Climate and Energy

Strategies	2030 Goals	2026 Targets	2025 Achievements
Strengthen Climate Resilience Develop climate change response and measure to reduce the impact of climate risks	0 days of production interruption due to climate disasters	0 days of production interruption due to climate disasters	0 days of production interruption due to climate disasters ✓ Target: 0 days
Drive Low-carbon Manufacturing Continue to use best available technology to reduce emissions of greenhouse gases (GHG) and become an industry leader in low-carbon manufacturing	Reduce Scope 1 and Scope 2 emissions by 31% (base year: 2025), and restore total emissions to 2020 levels[Note 1] NEW Reduce Scope 3 emissions by 15% (base year: 2025) [Note 2] NEW	Reduce Scope 1 and Scope 2 emissions by 6.2% (base year: 2025) NEW Reduce Scope 3 emissions by 3% (base year: 2025) NEW	Increased greenhouse gas emissions per unit of production (metric ton of carbon dioxide equivalent (MTCO2e)/12-inch equivalent wafer mask layer) by 2% — [Note 3] Target: Reduce 10% (base year: 2020)
Use Renewable Energy Continue to purchase renewable energy and install solar-energy power systems to achieve target of 100% renewable energy use	60% of the electricity consumption at all company operational sites comes from renewable energy	35% of the company's total electricity consumption comes from renewable energy	Reached 100% renewable energy use at overseas subsidiaries; renewable energy accounted for 20.1% of total company electricity consumption ✓ Target: TSMC overseas sites used 100% renewable energy; accounting for 20% of TSMC's power consumption
Increase Energy Efficiency Plan and implement new energy-saving measures each year to increase energy efficiency	Achieve a cumulative energy-saving rate of 7.5% from new energy-saving measures adopted between 2026 and 2030 [Note 1] Double energy efficiency after five years of volume production for each process technology	Achieve a cumulative energy-saving rate of 1.5% starting in 2026 Energy efficiency of 3nm process technology increases by 0.4 times in the 3rd year of volume production	Achieved a cumulative energy-saving rate of 16% from 2016 to 2025 ↑ Target: 15% Energy efficiency of 3nm process technology was 0.5 times higher in the 2nd year of volume production ↑ Target: Energy efficiency of 3nm process technology 0.2 times higher in the 2nd year of volume production

Applicable to all TSMC fabs around the world | Applicable to TSMC fabs in Taiwan and other specific fabs | Only applicable to TSMC fabs in Taiwan | Applicable to TSMC overseas fabs | ↑ Exceeded | ✓ Achieved | — Missed Target

Note 1: TSMC supports and commits to Science Based Targets (SBT) and, in 2025, reviewed and updated its existing carbon reduction and energy-saving targets to align with Science Based Targets initiative (SBTi) requirements. Updates included defining reduction scopes, adjusting the base year, optimizing energy efficiency planning, and setting more ambitious reduction levels to strengthen the Company's sustainability commitments.

Note 2: Based on SBTi requirements for Scope 3 coverage under Near-Term Targets, TSMC identified key emission sources: Category 1 (purchased goods and services, e.g., raw materials and outsourced packaging services), Category 2 (capital goods, e.g., equipment), Category 3 (fuel- and energy-related activities)

Note 3: For factors contributing to unmet targets, see "Drive Low-carbon Manufacturing ."

Climate resilience is critical to sustainable operations. The World Economic Forum's (WEF) Global Risks Report 2026 identifies environmental risks as three of the top ten global risks over the next decade: Extreme Weather Events, Biodiversity Loss and Ecosystem Collapse, and Critical Change to Earth Systems. Recognizing its responsibility, TSMC remains committed to achieving net-zero emissions by 2050. To align with SBTi requirements, the Company reviewed and updated its carbon and energy targets, set stricter reduction standards, adopted 2025 as the base year, and submitted its reduction plan in 2026, reinforcing its commitment to environmental sustainability.

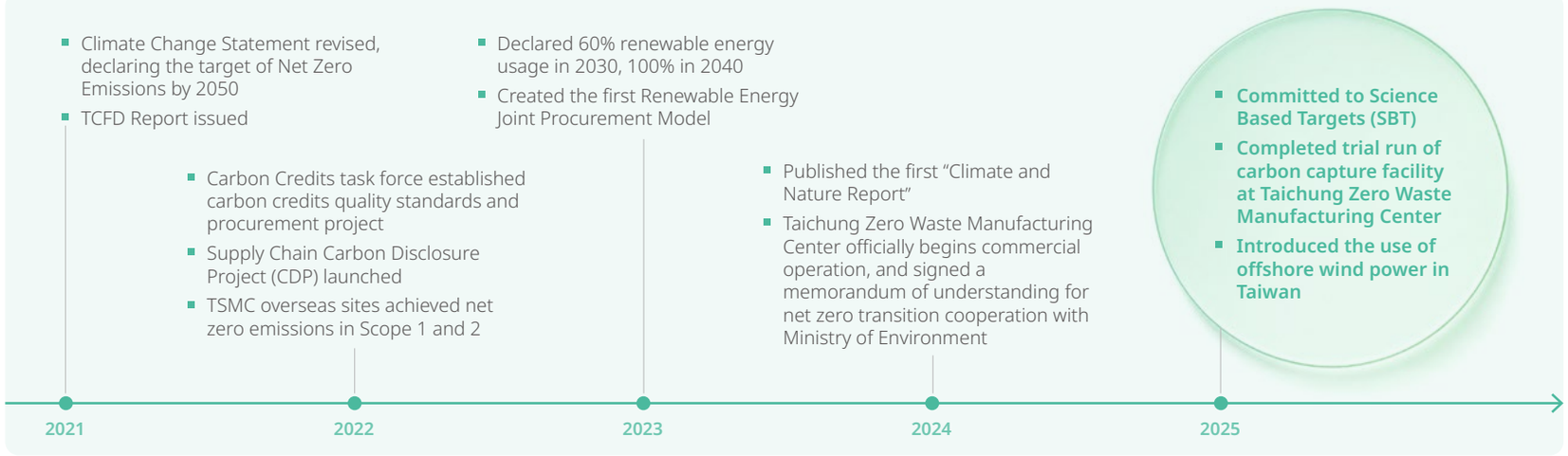
In 2025, TSMC made continued progress in renewable energy adoption and energy efficiency. At Taiwan fabs, renewable energy constituted 11.4% of total electricity use, and the Company brought its first offshore wind power online. On energy efficiency, five major energy conservation teams conducted 2,141 energy conservation measures across eight categories, delivering approximately 900 GWh of annual savings. At the Taichung Zero Waste Manufacturing Center, the semiconductor industry's first carbon capture facility completed trial operation, advancing low-carbon manufacturing through green innovation and setting a new benchmark for sustainable industry development.

Strengthen Climate Resilience

Environment Programme (UNEP) COP30 in 2025, the UNEP released its Global Cooling Watch Report 2025, proposing a "sustainable cooling pathway" framework to guide global cooling standards, aiming to cut greenhouse gas emissions and lower energy demand. Concurrently, The Ministry of Environment in Taiwan, where TSMC is headquartered, published its 2035 Nationally Determined Contributions (NDC 3.0), setting more ambitious decarbonization targets and an implementation framework. TSMC closely monitors international developments and continues to strengthen its GHG reduction standard practices. Guided by its climate management framework, the Company supports sustainable operations throughout its facilities and supply chain, regularly identifies climate risks and opportunities, and applies climate risk adaptation measures to enhance organizational resilience. In 2025, TSMC maintained uninterrupted production, demonstrating operational stability and strong adaptability.

