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Green

A Producer of Green Technology

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Upholding the green philosophy that we only have one Earth, Nanya Technology Corporation insists on leaving the best environment to every future generation. We actively manage all environmental impacts of our operations, and adopt higher standards than required by law for energy, resources, emissions, and waste to avoid or mitigate the risk of impacts. We also research and develop advanced and highly efficient products to assist consumers in lowering energy consumption and reducing carbon emissions when using products. We have set goals for our sustainability performance to fulfill our responsibility of cleaner production and to protect the natural environment. As climate change has become one of the most significant global risks, we implemented risk identification, assessment and management in accordance with the Task Force on Climate-related Financial Disclosures (TCFD) Recommendations to enhance our operational resilience under the climate change crisis.

SBT

Proposed carbon reduction goals that comply with the SBT and obtained certification from the SBTi. Reduce Scope 1+2 GHG emissions in 2030 by 25% compared to 2020, and Scope 3 GHG emissions in 2030 by 27% per product compared to 2020.

92.9%

Annual average process waste water recycling rate

1,624

The annual reduction of perfluorocarbons is equal to 1,624x the carbon absorption of Da'an Forest Park



Strategy and Performance of Material Topics



Greenhouse Gas Management

Energy conservation and carbon emissions reduction: Set short, medium, and long-term goals and actively implement related management measures.

Low-carbon manufacturing: Commit to improvement in production technologies and reduce greenhouse gas emissions in the production process.

2022 Goals	2022 Performance Target achievement statust	2023 Goals
Reduce greenhouse gas emissions per die by 38% from 2017	Note 1 ● Decreased 33%	Reduce greenhouse gas emissions per die by 31% from 2017
Reduction rate of PFCs emissions during process reaches a minimum of 93%	● Reduction rate reach 93%	Reduction rate of Fluorinated Greenhouse Gases (F-gases) emissions from processes reaches a minimum of 93%
Reduce F-gases emissions per die by 30% from 2015	Note 2 ● Reduced by 29.6%	Reduce F-gases emissions per die by 30% from 2015
Number of days production was suspended due to climate change disasters maintained at 0 days	● Maintained at 0 days	Number of days production was suspended due to climate change disasters maintained at 0 days



Energy Management

Implementation of energy conservation measures: Implement ISO 50001 Energy Management System for systematic management and improve the efficiency of energy usage.

Innovative applications: Use external exchanges or training to obtain the latest energy conservation technology or energy-saving methodology.

2022 Goals	2022 Performance Target achievement statust	2023 Goals
Cumulative energy saved with energy conservation measures from 2017 to 2022 reaches 64,000 MWh (2.3x10 ⁸ MJ) and above.	Note 3 ● Cumulative energy saved from 2017 to 2022 totaled 63,228 MWh (2.28x10 ⁸ MJ).	Cumulative energy saved with energy conservation measures from 2017 to 2023 reaches 67,500 MWh (2.43x10 ⁸ MJ) and above.
Annual renewable energy use reached 7,880 MWh (2.84x10 ⁷ MJ)	● Actual use was 7,880 MWh (2.84x10 ⁷ MJ).	Annual renewable energy use reached 25,000 MWh (9x10 ⁷ MJ)

● Exceed ● Achieve ● Unachieve

Note1: Due to trial production of the 1A/1B process and adding 89 new machines, electricity consumption in 2022 increased 2.2.% compared to 2021, and an increase in the electricity carbon emission factor of Taiwan Power Company by 1.4% caused an increase in GHG by 2.6%.

Note2: The increase in PFCs was mainly due to trial production of 1A/1B processes and the newly purchased machines; 5 TF/NF3 machines were added and usage increased 5.7%; die output decreased 3% compared with 2021.

Note3: Two energy conservation management plans were implemented in 2022 and reduce energy consumption by an estimated 2,960MWh/year. Completion of the project was delayed to 2023 due to production capacity allocation.

Note4: Process VOC emissions increased 19% compared with 2021, and die output decreased 3% compared with 2021.

Note5: According to the formula set by Hsinchu Science Park Bureau



Water Management

Response to risks: Establish backup water sources and water storage tanks and use emergency response organization between company plants to coordinate water usage.

Wastewater recycling and reuse: Establish wastewater collection processing and adopt different multiple recovery and reuse to improve the water recycling rate.

Water usage reduction: Conserve water through daily management.

