winbond

2022

Winbond — TCFD Report

Task Force on Climate-related Financial Disclosures

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A Message from the Chairman and CEO

The World Economic Forum (WEF) recently released “Global Risks Report 2023”, which indicates that the cost of living will dominate global risks in the short term. The energy crisis, food shortages, and inflation resulting from the war in Russia-Ukraine and the Covid-19 pandemic have become urgent global issues. Climate change continues to be the biggest long-term risk. Greenhouse gas emissions produced by humans since the dawn of the industrial revolution and capitalism have led to global warming. The high costs resulting from extreme weather events have increased the awareness of governments, international organizations, and civil society throughout the world. Industries are confronting pressure from economic stagnation, the challenges of energy transformation, and the risk of geopolitical instability at the same time they have to face up to the urgent and worsening climate issues that have been accumulating for over a century. This is not an easy task, but it is only through being more proactive in combating climate change and increasing the resilience of our Company that we can move towards sustainability.

As a provider of electronic technology, Winbond is deeply aware that our actions affect the global economy, and in fact function as a key factor in shaping the landscape of society. To comply with international standards and domestic policies related to environmental sustainability, we adopted the framework of the Financial Stability Board’s (FSB) Task Force on Climate-Related Financial Disclosures (TCFD) and published Winbond’s first TCFD report in 2022, which was the company’s 35th anniversary. Through this report, we hope to convey our social commitment to our stakeholders.

Our vision is to “be a hidden champion in providing sustainable semiconductors to enrich human life”. Our business activities, organizational design, talent development, culture shaping, technology development, and product design, manufacturing, and applications all follow this vision. How does an industry survive in a fast-changing world? On the surface, an industry must be dynamic and capable of adjusting to meet changes in society and technology, while in essence, the nature of an industry’s responsibility is static, and must always be centered around the core idea of improving human life. In terms of ESG, we believe that a company’s carbon footprint is an indicator of its innovative values. By organizing lectures, developing inspirational slogans, and arranging internal online courses, we plant the idea of carbon reduction in the heart of each employee through a caring corporate culture. In the future, we will establish a complete and thorough internal mechanism to incorporate carbon reduction action into our performance evaluations and link it with the compensation system to facilitate a transformation of our employees’ carbon reduction practices. This series of interconnected efforts will not only reduce the carbon footprint of the Company but also foster a shared consensus among employees regarding carbon reduction and ultimately help bring a brighter future to this world.

Climate change is an issue of universal concern to international industries, and net zero emissions have become a common goal and challenge that can be viewed both as a responsibility and an opportunity. How an industry increases the core competitiveness of its company, creates new business models in response to the risks resulting from climate change, and transforms climate change risks into green opportunities is the key to enhancing competitiveness. Winbond has been continually deploying and investing in net zero emissions transformation, and the company will continue to do so to in order to generate a positive impact on the environment and society and fulfill our commitment to sustainable development.

Arthur Yu-Cheng Chiao

Chairman and CEO

Important Milestones in Climate Change Adaptation

1998

- Obtained ISO14001 certification for environmental management system

2000

- Participated in World Semiconductor Council's PFC Emissions Reduction Program

2006

- Implemented ISO 14064 greenhouse gas inventory

2010

- Established CSR policy
- Established EICC Promotion Team
- Verified through (BSI) PAS 2050 Carbon Footprint Standard
- Obtained Carbon Footprint Label from Taiwan Electrical and Electronic Manufacturers' Association
- Set Green Semiconductors as our corporate vision

2011

- Formulated Corporate Social Responsibility Procedures

2015

- Established CSR Committee
- Completed first CSR report in 2014

2020

- Registered for EPA's TM002 Offset Project

2021

- Established ESG Committee
- Implemented ISO 50001 Energy Management System
- Completed ISO 14067 Product Carbon Footprint assessment for IC products
- Joined Taiwan Climate Partnership (TCP)
- Participated in CIX Auctions, obtained voluntary carbon credits from world's largest blue carbon project
- Celebrated Zero Carbon Family Day by adopting blue carbon offsets
- Acquired 15% equity stake in CHIA-HO Green Energy Corporation
- Established Carbon Emissions Information Platform

2022

- Wafer products verified through ISO 14067 Product Carbon Footprint
- Implemented ISO 14046 Water footprint assessment
- Implemented TCFD framework
- Received four awards from TCSA

TCSA

Corporate Sustainability Performance Award
Top50 Corporate Sustainability Award

Corporate Sustainability Report
Platinum Award

Best Performance in Specific Categories
People Development Award

Best Performance in Specific Categories
Growth through Innovation Award

Winbond celebrates the 35th Zero Carbon Family Day

Climate Impact X
DBS SGX TEMASEK

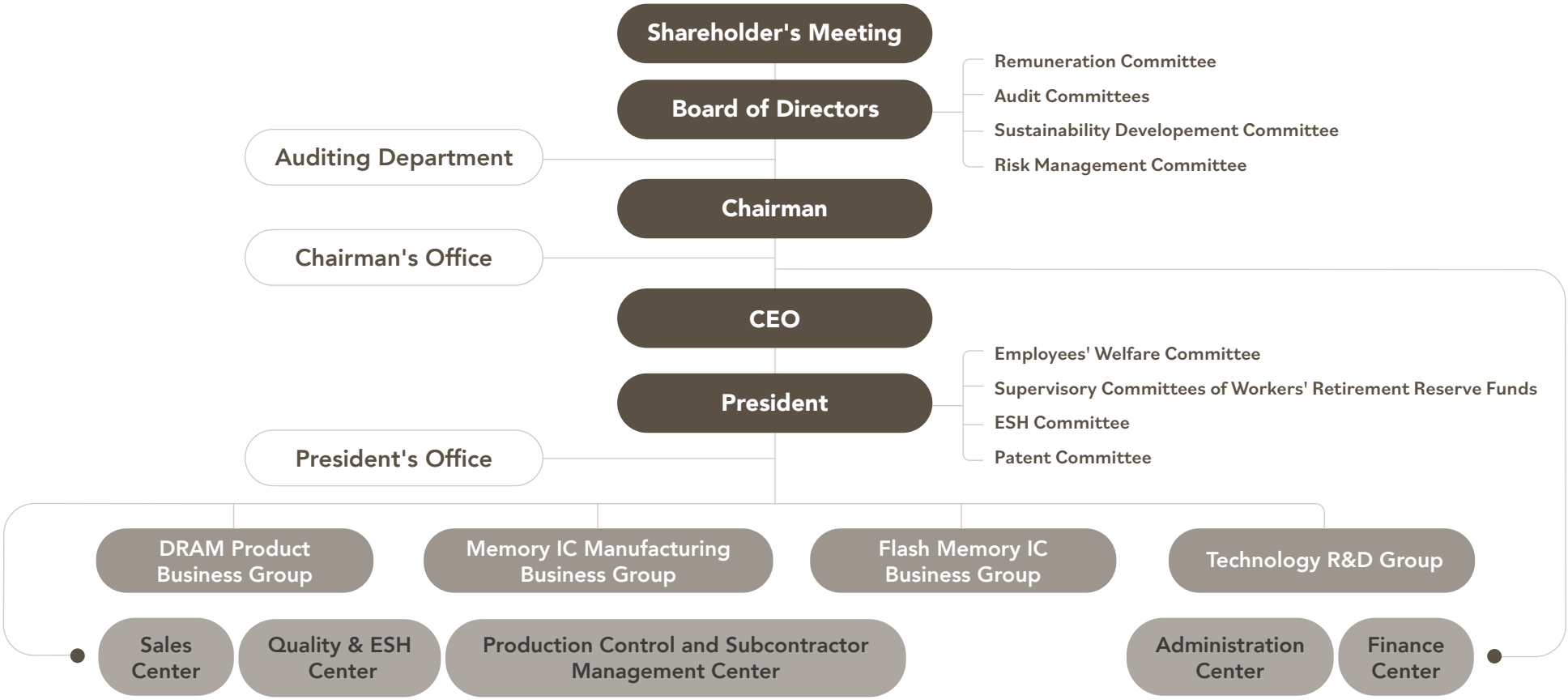
TCP
Taiwan Climate Partnership
台灣氣候聯盟

1.1 Climate Organizational Framework

Governance and Oversight by the Board of Directors

Winbond has established a well-developed governance framework. The Board of Directors is Winbond's highest governing body, in charge of its operations and decision-making. The Board of Directors is responsible for ensuring the sustainable development of the Company and guaranteeing the rights of the Company's shareholders and other stakeholders.

Winbond's 12th Board of Directors consists of 11 directors, 4 of whom are independent directors and 2 of whom are women. More than two-thirds of the directors do not work as managers or employees of the company. The Board held 7 meetings in 2022, and several important proposals were passed. The Renumeration Committee, Audit Committee and ESG Committee have been established under the Board of Directors, to which they are responsible for reporting their activities and decisions.

