the following principles of - inclusivity, materiality, responsiveness and reliability of performance data.	The Report is in accordance with the: GRI 2021 Standards; GRI 11 Sector Standard for Oil and Gas Evaluating the reliability of data and information for selected specific standard disclosures (PDF page 238); Water withdrawal, discharge – included COD load and consumptions (GRI 303-3 to 5). pttgc-isr2022 (New).pdf
C9. Additional metrics	Other, please specify (Air emissions)	The Report is in accordance with the: GRI 2021 Standards; GRI 11 Sector Standard for Oil and Gas Evaluating the reliability of data and information for selected specific standard disclosures (PDF page 238): SOx, NOx and other significant air emissions (GRI 305-7).	The Report is in accordance with the: GRI 2021 Standards; GRI 11 Sector Standard for Oil and Gas Evaluating the reliability of data and information for selected specific standard disclosures (PDF page 238): SOx, NOx and other significant air emissions (GRI 305-7). pttgc-isr2022 (New).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, in which we could refer as a guideline to implement the carbon pricing system.

C11.2

(C11.2) Has your organization canceled any project-based carbon credits within the reporting year?

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.

Type of internal carbon price

Other, please specify (Shadow Price and Internal Fee)

How the price is determined

Alignment with the price of allowances under an Emissions Trading Scheme
Alignment with the price of a carbon tax
Price/cost of voluntary carbon offset credits
Cost of required measures to achieve emissions reduction targets
Price with material impact on business decisions

Objective(s) for implementing this internal carbon price

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

Scope(s) covered

Scope 1
Scope 2

Pricing approach used – spatial variance

Differentiated

Pricing approach used – temporal variance

Evolutionary

Indicate how you expect the price to change over time

For external carbon price (carbon regulatory price or offsetting price), we analyse indicator by country policy & ambition including consult with information services provider.
For internal carbon price (Abatement cost and Carbon incentive), we update the prices from company decarbonization roadmap which will be revisited per company execution performance and direction.

Actual price(s) used – minimum (currency as specified in C0.4 per metric ton CO2e)

497

Actual price(s) used – maximum (currency as specified in C0.4 per metric ton CO2e)

4012

Business decision-making processes this internal carbon price is applied to

Capital expenditure
Opportunity management

Mandatory enforcement of this internal carbon price within these business decision-making processes

Yes, for some decision-making processes, please specify (Decision-making of investment processes including Corporate investment level and Plant improvement investment level.)

Explain how this internal carbon price has contributed to the implementation of your organization's climate commitments and/or climate transition plan

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:

1. GHG emission growth project that are new plant asset, asset debottom neck or revamp capacity which increase GHG emission in GC will incorporate future carbon cost and impact on project return (IRR with ICP)
2. GHG emission reduction project that are new investment to reduce operational GHG emission by efficiency improvement or low carbon energy switching which will be accelerated by shadow price incentive.

In addition, GC has applied internal carbon prices to assess the Marginal Abatement Costs Curve (MACC) from various projects to compare the cost-effectiveness of operations in reducing carbon.

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

Innovation & collaboration (changing markets)

Details of engagement

Run a campaign to encourage innovation to reduce climate impacts on products and services
Invest jointly with suppliers in R&D of relevant low-carbon technologies

% of suppliers by number

50

% total procurement spend (direct and indirect)

98

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

49.42

Rationale for the coverage of your engagement

GC has set decarbonization goals and pathways in 2021, where the goal is to attain net zero emissions for scope 1 and 2 and reduce GHG emissions by 50 percent for scope 3 within 2050. Thus, GC has been working continuously to improve and develop various programs to reduce GHG emissions throughout the value chain, including customers, and suppliers (both feedstock and non-feedstock groups).

GC developed Three-Pillar Low Carbon Transition Framework, as a company's climate transition plan, consisting of Efficiency-driven, Portfolio-driven, and Compensation-driven strategies to achieve net zero CO₂ emissions by 2050. The pillar of Compensation-driven is a major part of GHG emission reduction, which it covers approximately 55% of GHG emission reduction of net zero target. Research and feasibility study of Carbon Capture, Utilization, and Storage (CCUS) implementation will significantly support GC to achieve the net zero target.

