So-Giant Oil Seal Industrial Co., Ltd.

2024
Greenhouse Gas Inventory Report

Inventory Period: January 1, 2024 - December 31, 2024

May 2025

Table of Contents

Chapter 1: Company Introduction and Policy Statement

1.1 Preface

In recent years, climate change has become a critical global issue affecting economics, politics, and the environment. Taiwan has pledged to achieve net-zero emissions by 2050. In March 2022, the National Development Council announced the Net-Zero Emissions Pathway and 12 key strategies for a sustainable transition toward low-carbon and net-zero goals. These strategies provide a direction for industries, including small and medium-sized enterprises, to reduce emissions and achieve sustainability.

So-Giant Oil Seal Industrial Co., Ltd. (hereinafter referred to as 'SOG') recognizes the importance of understanding its GHG emission sources and calculations. To align with domestic and international trends, the company participated in the Industrial Low-Carbon Transformation Guidance Project by the Ministry of Economic Affairs. Through GHG source identification and emission quantification, the company seeks to understand its emissions, explore reduction potentials, meet carbon management requirements, and propose effective carbon management strategies.

1.2 Intended Use

This report is primarily intended for internal GHG management and as a reference for SOG's future emission reduction plans. It is developed as part of the GHG inventory guidance under the project.

The report presents GHG emissions information specific to SOG's primary factory. The inventory process adheres to principles of relevance, completeness, consistency, accuracy, and transparency.

1.3 Company Profile

Founded in 1988, SOG Oil Seal Industrial Co., Ltd. is located at No. 6, Industrial East Road, Nangang Industrial Park, Nantou City, Nantou County, Taiwan. The company specializes in the production of rubber sealing components and oil seals.

SOG operates under the business philosophy of 'Customer First, Concept Leadership, Competitive Growth,' prioritizing customer quality needs as its top guideline. It has successfully marketed its SOG brand products worldwide and received recognition as a TOP5000 outstanding enterprise in Taiwan. The company is a leader in its industry, setting trends in operational models and product development.

Committed to sustainable development, SOG obtained international quality management certifications in 1997 and introduced environmental, safety, and health management systems in 2012. The company is now focusing on sustainable resource utilization and low-carbon product services, aiming to reduce carbon footprints through low-carbon measures in its production

processes. SOG is dedicated to meeting global low-carbon product demands and achieving a win-win outcome for sustainable industrial symbiosis.