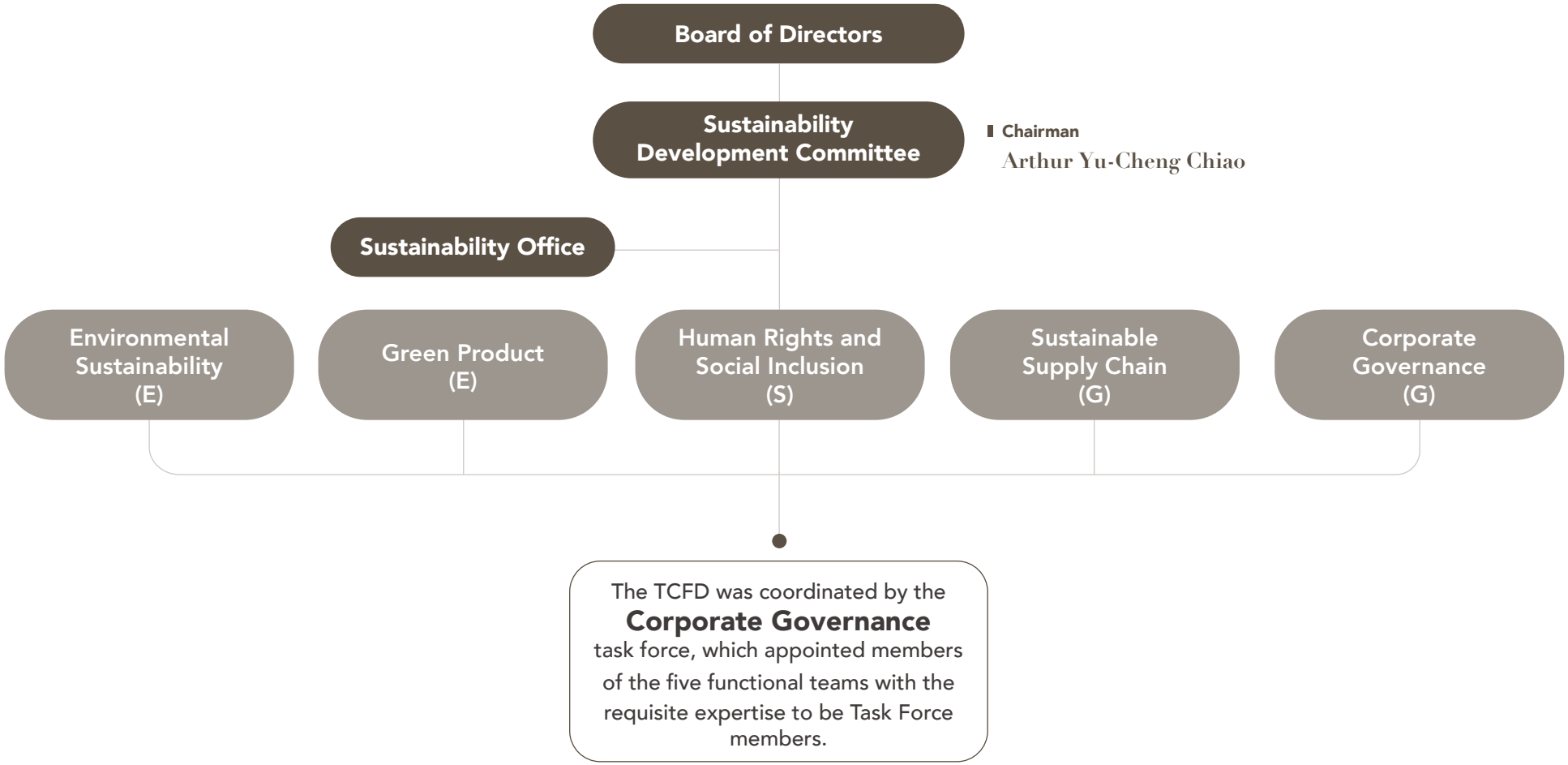


December 31, 2022

Assessment and Management of the Executive level

Winbond established the Winbond Corporate Social Responsibility (CSR) Committee in 2015 to serve as the key driver of the Company's sustainable development; in May 2022, the ESG Committee, which operates directly under the Board of Directors, was officially established as well. The Committee meeting should be held at least twice a year and is chaired by the Chairman. The purpose of the Committee is to plan the Company's sustainable development strategy and goals, formulate action plans, integrate company resources, and implement sustainability initiatives to enhance operational competitiveness.

The ESG Office and its five functional teams focusing on the areas of Environmental Sustainability, Green Product, Human Rights and Social Inclusion, Sustainable Supply Chain, and Corporate Governance were formed under the ESG Committee, which gives annual reports regarding the performance of the Committee to the Board of Directors to ensure the progress and implementation of corporate sustainable development. Members of the functional teams with the requisite expertise were tapped to form the TCFD.



1.2 Accountability Measures

Reporting to the Board of Directors

Winbond continues to incorporate climate change-related proposals into the decision-making process of the Board of Directors to ensure corporate leadership and sustainability in addressing climate change.

Important Climate-Related Proposals and Reports for the 2022 Board of Directors
• Report on the planning of greenhouse gas inventory and timeline (including subsidiary companies)
• Approval of increased capital expenditure budget for equipment replacement with energy-efficient equipment
• Establishment of the ESG Committee and the formulation of organizational regulations
• Approval of investment in Chia-ho Green Energy Corporation
• Planning report for achieving 2030 renewable energy targets
• Planning report for the 2022 carbon credit trading program
• Regular progress reports on execution of 2022 greenhouse gas inventory (including subsidiary companies)
• Regular progress reports on sustainability development initiatives

Competence Development for the Board of Directors Regarding Climate Change

To enhance the professional competencies of the Board of Directors, Winbond references current international trends, domestic regulations, and the Company's development needs, selects important issues in climate change, and invites experts in the relevant fields to serve as speakers (for information on the other education of directors, please refer to Winbond's 2022 Annual Report).

2022 Board of Directors Climate-Related Competency Development Topics
• Climate Change Impacts and Global Carbon Risk Management Trends
• Navigating the History of Carbon - An Introduction to the Biology Underlying the Carbon Footprint
• Pathways to Net Zero Emissions for Businesses: Natural Carbon Sinks and Carbon Credit Trading

Competence Development for Managers and Employees regarding Climate Change

Winbond has invested a great deal of time and resources into successfully communicating the risks and impacts of climate change to all of the company's employees. The Company uses a range of channels to actively cultivate the basic awareness of employees in the hope of instilling the concept of carbon reduction. Through a combination of internal and external training courses, slogans on the company intranet, and shared articles, Winbond encourages every employee to pay extra attention to the impact of climate change on both work and life, and to spread the idea to their family members and even implement the eco-friendly practices promoted by the Company at home. Doing so makes it easier for the Company to bring employees onboard when promotion carbon reduction actions to realize the goal of net zero emissions.

Winbond ESG Learning Platform

ESG 永續經營

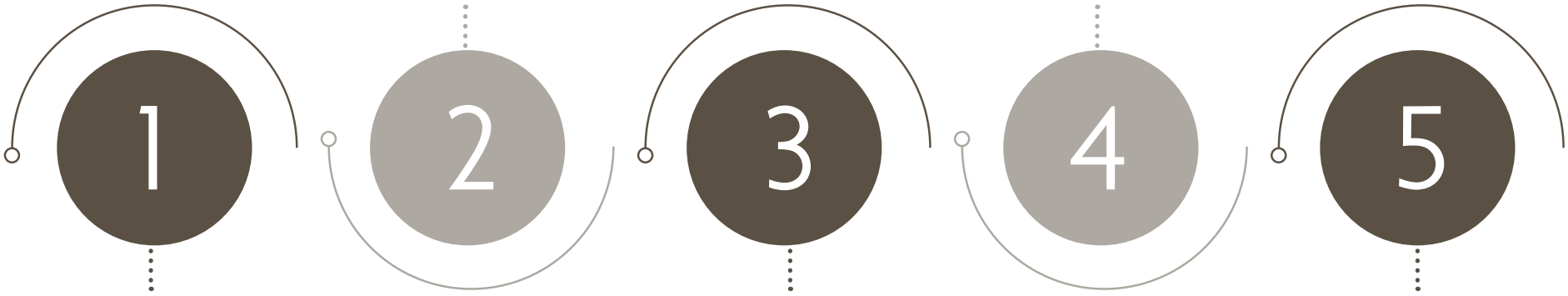
當責團隊

文化小學堂｜文化一點通

2.1 Risk Management Framework

Winbond is a manufacturer of semi-conductors. Natural disasters, accidents, man-made disasters, changes in the international political and economic situation, the introduction of new technologies by competitors, and changes in policies and regulations can potentially result in severe impacts on operations and finance. In light of this fact, Winbond established the Risk Management Committee under the Board of Directors to implement risk management through the Committee's subdivisions or responsible units in accordance with their scope of operations. Aside from formulating a sound set of internal regulations and operating procedures, the Committee is also responsible for developing comprehensive plans and procedures for preliminary assessments, hedging, and loss prevention and crisis management, and regularly reporting to its oversight and governing bodies.

Winbond has incorporated climate change risks into its long-term operations management. To understand the impacts of climate change risks on the environment and operations, Winbond has introduced the TCFD, conducts annual evaluations, discloses climate risks and opportunities as well as their financial impacts (both qualitative and quantitative), and proposes review and management strategies based on international regulatory trends and market development observations since 2021. Winbond will continue to monitor risks and impacts resulting from climate change, strengthen its operational capabilities, promote carbon reduction projects, increase energy efficiency, and firmly step towards sustainable development.



Risk Identification

Identify significant risk items, assessment methods, and risk appetite for the annual operational plans and goals of each unit, and obtain approval from the supervisor for the annual budget.

Risk Analysis

Calculate the risk value for identified significant risks, and in addition to the annual estimation, conduct quarterly revisions of the risk value. Any significant changes should be reported in the quarterly reports.

Risk Assessment

Each unit assesses significant risk items according to the appropriate operational frequency and compares them with the approved risk appetite, reporting to the management unit as needed.

Risk Response

When the actual situation exceeds the approved risk appetite, each unit immediately proposes risk response recommendations. Upon approval, the appropriate responses are implemented in accordance with risk management policies, procedures, and hierarchical responsibility criteria.

Supervision and Review

Risk management-related requirements are incorporated into the audit system in accordance with risk management policies and procedures for tracking, enabling the establishment of control points, self-assessment, and audit verification operations.