Alongside its energy conservation and carbon reduction efforts, TSMC further embraces a "Just Transition" by engaging stakeholders to address climate challenges. Internally, the Company conducts regular training programs and workshops on energy conservation, carbon reduction, water stewardship, and circular economy practices, equipping employees with green skills and raising environmental awareness. Externally, TSMC promotes its Water Positive initiative to restore local water resources and supports natural conservation and biodiversity protection through the Plant-A-Tree Program and the Eco Plus! Ecological Harmony Program. The Company also drives supply chain participation through the "T.S.M.C. Supply Chain Carbon Reduction Action Guide," supporting suppliers in meeting emissions targets and bolstering climate resilience across the value chain, while creating shared sustainable value throughout the transition.

Summary of Response Measures for Climate Change



Climate Management Framework

TSMC's Climate Change Statement and Environmental Policy serve as its guiding framework, with the Board of Directors overseeing related management measures. The ESG Steering Committee, chaired by the Chairman, defines the Company's short-, medium-, and long-term climate change strategies. Through the ESG Committee, the Company integrates cross-functional resources, drives project collaboration, and reports progress to the Board on a regular basis. In 2025, TSMC aligned with the IFRS S2 Climate-related Disclosures and the semiconductor manufacturing standards of Taiwan's Reference Guidelines for the Determination of Sustainable Economic Activities , boosting transparency and further elevating its sustainability governance.

	Corporate Management Strategies and Actions	2025 Execution Summary
Governance	• The Board will regularly review risks and opportunities related to climate change	✓ Expanded renewable energy use and reviewed progress at each stage ✓ The ESG Steering Committee regularly monitored and reviewed SBT submission progress and target execution NEW ✓ The Energy Saving and Carbon Reduction Committee defined five major energy conservation teams and adopted the achievement rate of annual energy conservation targets and the level of innovation for energy conservation ideas as benchmarks to encourage the conception and implementation of energy conservation ideas ✓ The chairperson of Risk Management Steering Council reported to the Audit and Risk Committee regarding net zero transition, water resources, power supply risks, natural disasters, regulations, and other issues related to climate change
Strategies	• Organize interdepartmental discussions and identify short-, mid-, and long-term climate risks and opportunities	✓ Planned and carried out 2,141 energy-saving measures across eight major categories , saving additional 900 GWh. See "Increase Energy Efficiency " for more information ✓ Promoted the "Green Energy for Charity" project" to install photovoltaic (PV) systems for charity organizations and schools in remote townships. See "Renewable Energy Systems " for more information
	• Assess the potential financial and operational impact on TSMC from major climate risks and opportunities	✓ Completed financial impact qualitative assessment of major climate risks and opportunities and conducted financial impact quantitative assessment of financial impact of major climate risks. See "TSMC Climate and Nature Report " for more information
	• Conduct scenario analysis and assess SBT and net zero emission reduction blueprint and actions	✓ See "TSMC Climate and Nature Report " for more information
	• Assist suppliers in enhancing awareness and adaptability to climate risks, develop and execute specific carbon reduction actions	✓ Required major emission contributors to execute GHG emission reduction agreement and commit to reduction targets ✓ Conducted "TSMC Supply Chain Carbon Reduction Action Guide" to assist suppliers in achieving carbon reduction targets
Risk Management	• Use TCFD frameworks to develop a process for identifying climate risks	✓ Evaluated the qualitative and quantitative financial impact of major climate risks/opportunities discussed in the climate risk/opportunity workshop
	• Set up and execute response measures based on the results of climate risk identification and prioritization	✓ Reported assessment results of the climate risks/opportunities and response plans to the ESG Committee Chairperson
	• Integrate climate risk identification and assessment in the ERM process	✓ See "6.2 Risk Management " in the annual report for more information
Metrics and Targets	• Set management indicators related to climate	✓ See "Climate and Energy Strategies, Goals, and Outcomes " for more information
	• Through ISO 14064 annual inventory and disclosure of GHG emissions, review the impact on the company's operations and assess the risks of Scope 1, Scope 2, and Scope 3 and related mitigation strategies	✓ Continued to execute carbon reduction measures based on various inventory and evaluation results. See "Drive Low-carbon Manufacturing " for more information
	• Set climate management targets and review progress and performance	✓ Set climate and energy targets for 2030 with regular performance review by senior executives. See "Climate and Energy Strategies, Goals, and Outcomes " and "GHG Reduction Standard Practices " for more information

Drive Low-carbon Manufacturing

TSMC reviews its overall carbon performance annually based on third-party verified greenhouse gas inventory results. In 2025, total greenhouse gas emissions were approximately 49.63 million metric tons of CO_2 equivalent, with Scope 1 Direct Emissions from Processes (including fluorinated greenhouse gases and nitrous oxide) accounting for 4%, Scope 2 Indirect Emissions from Energy Usage (electricity use) for 23%, and Scope 3 Indirect Emissions from the Value Chain — covering upstream and downstream activities such as raw material production, capital goods, upstream energy activities, waste treatment, commuting, and transportation — for 73%, representing the largest emission source. As advanced process capacity continued to expand, total greenhouse gas emissions increased by 2% compared to the base year (2020), falling short of the annual target. The Company is continuing to advance energy-saving and carbon reduction measures, while increasing renewable energy use to meet its decarbonization commitments.

TSMC closely follows international climate governance trends and maintains industry-leading greenhouse gas reduction practices. For Scope 1 direct emissions, the Company installed local scrubbers at process tools in 2025, lowering emissions of fluorinated greenhouse gases and nitrous oxide. The Company also converted central chiller systems to refrigerants with lower global warming potential (GWP) and ozone depletion potential (ODP), reducing hydrofluorocarbon use.

For fluorinated greenhouse gas substitution in manufacturing processes, TSMC collaborated with gas and equipment suppliers in 2025 to develop emission mitigation solutions for carbon tetrafluoride (CF_4) in etching processes and nitrogen trifluoride (NF_3) in chemical vapor deposition processes. The Company collected equipment testing data from suppliers and plans to introduce these solutions for small-scale in-fab validation. To accelerate its net-zero transition, TSMC invested in emerging technologies and built the semiconductor industry's first carbon capture facility at the Taichung Zero Waste Manufacturing Center. Using membrane technology, the facility captures carbon prior to release, lowering greenhouse gas emissions. The Company completed trial operation by the end of 2025, demonstrating leadership in carbon reduction technologies while enabling a circular approach that converts waste into resources.

For Scope 2 Indirect Emissions from Energy Usage, TSMC launched the EUV Dynamic Energy Saving Program in 2025 to improve electricity efficiency in advanced processes and conducted feasibility assessments for adopting high-performance cooling equipment, including electronic chillers, to support low-impact manufacturing. The Company also added six certified green buildings, bringing the total number of facilities with LEED Gold or higher certification to 57. Additionally, the Fab 15 Phase 5 Office Building obtained Net-Zero Building Energy Label, and the Fab 18 Phase 1 Office Building achieved Nearly Zero-Carbon Building Label. For Scope 3 Indirect Emissions from the Value Chain, TSMC expanded its Supply Chain Carbon Reduction Subsidy Project and partnered with ammonia suppliers to launch the "Blue Ammonia Adoption Project," becoming the first semiconductor company in Taiwan to use blue ammonia while continuing to explore low-carbon raw material alternatives. For more information, refer to "Promote Green and Low-Carbon Supply Chains."

