4.2 Energy and carbon management

The TWSE and its subsidiaries mainly provide financial and IT services, and the majority of its energy consumption is by its offices (including public facilities) and data centers, as well as gasoline consumption by company cars plus diesel fuel consumption by backup power generators. In 2022, the TWSE and its subsidiaries first completed its GHG Inventory Report in accordance with ISO 14064-1:2018, establishing the year 2022 as the inventory base year, in order to measure our greenhouse gas emissions and to formulate our carbon reduction plans accordingly.

To enhance the credibility of the inventory report, the TWSE and its subsidiaries acquired third party verification for Category 1, Category 2, and Category 4 of our GHG Inventory Report in 2025 [1]. The inventory scope includes Category 1's direct greenhouse gas emissions (refrigerants, gasoline, diesel, etc.), Category 2's indirect greenhouse gas emissions from imported energy (electricity), Category 3's indirect greenhouse gas emissions generated by transportation (business travel emissions), and Category 4's total indirect greenhouse gas emissions caused by organizations' use of products (capital goods, fuel, including energy-related activities).

Note 1: The TWCA, TIP, and the TCX have acquired third party assurance for Category 1 and Category 2. Please refer to the 2025 Sustainability Report of the TDCC for the third-party assurance statement of the TDCC and FundRich.

• Energy usage

Item	2024		2025	
	Energy consumption	GJ	Energy consumption	GJ
Gasoline (liters)	12,234.02	399.32	14,530.46	461.50
Diesel (liters)	8,662.00	304.47	6,825.39	246.79
Purchase of non-renewable energy (kWh)	11,779,138.91	42,404.90	12,016,279.45	43,258.61
Purchase of renewable energy (kWh)	9,782,483.00	35,216.94	11,511,382.76	41,440.98
Self-generated renewable energy (kWh)	16,330.00	58.79	19,920	71.71
Total energy consumption (GJ)	-	78,384.42	-	85,479.59
Energy intensity (GJ/person)	-	56.19	-	59.61

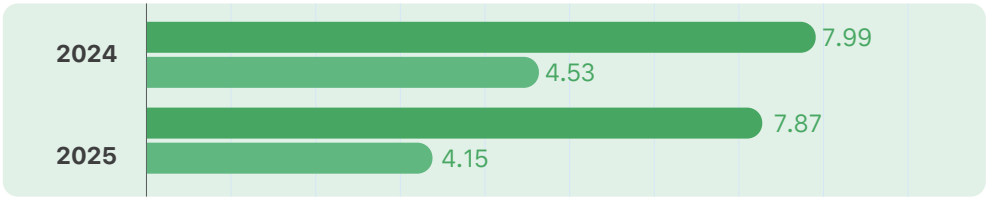
Note 1: This report covers data from the TWSE, TWCA, TIP, the TDCC, FundRich, and the TCX for 2025 and 2024, adjusted according to the GHG inventory results with assurance for such year. All calculations are rounded to the nearest two decimal places.
Note 2: The heating value coefficient is based on the latest announcement issued by the Ministry of Environment. For 2025, the heating value coefficient is 7,856 kcal/L for gasoline and 8,636 kcal/L for diesel.
Note 3: 1 gigajoule (GJ) = 10^9 joules (J); 1 kilocalorie (Kcal) = 4,186.8 joules (J); 1 kilowatt hour (kWh) = 3.6 megajoules (MJ)
Note 4: The energy types covered by the energy intensity ratio are fuel and electricity, additionally this ratio uses the energy consumption within the organization. Energy intensity is calculated based on the number of employees as of December 31 of that year, with 1,434 employees in 2025 and 1,395 employees in 2024.
Note 5: The types of greenhouse gases covered include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3).

• Greenhouse gas emissions

Item	2024	2025
Category 1 direct GHG emissions (tCO_2e)	500.63	529.03
Category 2 indirect GHG emissions from imported energy (tCO_2e)(by location)	10,651.44	10,755.51
Category 2 indirect GHG emissions from imported energy (tCO_2e)(by market)	5,818.89	5,428.03
Category 3 indirect GHG emissions from transportation (business travel) (tCO_2e)	196.67	341.42
Category 4 indirect GHG emissions from products an organization uses (capital goods, fuel, and energy-related activities)	9,228.38	9,218.06
Total (tCO_2e)(by location)	20,577.13	20,844.02
Total (tCO_2e)(by market)	15,744.59	15,516.54