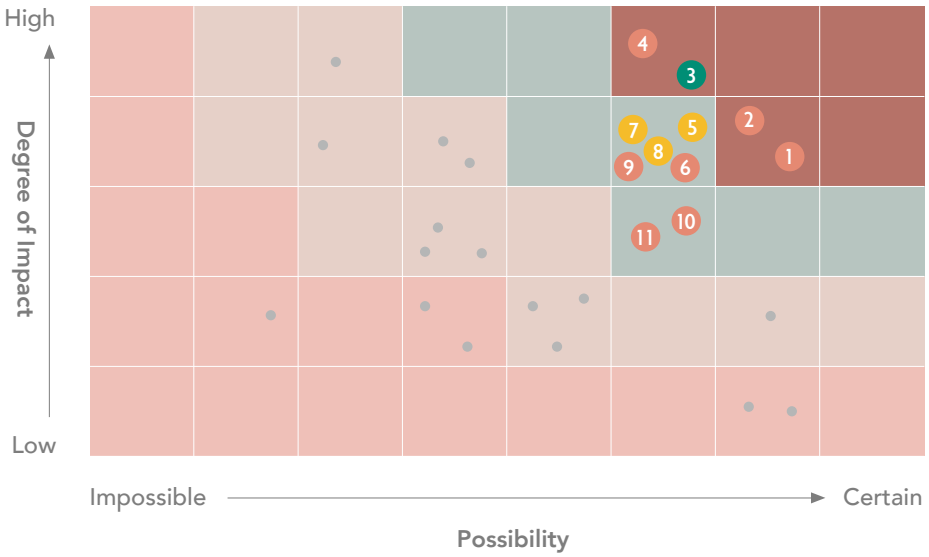
2.2 Procedures for Identifying Climate Change Risks and Opportunities

In 2022, Winbond established the TCFD with 40-plus members, over 60% of whom are employees at the department executive level. Members are divided into teams according to the nature of their job. Each team discusses climate change issues with relevance to their area of operations. Over the course of four workshops and educational training, the TCFD has identified four major climate risks and seven minor climate risks, as well as five major climate opportunities and four minor climate opportunities.

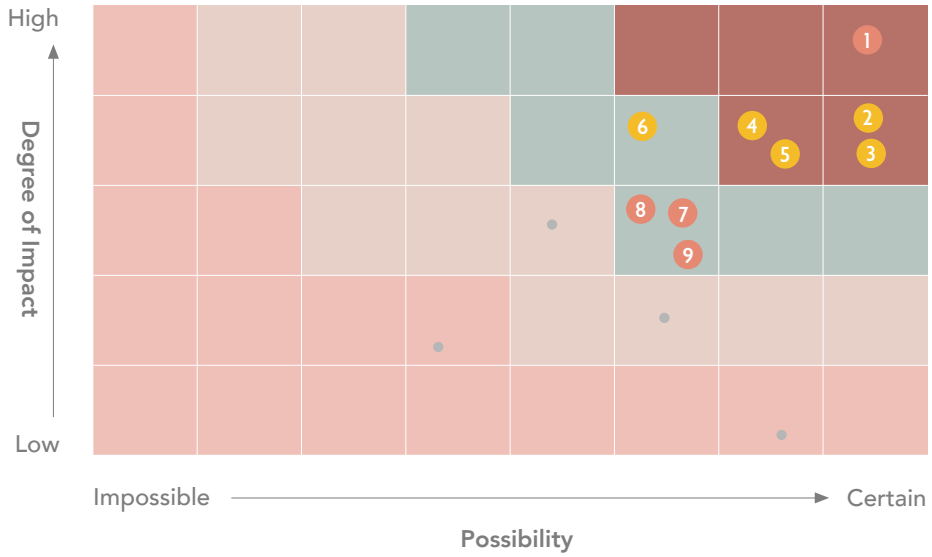
01	**Form a TCFD**	Formed by personnel from over 20 units, including Research and Development, Sales, Marketing, Fab Facility, Supply Chain Management, Environmental Safety and Health, Finance, Legal, and Human Resources
02	**Cooperate with external experts to create climate risk and opportunity lists**	Including 37 climate risks and 22 climate opportunities
03	**Define evaluation criteria**	Conducted evaluation based on impact degree, possibility of occurrence and time of occurrence
04	**Generate risk matrix and opportunity matrix for each team**	Each team identified major short-term, medium-term, and long-term risks and opportunities based on their impacts, possibility of occurrence , while considering their own business relevance
05	**Develop the consolidated risk matrix and opportunity matrix**	Aggregated the results from each team to generate the Winbond Climate Risk Matrix and Opportunity Matrix
06	**Evaluate the financial implications of major risks and opportunities**	Conducted scenario simulations to assess potential financial impacts resulting from high-impact and high-likelihood risks and opportunities
07	**Discuss response measures**	Engaged relevant units to review and develop response measures for major risks and opportunities

2.3 Climate Risk and Opportunity Matrix

Climate Risk Matrix



Climate Opportunity Matrix



Major Risks

1. Demand for renewable energy
2. Carbon tax/carbon fee
3. Unstable electricity supply
4. Extreme rainfall and drought

Minor Risks

5. Changes in customer behavior
6. Greenhouse gas emissions regulations
7. Changes in rainfall patterns and distribution
8. Demand for low-carbon products and services
9. Changes in natural resource availability
10. Signing of Voluntary agreements
11. Fuel tax/energy tax

Short-term 1-3 years **Medium-term** 3-5 years **Long-term** more than 5 years

Major Opportunities

1. Changes in customer behavior
2. Participation in renewable energy projects
3. Process optimization and R&D innovation
4. Development of low-carbon products and services
5. Improvements in energy efficiency

Minor Opportunities

6. Water resource management
7. Use of recycled materials
8. Exploration of alternative and diverse resources
9. Participation in carbon credit markets

Short-term 1-3 years **Medium-term** 3-5 years

2.4 Impacts of Major Climate Change and Responses

Major Climate Risks

Type	Climate Risk	Time of Occurrence	Potential Financial or Operational Impacts (−) *represents a negative impact* (+) *represents a positive impact*	Response Measures
Transition Risks	Demand for renewable energy	Medium-term	• Higher green electricity prices result in increased production costs (−) • Reducing carbon emissions leads to a decrease in carbon tax/fees (+) • Suppliers pass on their renewable energy expenditures, leading to increased procurement costs (−) • Limited production due to difficulty in acquiring renewable energy (−)	• 90% green energy target for CTSP Fab in 2030 • Planning to procure renewable energy electricity and evaluation of the purchase of T-RECs • CTSP Fab has installed a 499kW rooftop renewable energy generation system and continues to assess the feasibility of installing additional renewable energy generation systems • Investment in Chia-ho Green Energy Corporation in 2022, with ongoing evaluation of other renewable energy projects • Planning to establish a Customer Green Energy Demand Survey System to accurately understand our customers' green energy demand • Annual environmental surveys on key suppliers to identify carbon emissions sources, reduction plans, and management, with continuous monitoring
	Carbon tax/ carbon fee	Medium-term	• Increase in indirect costs (−) • Suppliers pass on their carbon tax/fee expenditures, leading to increased procurement costs(−) • Limited capacity expansion(−)	• Company-wide target of net-zero emissions in 2050 • Development of carbon emissions information platform for ongoing management and tracking, with plans to develop a carbon accounting system • Planning to procure renewable energy electricity and evaluation of the purchase of T-RECs. • Joining Singapore CIX platform to participate in carbon credit market and continuous monitoring of carbon offset mechanisms • Implementation of ISO 50001 energy management system with 21 energy-saving measures completed in 2022, resulting in a savings of 35.9 million kWh of electricity and a reduction of 16,485 tons of greenhouse gas emissions • Hold focused ESG exchanges to communicate supply chain decarbonization goals and encourage suppliers to reduce their carbon emissions
	Unstable electricity supply	Long-term	• Production impacts lead to reduced revenue(−) • Supplier supply disruptions affect Winbond's production(−)	• Planning for diversified power sources to mitigate the risks associated with electricity procurement and usage • Installation of emergency power generator systems and uninterruptible power supply systems to establish backup power sources for at least 80% of the fab's electricity consumption • Communicating electricity management measures to suppliers, including the need to establish emergency power distribution equipment and progressively increase the proportion of green energy
Physical Risks	Extreme rainfall and drought	Medium-term	• Production impact leading to reduced revenue (−) • Continuous operation of automated production lines with increased labor costs due to overtime payments in compliance with regulations (−) • Supplier supply disruption affecting Winbond's production (−) • Increased cost of natural disaster insurance (−)	• Promoting water conservation measures and installing water storage equipment • Adopting automation in production processes to reduce the need for manual operations. • Utilizing digital tools to enhance efficiency in remote work • Communicating relevant response measures to suppliers, such as strengthening facility infrastructure and drainage systems, conducting regular flood response drills, increasing water recycling rates, and preparing alternative water sources