Green Building Certificates

LEED

Added 6 buildings
Office building of Fab 18 Phase 7, Fab 20 Phase 1, office building of Fab 21 Phase 1, Fab 21 Computer Room, Fab 21 Phase 1, and Advanced Backend Fab 6 Phase 2

No.1 in global semiconductor industry and Taiwan
LEED green building certification area

57 12-inch fabs worldwide obtained the LEED Gold Certification or above
Three Platinums and 54 Golds

EEWH

Added 1 building
Office building of Fab 12 Phase 8

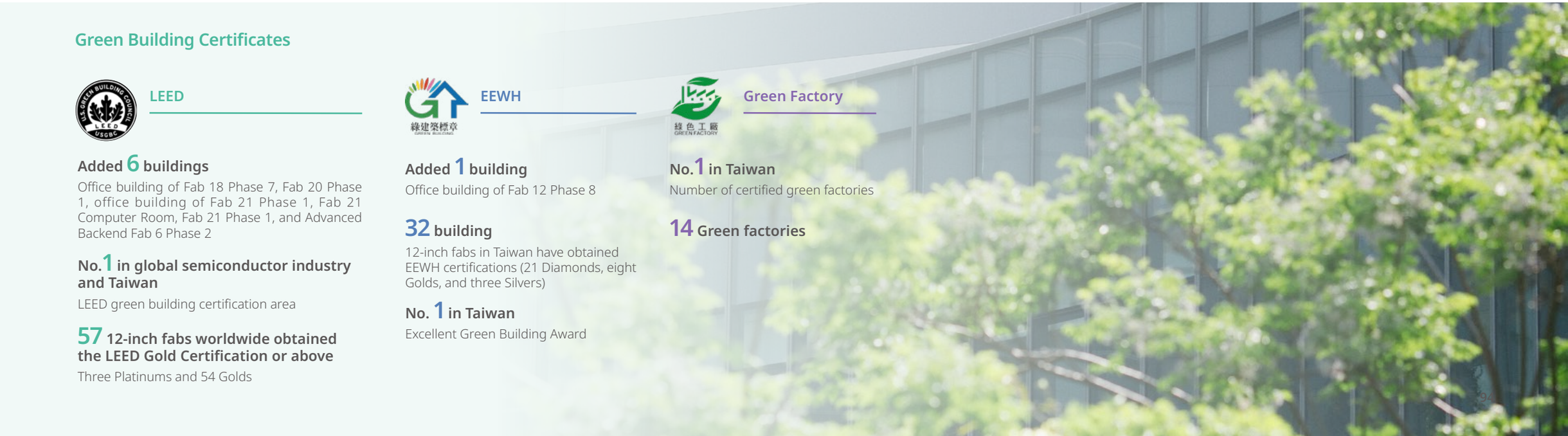
32 building
12-inch fabs in Taiwan have obtained EEWH certifications (21 Diamonds, eight Golds, and three Silvers)

No. 1 in Taiwan
Excellent Green Building Award

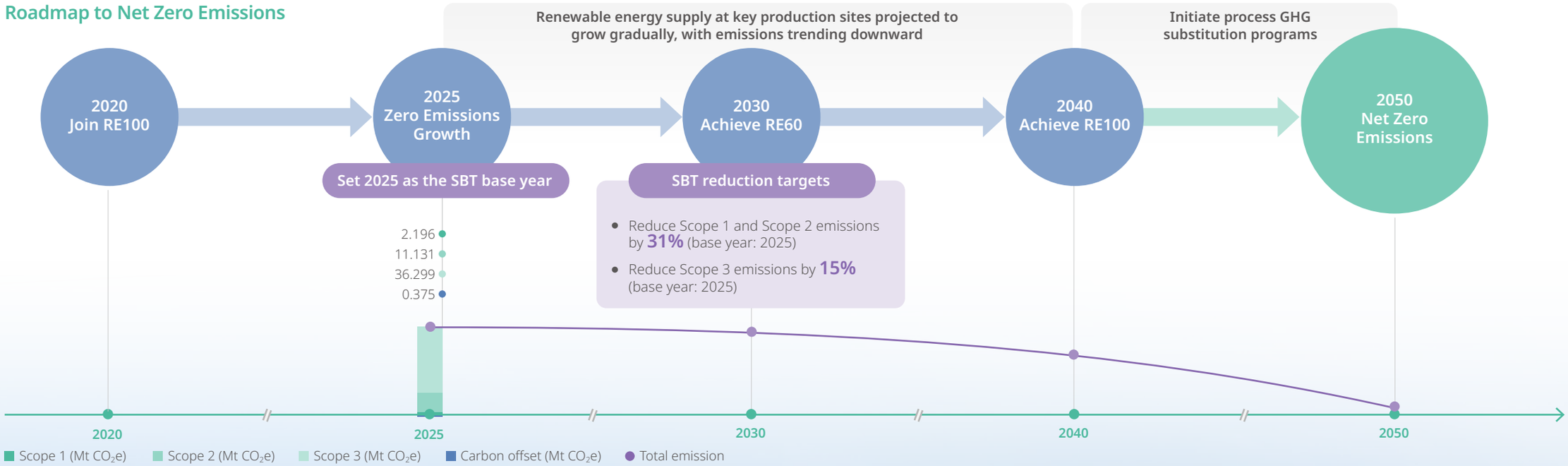
Green Factory

No.1 in Taiwan
Number of certified green factories

14 Green factories



Roadmap to Net Zero Emissions



Note: Starting in 2025, TSMC revised its Scope 3 inventory boundary to align with SBTi methodology requirements.



GHG Reduction Standard Practices



Scope 1 Direct GHG Emissions

Processes that use F-GHGs and nitrous oxide

- Optimize gas quantity used in production
- Install Point-of-Use abatement equipment for F-GHG and nitrous oxide
- Low Global Warming Potential Gas Substitution Project

3,540 Units

- Installed abatement systems on all newly installed process tools emitting fluorinated greenhouse gases and nitrous oxide

96%

- Installed/replaced abatement systems on 60 existing fluorinated greenhouse gas process tools; achieved a company-wide fluorinated greenhouse gas abatement rate of 96%

158 Units

- Transitioned all central chiller systems in new fabs to eco-friendly refrigerants



Scope 2 Indirect GHG Emissions (From Purchased Energy)

Energy usage

- Build green buildings
- Enhance energy efficiency
- Utilize renewable energy
- Incorporate energy-saving and low-carbon emission designs into next-generation process equipment
- EUV Dynamic Energy Saving Program

1

- Ranked first globally among semiconductor companies in green building certified floor area; certified seven new buildings, bringing cumulative totals to 57 LEED (U.S.) and 32 EEWH (Taiwan) certifications

2,141 Measures

- Surpassed peers with comparable technology in advanced process energy efficiency[Note 1]; executed 2,141 energy-saving measures, saving approx. 900 GWh and cutting emissions by nearly 420,000 metric tons

1

- Led the industry's only Next-Generation Semiconductor Manufacturing Tool Energy Conservation Project; collaborated with 11 suppliers to develop energy-efficient tools and components, achieving annual electricity savings of 460 GWh