Note 1: This report covers data from the TWSE, TWCA, TIP, the TDCC, FundRich, and the TCX in 2025 and 2024. All calculations are rounded to the nearest two decimal places.
Note 2: The calculation of greenhouse gas emissions is based on the operational control approach. The calculation method is activity data multiplied by the emission coefficient multiplied by GWP values. The emission coefficient is based on the Ministry of Environment's Greenhouse Gas Emission Coefficient Management Table published on February 5, 2024. GWP values are based on the IPCC Working Group III Sixth Assessment Report published in 2022. If there are no updates in the Sixth Assessment Report, the calculations should be based on the content of the IPCC Working Group I Sixth Assessment Report published in 2021.
Note 3: For Category 2 greenhouse gas emissions, purchased electricity is the main source. In 2025 and 2024, the electricity emission factors are based on the Bureau of Energy, Ministry of Economic Affairs' 2024 and 2023 electricity emission factors of 0.474 and 0.494 $kgCO_2e/kWh$, respectively.
Note 4: The types of greenhouse gases covered include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3).
Note 5: In accordance with GHG Protocol Scope 2 Guidance (2015), the TWSE discloses Scope 2 emissions according to both the location-based method and market-based method due to its purchase of renewable energy. For Category 2 emissions in the above table, location-based emissions are calculated by multiplying total electricity consumption by the average electricity emission factor of the location, while market-based emissions are calculated by multiplying solar power used and the amount bought through the power purchase agreement with Taiwan Power Company with the contract source emissions factor.

•Greenhouse Gas Emission Intensity (Category 1 + Category 2)





GHG emission intensity (tCO_2e/person) (by location)
GHG emission intensity (tCO_2e/person) (by market)
GHG emission intensity (tCO_2e/TWD million) (by location)
GHG emission intensity (tCO_2e/TWD million) (by market)

Note 1: GHG emission intensity is calculated based on the number of employees as of December 31 of that year, with 1,434 employees in 2025 and 1,395 employees in 2024.
Note 2: GHG emission intensity is calculated based on the consolidated revenue for that year with TWD28,705 million in 2025 and TWD27,806 million in 2024.

Use of renewable energy

To mitigate climate change, the TWSE strongly supports the government's promotion of renewable energy use. In 2025, all the TWSE offices in Taipei 101 continued to achieve 100% green energy usage. The First Data Center continued to purchase green energy and, as of June 2025, achieved its short-term goal of improving its renewable energy usage from RE50 to RE60. In addition, the First Data Center's solar panels and energy storage system generated 19,920 kWh of electricity in 2025, with a carbon reduction benefit of approximately 9,442 kg of CO_2e. The TWSE's renewable energy usage rate reached 60.96% in 2025, continuing its upward trajectory over the previous year. Furthermore, the installation of additional photovoltaic modules at the First Data Center was completed in November 2025, and is expected to generate 43,000 kWh in 2026, which can reduce carbon emissions by approximately 20,382 kg of CO_2e.

•TWSE renewable energy use

Year	Energy used (kWh)	% of total energy used
2024	9,231,246	56.56%
2025	10,512,330	60.96%

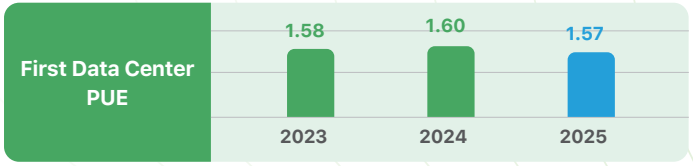
The TWSE exerts great effort in energy conservation to achieve its carbon reduction targets. In addition to using renewable energy, the TWSE has replaced older company cars and leases environmentally friendly and energy-saving models, gradually installed and upgraded energy-saving office equipment, as well as the central air-conditioning water-cooling system makes ice at night and uses it for cooling during the day. Furthermore, to reduce environmental harm caused by consumption, the TWSE has established an eco-friendly procurement policy for products purchased for operations, including most commonly purchased goods such as paper, computer supplies, office supplies, batteries, and light fixtures. The policy gives priority to products that meet the government's Green Mark criteria or are made of recycled materials.

