

# **GC Greenhouse Gas Report (Y2022)**



**PTT Global Chemical Public Company Limited**

**(31 May 2023)**

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## GHG REPORT FOR GC GROUP IN Y2022

### 1. General

#### 1.1. Background

PTT Global Chemical Public Company Limited (GC) has developed a corporate Greenhouse Gas (GHG) management program as a proactive initiative to respond to international and domestic pressures and to help the world in combating climate change.

#### 1.2. Standards for GHG Inventory Preparation

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).

#### 1.3 Responsible for GHG Inventory

- 1) The corporate GHG accounting team responsible for consolidating GHG data provided by the facilities will want to explore.
- 2) Facility staff responsible for reporting facility-level data to corporate should read the following sections.

#### 1.4 Reporting Period

This inventory report contains information related to GC GHG emissions the period 1<sup>st</sup> January to 31<sup>st</sup> December 2022 the total GHG emissions by scope, within our organizational boundary.

### 2. Organizational boundary

#### 2.1. General

GC consists of a number of companies with differentiated business activities. Therefore, there is need in a standardized and systematic procedure for compiling GHG emission data for the GC group that can be sustained over the long term and that will improve data quality for the group.

GC Greenhouse Gas Emission Accounting and Reporting Manual is an all-encompassing organizational GHG accounting manual for reference by all facilities under GC corporate GHG management program.

#### 2.2. Setting the organizational boundary

GC Manual uses the Operational Control approach for GHG accounting. Under the Operational Control approach, an organization accounts for GHG emissions from operations where it has full control over (all or nothing). The Operational Control gets by:

- 1) GC owns 100 % in equity share of the Company; or
  - 2) GC has the full authority to introduce and implement its operating policies at the operational level.
- Joint Venture as well as oversea facilities are not covered.

For the purpose of reporting up to the Global Reporting Initiative (GRI), Dow Jones Sustainability Index (DJSI), Carbon Disclosure Project (CDP) and GC using the Operational Control approach.

### **2.3. Greenhouse Gas Selection**

Under the Kyoto Protocol, six greenhouse gases have been selected based on the significant estimated volume in the atmosphere due to anthropogenic activities, and the significant potential for reduction. Countries which ratified the Protocol have committed to reduce the “basket-of-six” greenhouse gases, which include; Carbon dioxide (CO<sub>2</sub>), Methane (CH<sub>4</sub>), Nitrous oxide (N<sub>2</sub>O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) and Sulphur hexafluoride (SF<sub>6</sub>).

At the time of this report no official decision had been made yet by IPCC on what source of global warming potentials (GWP) values should be used in the second commitment period. This manual adopts the American Petroleum Institute (API 2009, p.3-6) guidance on GWP selection. The API (2009) prescribes the use of IPCC Second Assessment Report (SAR) until the end of the Kyoto Protocol 1<sup>st</sup> Commitment Period (31<sup>st</sup> December 2012), and the use of IPCC AR6 GWP values beyond 2020.

This report accounts for GHGs considered under the Kyoto Protocol, and the following Non-Kyoto GHG: Hydrofluorocarbons (HFCs) and CFC use in refrigeration. These compounds are to be phased out under the Montreal Protocol, and GC will account for its use and report any reduction initiatives. However, GWP of these GHGs will not be accounted for in the GHG Inventory.

## **3. GHG Inventory Component and List of Facility**

### **3.1 General**

In line with ISO 14064-1, the organization shall document the following, where quantified, separately at facility and organization levels:

- Direct GHG emissions for each GHG;
- GHG removals;
- Energy indirect GHG emissions;
- Other indirect GHG emissions; and
- Direct CO<sub>2</sub> emissions from the combustion of biomass (biogenic emissions).

The organization should document separately at facility and organization levels other categories of GHG emissions and removals as appropriate.

### **3.2 Identification and Categorization of GHG Sources and Sinks**

The organization shall, as appropriate, categorize the identified GHG sources following the categorization published by the GHG Protocol / ISO 14064:1 as follows:

### 3.2.1 Scope 1: Direct GHG Emissions

- Any fossil fuel combustion activity at stationary sources (captive power plants, process heaters, engines, turbines, flares, incinerators, oxidizers). This is normally for the generation of energy – e.g., Electricity, heat or steam.
- Process and vented emissions (process vents, equipment vents, maintenance/turnaround activities, non-routine activities).
- Any fossil fuel combustion of fuels in company owned or controlled vehicles (transportation of raw materials/products/waste; company owned vehicles);
- Fugitive emissions from pressurized equipment – e.g., Refrigeration chillers and SF<sub>6</sub> containing electrical switchgears, wastewater treatment etc.); and
- Accidental releases of GHG from equipment failure include those attributed to acts of nature or sabotage.