5,780 GWh

- Used about 5.78 billion kWh of renewable energy globally, accounting for 20.1% of total electricity use



Scope 3 Indirect GHG Emissions (Value Chain)

Raw material production, energy-related activities upstream, and transportation

- Require suppliers to pass third party verification
- Guide suppliers on energy saving
- Subsidize suppliers to replace or install new equipment
- Provide on-site carbon reduction guidance for suppliers
- Adopt low-carbon raw materials

93%

- Required high electricity-use suppliers[Note 2] to complete greenhouse gas inventories with third-party verification; achieved a verification rate of 93%

1,360 GWh

- Guided suppliers in setting energy-saving targets and action plans; added 338 GWh in annual electricity savings, cutting emissions by 160,000 metric tons; cumulative electricity savings since 2018 reached 1,360 GWh

165,000 Metric tons

- Provided NT$160 million in subsidies; selected 31 suppliers, cutting emissions by 165,000 metric tons

30 Suppliers

- Completed on-site guidance for 30 domestic suppliers, strengthening carbon reduction capabilities and performance

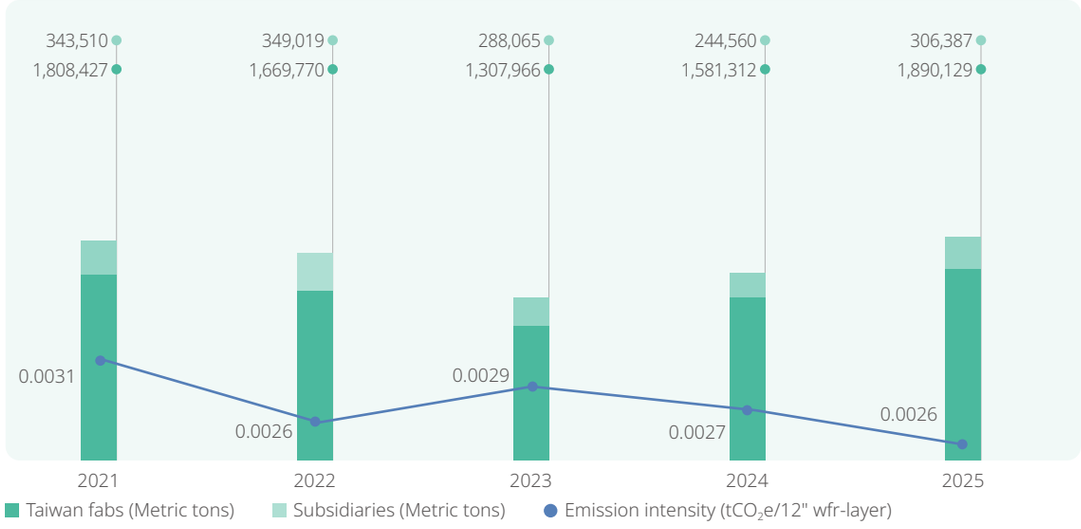
70,486 Metric tons

- Adopted electronic-grade IPA and blue ammonia; projected annual emission cuts of approx. 70,486 metric tons upon full adoption

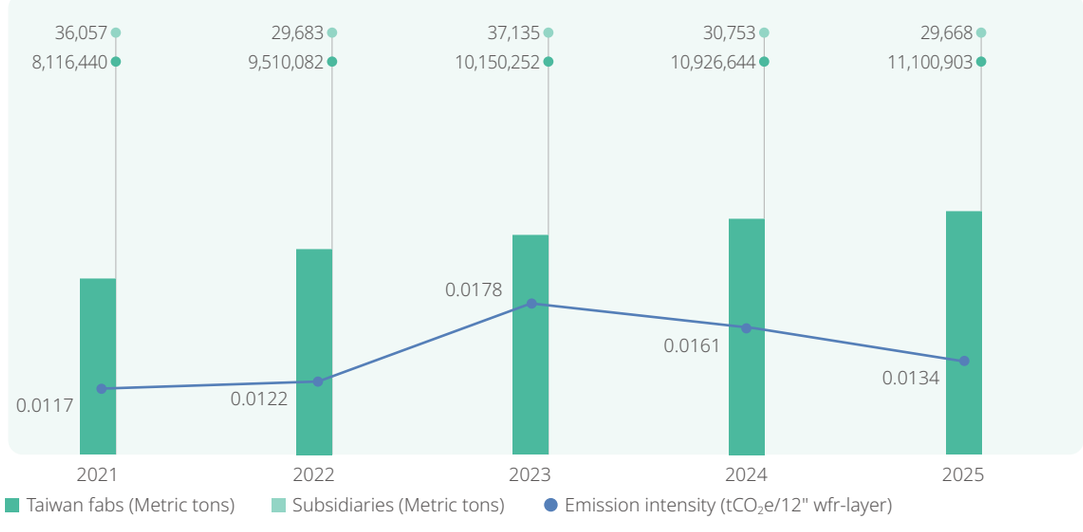
Note 1: Figures from the Joint Steering Committee (JSTC) report of the World Semiconductor Council

Note 2: High Energy Consumption Suppliers: Suppliers that consume more than 5GWh/year in a single factory.

Scope 1 GHG Emissions



Scope 2 GHG Emissions



Scope 3 GHG Emissions

UNIT: Metric tons



Note 1: Scope 1 data is prepared using the operational control approach as the inventory boundary. From 2020 to 2024, the Company used the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories and the 100-year Global Warming Potential (GWP100) values from the IPCC Fifth Assessment Report. In 2025, the Company applied the GWP100 values from the IPCC Sixth Assessment Report. Greenhouse gases 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 2: In terms of electricity emission factor, TSMC fabs in Taiwan (including the R&D Center) and VisEra adopted 0.474 kg CO_2e/kWh as announced by Ministry of Economic Affairs in 2024; TSMC (China) adopted the average emission factor of power grids in Shanghai City of 0.574 kg CO_2e/kWh in 2023; TSMC (Nangjing) adopted the national electricity average emission factor of 0.531 kg CO_2e/kWh; TSMC Washington, LLC adopted an electricity emission factor of 0.288 kg CO_2e/kWh; TSMC Arizona adopted an electricity emission factor of 0.320 kg CO_2e/kWh; JASM adopted an electricity emission factor of 0.423 kg CO_2e/kWh; and Japan 3DIC R&D Center adopted an electricity emission factor of 0.452 kg CO_2e/kWh.

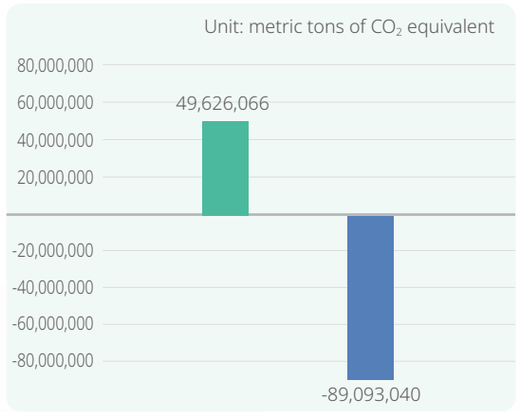
Product Carbon Footprint

TSMC regards product carbon footprint assessment as a core element of product stewardship and eco-design. The Company follows ISO 14067 and the Product Category Rules (PCR) for Integrated Circuit Wafer Fabrication Services, covering a "cradle-to-gate" boundary from raw material extraction to completion of TSMC's manufacturing processes. To track decarbonization progress more closely throughout its operations and supply chain, TSMC increased the frequency of product carbon footprint assessments to an annual basis starting in 2025, enabling precise monitoring of emissions in all fabs. Assessment results are verified by a third party every three years in accordance with ISO 14067 requirements. The findings support carbon reduction strategy development, process optimization, and sustainability disclosure, and are integrated into the ISO 14001 Environmental Management System to drive continuous improvement.