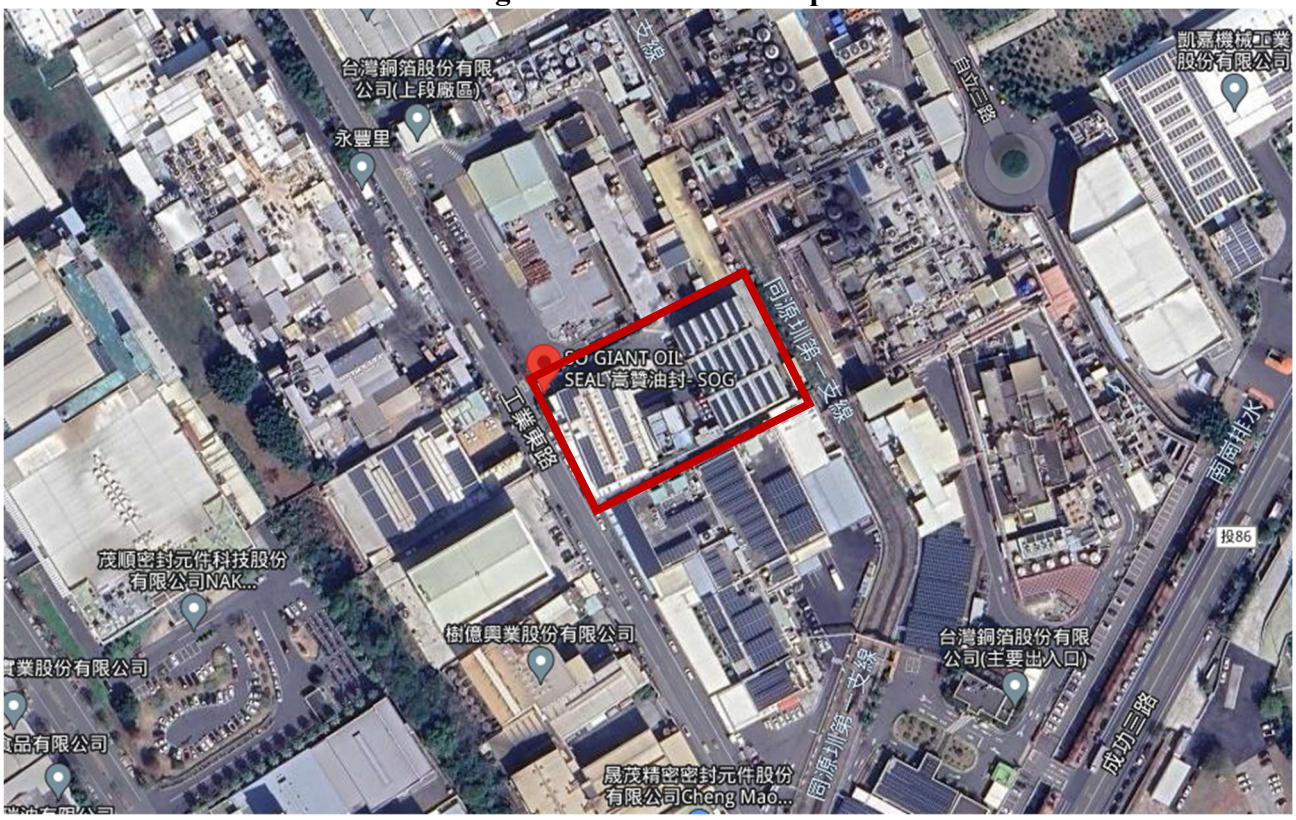
Chapter 2: Inventory Boundary Setting

2.1 Organizational Boundary Setting

The organizational boundary setting for this inventory follows the ISO/CNS 14064-1 standard and the guidelines provided by the Ministry of Environment for GHG emission inventory. SOG adopts the operational control approach to include all GHG emissions from facilities under its operational control.

The boundary of SOG's primary factory is based on its location at No. 6, Industrial East Road, Nangang Industrial Park, Nantou City. The boundary includes the factory area and administrative offices.

Fig2.1 SOG Location Map



2.2 Operational Boundary

After confirming the organizational boundary, the inventory identifies emission sources within the operational boundary. Emission sources are categorized into direct and indirect emissions to clearly define the report boundary and manage risks and opportunities related to GHG emissions. Exclusions of any sources will be supported with reasonable evidence and explanations in future reports.

The following summarizes the identified direct and indirect GHG emission sources.

Table 2.1 Summary of Operational Boundary of SOG's Primary Factory

Reporting Boundary	Emission Sources
Direct Emission Sources (Category 1)	1. Emergency Generators (Diesel) 2. Handheld Lawn Mowers (Diesel) 3. Forklifts (Diesel) 4. Official Vehicles (Gasoline) 5. Official Vehicles (Diesel) 6. Argon Welding Machines (Welding Rods) 7.Water Dispensers, Car Air Conditioners, Dehumidifiers, Refrigerators, Chillers, Air Conditioning Systems (Refrigerants) 8. Septic Tanks (Sewage) 9. ABC Fire Extinguishers[1]
Indirect Emission Sources From imported energy (Category 2)	Power Supply from Taiwan Power Company for the Entire Plant Area

Note: ABC Dry Powder Fire Extinguishers are not greenhouse gas emission sources; they are identified but their emissions are not calculated.