Major Climate Opportunities

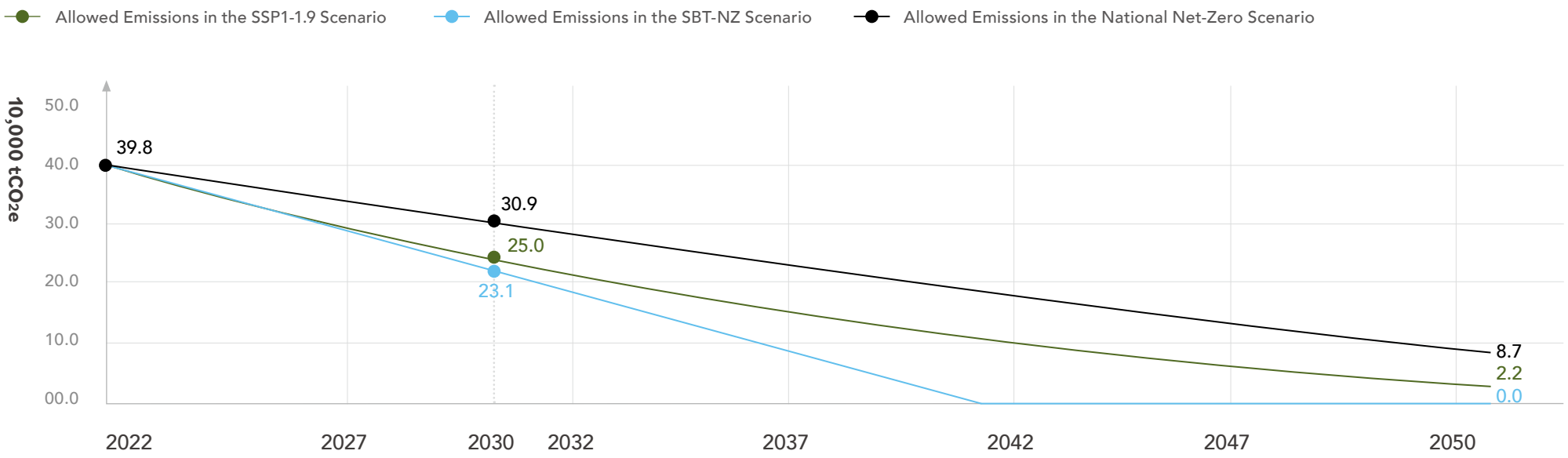
Climate Opportunity	Time of Occurrence	Potential Financial or Operational Impacts	Response Measures
Changes in customer behavior	Medium-term	• Product portfolio changes that accelerate positive development across entire supply chain • Obtaining orders and expanding revenue • Increased order stability and reduced revenue fluctuations • Improved company reputation	• Promoting the introduction of new product designs (design in) to meet customer needs • Increasing the portfolio of green or low-energy consumption products • Establishment of carbon information platform to assess product carbon footprints and hotspots, and formulation of reduction pathways and optimization plans • Evaluating and responding to customer requests for energy efficiency and carbon reductions, as well as requirements for renewable energy use • Participation in domestic and international sustainability evaluations to enhance transparency and reputation in terms of sustainability practices
Participation in renewable energy projects	Short-term	• Reduction in carbon emissions leading to a decrease in carbon tax/fee expenditures (+) • Diversified sources of electricity to mitigate risks • Support for compliance with renewable energy regulations and achieving corporate goals	• Planning to procure renewable energy electricity and evaluation of the purchase of T-RECs • Investment in Chia-ho Green Energy Corporation in 2022, with ongoing evaluation of other renewable energy projects • CTSP Fab installed a 499kW rooftop renewable energy generation system and continues to assess the feasibility of installing additional renewable energy generation systems
Process optimization and R&D innovation	Short-term	• Reduction in carbon emissions leading to a decrease in carbon tax/fee expenditures (+) • Reduction in water consumption leading to lower production costs • Obtaining orders and expanding revenue	• Continuing investment in process development to reduce carbon emissions and water consumption • Supporting packaging suppliers in innovating and optimizing their processes to reduce product carbon footprint, thereby enhancing Winbond's product competitiveness
Development of low-carbon products and services	Short-term	• Increased product prices • Expansion in market share and increase in revenue	• Investment in the design of green or low-energy consumption products, continuing research and development of innovations based on product carbon footprint analysis and verification • Acceleration of process evolution to increase the portfolio of green or low-energy consumption products • Understanding customer needs and evaluating the possibility of customization to provide low-carbon/green products
Improvements in energy efficiency	Short-term	• Reduced production and operational costs	• In 2022, a focus on energy-saving initiatives in four major areas: new technology adoption, usage management, component replacement, and equipment upgrades • Planning of multiple energy-saving projects for 2023, including the continuing replacement of natural gas boilers with electric boilers, replacement of rotating equipment, and implementation of energy-saving measures in the MAU water-washing system • Implementation of ongoing energy-saving measures in office areas, such as adjusting the operating hours of air conditioning and exhaust systems and adjusting air conditioning according to space usage

3.1 Transition Risk Scenario Analysis

Transition risk scenario analysis anticipates Winbond's BAU (Business as Usual) carbon emissions, and compares them with the carbon emissions allowed under various external scenarios to analyze the potential financial impacts that Winbond might experience if no transition initiatives are implemented.

Winbond conducted risk simulations using three scenarios: (1) National Net-Zero Pathway, in Taiwan which mainly assesses domestic regulatory risks, (2) The SSP1-1.9 scenario from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report, which represents an extremely low-emissions pathway, and (3) an annual reduction rate of 4.2% as required by the Science-Based Targets Net-Zero (SBT-NZ) Standard for carbon emissions.

External Scenario	Description	Assessed sources of emissions
National Net-Zero Pathway	Based on Taiwan's current net-zero target	Scope 1 + Scope 2
SSP1-1.9	Based on the SSP1-1.9 pathway in the IPCC Sixth Assessment Report	
SBT-NZ	Based on the emissions reduction pathway required to achieve the SBT's net-zero criteria by 2050	



Climate change issues may have financial implications for Winbond in terms of regulations, technology, the market, and reputation. In particular, the implementation of carbon tax and carbon fee, compliance with regulations for intensive electricity users to use of renewable energy electricity are expected to result in a financial impact of approximately 0.1-2% of revenue in 2030. Without any mitigation actions, the gap between projected carbon emissions and the allowed emissions in different scenarios will widen, and this, combined with increasing carbon tax and carbon fee over time, will lead to an annual escalation in the financial impact on the company. This impact will be particularly significant under stricter carbon reduction targets such as those in the SSP1-1.9 and SBT-NZ scenarios.

Reputation

- Market value loss
- Decreased orders
- Increased operating costs

Regulations

- Carbon tax imposition
- Carbon fee imposition

Market

- Decline in market share of products
- Weakening competitiveness in specific markets such as Europe and America

Technology

- Procurement of renewable energy to meet requirements under the Intensive Electricity User Clause

Carbon tax imposition		
External scenario	**Assumption**	**Financial impact on revenue in 2030**
National Net-Zero Pathway	Estimated at US$2~10 per ton CO_2e from 2021 to 2050 by referring to SSP2-4.5	<0.1%
SSP1-1.9	It will reach about US$650 per ton CO_2e in 2050 by referring to SSP1-1.9	1-2%
SBT-NZ		

Carbon fee imposition		
External scenario	**Assumption**	**Financial impact on revenue in 2030**
National Net-Zero Pathway	Estimated at NT$1,500 per tCO_2e	<0.1%

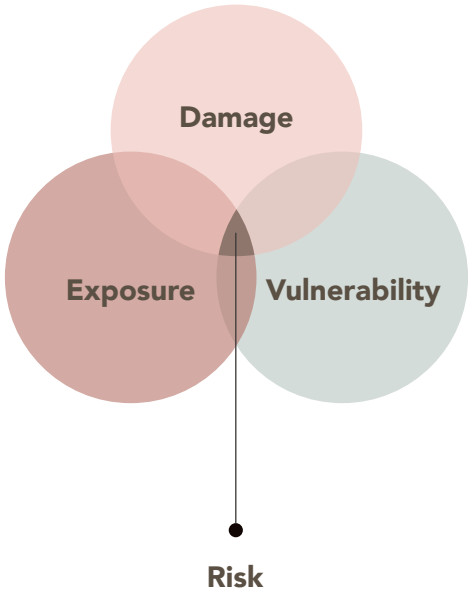
Use of renewable energy power		
External scenario	**Assumption**	**Financial impact on revenue in 2030**
National Net-Zero Pathway	Procurement costs are estimated based on the average wholesale price of Taipower's renewable energy power plus power supply costs	<0.01%
SSP1-1.9		
SBT-NZ		

Note: Considering the current international trend towards carbon taxation, carbon fee collection is only considered in the National Net-Zero Pathway scenario.

3.2 Physical Risk Scenario Analysis

Winbond follows the IPCC's Climate Models to evaluate the risks of flooding, debris flows, and landslides resulting from extreme precipitation. We conduct scenario simulations using data from the Taiwan Climate Change Projection Information and Adaptation Knowledge Platform (TCCIP), National Science and Technology Council (NSTC), National Science and Technology Center for Disaster Reduction (NCDR), and various climate models to avoid biased results.

The following results show that by the end of the 21st century, Winbond's main fabs and offices (including the CTSP Fab, Kaohsiung Fab and Zhubei Building) have a risk level of 0 (low possibility of flooding, debris flows, and landslides) under the four global warming scenarios.