TSMC's 2026 assessment results show that, compared with 2023, product carbon footprints decreased by 8.8% in mature process fabs (>7nm) in 2025, while advanced process fabs (≤ 7nm) dropped by 46.5%, reflecting TSMC's continued efforts in environmental stewardship and sustainable operations.

Beyond quantifying carbon emissions through product carbon footprint assessment, TSMC adopts the "Carbon Handprint " concept to measure the positive contribution of its technologies and products to global emissions reduction. Based on estimates from the Industrial Technology Research Institute's Industry, Science and Technology International Strategy Center (ISTI), ICT products using TSMC chips across six major smart applications enabled approximately 188,000 GWh of global electricity savings in 2025, avoiding about 89.09 million metric tons of carbon emissions. In particular, high-performance computing products enable approximately 11.8 kWh of global electricity savings for every 1 kWh of electricity used in production. These results demonstrate the positive Carbon Handprint generated by TSMC for its customers, with an overall impact equivalent to 1.8 times the Company's own operational carbon footprint.

Total Carbon Emissions and Carbon Handprint in 2025

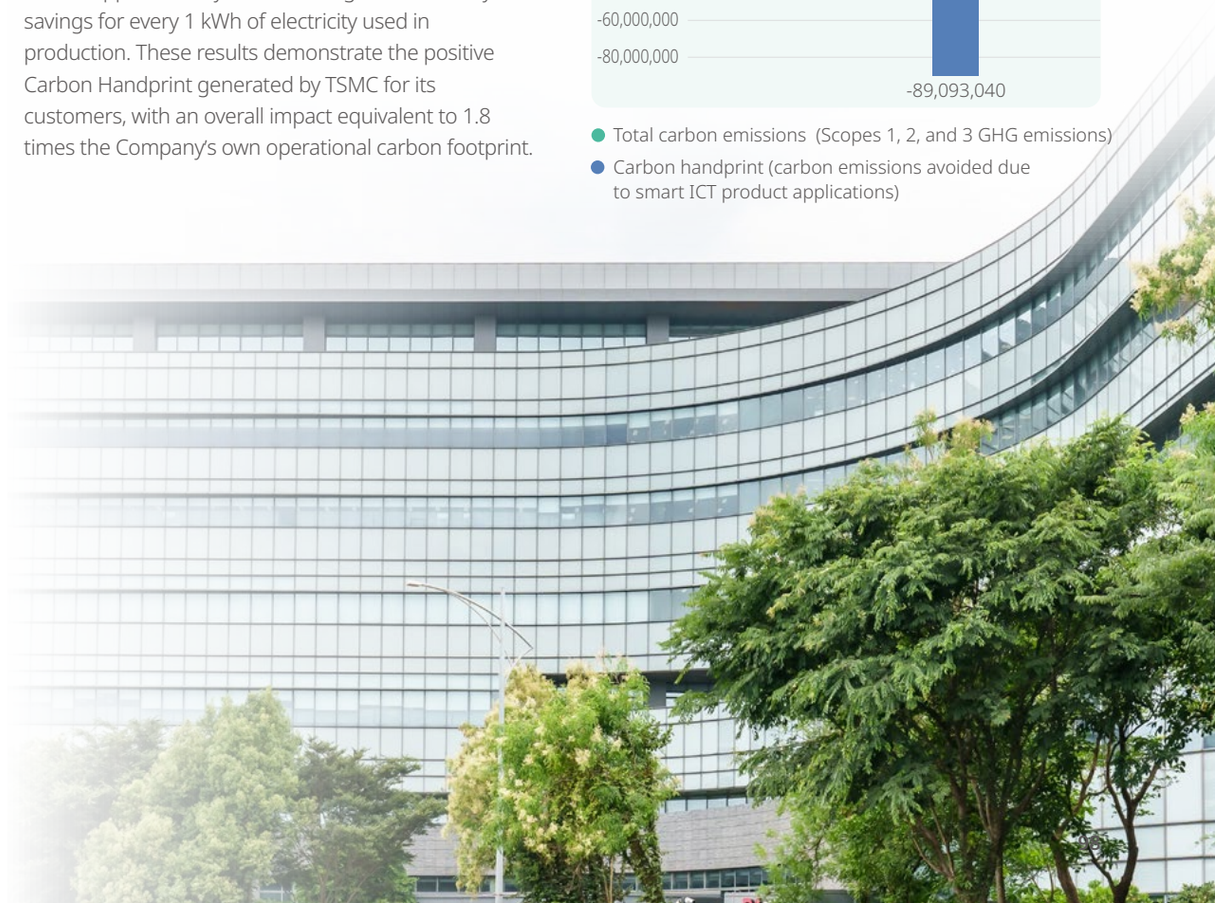


- Total carbon emissions (Scopes 1, 2, and 3 GHG emissions)
- Carbon handprint (carbon emissions avoided due to smart ICT product applications)

Product Carbon Footprint Data

Unit: Kg CO_2e/Wafer





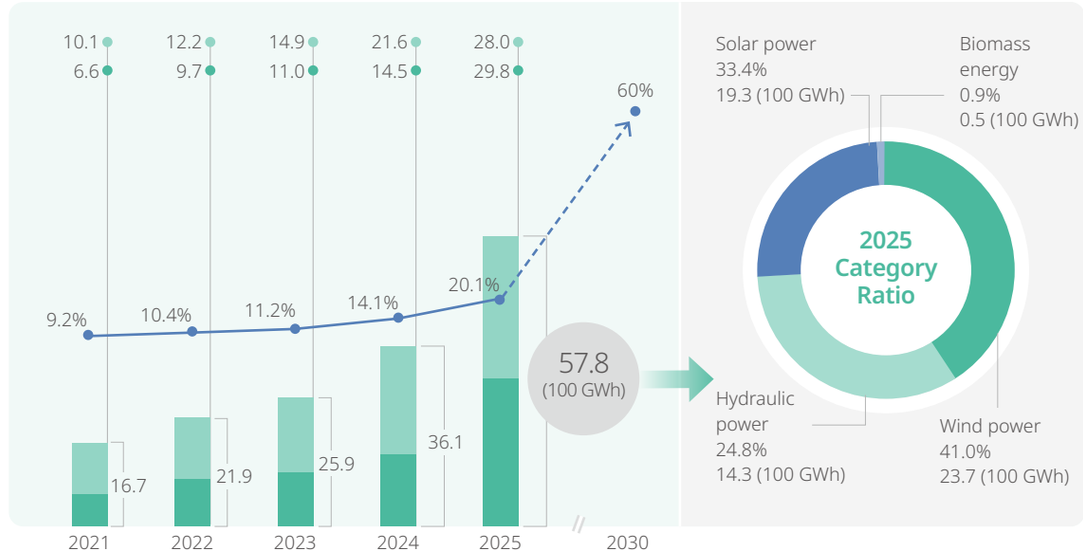
Use Renewable Energy

TSMC continues expanding its use of renewable energy. In 2025, renewable energy accounted for 20.1% of the Company's total global electricity consumption, while usage at Taiwan fabs and VisEra increased to 2,980 GWh, representing 11.5% of total electricity consumption in Taiwan operations. In September of the same year, TSMC became the first private company in Taiwan to use offshore wind power. Overseas fabs continue to increase renewable energy adoption in support of the RE100 target.