The target group was chosen from significant feedstock suppliers in order to begin the implementation in respect with spending. The engaged feedstock suppliers include PTT and Gas plant separation, which accounted for 98% of our spending since we mainly supply from within PTT group to increase synergy. GC and PTT Group joined forces with partners from the education and government sectors, from BCGeTEC, Faculty of Engineering, Chulalongkorn University, and Thailand's leading private companies to establish the "Thailand CCUS Consortium" to create cooperation in the development of CCUS technology. By capturing, utilizing, and storing carbon dioxide from the country's main industries, this technology will reduce the problem of carbon dioxide emissions from the industrial sector.

At the same time, GC also signed a Memorandum of Understanding to study the feasibility of Carbon Capture and Storage (CCS) implementation, or CCS Hub Model, with PTT Group to amplify our endeavors in reducing CO₂ from industrial sector through application of a CCS prototype project in order to achieve the goals of carbon neutrality and net zero. GC has participated and engaged in many conferences and international exhibitions with PTT group to expand the possibility of CCUS development, e.g., participated in Future Energy Asia 2022 Exhibition and Summit, which marked an important step towards national cooperation in developing efficient technology prototypes, etc.

Impact of engagement, including measures of success

Impact of engagement: Increase the application of Carbon Capture, Utilization, and Storage (CCUS) and Carbon Capture and Storage (CCS) technologies and their capacity of engaged suppliers.

Measure of Success: Engaged suppliers could successfully capture and store up to 1.32 million tons of carbon dioxide per year within 2029.

Positive Outcome: Engaged suppliers could increase the capture of CO₂ resulting in their GHG emission reductions.

Comment

-

Type of engagement

Engagement & incentivization (changing supplier behavior)

Details of engagement

Run an engagement campaign to educate suppliers about climate change
Facilitate adoption of a unified climate transition approach with suppliers

% of suppliers by number

0.2

% total procurement spend (direct and indirect)

1.56

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

0.2

Rationale for the coverage of your engagement

GC has set decarbonization goals and pathways in 2021, where the goal is to attain net zero emissions for scope 1 and 2 and reduce GHG emissions by 50 percent for scope 3 within 2050. Thus, GC has been working continuously to improve and develop various programs to reduce GHG emissions throughout the value chain, including customers, and suppliers (both feedstock and non-feedstock groups).

GC establishes a vendor's decarbonization roadmap creation program focusing on supporting the suppliers to develop their decarbonization roadmap, including assisting an assessment of supplier's readiness. This engagement is a pilot program, where the target group was chosen by selecting suppliers who are significant suppliers for GC's business operation related to waste treatment and downstream transportation activities which affect GC's Scope 3, Category 5 and 9. The engagement activity was planned to conduct throughout the year. In this case, only tier 1 non-feedstock suppliers will participate in this program, and 9 suppliers from a total of 4,242 suppliers were chosen to attend. The targeted supplier groups will be encouraged to provide the GHG emission profile, including any significant information related to developing the decarbonization roadmap. GC have just started to implement this program in 2022, and there will be a decarbonization criteria in the procurement process by 2024. Also, GC will check the progress on a bi-weekly basis.

Impact of engagement, including measures of success

Impact of engagement: 1) suppliers could be able to develop a suitable decarbonization roadmap that could be a potential and strong climate strategy to guide them pursuing on achieving Net Zero 2) the decarbonization criteria could be integrated into company's sourcing process, where the suppliers that have GHG roadmap could benefit on being chosen as a bidder list.

Measure of Success: 100% of the engaged suppliers could successfully develop their own decarbonization roadmap.

Positive Outcome: Currently, 100% of engaged suppliers have a potentials and readiness to develop a decarbonization roadmap resulting in their GHG emission reductions.

Comment

-

C12.1b

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

Type of engagement & Details of engagement

Collaboration & innovation	Collaborate with customers in creation and review of your climate transition plan
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% of customers by number

0.66

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

81.23

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

GC has engaged with key customers that their emissions covered a major part of the customer-related (downstream) Scope 3 emissions i.e., PTTOR, Thai PET resin, and Thai Shinkong. These key customers possess Categories 9 and 11 of GC's Scope 3 emissions, which accounted for 81.23% of the total customer-related Scope 3 emissions. The engagement focused on reducing both categories of the emissions. To minimize Category 9, GC has collaborated with such customers to develop pipeline infrastructure for transmitting products e.g., diesel and other downstream products, instead of transferring by automobile or road transportation. Also, to minimize Category 11, GC and the customers have plan to increase a of biofuels, which are methyl ester (B100) and Ethanol for their productions.