### 3.2.2 Scope 2: Energy Indirect GHG Emissions

- Consumption of purchased electricity, heat or steam supplied to the group by an external entity outside of the Organizational Boundary.

### 3.2.3 Scope 3: Other Indirect GHG Emissions

- Scope 3 emissions are any type of emissions which occur outside of the Organizational Boundary of GC.
- GC refer calculated to the Scope 3 Standard for requirements and guidance related to Technical Guidance for Calculating Scope 3 Emissions by GHG Protocol.

## 3.3 List of Facility

No.	Name	Business Unit	Location
1	GC 1 (RO)	Office building	59, Ratniyom Road, Noenphra, Mueang Rayong, Rayong 21150, Thailand.
2	GC 2 (I-1)	Olefins	14, I-1 Road, Tambol Maptaphut, Amphur Mueang Rayong, Rayong 21150, Thailand.
3	GC 2 (UT)	Utilities	
4	GC 2 (HDPE)	Polymers	
5	GC 2 (OLE 4)	Olefins	
6	GC 2 (HGP)	Olefins	
7	GC 3 (I-4)	Olefins	9, I-4 Road, Map Ta Phut Industrial Estate, Map Ta Phut, Mueang Rayong, Rayong 21150, Thailand.
8	GC 4 (ARO 1)	Aromatics	4, I-2 Road, Map Ta Phut Industrial Estate, Map Ta Phut, Mueang Rayong, Rayong 21150, Thailand.
9	GC 5 (ARO 2)	Aromatics	98/9, Rayong Highway 3191, RIL Industrial Estate, Maptaphut District, Rayong 21150, Thailand.
10	GC 6 (REF)	Refinery	8, I-8 Road, Map Ta Phut Industrial Estate, Map Ta Phut, Mueang Rayong, Rayong 21150, Thailand.
11	GC 7 (BTF)	Jetty & Buffer Tank Farm	19 Rong Pui Road, Map Ta Phut, Mueang Rayong, Rayong 21150, Thailand.
12	GC 8 (ATF)	Tank Farm	11, I-4 Road, Map Ta Phut Industrial Estate,

No.	Name	Business Unit	Location
			Map Ta Phut, Mueang Rayong, Rayong 21150, Thailand.
13	GC 9 (LAB)	Lab Center	24/9, Pakorn Songkrorat Road, Map Ta Phut, Mueang Rayong, Rayong 21150, Thailand
14	GC 11 (OLE 3)	Olefins	8 Padaeng Road, Maptaphut Amphur Mueng Rayong, Rayong 21150, Thailand.
15	GC 11 (LDPE)	Polymers	
16	GC 11 (LLDPE)	Polymers	
17	GC 12 (BPE)	Polymers	8, I-10 Road, Map Ta Phut Industrial Estate, Map Ta Phut, Muang Rayong, Rayong 21150, Thailand.
18	GC 16 (EO/EG)	EO-Based	9 Soi G-12 Pakorn Songkhraorat Road, Tambon Map Ta Phut Amphur Muang Rayong, Rayong 21150, Thailand.
19	GC 16 (EA)	EO-Based	
20	GGC (Plant I)	Green Chemicals	8, Pakornsongkhorat Road, Map Ta Phut, Muang Rayong, Rayong 21150, Thailand.
21	TTT	Jetty & Buffer Tank Farm	19 I-1 Road, Map Ta Phut, Muang Rayong, Rayong Province 21150, Thailand.
22	GCME	Office building	22/2 Pakornsongkoraj Rd. T.Maptaput, A.Mueang, Rayong 21150, Thailand.
23	NPC S&E	Office building	20/9 Pakorn Songkhraorat Road, Tambon Map Ta Phut Amphur Muang Rayong, Rayong 21150, Thailand.
24	GC 17 (GC Stryrenics)	Polymers	7 I-1 Rd., Map Ta Phut Industrial Estate, Map Ta Phut, Muang Rayong, Rayong 21150, Thailand.
25	ENCO (Head Office)	Office building	555/1 Energy Complex, Building A, 14th-18th Floor, Vibhavadi Rangsit Road, Chatuchak, Bangkok 10900, Thailand.
26	GC 18 (Phenol I & II)	Phenol	9 Soi G9 Hemaraj eastern Industrail Eastern Pakornsongkrohraj,Rd Map Ta Phut Rayong 21150, Thailand.
27	GC 18 (BPA)	Phenol	
28	GCL (GC Logistics)	Polymer Logistics	<u>Head Office</u> 555/1, A Building, Energy Complex, 8 Fl., Vibhavadi Rangsit Rd., Chatuchak, Bangkok 10900, Thailand. <u>International Distribution Center</u> 48 Rongpui Rd., Maptaphut, Muang, Rayong 21150, Thailand.
29	GC 13 (INNO)	Innovation building	83/9-10 Moo 5, Tambon Thap Ma, Muang Rayong, Rayong 21000 Thailand.
30	GC Corporate (Scope 1)	Corporate	Bangkok and Rayong
31	GC14 (Maintenance)	Office building	32 Rong Pui Road, Map Ta Phut, Mueang Rayong, Rayong 21150 Thailand.
32	GCMPA	Polymers	8 Pakorn Songkhraorat Road, Tambon Map Ta Phut Amphur Muang Rayong, Rayong 21150, Thailand
33	TPRC	Polymers	18, Soi G-2 Pakorn Songkhraorat Road, Tambon Map Ta Phut Amphur Muang Rayong, Rayong 21150, Thailand