In energy transition efforts, TSMC completed participation in the Ministry of Economic Affairs and Taiwan Power Company's "Flexible Green Power Allocation Pilot Program" in 2025 and continued engagement in the updated "Green Power Market Flexible Allocation Pilot Program." With TSMC integrating over 40 renewable energy suppliers and confirming the electricity demands of each fab, the mechanism achieves more precise and real-time supply-demand balancing in 15-minute intervals, enhancing renewable electricity efficiency and flexibility throughout TSMC fabs. Total installed capacity participating in the program reached 2.3 GW, including 1.2 GW from the ongoing Roof-mounted PV Procurement Project, supporting renewable energy diversification and the green economy. As of 2025, TSMC has signed renewable energy purchase agreements totaling 7.3 GW of capacity. Once all projects are fully operational, they are expected to supply approximately 15,800 GWh of renewable electricity annually, avoiding about 7.5 million metric tons of carbon emissions.

In 2025, TSMC collaborated with the Taiwan Semiconductor Industry Association (TSIA) and the SEMI Energy Collaborative (EC) to strengthen renewable energy development. The Company worked with government agencies, power utilities, and industry partners to review regulatory frameworks and remove supply barriers, with the aim of reducing carbon emissions in the semiconductor industry and jointly advancing environmental sustainability.

Renewable Energy Consumption and Ratio



Note: Definition of renewable energy use: Self-generated renewable energy, purchased renewable energy and renewable energy certificates

Renewable Energy Development Timeline

2021
- Committed to reaching 40% of the Company's electricity consumption as renewable energy by 2030

2022
- Established diverse supply of renewable energy by contracting with a small-scale hydroelectric station which started supply in December

2023
- Brought forward the 2050 target of 100% renewable energy coverage in the company to 2040
- Committed to 60% renewable energy coverage in 2030
- Pioneered supply chain renewable energy joint procurement model
- Participated in the green power allocation sandbox project

2024
- Joined the "Energy Collaborative" jointly initiated by SEMI and SCC
- Initiated the "roof-mounted PV procurement project" and "maximal renewable energy installation project for existing fabs"

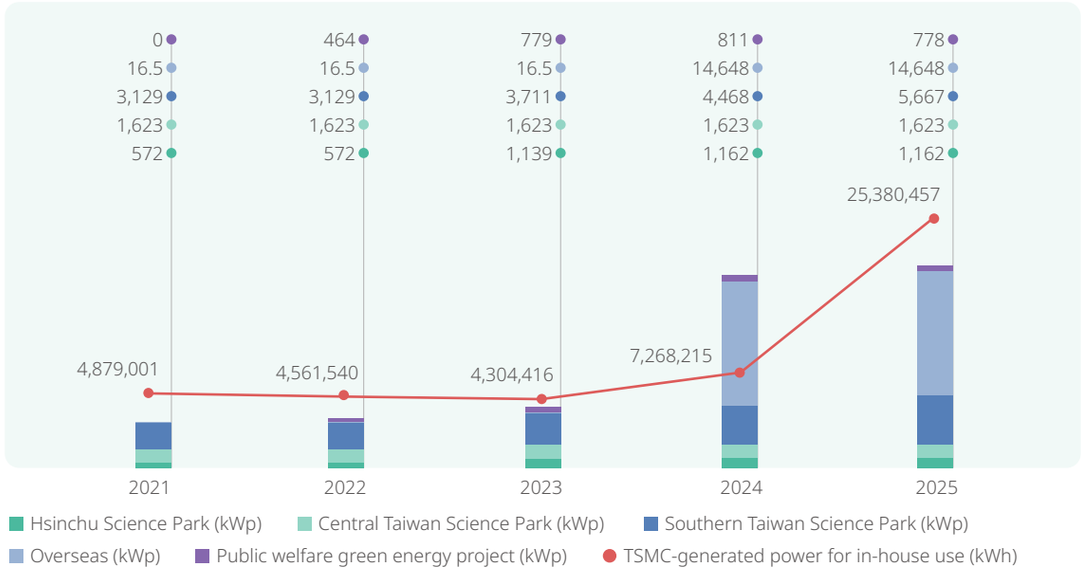
2025
- **Participated in the green power market flexible allocation pilot program**
- **Began utilizing offshore wind power in Taiwan**

Renewable Energy Systems

Beyond procuring renewable energy, TSMC also installs on-site photovoltaic systems to generate zero-carbon renewable electricity for its fabs, while advancing the Maximal Renewable Energy Installation Project for existing Fabs. In 2025, newly installed solar capacity reached 1,199 kWp, and a 14.6 MWp solar power system at the TSMC Arizona fab parking facility entered operation — bringing total company self-generated electricity to over 25 GWh, a 3.4-fold increase over the prior year, and cutting emissions by approximately 8,872 metric tons. TSMC Arizona also installed 86 EV charging stations, providing shaded parking spaces for employees and contractors and encouraging electric vehicle adoption to reduce transportation-related emissions.

In 2025, TSMC continued its Public Welfare Green Energy Program to strengthen community well-being. Led by the TSMC Charity Foundation, the program leverages TSMC's facility resources and subcontractor network, in collaboration with government agencies and academic institutions, to install solar photovoltaic systems free of charge at social welfare organizations and rural schools, creating a stable source of revenue for these institutions through green electricity sales. In 2025, 14 new sites were added, with an installed capacity of approximately 778 kWp and electricity generation of 0.834 GWh, yielding annual electricity sales revenue of approximately NT$3.55 million.

TSMC Renewable Energy Installed Capacity and Power Generation for In-house Use



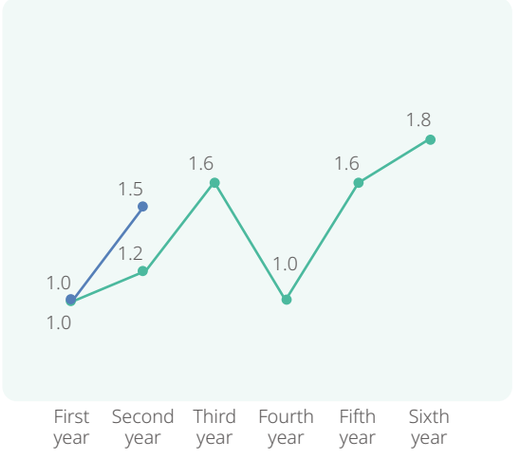
TSMC Arizona fab parking lot solar PV system



Increase Energy Efficiency

In 2025, TSMC's total energy consumption reached 30,990 GWh, with purchased electricity constituting approximately 92.8%, natural gas 7.1%, and diesel 0.1%. In preparation for its 2026 application to the Science Based Targets initiative (SBTi), the Company reviewed and raised its energy-saving targets, increasing in 2025 the annual average electricity-saving target from 1.2% to 1.5%. Newly established fabs — Fab 20 and Fab 22 — as well as overseas operations such as TSMC Arizona, also joined the energy-saving program, further enhancing energy efficiency.