2022 Goals	2022 Performance Target achievement statust	2023 Goals
Accumulated water consumption per unit production capacity decreased >38.5% compared to 2017	● 38.5%	Accumulated water consumption per unit production capacity decreased 38.5% compared to 2017
Annual average process wastewater recycling rate: 90% and above	● Annual average process wastewater recycling rate: 92.9%	Annual average process wastewater recycling rate: 93% and above
Other losses in production caused by restricted water supply: 0 wafer (slice)	● Other losses in production caused by restricted water supply: 0 wafer (slice)	Other losses in production caused by restricted water supply: 0 wafer (slice)



Waste and Pollution Prevention

Circular economy: Increase waste recycling and reuse rate to use resources effectively.

Source reduction: Continue to promote waste reduction and increase waste recycling rate.

2022 Goals	2022 Performance Target achievement statust	2023 Goals
0 cases in violation of environmental laws and regulations	● 0 cases	0 cases in violation of environmental laws and regulations
Rate of auditing and coaching waste disposal contractors on-site > 90%	● Auditing and counseling rate of 98%	Rate of auditing and coaching waste disposal contractors on-site > 98%
Reduce VOC emissions per die by 46% from the base year of 2017	Note 4 ● Decreased 38.8 %	Reduce VOC emissions per die by 40% from the base year of 2017

5-1 Climate Change Management

Climate Change Adaptation

Nanya Technology Corporation responded to the international trend of carbon reduction by implementing the Recommendations of the Task Force on Climate-related Financial Disclosures (TCFD), which was provided the international Financial Stability Board (FSB), in 2018 and publicly supported the TCFD in 2021, publishing a **TCFD report** for 2 consecutive years since 2022 (QR code to be supplemented). We are actively establishing mechanisms and strengthening operations. We developed strategies and actions in response to climate change on aspects of governance, strategy, risk management, and metrics and targets, in hopes of reducing the impact of climate risks. Actions in 2022 are described below:

Management strategies and actions

- In terms of governance level, climate change is listed as an issue for the board of directors. The Sustainable Development Committee is a functional committee established to management measures relating to the trend of sustainability and climate change.
- Enhance the climate governance ability of the board of directors and management, and raise the awareness of all employees of climate change.

2022 Operation status

- A total of 6 board meetings and 1 Sustainable Development Committee meeting were convened in 2022.
- Of the hours of continuing education received by directors in 2022, 48.9% was related to climate change. ESG issues are incorporated into the Company's manager training, and new employees are required to receive training in ESG and climate change.

Governance



- Management periodically participates in quarterly sustainable development and risk management meetings to examine the Company's implementation results and decide on work items.
- Implement improvement plans through monthly climate change management meetings, ISO50001 energy management monthly meetings, and ISO14001 environment management monthly meetings.

- The Corporate Sustainability Committee and Risk Management Committee convened a total of 8 quarterly meetings, and included discussions on responses to climate change. The discussion topics were listed as resolutions or action items that required follow-ups and improvements. For example, formulating a renewable energy policy, and discussing risks of power stability issues were listed as resolutions.

Management strategies and actions

- According to the internal risk management schedule, short-term is defined as within 3 years, mid-term is 3-10 years, and long-term is 10 years and above. Stakeholders' needs and climate change issues are periodically collected. Using the TCFD framework, short, medium, and long-term climate-related risks and opportunities are periodically identified, as are their impacts on operations, strategies, and financial plans.

2022 Operation status

- Using TCFD climate risk scenario simulation, short, medium, and long-term climate-related risks and opportunities were discussed and identified cross-departmentally. A total of 25 risk factors and 6 opportunities were identified.
- Considering the risks and opportunities in different climate change and physical scenarios, as well as the operational characteristics of Nanya Technology Corporation, we formulated five strategies, including developing green products, implementing cleaner production, strengthening adaptation ability, and working with sustainability partners.

Strategy



- Scenario analysis includes:
Transition Scenarios: NDC, pathway to net zero (APS, NTZ)
Physical scenario: AR5 RCP2.6-8.5 (adjusted to SSP based on the latest information)

Management strategies and actions

- According to the Company's operational risk management procedures, we assessed the significance of related risks and opportunities brought by different scenarios of climate change, and formulated relevant response measures, which were included in Enterprise Risk Management (ERM) and periodically confirmed by senior managers. Formulate a complete emergency response plan for risks of natural disasters related to climate change.