Chapter 3: Reported GHG Emissions

3.1 GHG Emission Types and Quantities

The Kyoto Protocol, adopted at the Third Conference of the Parties to the UN Framework Convention on Climate Change (UNFCCC), mandates reductions in seven types of GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3).

This inventory includes emissions of CO_2, CH_4, N_2O, and HFCs. The emission quantities for each gas are detailed in Table 3.1.

Table 3.1 Total Greenhouse Gas Emissions of SOG

Greenhouse Gas / Item	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	NF_3	Total GHG Annual Emissions (CO_2e, Metric Tons)
Emission Equivalent (Metric Tons CO_2e/year)	409.4543	5.8725	0.7371	1.5927	0.0000	0.0000	0.0000	**417.657**
Percentage Share (%)	98.04	1.41	0.18	0.38	0.00	0.00	0.00	100.00

3.2 Direct GHG Emissions (Category 1)

Direct GHG emissions originate from sources owned or controlled by the organization, including stationary sources (e.g., emergency generators), mobile sources (e.g., vehicles), process emissions (e.g., welding equipment), and fugitive emissions (e.g., refrigerant leaks from cooling equipment).

Table 3.2 Direct Greenhouse Gas Emission Sources of SOG

Inventory information						Possible GHGs						
NO.	**Equipment**	**Category**	**ISO14064-1:2018 Inventory categories**	**Emission Category**	**Type**	**CO_2**	**CH_4**	**N_2O**	**HFCs**	**PFCs**	**SF_6**	**NF_3**
1	Emergency Generator	1	1.1 Direct Emissions from Stationary Combustion Sources	Diesel	Stationary	✓	✓	✓				
2	Handheld Lawn Mower	1	1.1 Direct Emissions from Stationary Combustion Sources	Diesel	Stationary	✓	✓	✓				
3	Forklift	1	1.2 Direct Emissions from Mobile Combustion Sources	Gasoline	Mobile	✓	✓	✓				
4	Official Vehicle	1	1.2 Direct Emissions from Mobile Combustion Sources	Diesel	Mobile	✓	✓	✓				
5	Official Vehicle	1	1.2 Direct Emissions from Mobile Combustion Sources	Diesel	Mobile	✓	✓	✓				
6	Welding Equipment	1	1.3 Direct Process Emissions and Removal from industrial process	Welding Rods	Process	✓						
7	Water Dispenser	1	1.4 Direct Fugitive Emissions from the release of GHGs in anthropogenic systems	Refrigerant (R134a)	Fugitive				✓			
8	Car Air Conditioner	1	1.4 Direct Fugitive Emissions from the release of GHGs in anthropogenic systems	Refrigerant (R134a)	Fugitive				✓			

Inventory information						Possible GHGs						
NO.	Equipment	Category	ISO14064-1:2018 Inventory categories	Emission Category	Type	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	NF_3
9	Dehumidifier	1	1.4 Direct Fugitive Emissions from the release of GHGs in anthropogenic systems	Refrigerant (R134a)	Fugitive				✓			
10	Refrigerator	1	1.4 Direct Fugitive Emissions from the release of GHGs in anthropogenic systems	Refrigerant (R134a)	Fugitive				✓			
11	Refrigerator	1	1.4 Direct Fugitive Emissions from the release of GHGs in anthropogenic systems	Refrigerant (R600a)[1]	Fugitive				✓			
12	Chiller	1	1.4 Direct Fugitive Emissions from the release of GHGs in anthropogenic systems	Refrigerant (R22)[2]	Fugitive				✓			
13	Air Conditioner	1	1.4 Direct Fugitive Emissions from the release of GHGs in anthropogenic systems	Refrigerant (R410a)	Fugitive				✓			
14	Septic Tank	1	1.4 Direct Fugitive Emissions from the release of GHGs in anthropogenic systems	Sewage	Fugitive		✓					

Notes:
1.R-600a((Isobutane, C_4H_{10})，is identified as a source, but emissions are not calculated due to the absence of a GWP value from the IPCC.
2.R22 refrigerant is regulated under the Montreal Protocol; hence, emissions are identified but not included in the calculation.