Process Energy Efficiency



Note 1: The standardized baseline for energy efficiency is the values taken from the first year of volume production.
Note 2: The data covers fabs in Taiwan. (excluding the R&D Center)
Note 3: Process energy efficiency is defined as product equivalent per kWh of electricity consumed (12-inch wafer-mask layer equivalents / kWh).

Case Study

Developed a Smart Standby Energy-Saving Mechanism, Saving 85 million kWh

During wafer fabrication, electric-heating local scrubbers — both primary and backup units — must maintain standby temperatures of 700 ° C–1,000 ° C to treat a wide variety of process tail gases. Even when the primary unit operates normally, backup units must remain active to enable immediate switchover in the event of an anomaly. To enhance energy efficiency, TSMC initiated the development of a smart standby energy-saving mechanism in 2020, conducting independent temperature ramp-up tests and operator response training for each equipment type. By optimizing the linkage between primary and backup units, backup units automatically enter a smart sleep mode when the primary unit is operating normally, significantly lowering standby energy consumption. When an abnormal temperature drop signal from the primary unit is detected, the backup unit immediately initiates a rapid heat-up sequence to reach operating temperature, ensuring uninterrupted tail gas treatment.

This mechanism not only lowers standby energy consumption of backup units but also minimizes component wear caused by prolonged high-temperature operation, extending overall system lifespan and enhancing operational stability. Through sustained team efforts, TSMC completed performance validation and operator training for four equipment types in 2025 and fully deployed the mechanism across 2,444 units at all 8-inch and 12-inch wafer fabs — saving 85 GWh while strengthening system reliability and response capability.



TSMC enhances standby mode for electric-heating local scrubber backup units.

Expand Energy-saving Measures

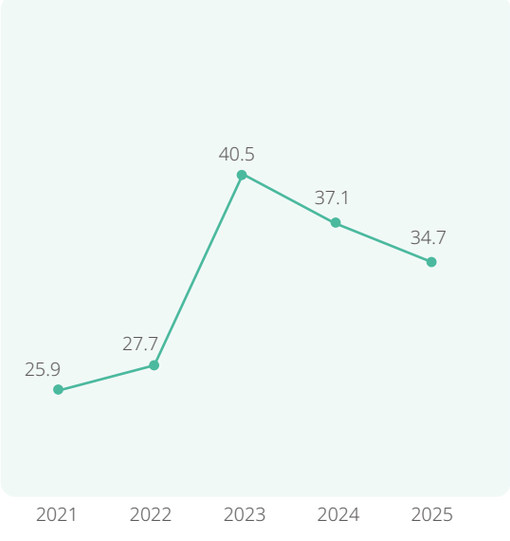
TSMC is committed to identifying energy-saving opportunities. In addition to establishing five major energy conservation teams based on process technologies, the Company drives energy efficiency through a range of initiatives. In 2025, TSMC executed 2,141 energy conservation measures across eight categories, including tool exhaust reduction, optimization of cooling water temperature and usage, optimization of pipeline heating system temperatures, installation of aerogel insulation kits, and upgrades to hot water recovery tanks. These initiatives delivered approximately 900 GWh of annual energy savings, reduced nearly 420,000 metric tons of CO_2 emissions, and generated electricity cost savings of approximately NT$3.85 billion.

To strengthen energy efficiency in advanced processes, TSMC collaborated with suppliers through the EUV Dynamic Energy Saving Program, successfully reducing peak power consumption by 44% while maintaining production capacity. In 2025, the Company also completed testing of standby energy-saving modes for electric-heating local scrubbers, enabling the equipment to enter sleep mode during idle periods and supporting more environmentally responsible process management.

Under the Energy Conservation Action Project for Next Generation Fab Tools, TSMC expanded its external collaborations, increasing the number of equipment partners from six to 11 in 2025 and continuing to develop energy-saving components for fab tools. Energy savings from new tools reached 460.14 million kWh in 2025. The Company also launched a feasibility assessment for developing tool energy-saving modes, aiming to reduce energy consumption during standby and improve operational efficiency.

Unit Product Energy Consumption

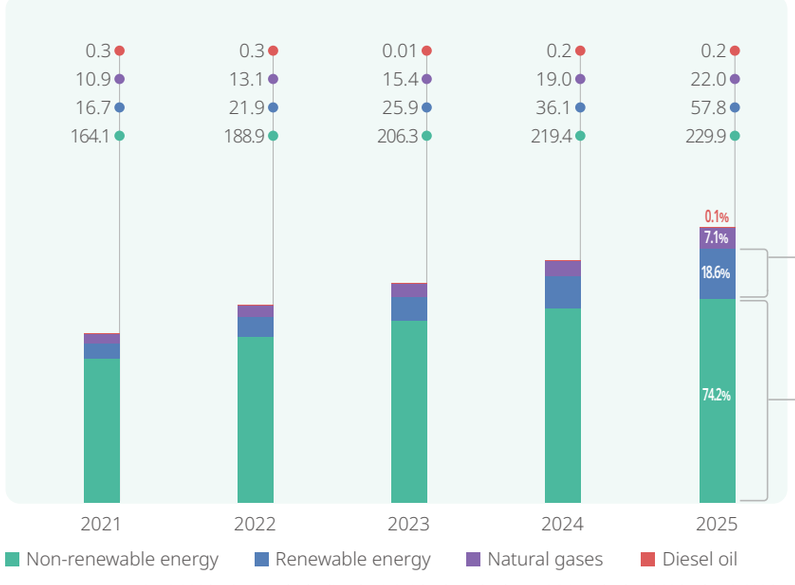
Unit: kWh/12-inch equivalent wafer mask layer



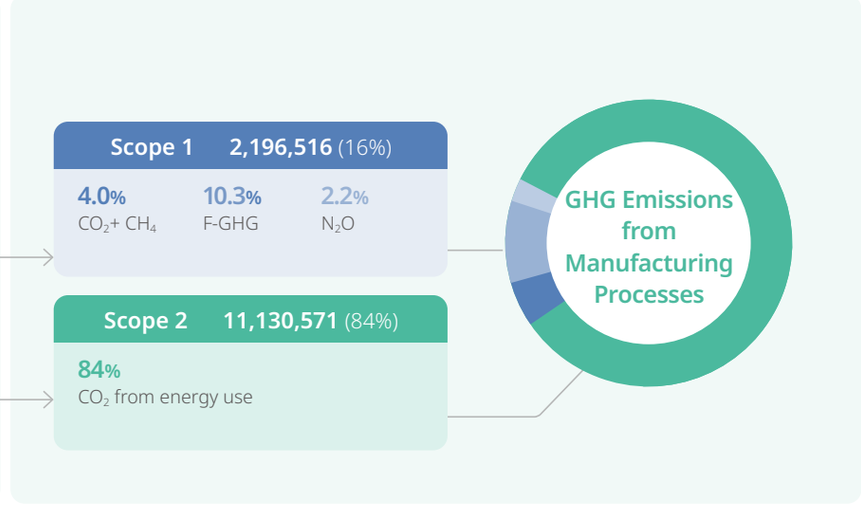
Note 1: The data covers fabs in Taiwan (including the R&D Center), TSMC (China), TSMC (Nanjing), TSMC Washington, LLC, TSMC Arizona Corporation, JASM, and VisEra.
Note 2: Diesel and natural gas are not used for production and are excluded from the calculation.