No.	Name	Business Unit	Location
34	GGC (Plant II)	Green Chemicals	199/1 Moo 2, Khao Sok, Nong Yai, Chon Buri 20190, Thailand
35	GC 19 (GC Oxirane)	EO-Based	12 Soi G-4 Pakorn Songkhraorat Road, Tambon Map Ta Phut Amphur Muang Rayong, Rayong 21150, Thailand
36	GCP (GC Polyols)	Polymers	9 Soi G-14 Pakorn Songkhraorat Road, Tambon Map Ta Phut Amphur Muang Rayong, Rayong 21150, Thailand
37	GC Estate	Office building	888 Sukhumvit Road 20, Huai Pong, Amphur Muang Rayong 21150, Thailand
38	Envicco	PCR Polymers	P433+XQ7 GC Estate Rd, Ban Chang, Ban Chang District, Rayong 21130, Thailand

#### 4. GHG Reporting and Accounting

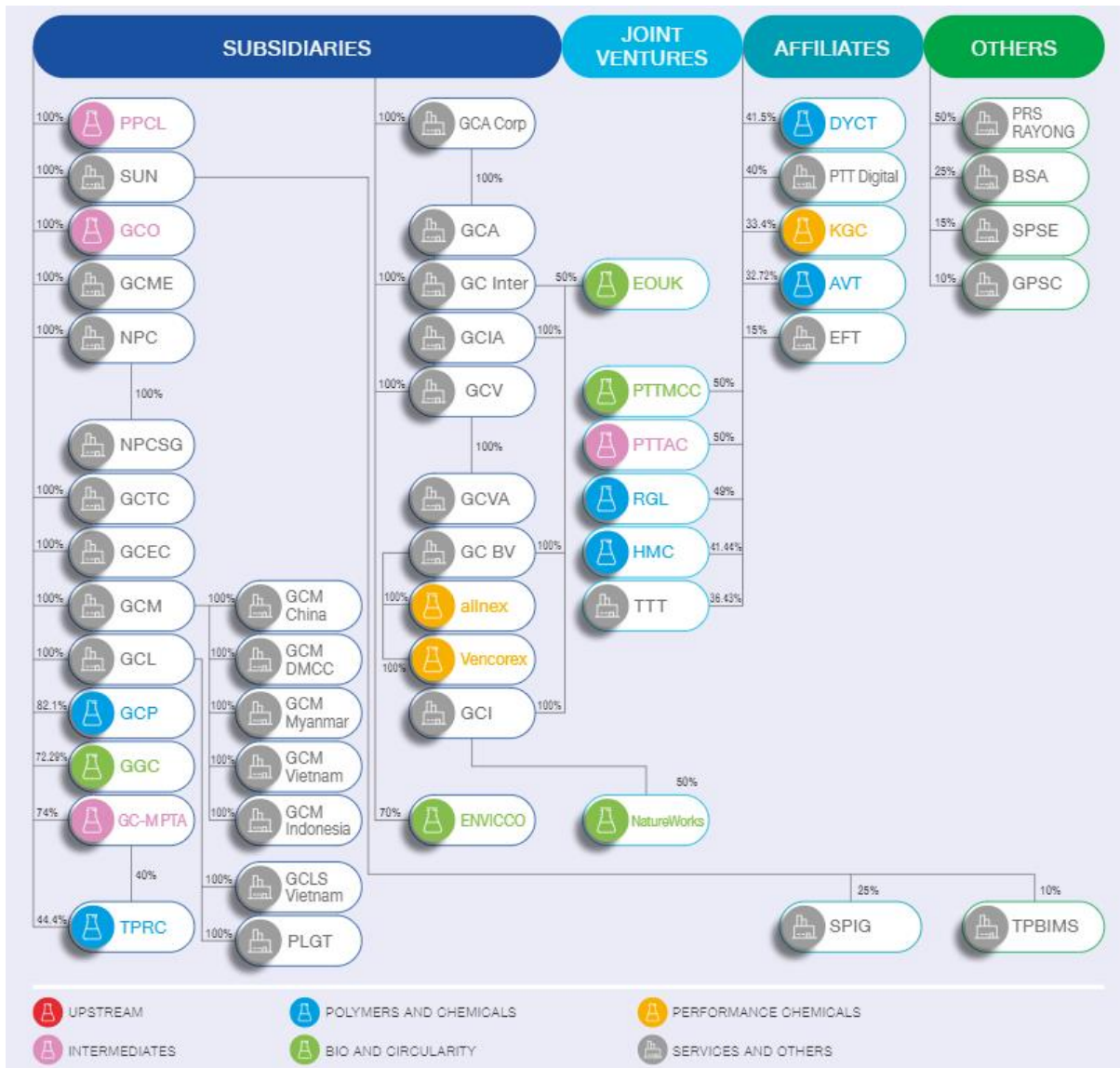
##### 4.1. General

GC uses the Operational Control approach for GHG accounting. Under the Operational Control approach, an organization accounts for GHG emissions from operations where it has full control over (all or nothing). For GHG accounting will be reported the site location within Thailand only. The Operational Control gets by:

- 1) GC owns 100% in equity share of the Company; or
- 2) GC has the full authority to introduce and implement its operating policies at the operational level.

For GPSC, combined GHG Emission in the PTT, Not including in operational control approach for GHG accounting in GC Group.

For GGC owns 100% in equity share of the TEX Company. It's not included in the operational control approach for GHG accounting in GC Group.



**Organizational Structure of GHG Reporting and Accounting**





### Structure Business of GC Group

#### 4.2. De Minimis of GHG Sources

GC applies the following De Minimis provision:

- 1) De Minimis represents GHG emitting activities which in aggregate forms less than 5% of the company’s total aggregated GHG emissions. De Minimis emissions may be quantified once at the start of the GHG accounting exercise, and the value may be used for GHG reporting in subsequent years. A recalculation of the GHG emissions for these De Minimis sources should be repeated at least once in 7 years, or when changes to the system which significantly affects the GHG emitting characteristics of the activity is implemented.
- 2) GC De Minimis includes the GHG emitting activities that required huge effort and insignificant impact to GHG emission as follows:
  - **Welding and cutting in Workshop area:** Welding and cutting activity occasionally taken place in workshop area, approximately 0.0001% of total GHG emission. Electricity consumption in Workshop is already included in scope 2 (Energy indirect greenhouse gas emission), while the use of acetylene is omitted.

- **Afforestation & Reforestation:** GHG reduction approach due to afforestation and reforestation activity is now being reviewed and will be evaluated as soon as possible.
- **Fertilizer used:** Fertilizer is mainly used for plantation in factories within GC group. However, the group gardening is serviced by external contractors, as well as fertilizing is controlled in their scopes of work, approximately 0.0002% of total GHG emission.
- **CH<sub>4</sub> Generated from toilet:** CH<sub>4</sub> generated from toilet is not practically measurable. Though, approximately 0.0001% of total GHG emission could be calculated following: 6.2.2 Domestic wastewater, Chapter 6, IPCC 2006 Vol 5. The quantification shows a very slightly significant impact to the total GHG.
- **LPG using to start-up flare:** Flare system commonly uses LPG for starting up the system, after that natural gas and flare gas are continuously consumed for pilot flare. Thus, LPG used to start-up flare is ignored since very less consumption, approximately 0.0001% of total GHG emission.