Impact of engagement, including measures of success

Impact of engagement:

- 1) Customers could reduce their fuel consumption for fuel transportation by changing the fuel transportation mode from road transportation to pipeline system
- 2) Customers increase amount of biofuels in their productions.

Measures of success:

- 1) Engaged customers are expected to have at least 1 emission reduction initiative or solution with GC
- 2) Increasing biofuels in the customers productions to 186 million liters/year.

Positive Outcome:

- 1) As a result of the engagement, GC and customers were able to reduce GHG emissions by decreasing the use of fuel through road transportation resulting in GHG emission reductions about 878 tCO2e/year.
- 2) GC and the customers expect to increase a of biofuels for their productions to approximately 186 million liters/year (equivalent to 416,528 tCO2e) in 2024

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.

GC regularly engages with our stakeholders involved in climate-related policies and activities including our suppliers, customers, government representatives as well as industry peers and trade association and organization members to review our climate change-related policies, positions, and activities. GC works closely with government institutions as a part of the working team including being a part of the Climate Change steering committee of the Federation of Thai Industries (F.T.I), being a part of the Ministry of Foreign Affairs, Kingdom of Thailand, and a part of the Ministry of Finance. These institutions continuously perform programs related to engaging with stakeholders to support them in comprehending expectations from financial institutions, including customer trends, on climate change that will lead to setting and understanding of climate change lobbying positions and activities.

Success metric: Number of policy launches that indicated positive impact to GC's low carbon business.

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 regularly communicates GC's Net zero roadmap, along with revised and updated procurement framework to corporate's suppliers and vendors. The suppliers that were selected as a part of pilot categories (part of decarbonization strategy) are requested to disclose their GHG emission performance. 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. This implementation was started in 2021.

In 2022 – 2023, GC expanded the implementation to support the target groups to develop their own decarbonization roadmap via educating and consulting them to utilize effective tools to collect GHG emissions, and supporting them to perform readiness assessment. Expectation of this implementation is the suppliers could successfully develop the decarbonization roadmap that could support GC to practically establish climate-related requirement as part of organization's procurement process.

% 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

External engagement activities that could directly or indirectly influence policy, law, or regulation that may impact the climate

Yes, we engage directly with policy makers

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 (Climate Strategy 2023).pdf

GC Public Commitment on Engagement Activities (website).pdf

Describe the process(es) your organization has in place to ensure that your external engagement activities are consistent with your climate commitments and/or climate transition plan

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?

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

Thailand Nationally Determined Contributions (NDCs).

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

Carbon pricing, taxes, and subsidies

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

Emissions trading schemes

Policy, law, or regulation geographic coverage

National

Country/area/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 on this policy, law, or regulation is aligned with the goals of the Paris Agreement?

Yes, we have evaluated, and it is aligned

Please explain whether this policy, law or regulation is central to the achievement of your climate transition plan and, if so, how?

GC proactively participated in discussions on environmental and climate change policies with the government to promote projects and initiatives that support Thailand's low carbon economy transition in line with Thailand's NDC and the Paris Agreement such as discussions to drive the Bio-Circular-Green Economy model which focuses on resource efficiency and circularity in the biochemicals sector, including the carbon pricing projects.

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:

1. GHG emission growth project that are new plant asset, asset debottom neck or revamp capacity which increase GHG emission in GC will incorporate future carbon cost and impact on project return (IRR with ICP)
2. GHG emission reduction project that are new investment to reduce operational GHG emission by efficiency improvement or low carbon energy switching which will be accelerated by shadow price incentive.