3.3 Indirect Emission Sources from imported energy (Category 2)

Indirect GHG emissions arise from the generation of imported electricity. Table 3.3 summarizes the energy-related indirect emissions of the factory.

Table 3.3 Indirect Emission Sources from imported energy of SOG

Inventory information						Possible GHGs						
NO.	Equipment	Category	ISO14064-1:2018 Inventory categories	Emission Category	Type	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	NF_3
1	Miscellaneous Facilities	2	2.1 Indirect Emissions from imported energy	Purchased Electricity	Purchased Electricity	✓						

3.4 Total GHG Emissions

The total GHG emissions of SOG's primary factory for the year 2024 amounted to 417.657 tons CO_2e.

Chapter 4: Data Quality Management

4.1 Quantification Method

The quantification of GHG emissions for SOG's primary factory uses two internationally recognized methods: the 'Emission Factor Method' and the 'Mass Balance Method.' Detailed calculations for various emission sources are described below.

1.Category 1

(1) Stationary Combustion Emission Sources (Emergency Generators and Handheld Lawn Mowers)

- GHG Emission Calculation Formula：

  GHG Emission=Activity Data×Emission Factor×Global Warming Potential (GWP)

- Activity Data: Fuel consumption (diesel, gasoline) in kiloliters
- Emission Factor: Sourced from the Greenhouse Gas Emission Factor Management Table (Version 6.0.4)

Table 4.1. Stationary Combustion Emission Sources(Emergency Generators and Handheld Lawn Mowers)

Emission Source	Raw material/ fuel or product	Category	Emission Type	Activity Data		Emission Factor and GHG Emission							
				Activity Data	unit	GHGs	Emission Factor Type	Emission Factor	Emission Factor Source	Emission Factor unit	Emission (tons/year)	GWP	CO_2e (tons/year)
Emergency Generator	Diesel	1	Stationary	0.0100	kiloliters	CO_2	Nation level emission factor	2.6060317920	Ministry of Environment Greenhouse Gas Emission Coefficient Management Table Version 6.0.4	tons/kL	0.0261	1	0.0261
						CH_4		0.0001055074			0.0000	27.0	0.0000
						N_2O		0.0000211015			0.0000	273	0.0000
Handheld Lawn Mower	Gasoline	1	Stationary	0.0044	kiloliters	CO_2	Nation level emission factor	2.2631328720	Ministry of Environment Greenhouse Gas Emission Coefficient Management Table Version 6.0.4	tons/kL	0.0100	1	0.0100
						CH_4		0.0000979711			0.0000	27.0	0.0000
						N_2O		0.0000195942			0.0000	273	0.0000

(2) Mobile Combustion Emission Sources (Forklifts and Official Vehicles)

- GHG Emission Calculation Formula：

  GHG Emission=Activity Data×Emission Factor×Global Warming Potential (GWP)

- Activity Data: Fuel consumption (diesel, gasoline) in kiloliters
- Emission Factor: Sourced from the Greenhouse Gas Emission Factor Management Table (Version 6.0.4)

Table 4.2 Mobile Combustion Emission Sources (Forklifts and Official Vehicles)