### 4.3. Biogenic CO<sub>2</sub> Emissions

Biogenic emissions are direct CO<sub>2</sub> emissions from biologically sequestered carbon (e.g., CO<sub>2</sub> from burning biomass/biofuels). These emissions shall be quantified and reported separately from the Scopes. Biogenic emissions occur in all types of biomasses, biofuels, and biogas. Biogenic CO<sub>2</sub> should only contain that part of the fuel that relates to the quantities of biofuel and not to the total volume of liquids into which the biofuels are blended (if blended).

## 5. GHG Emissions Sources

### 5.1. General

GC Group estimated the GHG emissions based on direct GHG emissions, energy indirect GHG emissions, and other indirect GHG emissions as the operational boundaries.

- **Direct GHG emissions (Scope 1)** refer to the GHG generated from the emission sources possessed or controlled by GC Group. They include emissions from
  - Process and vented emissions from: CO<sub>2</sub> Separation, Ethylene production, other process and Vent emission.
  - Fugitive emission from: Use of HFCs and SF<sub>6</sub>, Wastewater Treatment Plant and Other facilities.
  - Emission from combustion: Flare combustion, Coke combustion, Mobile fuel combustion and Stationary fuel combustion.
- **Energy indirect GHG emissions (Scope 2)** refer to the amount emitted as a result of GC

Group activities, although their emission sources are possessed or controlled by other companies. Generally, they include emissions from

- Electricity purchased.
- Steam purchased.
- **Other indirect GHG emissions (Scope 3)** refer to the amount indirect emissions which are a consequence of the activities of the GC Group, the significant emission is identified. The method of identification is considered by sizing, level of influence, risk, opportunity, sector guidance, outsourcing, and employee engagement. If the result of evaluation is more than 2.5 points, it is identified to be significant emission to report as following.
  - Categories 1- Purchased goods and service; Raw material, Chemical, Catalyst, and Packaging
  - Categories 2- Capital goods
  - Categories 3- Fuel-and-energy-related activities (not included in scope 1 or scope 2)
  - Categories 4- Upstream transportation and distribution
  - Categories 9- Downstream transportation and distribution; Polymer product
  - Categories 10- Processing of sold products; Polymer product.
  - Categories 11- Use of sold product.
  - Categories 12- End-of-life treatment of sold product.
  - Categories 15- Investment

## 5.2 Break down of GHG emissions.

### 1) Breakdown of GHG emissions by facility

Facility Name	Scope 1 (t-CO <sub>2</sub> eq)	Scope 2 (Location based) (t-CO <sub>2</sub> eq)	Scope 2 (Market based) (t-CO <sub>2</sub> eq)	Scope 3 (t-CO <sub>2</sub> eq)	Total (t-CO <sub>2</sub> eq)
GC 1 (RO)	1,279	4,006	0	0	5,284
GC 2 (I-1)	244,145	0	0	0	244,145
GC 2 (UT)	1,628,614	314	13,507	0	1,642,435
GC 2 (HDPE)	4,660	0	0	0	4,660
GC 2 (OLE4)	549,781	0	0	0	549,781
GC 2 (HGP)	1,003	0	0	0	1,003
GC 3 (I-4)	858,513	0	195,903	0	1,054,416
GC 4 (ARO 1)	230,225	0	293,030	0	523,255
GC 5 (ARO 2)	653,549	0	308,377	0	961,926
GC 6 (REF)	876,829	3,034	0	0	879,863
GC 7 (BTF)	1,796	0	0	0	1,796
GC 8 (ATF)	865	0	5,590	0	6,455
GC 9 (LAB)	9	0	2,798	0	2,807
GC 11 (OLE3)	660,265	0	159,617	0	819,883
GC 11 (LDPE)	10,007	0	109,013	0	119,020
GC 11 (LLDPE)	18,384	0	103,586	0	121,969
GC 12 (BPE)	579	19	15,110	0	15,708

