4.2 Process Improvement

4.2.1 Greenhouse Gas Emission Management

In order to implement the Company's environmental policy of greenhouse gas carbon management, we regularly conduct an inventory of greenhouse gas emissions every year.

Since 2012, the Company has been collecting data in compliance with ISO/CNS 14064-1 for information management. In 2012, Guanyin Plant 4 and Dayuan Plant 5 expanded their production lines, and formally started mass production in 2013, so the base year was set to be 2013. The Company has maintained the services of BSI Taiwan for inspection and approval.

We referred to the ISO 14064-1 standards, the Greenhouse Gas Emissions Inventory Guidelines of Taiwan's Environmental Protection Administration, and the requirements and suggestions of the WBCSD/WRI greenhouse gas verification protocol to set the boundaries of our greenhouse gas emission sources, which is 100% operational control; therefore, all five of our plants are covered in the inventory, including the Guishan Plant, the three plants in Guanyin, and the Dayuan Plant. In 2022, the scope of the inventory was expanded to include our Taipei office.

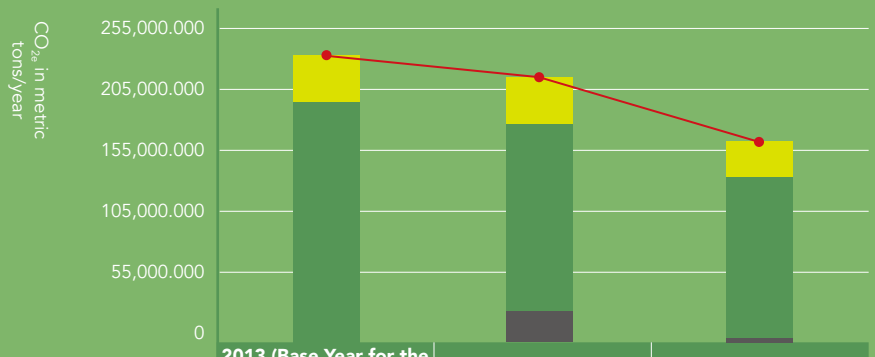
Because of the Environmental Protection Administration's requirements, the Global Warming Potential (GWP) values of various greenhouse gases announced in IPCC AR4 are used for Guanyin Plant 2, Guanyin Plant 3 and Dayuan Plant 5 are, while IPCC AR6 is used for Guishan Plant 1, Guanyin Plant 4, and the Taipei Office. The calculation of greenhouse gas emissions is based on the emission coefficient method, which enhances the reliability of greenhouse gas inventory data.

2022 (Jan. 1, 2022-Dec. 31, 2022) was the eleventh year that we have conducted an inventory of our greenhouse gas emissions. The inventory was conducted in accordance with ISO 14064-1:2018 and the requirements of the Environmental Protection Administration, and other indirect emissions (upstream electricity) was disclosed from 2020 onwards to provide our management with information to refer to when making operational performance decisions for continuous improvement.

The types of greenhouse gases verified in 2022 are based on the seven greenhouse gases defined by the ISO 14064-1 standards; they include carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, and nitrogen trifluoride. The activities, products, and services of each plant have been taken into consideration, and the survey results show that carbon dioxide emissions takes up the majority of emissions, accounting for 99.66%.

The coefficient is based on the GHG emission factor management table version 6.0.4, Taipower's electricity coefficient of 0.509 kg CO_{2e}/kWh in 2021, and the upstream electricity coefficient of 0.0882 kg/CO_{2e} announced on the EPA's product carbon footprint information website in 2022.

Volume of Greenhouse Gas Emissions



* Note on scope of the figures:
2013: Plants 1-5 (including off-site dormitories).
2021: Plants 1-5 and other indirect emissions from each plant.
2022: Plant 1-5, Taipei Office, and other indirect emissions from Plant 1, Plant 4, and Taipei Office only.

	2013 (Base Year for the Verification)	2021	2022
Direct emissions-CO_{2e} in metric tons	36,173.629	36,970.390	27,860.485
Indirect emissions through energy consumption-CO_{2e} in metric tons	194,477.534	151,125.526	129,452.126
Other indirect emissions-CO_{2e} in metric tons	-	23,895.342	3,223.058
Total	230,651.163	211,991.258	160,535.669

*We have converted the inventory data in this image to AR6.

Comparison of Greenhouse Gas Emissions of Each Plant Unit: Metric tons of CO_{2e}

Plant	2013 (Base Year)	2021	2022	Difference Between 2013 (Base Year) and 2022
Guishan Plant 1	20,468.182	16,965.467	14,712.233	**(5,755.950)**
Guanyin Plant 2	54,215.717	47,154.368	42,181.117	**(12,034.600)**
Guanyin Plant 3	81,131.009	75,203.379	60,669.983	**(20,461.026)**
Guanyin Plant 4	5,921.688	5,884.850	3,967.731	**(1,953.956)**
Dayuan Plant 5	68,914.567	42,887.852	35,677.550	**(33,237.017)**
Taipei Office	-	-	103.997	-
Total	230,651.163	188,095.916	157,312.611	**(73,338.552)**

*All data in this table have been converted to AR6 calculations, and the scope of emissions is only direct emissions and indirect emissions from energy sources.

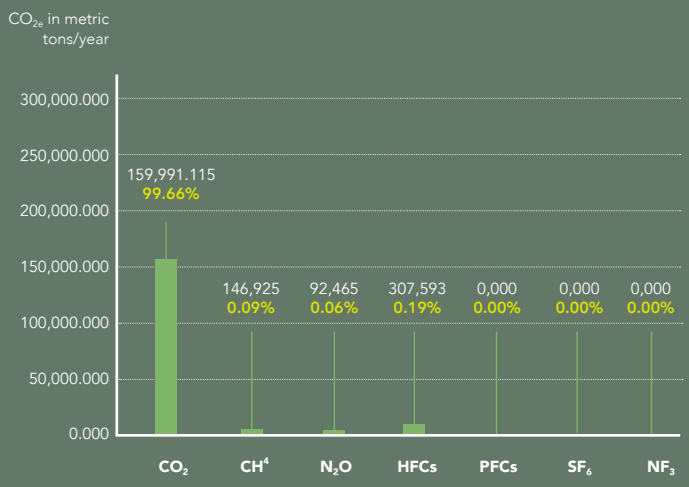
Due to the decrease in production in 2022, the total greenhouse gas emissions decreased by 30,783 metric tons of CO_{2e} compared to 2021. Since 2020, we have made adjustments in our source of energy, gradually switching from fuel oil to natural gas. The transition to natural gas was completed in 2022. Increases or decreases in major greenhouse gases are as follows:

Electricity: Reduced by 21,687.2 metric tons of CO_{2e}.
Fuel oil: Reduced by 10,229.4 metric tons of CO_{2e}.
Bituminous coal: Reduced by 3,211.3 metric tons of CO_{2e}.
Steam: Reduced by 60.8 metric tons CO_{2e}.
Natural gas: Increased by 4,432.5 metric tons of CO_{2e}.

To fulfill our corporate responsibility to protect the environment as a global citizen, we continued to adhere to the following greenhouse gas reduction measures in our greenhouse gas policy in 2023:

- **Continued promotion of energy conservation measures**
- **Participation of all staff in energy saving and carbon reduction activities**
- **Comply with environmental regulations, customer needs, and other relevant regulations**

Types of Greenhouse Gas in the 2022 Inventory



4.2.2 Energy Management

(1) Energy Saving Operations
Energy Management Operational Organization