2022 Operation status

- Material risks that we identified were mainly transition risks, such as changes to the electricity structure, customer requirements on low carbon products, and the impact of implementing SBTs; the mid-term financial impact of the three items is estimated to account for 3-4% of annual revenue, and was reported to senior management for review during the annual Risk Management Committee meeting. We continue to reduce potential impacts through backup power supplies, energy conservation plans, and the use of renewable energy.
- The main opportunities identified are product technology and new market development: Due to the trend of net zero emissions, smart clean energy technologies will drive growth in demand on DRAM. According to the scenario analysis by the IEA, the clean energy technology market will triple in size by 2030, and the Company will seize this opportunity to continue investing in innovative R&D (reached 12% of revenue in 2022), so as to seize business opportunities. The Company's DRAM products have already been applied in solar PV systems and charging stations.
- Verification of GHG emissions in 2022 will be completed in May 2023. Completed the inventory of the carbon footprint of all products and implemented management plans to improve the three hot spots of carbon footprint in the 2021 inventory.

Risk Management



- The scopes 1/2/3 of greenhouse gas inventory and verification are conducted annually to confirm sources of greenhouse gases for key project management.
- Compile product life cycle inventory and improve hot spots.

Management strategies and actions

- Mitigation goals:
 1. Compile and verify Scope 1/2/3 emissions every year,
 2. Set greenhouse gas management goals and energy and resource recycling and reuse goals
 3. Participate in the international Carbon Disclosure Project (CDP) and water safety project, disclose related information, and communicate with stakeholders
 4. Propose SBTs for certification

2022 Operation status

- The Company's GHG emissions in 2022 was 444,000 thousand tons, and emissions per unit product was 405 kg CO₂e/thousand die, down 31% compared to 2017.
- A total of NT\$41.57 million was invested and 25 energy conservation plans were completed in 2022, saving an estimated 4,378 MWh, reducing carbon emissions by 2,228 tons, and saving NT\$116 million in electricity fees.
- Obtained certification for SBT in 2030

Metrics and Targets



- Adaptation goals:
 1. Strengthen the Company's drought resistance and increase the water recycling rate
 2. Promote green buildings and green factory certifications

- Use 7.88 million kWh of electricity from onshore wind farms according to the schedule for purchasing renewable energy. Continue to increase renewable energy purchases and use 25 million kWh starting in 2023, which is expected to reduce carbon emissions by 12,500 tons.
- Rated by the CDP at Leadership Level A— in climate change and A-LIST in water security in 2022
- Process wastewater recycling rate reached 92.9% in 2022
- Received the green factory certification and added 1 green building.

Climate Change Mitigation

The main sources of GHG emissions in semiconductor plants are electricity and perfluorocarbons (PFCs). Among them, electricity is essential for operation and production, enabling all machinery and equipment at plants to normally operate. PFCs are perfluorocarbons and other compounds of the same kind used in production process, categorized into the greenhouse gases with high global warming potential.

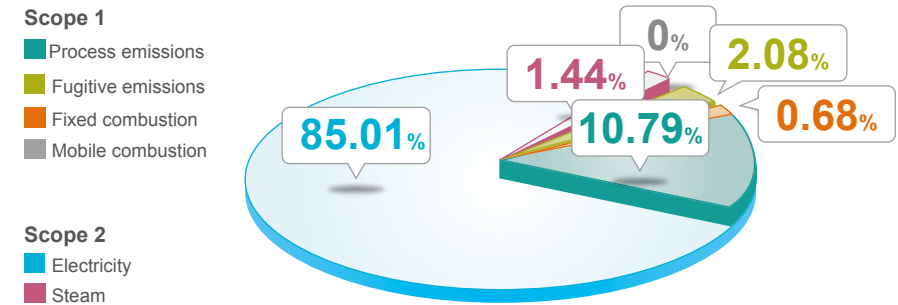
Greenhouse Gas Inventory

The Company referenced ISO 14064-1 and requirements set forth in the Greenhouse Gas Reduction and Management Act, Greenhouse Gas Inventory Registration and Management Regulations, Greenhouse Gas Verification Guidelines, Greenhouse Gas Registration Guidelines, WBCSD/WRI Greenhouse Gas Protocol, and sets the boundaries of the organization at 100% control of operations. At present, verification of Scope 1, Scope 2, and Scope 3 emissions is carried out by a third party verification institution according to international standards.