Risk value =

- Risk of flooding, debris flows, and landslides
- Categorized by risk level:

Level	Risk Value
Low Risk	0-12
Moderate Risk	13-25
High Risk	26-50

Hazard ×

- Extreme rainfall: Possibility of cumulative rainfall reaching 650 millimeters within 24 hours
- Four scenarios: RCP 2.6, RCP 4.5, RCP 6.0, RCP 8.5
- Categorized by hazard level:

Level	Return Period
1	1000 Years
2	500 Years
3	100 Years
4	50 Years
5	<50 Years

Vulnerability × Exposure

- Flood potential: Defined based on the criteria set by Water Resources Agency of the Ministry of Economic Affairs and the government's flood relief qualifications

Level	Flood Magnitude Class	Level	Flood Magnitude Class
0	No potential	3	1.0-2.0 m
1	0.3-0.5 m	4	2.0-3.0 m
2	0.5-1.0 m	5	> 3.0 m

- Debris flow potential: Defined based on the criteria set by Soil and Water Conservation Bureau of the Council of Agriculture, Executive Yuan

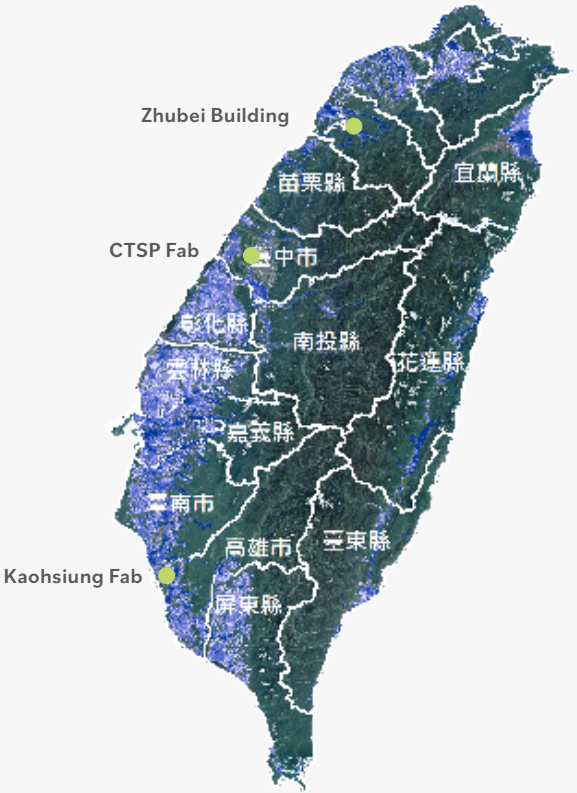
Level	Potential Magnitude of Class	Level	Potential Magnitude of Class
0	No potential	3	Moderate
1	Continuous Monitoring	4	High
2	Low		

- Landslide potential: Defined based on the criteria set by Central Geological Survey of the Ministry of Economic Affairs

Level	Potential Magnitude of Class	Level	Potential Magnitude of Class
0	No potential	1	Intersected

Physical Risk Scenario Analysis

Flooding vulnerability



Potential flooding distribution

- Level 5 (>3 m)
- Level 4 (2-3 m)
- Level 3 (1-2 m)
- Level 2 (0.5-1 m)
- Level 1 (0.3-0.5 m)
- No Potential

Debris flow hazard level

Potential debris flow torrent

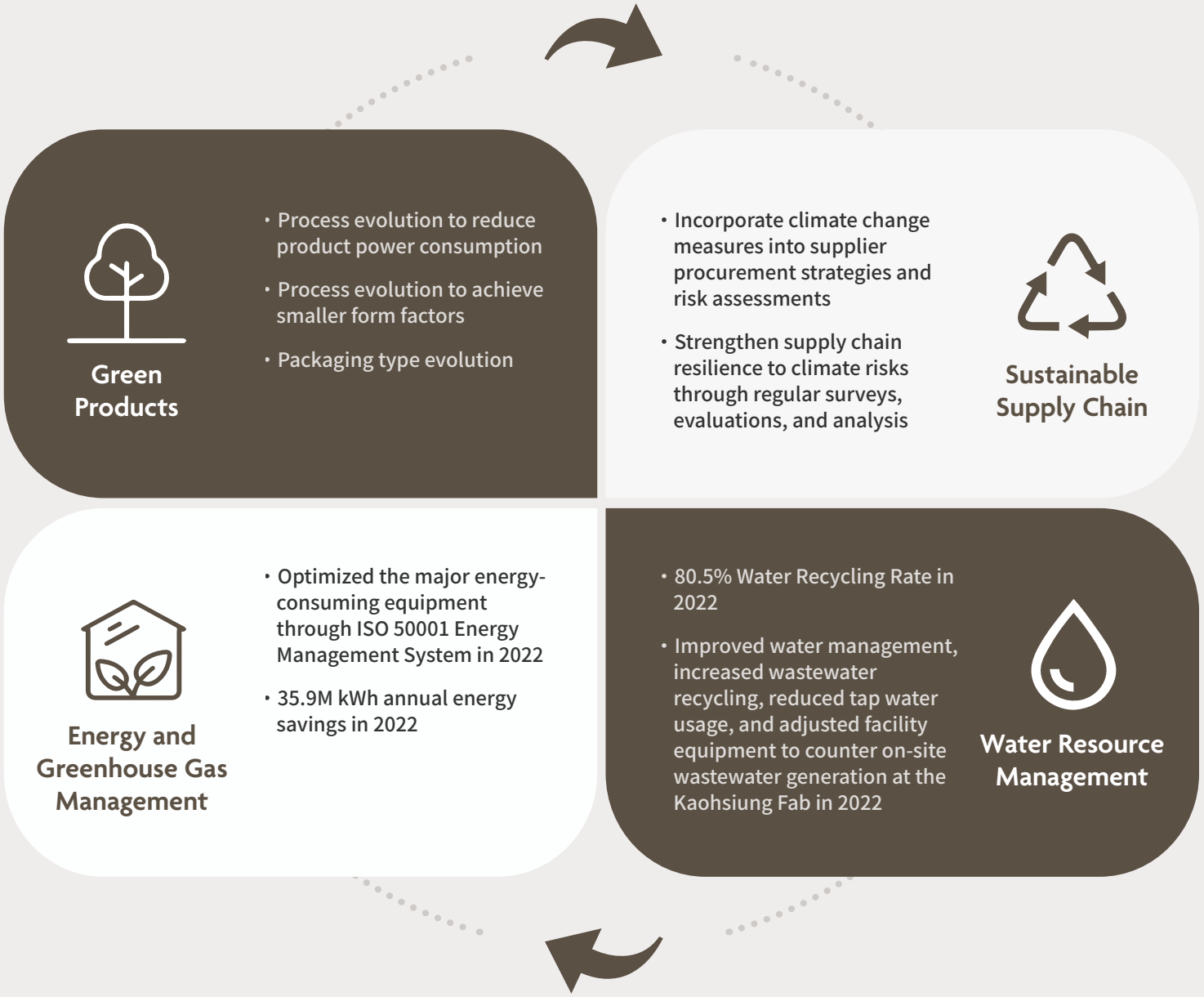
- Level 4 (High risk)
- Level 3 (Moderate risk)
- Level 2 (Low risk)
- Level 1 (Continuous monitoring)
- No Potential

Landslide vulnerability

Landslide-prone geologically sensitive area

- Intersected
- No Potential

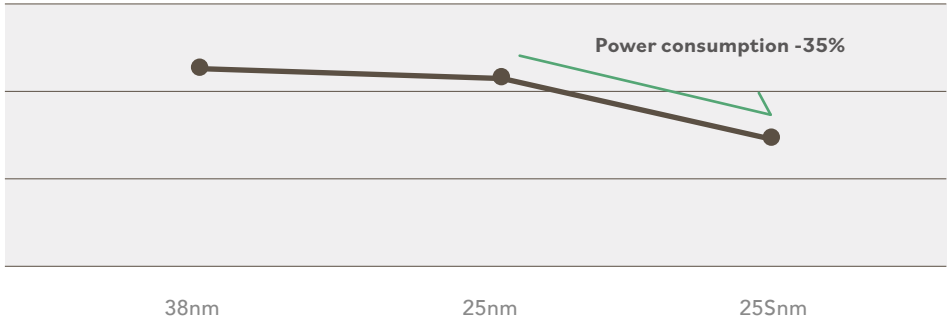
4. Mitigation and Adaptation Measures



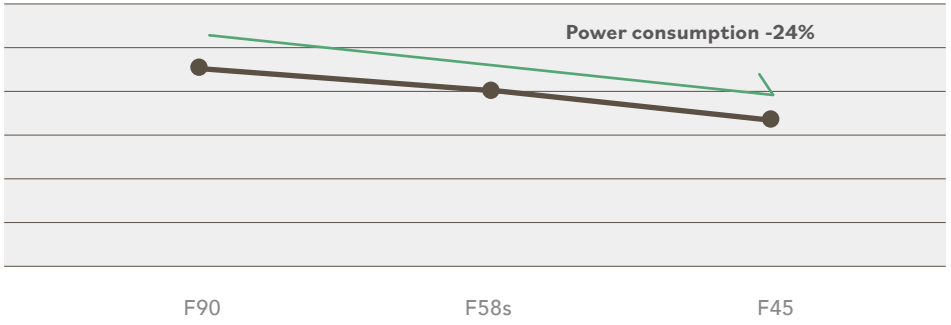
4.1 Green Products

In addition to improving productivity, process advancements lead to a reduction in power consumption and carbon emissions during product usage. For instance, the power consumption of Winbond's 2Gb DDR3 series products decreased by 35% from the 25nm to the 25Snm. Similarly, the power consumption of flash memory products decreased by 24% from the 90nm to the F58Snm and then to the 45nm.

DDR3 series power consumption

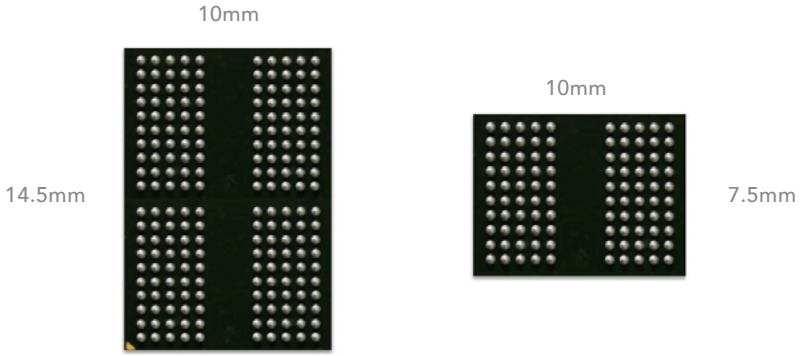


Power consumption of F90, F58s, F45 products



Additionally, the HYPERRAM series products have introduced wafer-level chip select packaging (WLCSP), which offers advantages such as minimal inductance between the die and the circuit board, excellent thermal conductivity, compact package size, and minimal weight. These features make Winbond's HYPERRAM series products the optimal memory choice for mobile products like cellular phones, smart watches, and other wearable electronics.