•TWSE energy conservation measures

Item	Content
Chiller	The chiller units are operated alternately on a schedule so as to ensure optimum efficiency. The First Data Center building is also equipped with ice storage air conditioning, which creates ice during the night at off-peak hours, plus uses the cooling from the ice melt during the day. The process can divert energy consumption from peak hours and is cost-effective and energy saving.
Chilled water pump, cooling water pump, cooling tower	Using frequency conversion technology, the chilled water pumps, cooling water pumps, and cooling towers can be adjusted depending on motor rotational speed to achieve energy conservation.
Computer room	Computer rooms adopt high-efficiency EC fans plus constant temperature and humidity air conditioning units for regulating the temperature in addition to the humidity of the environment.
Air distribution system	The First Data Center building adopts frequency conversion technology with its air handling units to cool entire sections through the VAV air distribution system.
Central control system	The central control system manages and monitors the building's systems/operations, ensuring energy conservation, and issuing alerts in the case of abnormal situations.
Air conditioning system energy conservation	The operational parameters for the central air conditioning system of the First Data Center continue to be optimized to achieve energy conservation.
Thermal insulation in the data center	The use of thermal insulation materials in the First Data Center effectively blocks outdoor heat from entering the building, achieving energy savings.
Eco-friendly procurement	The TWSE established an eco-friendly procurement policy, giving priority to products that meet the government's Green Mark criteria or are made of recycled materials.

• Data center PUE

The Power Usage Effectiveness (PUE) of the TWSE's First Data Center fell slightly from 2024 to 2025's 1.57. Through ongoing HVAC system energy-saving initiatives, improvements to the server room operating environment, and regular maintenance practices, the TWSE is reducing electricity consumption and continuously working toward lowering the PUE value and reducing carbon emissions.



Note 1: Power Usage Effectiveness (PUE) is calculated by dividing the total power usage by the data center by the total power usage of ICT equipment in the server rooms.
Note 2: Since the solar power generation and consumption in 2023, 2024, and 2025 account only for a small percentage of total electricity consumption, it is not included in either the numerator or denominator of PUE calculations.

•TWSE carbon reduction targets and performance

2025 Performance

- Due to office renovations in Taipei 101 this year, the TWSE had to temporarily expand its lease area, resulting in a substantial purchase of capital goods and a sudden increase in overall emissions for this single year. Since the cause is a single, abnormal event and not an ongoing trend, the increase in emissions is expected to cease once the renovations are complete. Excluding the emissions caused by the new capital expenditures, the emissions from other sources have decreased by a total of 36.32% compared to the base year (2022), achieving the annual reduction target of 14.2%.
- Received numerous sustainability-related awards: BSI's ESG Sustainable Development Award – Net Zero Award; Outstanding Private Enterprise in Green Procurement, recognized by the Department of Environmental Protection, Taipei City Government.
- Conducted a paperless competition to promote the policy of a paperless office.
- Completed the 2024 GHG inventory and assurance and obtained ISO 14068-1:2023 carbon neutrality verification.
- The First Data Center achieved 60% renewable energy use, and following the installation of additional solar power equipment, the installed solar panels generated 19,920 kWh.
- The Taipei 101 offices achieved 100% green energy use.
- Replaced all electric equipment with products that meet the Level 1 Energy Label; replaced company cars with environmentally friendly and energy-saving models.
- Promote suppliers' commitment to sustainable development; conducted SDG activities with the theme, Sustainable Piggy Bank: Saving Green for the Future.
- Replaced electrical equipment on office floors nine to eleven with energy-saving models in conjunction with office renovations; all office materials are environmentally friendly, non-toxic, and low-formaldehyde.

Short-term targets (2026)

- Conduct the 2025 GHG Inventory, verification, and achieve carbon neutrality.
- Increase annual solar power generation of the First Data Center by over 100%; implement an energy management platform to record energy consumption and analyze energy-saving measures; optimize office lighting by replacement with flat LED panel lights.
- Promote the use of renewable energy for the Second Data Center.
- Continue to organize activities that combine sustainability strategic goals with public welfare and social responsibility, including family day, paperless office, and the Earth Guardians SDG initiative.
- Report green procurement performance for 2025 on the Ministry of Environment's Net-Zero Green Life Information Platform.
- Expand solar power generation.
- By 2026, reduce GHG emissions by 18.9% from the baseline (2022).

Medium-term targets (2030)

- By 2030, reduce GHG emissions by 37.8% from the baseline (2022).
- Reduce emergency generator diesel fuel consumption and carbon emissions by 4%.
- Replace and upgrade equipment with energy-saving models.
- Reduce office paper usage and purchase of mineral water by 10%.

Long-term targets (2050)

- Continue to include other items in the scope of inventory, and formulate corresponding measures according to future development to achieve net zero emissions.