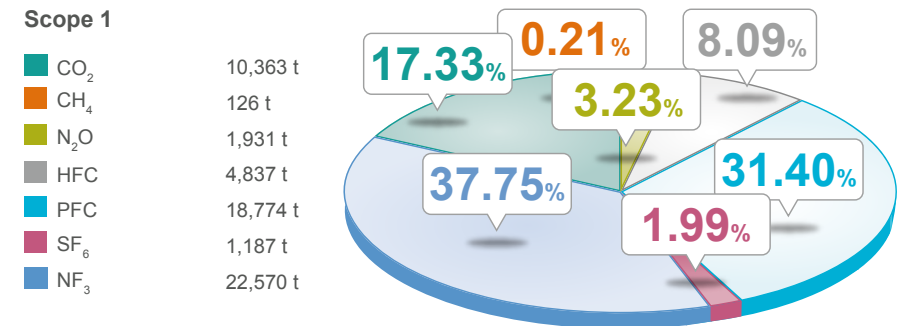
The scope of inventory of Nanya Technology Corporation covers all production locations in Taiwan. The main sources of GHG emissions were purchased electricity and steam (accounting for about 86.44%) and process emissions (accounting for about 10.26%). GHG emissions in 2022 totaled 440,954 metric tons CO₂e. Scope 1 emissions totaled 59,788 metric tons CO₂e, and there was no GHG emissions from biomass fuel; Scope 2 emissions totaled 381,166 metric tons CO₂e. The data above does not include emissions of subsidiaries. The Company has begun compiling an inventory in 2022, and the inventory will be formally disclosed after verification in 2024.

GHG emission factors were based on the GHG emission factory management table declared on the national registration platform of Taiwan's Environmental Protection Administration, the IPCC 2006, emission factors released by Taiwan's Bureau of Energy, Ministry of Economic Affairs, and emission factors made public by the company-owned steam plant of Nan Ya Plastics Corporation's utility plant. The GWP value is cited from the IPCC AR4. Compared with the base year of 2017, the greenhouse gas emissions in 2022 increased by approximately 17.1%, and the number of chips produced increased by approximately 17.2%. In terms of emissions per unit wafer, the emission intensity in 2022 was 0.75 kg-CO₂e/wafer area(cm²), which was higher than that in 2021. However, if viewing from the emission intensity of per unit chip output, the total GHG emissions per unit capacity in 2022 decreased 33% compared with the base year of 2017.

Percentage accounted for by Scope 1 and Scope 2 emissions in 2022

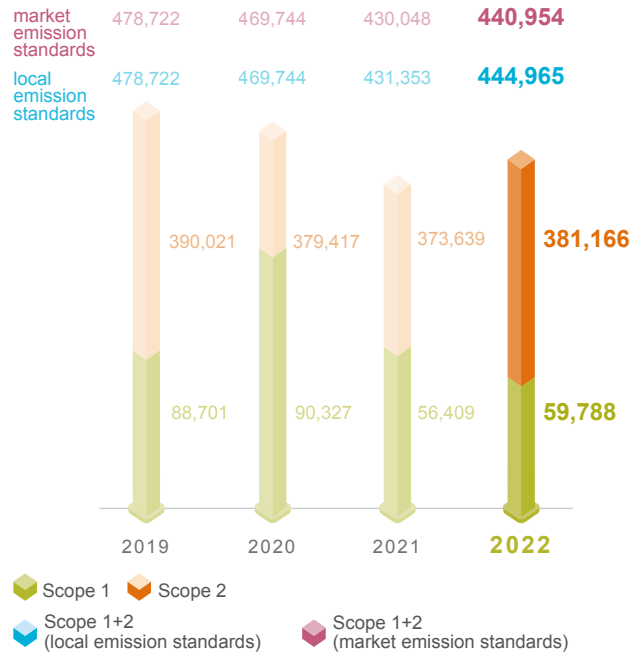


Percentage accounted for by Scope 1 GHG emissions



2019 to 2022 Scope 1 and Scope 2 emissions

(Metric tons CO₂e)