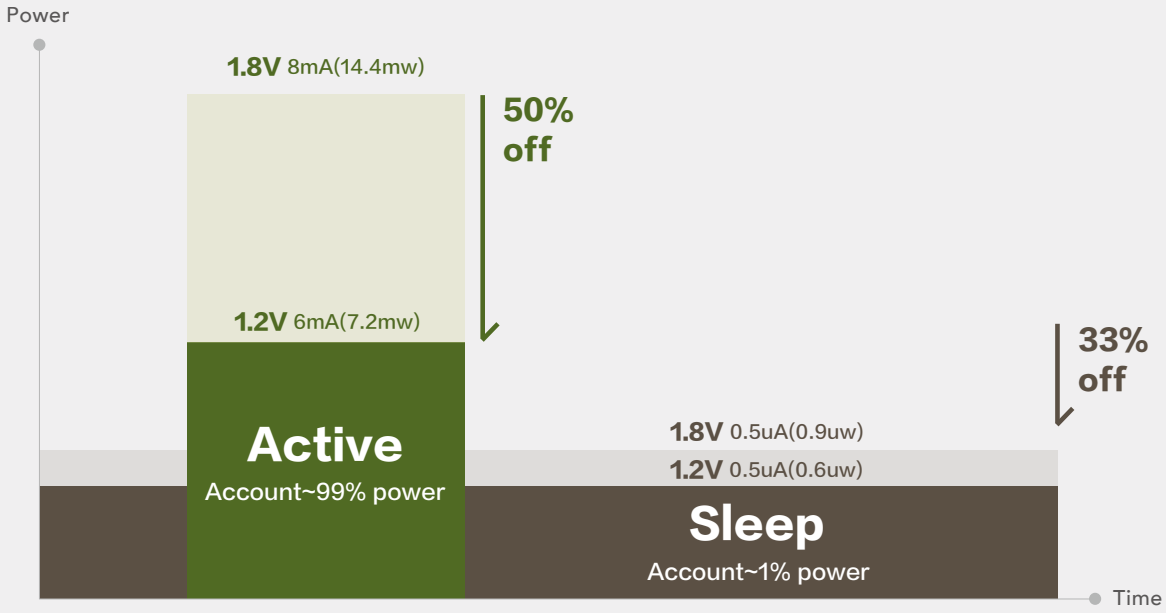
Our LPDDR4/4X products adopt a space-saving 100-ball BGA package that can be applied to products with smaller PCB sizes as requested by customers. This enables more compact product layout designs and meets the emerging demand for higher data throughput in smaller packages in the IoT, consumer electronics, industrial, and automotive sectors.



200BGA **100BGA**

Reducing power consumption and extending battery life have always been one of Winbond's goals. In addition to continuously designing flash memory with lower operating currents through process evolution, Winbond has developed new process and circuit architectures, resulting in the world's first NOR Flash that supports a working voltage of 1.2V. The power consumption of the 1.2V NOR Flash is only 55% of the commonly used 1.8V NOR Flash, yet it maintains a read speed of up to 104MHz. This allows its performance to be on par with the standard of 1.8V/3V Flash while significantly benefiting power-sensitive wearable devices such as wireless earphones, smartwatches, fitness trackers, and smart glasses in the consumer electronics market.

In addition, Winbond's flash memory has been verified as supporting the environmentally friendly and low-power consumption Low Temperature Soldering (LTS) process (~190°C). According to customer calculations, compared to the industry's current lead-free Surface Mount Technology (SMT) with temperatures ranging from 220 to 260°C, each production line that uses the low-temperature soldering process can reduce carbon dioxide emissions by 57 metric tons annually, effectively reducing carbon emissions during the manufacturing process. Winbond's flash memory has undergone reliability verification procedures, including drop, vibration, and temperature cycling tests, under JEDEC standards. This validation demonstrates that the product fully supports the LTS process without any quality concerns, contributing to environmental protection and sustainable development efforts to create a better future.



Power =

Active + Sleep

Reduce Active or Standby power, which one is important?

4.2 Sustainable Supply Chain

Supply Chain Management

1. Sustainable Procurement Strategies and Measures

To systematically drive Winbond's supply chain towards low-carbonization, we plan measures such as carbon reduction initiatives for raw material suppliers and carbon emissions management for back-end testing and packaging processes using product carbon reduction as the basis for suppliers' carbon reduction activities.

- Hold focused ESG exchanges with key carbon-emitting raw material suppliers and back-end testing suppliers.
- Conduct surveys on the electricity usage, water usage, waste management, resource recycling, greenhouse gas emissions, energy consumption, and carbon footprint management of key carbon-emitting raw material suppliers and back-end testing suppliers

2. Assessment and Management of Sustainability Risks

To gradually increase the internal resilience of Winbond's supply chain, we engage suppliers in ESG self-assessment surveys to evaluate sustainability risks and impacts, organize corresponding follow-up audit activities, and regularly track progress and make improvements.

- Use RBA7.1.1 as the core assessment framework
- Include eight major aspects: Corporate Sustainability Formalization, Continuous Operations Planning, Supply Chain Management, Service Quality Management, Environmental Management and Climate Change Response, Human Rights and Labor Protection, Occupational Safety and Health, Ethics and Governance

3. Winbond Supplier ESG Interactive Platform

To enhance the overall efficiency disseminating sustainability information throughout the supply chain and fostering the growth of related knowledge, both measures mentioned above are managed through digitization. The platform brings together suppliers for interactive engagement on a digital platform:

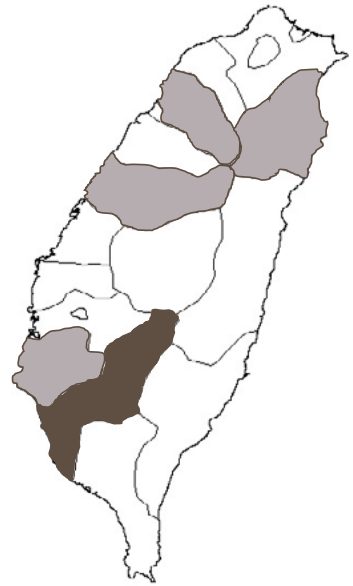
- Publish Winbond's sustainable management policies and promote information about corporate sustainable development
- Digitally manage various sustainability surveys and information retrieval, share sustainability-related information with suppliers and foster mutual learning and growth

Physical Risk Assessment for Suppliers

To assess flooding, debris flows, and landslides resulting from climate change, Winbond commissioned consultants to conduct a hazard vulnerability analysis of over 1,400 domestic suppliers' operation locations.

The results show that no suppliers are at high risk. Under the RCP 8.5 scenario, six suppliers are classified as moderate risk. These six suppliers fall under the categories of accessories and equipment, and they represent approximately 1.2% of Winbond's procurement amount in those categories for the year 2022. Additionally, all the supplied items have more than two sources of supply. Taking all of this into account, it is expected that Winbond will experience minimal indirect impacts in the event of natural disasters such as flooding.

	Level of Risk	RCP 2.6 Scenario	RCP 4.5 Scenario	RCP 6.0 Scenario	RCP 8.5 Scenario
Mid-century (2041-2060)	Low risk	99.7%	99.7%	99.8%	99.6%
	Moderate risk	0.3%	0.3%	0.2%	0.4%
	High risk	0.0%	0.0%	0.0%	0.0%
End of Century (2081-2100)	Low risk	99.9%	99.8%	99.7%	99.6%
	Moderate risk	0.1%	0.2%	0.3%	0.4%
	High risk	0.0%	0.0%	0.0%	0.0%



Number of Suppliers at Moderate Risk in the Area

- 1 supplier
- 2 suppliers

4.3 Energy and Greenhouse Gas Management

Energy Management

In recent years, due to the expansion of fabs and the addition of new machinery and equipment, the Company's usage of raw materials and fuel has been on the rise. Total energy consumption in 2022 amounted to approximately 689 million kWh. In response, Winbond has been implementing energy-saving measures, adding 21 new initiatives in 2022. In the same year, the CTSP Fab obtained ISO 50001 certification for energy management systems. Additionally, there are plans to introduce ISO 50001 at the Kaohsiung Fab to expand the scope and effectiveness of energy management. The energy-saving efforts have resulted in an increase of approximately 35.9 million kWh compared to the previous year. The energy consumption indicator per unit product in 2022 was 22.76 kWh per layer of photomask for 12-inch wafers. This represents a 3.4% increase compared to 22.01 kWh in 2021 and a 2.4% increase compared to the target value of 22.26 kWh for 2022. The increase in average electricity usage per unit product was influenced by global economic factors and decreased production capacity in the second half of 2022. Going forward, efforts will continue to be made to promote energy-saving initiatives and reduce environmental impacts.

Energy Savings over the Years

Indicators and Goals	Goal for 2022	2022 Performance
Electricity consumption per unit product (kWh/layer - photomask)	≦ 22.26	22.76
Electricity consumption per unit product (MJ/layer - photomask)	≦ 80.1	82

From 2018 to 2022, cumulative energy savings amounted to 380 million kWh, approximately equivalent to the annual electricity consumption of **108,361 households**.

Energy Saving Statistic	2018	2019	2020	2021	2022
Cumulative energy-saving measures	201	208	219	227	248
Annual energy savings (million kWh)	63.2	65.1	67.6	74.0	109.9
Annual energy savings (billion J)	227,556	234,244	243,201	266,338	395,567

Planning for the Use of Renewable Energy

In 2022, Winbond conducted comprehensive planning for the future use of renewable energy and delved into understanding the status of various types of renewable energy industries and their applicability to its electricity consumption. Through ongoing discussion with renewable energy project developers, Winbond aims to introduce the use of renewable energy as soon as possible.