Emission Source	Raw material/ fuel or product	Category	Emission Type	Activity Data		Emission Factor and GHG Emission							
				Activity Data	unit	GHGs	Emission Factor Type	Emission Factor	Emission Factor Source	Emission Factor unit	Emission (tons/year)	GWP	CO_2e (tons/year)
Forklift	Diesel	1	Mobile	0.1874	kiloliters	CO_2	Nation level emission factor	2.6060317920	Ministry of Environment Greenhouse Gas Emission Coefficient Management Table Version 6.0.4	tons/kL	0.4885	1	0.4885
						CH_4		0.0001371596			0.0000	27.0	0.0000
						N_2O		0.0001371596			0.0000	273	0.0000
Official Vehicle	Diesel	1	Mobile	9.8919	kiloliters	CO_2	Nation level emission factor	2.6060317920		tons/kL	25.7786	1	25.7786
						CH_4		0.0001371596			0.0014	27.0	0.0378
						N_2O		0.0001371596			0.0014	273	0.3822
Official Vehicle	Gasoline	1	Mobile	4.9090	kiloliters	CO_2	Nation level emission factor	2.2631328720		tons/kL	11.1098	1	11.1098
						CH_4		0.0008164260			0.0040	27.0	0.1080
						N_2O		0.0002612563			0.0013	273	0.3549

(3) Emissions from process (Welding Equipment)

- GHG Emission Calculation Formula：

  GHG Emission=Activity Data×Emission Factor×Global Warming Potential (GWP)

- Activity Data: Welding rod consumption in tons
- Emission Factor: Calculated using the mass balance method based on chemical reaction stoichiometry ($C+O_2 \rightarrow CO_2$).The calculated Emission Factor is 3.6666666667.

Table 4.3 Emissions from process (Welding Equipment)

Emission Source	Raw material/ fuel or product	Category	Emission Type	Activity Data		Emission Factor and GHG Emission							
				Activity Data	unit	GHGs	Emission Factor Type	Emission Factor	Emission Factor Source	Emission Factor unit	Emission (tons/year)	GWP	CO_2e (tons/year)
Welding Equipment	Welding Rods	1	Process	0.0000	tons	CO_2	Calculated using the mass balance method	3.6666666667	mass balance method	tons/tons	0.0000	1	0.0000

Note. The carbon content of the welding rod was not detected. Based on the principle of conservatism, the calculation is based on 100% carbon content.

(4) Fugitive Emission Sources (Septic Tanks)

- GHG Emission Calculation Formula：

  GHG Emission=Activity Data×Emission Factor×Global Warming Potential (GWP)

- Activity Data: Annual man-hours
- Emission Factor: Referenced from the Greenhouse Gas Emission Factor Management Table (Version 6.0.4).

Table 4.4 Fugitive Emission Sources (Septic Tanks)

Emission Source	Raw material/ fuel or product	Category	Emission Type	Activity Data		Emission Factor and GHG Emission							
				Activity Data	unit	GHGs	Emission Factor Type	Emission Factor	Emission Factor Source	Emission Factor unit	Emission (tons/year)	GWP	CO_2e (tons/year)
Septic Tank	Sewage	1	Fugitive	133,112.0000	man-hours	CH_4	Nation level emission factor	0.0000015938	Ministry of Environment Greenhouse Gas Emission Coefficient Management Table Version 6.0.4	tons/ man-hours	0.2121	27.0	5.7267

(5) Fugitive Emission Sources (Refrigerants)

- GHG Emission Calculation Formula：

  GHG Emission= Refrigerant Leakage × Global Warming Potential (GWP)

  Refrigerant Leakage= refrigerant charge × equipment leakage rate (%)

- Activity Data: Annual refrigerant charge(ton)
- Emission Factor: Derived from IPCC recommended leakage rate values as Table4.5.