Facility Name	Scope 1 (t-CO <sub>2</sub> eq)	Scope 2 (Location based) (t-CO <sub>2</sub> eq)	Scope 2 (Market based) (t-CO <sub>2</sub> eq)	Scope 3 (t-CO <sub>2</sub> eq)	Total (t-CO <sub>2</sub> eq)
GC 16 (EOEG)	33,343	0	111,508	0	144,851
GC 16 (EA)	0	0	16,612	0	16,612
GGC (Plant 1)	190	0	63,757	0	63,947
TTT	1,840	0	0	0	1,840
GCME (PTTME)	978	559	0	0	1,537
NPC S&E	714	383	0	0	1,096
GC 17 (GC Stryrenics)	2,826	0	0	0	2,826
ENCO (Head Office)	0	215	0	0	215
GC 18 (Phenol)	13,036	0	329,445	0	342,481
GC 18 (BPA)	522	0	110,086	0	110,608
GC Logistics (PTTPL)	1,712	427	8,624	0	10,762
GC 13	0	180	0	0	180
GC Corporate (Scope 1)	4,395	0	0	0	4,395
GC 14	0	180	0	0	180
GC-M PTA	204,706	0	104,450	0	309,156
TPRC	29,288	0	16,724	0	46,012
GGC (Plant 2)	25,423	7,097	0	0	32,520
GC 19 (GCO)	81,292	0	129,291	0	210,583
GCP	7,853	0	11,345	0	19,198
GC Estate	1	369	0	0	370
Envicco	0	0	3953	0	3,953
GC Scope 3	-	-	-	35,303,340	35,303,340
<b>GC Group</b>	<b>6,148,622</b>	<b>16,783</b>	<b>2,112,327</b>	<b>35,303,340</b>	<b>43,581,071</b>

## 2) Break down GHG emissions by Activity.

Activity	GHG Emissions (t-CO <sub>2</sub> eq)	%
<b>Scope 1</b>		
CO <sub>2</sub> Separation	12,557	0.03
Ethylene Production	304,250	0.70
Other Process and Vented Emissions	128,848	0.30
Fugitive emissions of SF <sub>6</sub> and HFCs	9,903	0.02
Fugitive Emissions from Wastewater Treatment Plants	-	-
Fugitive Emissions from Facilities	2,318	0.01
Flare Combustion	214,194	0.49
Mobile Fuel Combustion	7,725	0.02
Stationary Fuel Combustion	5,464,814	12.54
Coke Combustion	4,013	0.01
<b>Total Scope 1</b>	<b>6,148,622</b>	<b>14.11</b>
<b>Scope 2</b>		
Location-based	16,783	0.04
Market-based	2,112,327	4.85
<b>Total Scope 2</b>	<b>2,129,109</b>	<b>4.89</b>
<b>Scope 3</b>		
Categories 1- Purchased goods and services (Raw material,	5,642,268	12.95

Activity	GHG Emissions (t-CO <sub>2</sub> eq)	%
Chemical, Catalyst, and Packaging)		
Categories 2- Capital goods	46,032	0.11
Categories 3- Fuel- and energy-related activities	978,957	2.25
Categories 4- Upstream transportation and distribution	540,983	1.24
Categories 9- Downstream transportation and distribution (Polymer product)	22,314	0.05
Categories 10- Processing of sold products (Polymer product)	2,475,156	5.68
Categories 11- Use of sold product	22,798,563	52.31
Categories 12- End-of-life treatment of sold product	990,880	2.27
Categories 15- Investments	1,808,187	4.15
<b>Total Scope 3</b>	<b>35,303,340</b>	<b>81.01</b>

### 5.3 GHG Emissions Summary

GC Group's total Scope 1 GHG Emission including GHG emitted within the organizational boundary is **6,148,622 tCO<sub>2</sub>eq**, accounting for **14.11%** of the company's total emissions.

For GC Group's total Scope 2 GHG Emission are GHG emitted in the course of purchasing electricity and steam to GC Group is **2,129,109 tCO<sub>2</sub>eq**, accounting for **4.89%** of the company's total emissions.

For GC Group's total Scope 3 GHG Emission excluding GHG emitted from activities accounted as Scope 1 & 2 emissions in other companies within the GC Group is **35,303,340 tCO<sub>2</sub>eq**, accounted for **81.01%** of the company's total emissions.

Anthropogenic biogenic emissions are **150 tons**.

## 6. Base year

Year 2020 is nominated as a fixed base year, as it is the year where sufficiently reliable GHG data for GC is available verification. This baseline is used to compare a current year's GHG emissions. GC may decide to participate in may have a definition on what is considered significant change to the GHG inventory which trigger base year recalculation.