In response to the government's renewable energy policy, Winbond installed a **499 kW** rooftop renewable energy generation system in 2019. The generated renewable energy is currently sold to Taiwan Power Company. In 2022, **electricity generation reached 660,000 kilowatt-hours**, making a significant contribution to renewable energy in Taiwan.

Energy-saving Measures and Performance in 2022

Type	Energy-saving/Carbon Reduction Project	Energy Savings (kWh)	Energy Savings (billion joules)	Greenhouse Gas Emissions Reduction (tCO_2e)
Lighting	Replacement of LED lighting equipment in mechanical areas of the facility	49,801	179	25
	Replacement of LED lighting equipment in the office areas	17,928	65	9
Facility Equipment	Smart air conditioning	2,270,518	8,174	1,156
	Optimization of the MAU air washer system	499,084	1,797	254
	Enhanced the plate heat exchanger efficiency of UPW (Ultra-Pure Water) and PCW (Process Cooling Water) system	589,641	2,123	300
	Replacing heating units of machinery in fab	516,932	1,861	263
	Energy-saving improvements for exhaust systems	623,506	2,245	317
	Optimization of VOC system operation	83,665	301	43
	Optimization of bulk gas purifier regeneration	53,586	193	27
	Optimized the loading of PCW(Process Cooling Water) system	39,841	143	20
	Water and energy saving of UPW(Ultra-Pure Water) system	1,594	6	1
	Improved water production rate of RO system	79,681	287	41
	Optimization of compressor dryer units	896	3	0.5
	Reduction of exhaust emissions from VMB and gas cabinets	490,040	1,764	249
	Energy-saving for air conditioning in the cleanroom of testing production	81,673	294	42
	Motor upgrades for soft water system	730	3	0.4
Fab Construction	Waste heat recovery from the hot purified water heat pump system	8,488,000	30,557	4,320
	Waste heat recovery for air compressor dryers	54,750	197	28
	High-efficiency boilers	9,855,000	35,478	3,230
	Increasing the outlet temperature of the chilled water system to save energy	10,444,110	37,599	5,316
	Energy-saving LED lighting	1,656,000	5,962	843
Total		***35,896,976***	***129,231***	***16,485***

Green House Gas Management

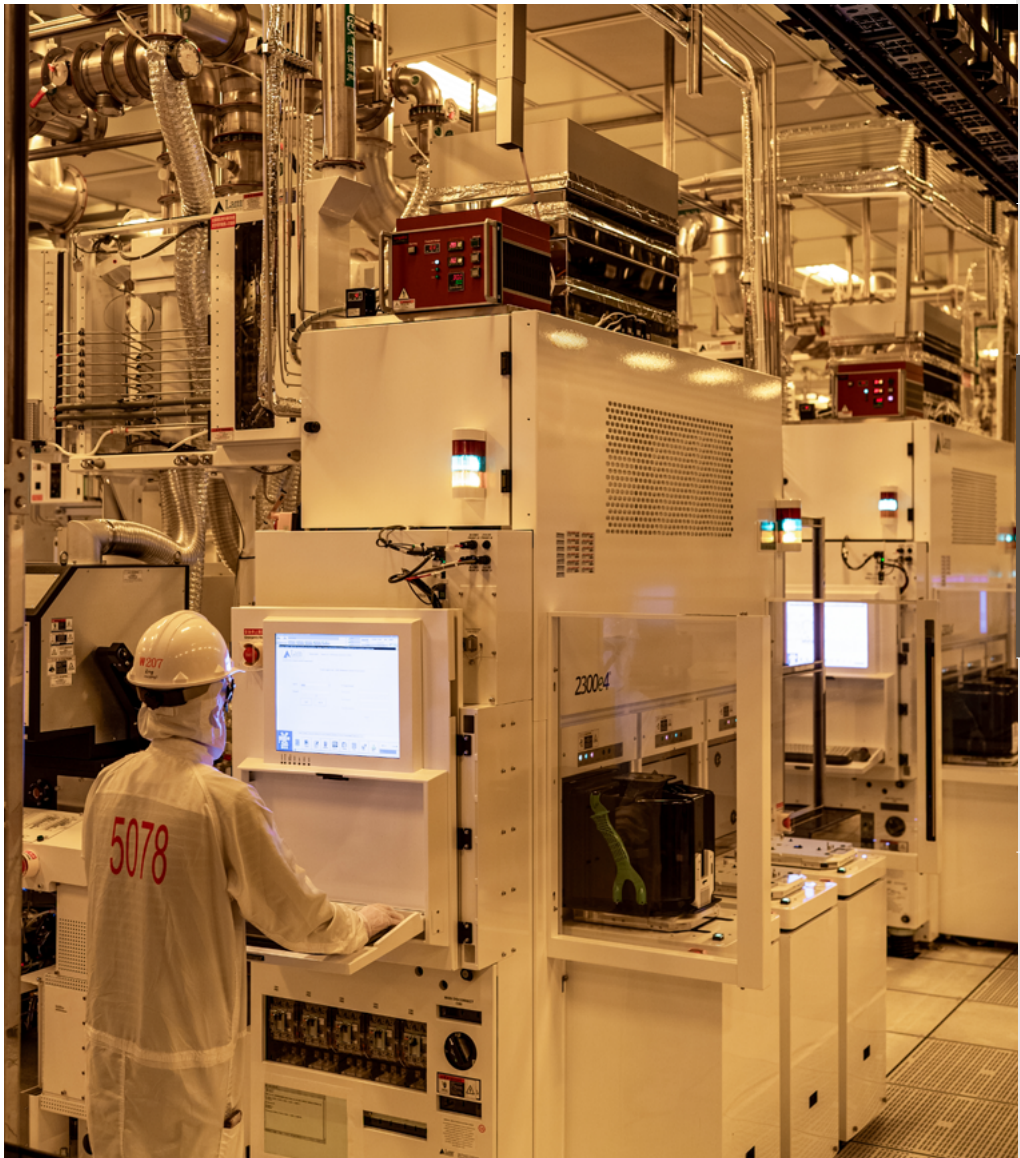
- **ISO14064–1** Winbond actively participates in the government's greenhouse gas inventory program by implementing an internal greenhouse gas management mechanism. Through operational control, Winbond promotes inventory and verification of greenhouse gas emissions, sets reduction targets, and develops improvement plans.
- **ISO14067** In 2021, a carbon footprint inventory was conducted for selected wafer products, followed by a carbon footprint inventory for IC products in 2022.
- **Other** Since 2000, Winbond has been involved in the Taiwan Semiconductor Industry Association and World Semiconductor Council's Perfluorocarbon (PFC) Emissions Reduction Program, implementing process adjustments and alternative gas usage and installing Fluorocarbon (FC) reduction equipment. Winbond has obtained a preliminary project reduction quota of 285,771 tCO_2e from the Environmental Protection Administration.

Greenhouse Gas Emission Strategies, Goals, and Performance

- The main greenhouse gas emissions of Winbond come from the use of FCs in the manufacturing process and purchased electricity. These account for over 94% of the Company's total greenhouse gas emissions. Therefore, reducing direct FC emissions and achieving energy savings in electricity consumption are the primary goals for Winbond.
- In terms of production and manufacturing, Winbond works to optimize resource utilization, installs exhaust gas treatment equipment to reduce emissions, and continues to implement energy-saving programs to reduce electricity consumption. In addition to promoting video conferencing, Winbond provides shuttle buses between the fabs and high-speed rail/metro stations on workdays. The CTSP Fab and Kaohsiung Fab also provide commuting buses for engineering assistants to reduce fuel consumption and air pollution from personal vehicles.
- In 2022, Winbond reduced emissions by 250,230 tCO_2e, which is equivalent to the carbon sequestration capacity of 648 Daan Forest Parks in a year.

	Goal for 2022	2022 Performance
Unit Product Emissions (kg CO_2e/layer - photomask)	≦ 13.3	13.2

Note According to data published by the Forestry Bureau of the Council of Agriculture, Executive Yuan, and the Department of Land Administration, Taipei City Government, Daan Forest Park absorbs 386 metric tons of carbon dioxide annually.



Greenhouse gas emissions are divided into three scopes. The inventory for scopes one and two has already been completed. The inventory for Scope three emissions in 2022, which include emissions from sources not owned or controlled by the company, will be completed in 2023.

Due to the expansion of the fabs and the addition of new equipment, the usage of raw materials and fuels has increased. Coupled with the establishment of the Kaohsiung Fab in 2022, this has resulted in a noticeable increase in overall emissions. Additionally, the decline in the global economy in the second half of 2022 led to a decrease in production capacity, resulting in an increase in average emissions per unit of product.

Greenhouse Gas Emissions Reduction Performance for The Year

Unit: tCO_2e	2020	2021	2022
Direct greenhouse gas emissions reduction (Scope 1)	173,089	192,106	194,302
Indirect greenhouse gas emissions reduction (Scope 2)	34,386	37,139	55,928

Greenhouse Gas Emissions for the Year

Unit: tCO_2e	2020	2021	2022
Scope 1	53,271	38,760	44,374
Scope 2	278,046	277,284	353,523
Total	331,317	316,044	397,897
Emission intensity (kg CO_2e/layer - photomask)	13.5	12.6	13.2

Notes

- In 2020, the machine process gas (PFC) monitoring system was implemented to differentiate the usage of PFCs in each machine process. The quantification method for greenhouse gas emissions was adjusted from Tier 2a to Tier 2b. Therefore, the base year for the greenhouse gas inventory is tentatively set as 2020, with emissions totaling 331,317 tCO_2e.
- The global warming potentials (GWPs) used in this table are sourced from the IPCC Fourth Assessment Report (2007).
- The greenhouse gas types included are nitrous oxide (N_2O), methane (CH_4), carbon dioxide (CO_2), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3).
- The standards, methodologies, assumptions, and/or calculation tools used: Energy consumption data are obtained from measured values on billing statements, natural gas monthly consumption settlement reports, and material requisition forms and AS400/ material inventory variation checklists without any estimations.
- For emission factors, we primarily referenced the latest version of the Environmental Protection Administration's greenhouse gas emission factor recommendations, taking into account the uncertainty data associated with emission factors. The uncertainty assessment for the activity data is based on the calibration and testing technical specifications of the measurement instruments.
- The electricity emission factor for 2022 is not available, so the emission factor from 2021 is used for calculations.
- Data for the Taiwan Office and the newly constructed Kaohsiung Fab have been added for 2022.