Table 4.5 Emission Factors for Refrigerant Leakage Rates by Equipment Type

Equipment Type	Leakage Rate (%)
Household Refrigeration and Freezing Equipment	0.1≦x≦0.5
Independent Commercial Refrigeration Equipment	1≦x≦15
Medium and Large Refrigeration Equipment	10≦x≦35
Transportation Refrigeration Equipment	15≦x≦50
Industrial Refrigeration Equipment (including food processing and storage)	7≦x≦25
Chillers	2≦x≦15
Air Conditioners for Residential and Commercial Buildings	1≦x≦10
Mobile Air Purifiers	10≦x≦20

Table 4.5 Fugitive Emission Sources (Refrigerants)

Emission Source	Raw material/ fuel or product	Category	Emission Type	Activity Data		Emission Factor and GHG Emission							
				Activity Data	unit	GHGs	Emission Factor Type	Emission Factor	Emission Factor Source	Emission Factor unit	Emission (tons/year)	GWP	CO_2e (tons/year)
Water Dispenser	Refrigerant (R134a)	1	Fugitive	0.0016	tons	HFCs	Nation level emission factor	0.0030000000	Ministry of Environment Greenhouse Gas Emission Coefficient Management Table Version 6.0.4	tons/tons	0.0000	1,526	0.0000
Car Air Conditioner	Refrigerant (R134a)	1	Fugitive	0.0037	tons	HFCs	Nation level emission factor	0.1500000000		tons/tons	0.0006	1,526	0.9156
Dehumidifier	Refrigerant (R134a)	1	Fugitive	0.0005	tons	HFCs	Nation level emission factor	0.0550000000		tons/tons	0.0000	1,526	0.0000
Refrigerator	Refrigerant (R134a)	1	Fugitive	0.0002	tons	HFCs	Nation level emission factor	0.0030000000		tons/tons	0.0000	1,526	0.0000
Air Conditioner	Refrigerant (R410a)	1	Fugitive	0.0047	tons	HFCs	Nation level emission factor	0.0550000000		tons/tons	0.0003	2,257	0.6771

2.Category 2

(1) Indirect Emissions from imported energy

- GHG Emission Calculation Formula：

  GHG Emission=Activity Data×Emission Factor×Global Warming Potential (GWP)

- Activity Data: Annual electricity consumption (kilowatt-hours)
- Emission Factor: Based on the 2023 power emission factor of 0.494 tons CO_2e/MWh announced by the Bureau of Energy.

Table 4.7. Indirect Emission Sources (Purchased Electricity)

Emission Source	Raw material/ fuel or product	Category	Emission Type	Activity Data		Emission Factor and GHG Emission							
				Activity Data	unit	GHGs	Emission Factor Type	Emission Factor	Emission Factor Source	Emission Factor unit	Emission (tons/year)	GWP	CO_2e (tons/year)
Purchased Electricity	Purchased Electricity	2	Purchased Electricity	753.1200	MWh	CO_2	Nation level emission factor	0.4940000000	announced by the Bureau of Energy	tons/MWh	372.0413	1	372.0413

4.1.1 Activity Data Collection and Conversion Methods

Activity data for various emission sources is collected and consolidated by respective departments. Data sources include invoices, receipts, and usage records, as detailed in Table 4.8.

Table 4.8. Summary of Activity Data Collection Methods

Operational Boundary	Emission Source	Responsible Department	Description of Activity Data Collection
Direct Emission Sources	Emergency Generator	Management Department	Estimated based on fuel purchase receipts
	Handheld Lawn Mower	Management Department	Estimated based on fuel purchase receipts
	Official Vehicle	Management Department	Estimated based on fuel purchase receipts
	Forklift	Management Department	Estimated based on fuel purchase receipts
	Welding Equipment	Management Department	Estimated based on procurement receipts
	Water Dispensers, Car Air Conditioners, Dehumidifiers, Refrigerators, Chillers, Air Conditioners	Management Department	Estimated based on equipment nameplates
	Septic Tank	Management Department	Estimated based on working hour records
Indirect Emissions from imported energy	Purchased Electricity	Management Department	Collected based on electricity bills from Taiwan Power Company

4.1.2 Emission Factor Sources

The emission factors used are primarily derived from the "Greenhouse Gas Emission Factor Management Table (Version 6.0.4)."