## 7. Data Quality Management Procedure

A data quality management program is essential to ensure that a GHG accounting and reporting system meets the five principles of the GHG accounting manual. In order to maintain the quality of the GC GHG Inventory, the following considerations shall be implemented in the GC GHG accounting and reporting program:

### **7.1 Organizational Structure**

A GHG reporting organizational structure shall be developed and communicated to all employees involved in the program. All involved shall understand which department/individual are responsible for which task, and who shall the results/ data be communicated to. The organizational structure shall include owners (department/individual) for all activities within this program which includes but not limited to data collection, verification, consolidation, and reporting.

### **7.2 Data management Procedures**

The four key items necessary to ensure quality of data are:

- 1) Data collection.
- 2) Data recording and retention system.
- 3) QA/QC procedure; and
- 4) Emergency procedures

The procedures for the above four items shall be outlined in more detail in each company's customized data management manual. Companies may reference ISO 14001 in developing its Data Management Manual.

### **7.3 Uncertainty Analysis**

Uncertainty investigations can be part of a broader learning and quality feedback process. They can support a company's efforts to understand the causes of uncertainty and help identify ways of improving inventory quality. These investigations establish lines of communication and feedback with data suppliers to identify specific opportunities to improve the quality of the data and methods used.

Estimation uncertainty arises any time greenhouse gas emissions are quantified. Therefore, all emission or removal estimates are associated with estimation uncertainty. Estimation uncertainty can be further classified into two types: model uncertainty, and parameter uncertainty.

Model uncertainty relates to any type of modeling conducted to estimate any amount of release, for example accidental release, fugitive emissions etc. Manual estimation using professional judgment also counts within this category. If an accidental release occurred, and the site engineer estimated the release amount by considering the time when the release occurred, stopped and flow rate, then the accuracy of the estimated time and flow of release shall be considered.

Parameter uncertainty relates to activity data, emissions factor, meter, and/or measurement accuracy. For activity data and emission factor data, the log-normal distribution is often determined to be a reasonable fit. This report focuses on quantifying parameter uncertainty from activity data and emission factors; however, the pedigree matrix approach and many of the propagation techniques discussed below may also apply for direct emissions data. For meter and measurement, if a flow rate meter has an accuracy of  $\pm 5\%$ , then data read from it will have uncertainty of  $\pm 5\%$ . GC may combine its parameter uncertainty information using either of the following approaches by order of preference:

- First Preference: A Full Quantitative Approach
- Second Preference: Simplified Quantitative Approach; and
- Third Preference: A Qualitative Approach.

#### **7.4 Emergency Procedure**

An emergency procedure is related to data collection issues with respect to metering failure or human error. Procedures should be applied, in line with ISO 14001 requirement to eliminate or reduce the risk of data loss/incomplete data collection. Compliance with ISO 14001 procedural methods is encouraged, but not mandatory.

### **8. GC Greenhouse Gas Statement 2022**

GC hereby confirms that our 2022 GHG emissions calculations have been conducted as per the GC GHG accounting and reporting manual using the corresponding GHG accounting tool version 1. Any diversions to the manual or exclusions are outlined in this assertion. This has been prepared according to ISO 14064-1:2018.

We assert that for the period 1<sup>st</sup> January to 31<sup>st</sup> December 2022 the total GHG emissions by scope, within our organizational boundary are as follows:

Scope	GHG emissions (tons CO <sub>2</sub> equivalent)			
	2019	2020* (recalculated)	2021* (recalculated)	2022
Direct GHG Emissions	5,822,792	5,787,067	6,538,153	6,148,622
Energy Indirect GHG Emissions (Market-based)	1,950,204	1,961,434	2,222,215	2,112,327
Energy Indirect GHG Emissions (Location-based)	7,470	17,487	15,953	16,783
Other indirect GHG emissions	36,589,396	38,446,123	36,923,888	35,303,341
Categories 1- Purchased goods and service	5,837,221	5,707,398	6,087,267	5,642,268
Categories 2- Capital goods	-	-	258,236	46,032
Categories 3- Fuel-and-energy-related activities (not included in Scope 1 or 2)	1,171,556	1,148,852	1,031,996	978,957
Categories 4- Upstream transportation and distribution	546,629	588,896	560,586	540,983
Categories 9- Downstream transportation and distribution	30,430	31,904	40,138	22,314
Categories 10- Processing of sold products	2,345,717	2,404,437	2,501,051	2,475,156
Categories 11- Use of sold product	23,133,788	25,069,677	24,266,496	22,798,563
Categories 12- End-of-life treatment of sold product	608,276	589,289	604,053	990,880
Categories 15- Investment	2,915,779	2,905,669	1,574,065	1,808,187

Remarks: \* In Y2019 GWP version AR4 was used.