These contributions are in line with GC's ambitions to achieve net zero emissions by 2050 which supports the goal of restricting global temperature rise to 1.5°C above pre-industrial levels. In the long-term, this supports and enables GC to drive our own corporate transition strategy which aims to achieve net zero emissions by 2050

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

pttgc-isr2022 (New).pdf
PTT GC_TCFD 2023 (New).pdf
pttgc-ar2022.pdf

Page/Section reference

ISR 2022: Governance (Document Page 146-147), Strategy (Document Page 144 - 145, 154, 158, 167), Emission figures (Document Page 179-180), Emission targets (Document Page 181)
TCFD 2023: Governance (PDF Page 6-10), Strategy (PDF Page 11-32), Risks & Opportunities (PDF Page 21-32), Emission figures (PDF Page 41), Emission targets (PDF Page 42,43)
AR 2022: Climate Change implementation and GHG emissions highlights (PDF Page 7-20)

Content elements

Governance
Strategy
Risks & opportunities
Emissions figures
Emission targets
Other metrics

Comment

GC disclosed our climate change response in Integrated Sustainability Management Report 2022 and TCFD report 2023.

C12.5

(C12.5) Indicate the collaborative frameworks, initiatives and/or commitments related to environmental issues for which you are a signatory/member.

	Environmental collaborative framework, initiative and/or commitment	Describe your organization's role within each framework, initiative and/or commitment
Row 1	International Sustainability & Carbon Certification (ISCC) Task Force on Climate-related Financial Disclosures (TCFD) UN Global Compact	GC as a UNGC LEAD position on the active member since 2016 GC is fully integrated sustainability report. GC has been a member/supporter of TCFD since 2021. GC considers the risks and opportunities associated with climate change and has identified key climate change-related risks and opportunities, consisting of both physical risks and transition risks. GC follows the TCFD guidelines to formulate a strategic plan, action plan, and measures to cope with such risks based on data from the IPCC international body, who has assessed the Representative Concentration Pathways (RCPs) and analyzed climate impacts. GC's plant has been certified by ISCC PLUS since 2021. GC's Olefins Cracker Plant and Polyethylene Plant have obtained the "ISCC PLUS" certification from the International Sustainability & Carbon Certification, reflecting our readiness and commitment to support bio-economy and circular economy.

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 QSH&E 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 avoidance of negative impacts on threatened and protected species Commitment to no conversion of High Conservation Value areas	<Not Applicable>

C15.3

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

Impacts on biodiversity

Indicate whether your organization undertakes this type of assessment

No, but we plan to within the next two years

Value chain stage(s) covered

<Not Applicable>

Portfolio activity

<Not Applicable>

Tools and methods to assess impacts and/or dependencies on biodiversity

<Not Applicable>

Please explain how the tools and methods are implemented and provide an indication of the associated outcome(s)

<Not Applicable>

Dependencies on biodiversity

Indicate whether your organization undertakes this type of assessment

No, but we plan to within the next two years

Value chain stage(s) covered

<Not Applicable>

Portfolio activity

<Not Applicable>

Tools and methods to assess impacts and/or dependencies on biodiversity

<Not Applicable>

Please explain how the tools and methods are implemented and provide an indication of the associated outcome(s)

<Not Applicable>

C15.4

(C15.4) Does your organization have activities located in or near to biodiversity- sensitive areas in the reporting year?

No

C15.5

(C15.5) 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

C15.6

(C15.6) 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

C15.7

(C15.7) 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	Chief Executive Officer & President	Chief Executive Officer (CEO)

SC. Supply chain module

SC0.0

(SC0.0) If you would like to do so, please provide a separate introduction to this module.

SC0.1

(SC0.1) What is your company's annual revenue for the stated reporting period?

	Annual Revenue
Row 1	

SC1.1

(SC1.1) Allocate your emissions to your customers listed below according to the goods or services you have sold them in this reporting period.

SC1.2

(SC1.2) Where published information has been used in completing SC1.1, please provide a reference(s).

SC1.3

(SC1.3) What are the challenges in allocating emissions to different customers, and what would help you to overcome these challenges?

Allocation challenges	Please explain what would help you overcome these challenges
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SC1.4

(SC1.4) Do you plan to develop your capabilities to allocate emissions to your customers in the future?

SC2.1

(SC2.1) Please propose any mutually beneficial climate-related projects you could collaborate on with specific CDP Supply Chain members.

SC2.2

(SC2.2) Have requests or initiatives by CDP Supply Chain members prompted your organization to take organizational-level emissions reduction initiatives?

SC4.1

(SC4.1) Are you providing product level data for your organization's goods or services?

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