Energy Consumption

Unit: 100 GWh



Unit: Metric tons

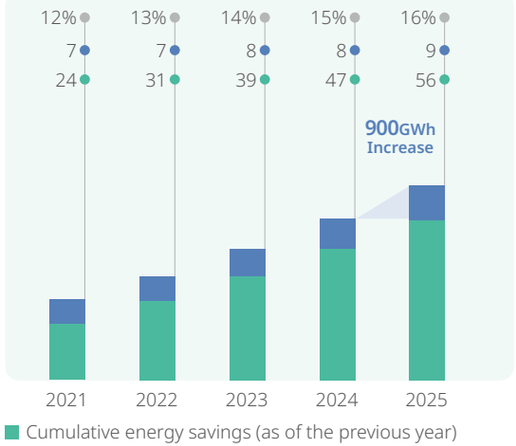


Note 1: (Import) LNG = 9,000 kcal/m3; vehicle diesel = 8,642 kcal/L; 1 kcal = 4,186.8 J; 1 kWh = 860 kcal ≒ 3,600 kJ
Note 2: GHG emissions from production processes include only direct emissions (scope 1) and indirect emissions from electricity use (scope 2).

To boost the efficiency of energy-saving and carbon reduction management teams in all fabs, TSMC held training at the Hsinchu, Taichung, and Tainan fabs in 2025, focusing on forward-looking technologies such as carbon sequestration and carbon-free electricity. The training covered TSMC's SBT net-zero roadmap and strategic blueprint, promoting green transformation through technical knowledge exchange. A total of 295 participants attended the three sessions.

Cumulative Energy Savings

Unit: 100 GWh

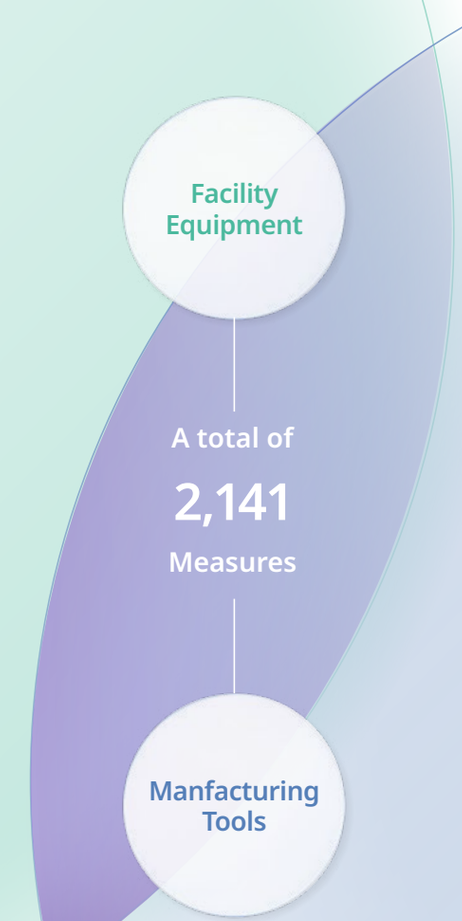


Note: 1 kWh = 3,600 kilojoules

Continuous Innovation with Five Key Energy Conservation Teams

Advanced Processes R&D Team	12-inch Wafer Fab Team	Advanced Backend 8-inch Wafer Fab Team	EUV Team	Facility Team
Targets (including existing and future tools)				
Next Generation 3nm/2nm	12-inch wafer fabs (including overseas fabs)	Backend fabs and 8-inch wafer fabs (including overseas fabs)	EUV tools	Shared facilities not used for production
Mission				
• Develop energy-efficient components • Optimize programs • Set tool specifications	• Replace and upgrade equipment with low energy efficiency • Optimize programs • Launch energy-saving programs at new domestic and overseas fabs	• Replace and upgrade equipment with low energy efficiency • Set specifications for new tools in backend fabs	• Optimize programs • Develop energy-efficient components	• Upgrade equipment with low energy efficiency • Develop smart energy conservation systems • Set specifications for new tools
Achievements from Key Programs in 2025				
✓ Installed high-performance equipment in new tools at Fab 20 and Fab 22, saving 127.65 GWh ✓ Executed the Low Global Warming Potential Gas Substitution Project, projected to reduce HFCs consumption by approximately 16%	✓ Optimized tool exhaust and cooling water usage through process adjustments at existing fabs, saving 91.13 GWh ✓ Adopted 5nm high-performance tools with optimized settings at TSMC Arizona, saving 28.94 GWh NEW	✓ Accelerated high-performance pump/chiller replacement plans at Fabs 2, 3, 5, 6, and 8, saving 7.22 GWh ✓ Deployed high-performance equipment and optimized settings at advanced backend fabs, saving 44.12 GWh	✓ Advanced the EUV Dynamic Energy Saving Program ; field measurements showed energy savings of up to 8% of total annual tool energy consumption NEW	✓ Executed energy-saving mechanisms for electric-heating local scrubbers , saving 85 GWh NEW

Energy Conservation Measures



Lighting Energy Savings
All Fabs

- Replaced yellow-light fixtures with LED lighting

44	59.54 GWh	28,222 Metric tons
Energy-saving measures	Energy-saving kWh	Reduced of CO_2

A.C. Energy Savings
All Fabs

- Converted air compressor cooling water supply from chilled water to warm water NEW
- AI powered chilled water energy saving system
- Replaced cold water with PCW for cooling air compressors throughout first- and second-stage compression

20	60.75 GWh	28,794 Metric tons
Energy-saving measures	Energy-saving kWh	Reduced of CO_2

Increased Performance
All Fabs

- Consolidated UPS systems NEW
- Replaced aging equipment with new units NEW
- Installed variable-frequency drive (VFD) controls on equipment NEW
- Applied wet film plate energy-saving measures NEW

120	78.75 GWh	37,326 Metric tons
Energy-saving measures	Energy-saving kWh	Reduced of CO_2

Standby Energy Savings
All Fabs

- Energy-saving mode for uninterrupted power supply system
- Reduced standby temperature for local scrubber backup units
- Cooling fan for battery cabinet to conserve energy

41	52.11 GWh	24,701 Metric tons
Energy-saving measures	Energy-saving kWh	Reduced of CO_2

Energy Usage Management
All Fabs

- Reduced PCW and exhaust consumption for tools
- Optimized tool program settings

256	91.13 GWh	43,196 Metric tons
Energy-saving measures	Energy-saving kWh	Reduced of CO_2

Unit Replacement
All Fabs

- Replaced high-performance pumps and chillers

414	42.13 GWh	19,970 Metric tons
Energy-saving measures	Energy-saving kWh	Reduced of CO_2

New Unit Specs
All Fabs

- Installed high-efficiency energy-saving auxiliary equipment and components in new tools
- Optimized water usage and exhaust settings for new tools

1,065	460.14 GWh	218,106 Metric tons
Energy-saving measures	Energy-saving kWh	Reduced of CO_2

Equipment Adjustments
All Fabs

- Upgraded tools with energy-saving components
- Hot DI water circulation system

181	42.65 GWh	20,216 Metric tons
Energy-saving measures	Energy-saving kWh	Reduced of CO_2

Note: The carbon emission equivalent factor is 0.474 kg CO2e per kWh; 1 kWh = 860 kcal = 3,600 kJ