\*\* In Y2020-2022, GWP was changed from AR4 to AR6.

\*\*\* In Y2021-2022, Scope 3 calculation in categories 2 capital goods was added.

Other indirect GHG emissions (Scope 3) included Purchased goods & services, Capital goods, Fuel-and energy-related activities (not included in scope 1 or 2), Upstream transportation & distribution, Downstream transportation & distribution, Processing of sold products, Use of sold products, End of life treatment of sold products, and Investment.



Scope (as defined within ISO 14064-1:2018)	GHG emissions (tons CO <sub>2</sub> equivalent)			
	2019	2020* (recalculated)	2021* (recalculated)	2022
Direct GHG Emissions and removals (Category 1)	5,822,792	5,787,067	6,538,153	6,148,622
Indirect GHG Emissions from imported energy (Category 2, Location-based)	1,950,204	1,961,434	2,222,215	2,112,327
Indirect GHG Emissions from imported energy (Category 2, Market-based without attribute bundle)	7,470	17,487	15,953	16,783
Indirect GHG Emissions from transportation (Category 3, Upstream transportation and distribution)	546,629	588,896	560,586	540,983
Indirect GHG Emissions from transportation (Category 3, Downstream transportation and distribution)	30,430	31,904	40,138	22,314
Indirect GHG Emissions from products used by organization (Category 4, Purchased goods and services)	5,837,221	5,707,398	6,087,267	5,642,268
Indirect GHG Emissions from products used by organization (Category 4, Capital goods)	-	-	258,236	46,032
Indirect GHG Emissions from products used by organization (Category 4, Fuel-and energy-related activities)	1,171,556	1,148,852	1,031,996	978,957
Indirect GHG Emissions associated with the use of products from the organization. (Category 5, Processing of sold products)	2,345,717	2,404,437	2,501,051	2,475,156
Indirect GHG Emissions associated with the use of products from the organization. (Category 5, Use of sold products)	23,133,788	25,069,677	24,266,496	22,798,563
Indirect GHG Emissions associated with the use of products from the organization. (Category 5, End of life treatment of sold products)	608,276	589,289	604,053	990,880
Indirect GHG Emissions associated with the use of products from the organization. (Category 5, Investment)	2,915,779	2,905,669	1,574,065	1,808,187

Anthropogenic biogenic emissions are **150 tons**.

Due to the calculation of GHG in 2022 has updated in several areas such as new operating sites update. Therefore, 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.

In 2022, Examples of performance enhancement projects include activities on energy conservation projects as follows:

- Propane Dehydrogenation (PDH) Optimization Model to improve process efficiency and reduce CO<sub>2</sub> Emissions 1,700 tons CO<sub>2</sub> equivalent per year.
- Floating Solar by generate power from floating solar panels for the company's use. This project can reduce CO<sub>2</sub> Emissions 1,700 tons CO<sub>2</sub> equivalent per year.
- Wastewater Reverse Osmosis (WWRO) reduces CO<sub>2</sub> Emissions 3,477 tons CO<sub>2</sub> equivalent per year.

These projects were leading to the GHG reduction of 59,903 tons CO<sub>2</sub> equivalent with 261 million Thai Baht investment and 471.6 million Thai Baht cost saving (estimate).

GC has set target of GHG emissions reduction (Greenhouse gas emission reduction):

- 1) greenhouse gas emissions reduction (scope 1 and 2) by 20 percent within 2030 compared to base year (2020), and 2) net zero emission (scope 1 and 2) within 2050 based on net zero commitment.

In 2022, which represents are emit greenhouse gases emission (scope 1 and 2) by 8.27 million tons CO<sub>2</sub> equivalent and its achieve the target, and emit greenhouse gases emission intensity (scope 1 and 2) by 407 kgCO<sub>2</sub> equivalent per ton productions, decrease from greenhouse gas emission intensity by 1.1 percent, compared with the previous year, according to; Turnaround activity for GC 11 (OLE3), GC 18 (BPA), GC 4 (ARO1), GC 19 (GCO), GC 6 (REF), GC 16(Glycol).

GC ensures the selection of appropriate methodology for data collection. The outcomes of all submitted information are in accordance with the global standard, which is also reviewed internally by senior management and externally reviewed by credible third party to ensure that applied approach is rigorous and transparent.