Carbon Emissions Information Platform

Winbond partnered with consultants from Microsoft Taiwan and SoftwareONE Taiwan to create the Carbon Emissions Information Platform and establish a mechanism to automate carbon emissions data. Through presenting real-time data, the platform provides more transparent data for managers to reference.

In the semiconductor industry, the processes have become increasingly complex and diverse. For example, memory wafers go through multiple processes from design to manufacturing and shipping. Each process involves different equipment, energy consumption, greenhouse gas emissions, carbon footprints from power consumption, and even non-process-related activities such as transportation, administrative management, and fire protection, all of which require accurate calculation. This complexity presents a high level of difficulty. The Carbon Emissions Information Platform assists Winbond in addressing pain points by providing features such as an inventory of historical data and the monitoring of real-time reports. Additionally, it enables the prediction of carbon emissions based on future capacity growth, allowing for the planning of relevant reduction measures.

The first phase of implementation, which focused primarily on automated data collection and the management of factory carbon emissions, was completed in 2022. The second phase, scheduled for completion in 2023, aims to calculate the carbon footprints of our products and ensure the reliability of the Carbon Emissions Information Platform through the verification of product carbon footprints.

4.4 Water Resource Management

To understand the risks related to water resources, Winbond implemented the water risk evaluation tools of the World Resource Institution (WRI). By adopting the Aqueduct Water Risk Atlas through the AQUEDUCT website, we were able to include the distribution of water resources in Taiwan into the analysis, and found that all our operation sites in Taiwan are in low-risk areas.

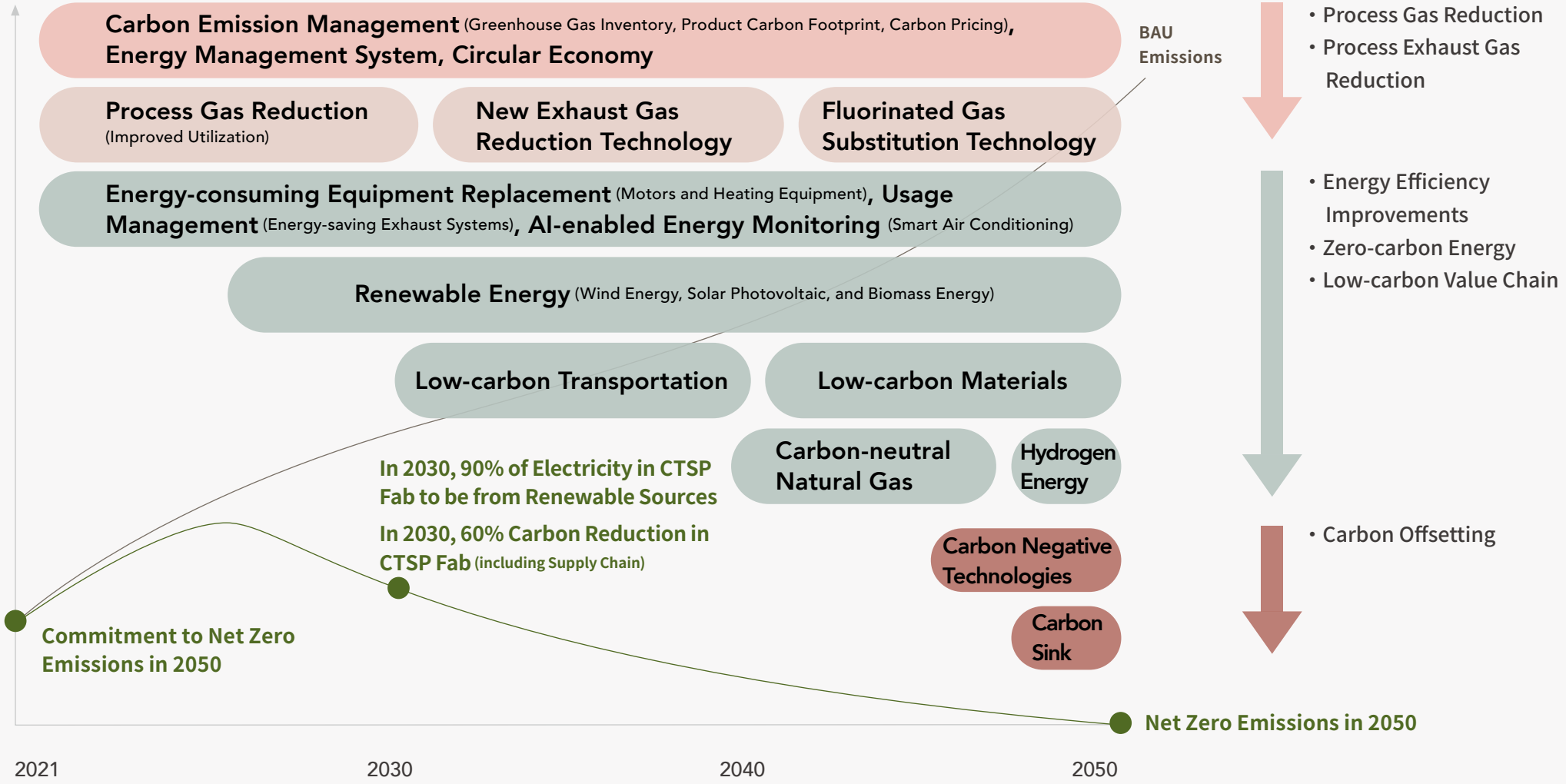
Winbond's major water source is the tap water supplied by the Taiwan Water Corporation. The CTSP Fab uses water from Liyutan Dam and Techi Dam. The Kaohsiung Fab uses water from the A Gong Dian Reservoir, with a small portion coming from rainwater and air conditioning condensate.

	Goal for 2022	2022 Performance
Water usage per unit product (kWh/layer - photomask)	≦ 145	134
Overall water recycling rate	≧ 80%	80.5%

Unit: Million liters		2020	2021	2022
Water intake divided by source	Third-party tap water (Total)	3,633	3,293	4,131
	Total intake	3,633	3,293	4,131
Water consumption		1,216	975	960

5.1 Towards Net Zero Emissions

After a comprehensive evaluation, Winbond will introduce the most appropriate carbon reduction methods in the hope of achieving net zero emissions in 2050.



5.2 Climate-Related Management Metrics

The introduction of the TCDF management framework and publication of TCFD report allows Winbond to assess our operational resilience in the face of climate issues. In the future, we will continue to track and monitor our climate management metrics so that we can pursue corporate growth while also working to support and protect the environment and society so that we can realize our corporate vision of “Be a hidden champion in providing sustainable semiconductors to enrich human life”.

Metric	Target
Greenhouse Gas Emissions	**2023 target** Additional 15,700 tCO_2e reduction at CTSP Fab **2030 target** 60% Carbon Reduction in CTSP Fab (compared to 2021)
Renewable Energy Power Usage	**2023 target** 90% of CTSP Fab power sourced from renewable energy
Overall Water Recycling Rate	≧ 80%
Supply Chain Decarbonization	**2023 target** Carbon emissions reduced by 10% across supply chain (compared to 2021)
Operational Interruption Due To Climate Disasters	0 days

Appendix TCFD Indicator Reference Table

Core Element	TCFD Recommended Disclosure	Corresponding Chapter in this Report	Page
Governance	Board of Directors' oversight of climate-related issues	1. Climate Governance	3
	Role of management in assessing and managing climate-related issues	1. Climate Governance	3
Strategy	Identification of short, medium, and long-term climate-related risks and opportunities	2.3 Climate Risk/Opportunity Matrix	8
	Impact of climate-related risks and opportunities on business, strategy, and financial planning	2.4 Impacts of Major Climate Change and Responses	9
	Scenario analysis, including a 2°C or more extreme scenario	3. Scenario Analysis	11
		4.2 Sustainable Supply Chain	19
Risk Management	Process for identifying and assessing climate-related risks	2.2 Procedures for Identifying Climate Change Risks and Opportunities	7
		4.4 Water Resource Management	25
	Process for managing climate-related risks	2.1 Risk Management Framework	6
		2.2 Procedures for Identifying Climate Change Risks and Opportunities	7
	Integration of identification, assessment, and management processes into overall risk management system	2.1 Risk Management Framework	6
		2.2 Procedures for Identifying Climate Change Risks and Opportunities	7
Metrics and Targets	Metrics used to assess climate-related risks and opportunities within the framework of strategy and risk management processes	2.2 Procedures for Identifying Climate Change Risks and Opportunities	7
		5.2 Climate-Related Management Metric	27
	Disclosure of Scope 1, Scope 2, and Scope 3 (if applicable) greenhouse gas emissions and related risks	2.3 Climate Risk and Opportunity Matrix	8
		4. Mitigation and Adaptation Measures	15
	Management targets and associated performance metrics	4. Mitigation and Adaptation Measures	15
		5. Metrics and Targets	26