4.1.3 Global Warming Potential (GWP)

This report utilizes GWP values published in the IPCC 2021 report to estimate the relative radiative forcing effect of different GHGs compared to CO_2. Using the GWP conversion factor, emissions of various GHGs are converted into CO_2-equivalents.

4.2 Explanation of Changes in Quantification Methods

When the quantification method changes, SOG must calculate emissions using the new method and compare it with the original method to explain the differences and justify the adoption of the new method.

4.3 Emission Factor Updates

If the source of emission factors updates its data, relevant documentation will be revised to align with the latest information.

4.4 Significant Figures

Significant figures for GHG inventory tasks are determined based on the Environmental Protection Administration's guidelines. Specific settings are as follows:

1. Activity Data: Rounded to four decimal places.
2. Emission Factors: Rounded to ten decimal places.
3. GHG Inventory Reports: Individual emissions and equivalents are rounded to four decimal places; total emissions are rounded to three decimal places.

Chapter 5: Baseline Year

5.1 Baseline Year Setting

As SOG's primary factory began its GHG inventory in 2024, the baseline year is set to 2024. The baseline inventory details are provided in Table 5.1, indicating a total baseline emission of **417.657** tons CO_2e。

Table 5.1 Greenhouse Gas Emission Inventory for the Baseline Year of SOG

Statistics of Total Emissions for Seven Major Greenhouse Gases (Whole Plant)									
GHGs	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	NF_3	Total Annual Emissions[1]	Biogenic Emissions
Emissions (tons CO_2e/yr)	409.4543	5.8725	0.7371	1.5927	0.0000	0.0000	0.0000	417.657	0
Percentage(%)	98.04	1.41	0.18	0.38	0.00	0.00	0.00	100.00	0
Note1.According to Article 2, Paragraph 1 of the GHG Inventory Registration and Management Measures, GHG emissions are expressed in tons of CO2-equivalent (CO2e), rounded to three decimal places.									

Statistics of Emissions for Seven Major Greenhouse Gases in Category 1								
GHGs	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	NF_3	Total Annual Emissions[1]
Emissions (tons CO_2e/yr)	37.4130	5.8725	0.7371	1.5927	0.0000	0.0000	0.0000	45.615
Percentage (%)[2]	82.02	12.87	1.62	3.49	0.00	0.00	0.00	100.00
Note1.According to Article 2, Paragraph 1 of the GHG Inventory Registration and Management Measures, GHG emissions are expressed in tons of CO2-equivalent (CO2e), rounded to three decimal places. Note2.Percentages represent the proportion of total emissions for each greenhouse gas in Category 1								

Statistics of Emissions by Scope and Type for Categories 1 and 2						
Scope	**Category 1**				**Category 2**	**Total Emissions**
	Stationary	**Process**	**Mobile**	**Fugitive**	**Indirect Emissions from imported energy**	
Emissions (tons CO_2e/yr)	45.6153				372.0413	417.657
	0.0361	0.0000	38.2598	7.3194		
Emissions (tons CO_2e/yr)	10.93				89.08	100.01
	0.01	0.00	9.17	1.75		
Note1.According to Article 2, Paragraph 1 of the GHG Inventory Registration and Management Measures, GHG emissions are expressed in tons of CO2-equivalent (CO2e), rounded to three decimal places.						

Chapter 6: References

This report references the following documents:

1. Intergovernmental Panel on Climate Change, IPCC Guidelines for National Greenhouse Gas Inventories, 2006.10.
2. Intergovernmental Panel on Climate Change, The Fifth Assessment Report : Climate Change 2014 – The Science of Climate Change, 2014.
3. ISO 14064-1：2018, Greenhouse gases - Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals.
4. Bureau of Standards, Metrology, and Inspection, CNS 14064 Part 1: Quantification and Reporting of GHG Emissions and Removals at the Organizational Level, January 2021.
5. Ministry of Environment, Guidelines for GHG Emissions Inventory, February 2023.

Annex

Annex 1: Organizational Chart