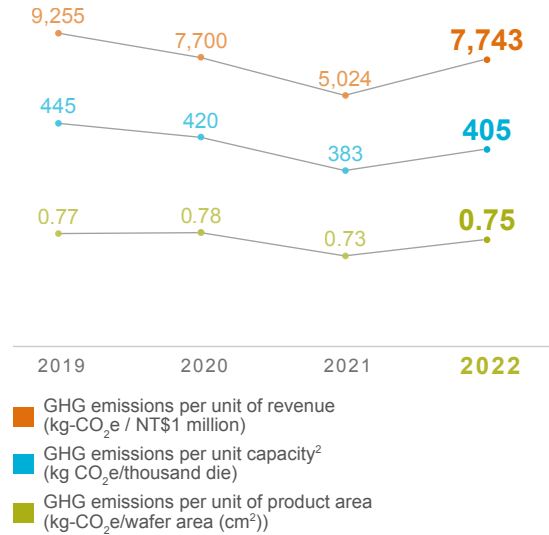
Note 1: PFCs emissions totaled 9 types of process gases, including carbon tetrafluoride (CF₄), perfluoropropane (C₃F₈), hexafluorobutadiene (C₄F₆), tetrafluorocyclobutane (C₄F₈), trifluoromethane (CHF₃), difluoromethane (CH₂F₂), monofluoromethane (CH₃F), sulfur hexafluoride (SF₆), and nitrogen trifluoride (NF₃).

Note2: Other direct emissions include CO₂, CH₄, N₂O process gas, HFCs and SF₆ non-process gas, such as fire extinguishers, refrigerators, freezers, and high voltage control panel.

Note3: Indirect energy emissions include electricity and steam use, in which the carbon emission factor of electricity is 0.509 kg CO₂e/kWh announced by the Ministry of Economic Affairs on July 22, 2022.

Note4: Starting in 2021, we installed N₂O reduction equipment in the film process, so Scope 1 emissions decreased.

GHG1 emission trends in 2019-2022



Note 1: GHG emissions in this table includes Scope 1 and Scope 2

Note2: The calculation of production capacity was the output of Good Electronic Chip (GEC), and the output of various products was converted into around 4Gb product particle numbers, using per thousand die (k-pcs) as the calculation unit.

To improve the integrity of greenhouse gas (GHG) inventory in our value chain, we have conducted scope 3 inventory in accordance with the Greenhouse Gas Protocol, and have met the ISO 14064-1 standards. The emissions of 7 items in Scope 3 GHG emissions passed verification in 2022. In all scope 3 inventory categories, the highest GHG emissions came from the use of sold products, followed by Emission from processing of sold products. Purchased goods and services at the third place.

Scope 3	Source of calculation	Scope 3 emissions (ton-CO ₂ e)
Purchased goods and services*	Carbon emissions from the main material purchased, auxiliary materials in the process	122,713.5
Fuel- and energy-related activities*	Carbon emissions from the ton-km for transporting fuel used in the factory and energy transported to the factory	77,373.4
Upstream transportation and distribution*	Carbon emissions from transportation and distribution of products purchased between the Company's tier 1 suppliers.	2261.6
Downstream transportation and distribution	Carbon emissions from the ton-km for transporting products from the plant to customers.	1,997.9
Emission from processing of sold products	Emission from packaging and testing sub-con by capacity allocation	131,079
Employee commuting*	Carbon emissions from company cars and commuting	2,051.9
Business travel*	Carbon emissions from employees traveling overseas on business trips	24.8
Waste generated by operations*	Carbon emissions from waste generated in the production process, including waste transport and disposal.	1,488.5
Use of sold products*	Carbon emissions from electricity consumption of products used by customers	534,761.7
Assets and equipment	Investments in equipment and property	66,772.8
Total		940,525

Note1 : Source of main emission factors in Scope 3: The Simapro database is reference for products and services purchased; the carbon footprint platform is referenced for fuel and energy related activities, upstream and downstream transportation and distribution, employee commuting, waste generated by operations, and use of sold products; the ICAO carbon emissions calculator is referenced for business trips; GHG emissions is distributed based on investment percentage in investee companies for investments.

Note2 : The emissions of 7 items in Scope 3 GHG emissions passed verification in 2022. Including "purchased goods and services, fuel- and energy-related activities, upstream transportation and distribution, waste generated by operations, business travel, employee commuting and use of sold products " the emissions of 7 items is 740,675.3 metric tons CO₂e.

Note3 : *The items in Scope 3 GHG emissions passed verification in 2022.

Greenhouse Gas Reduction

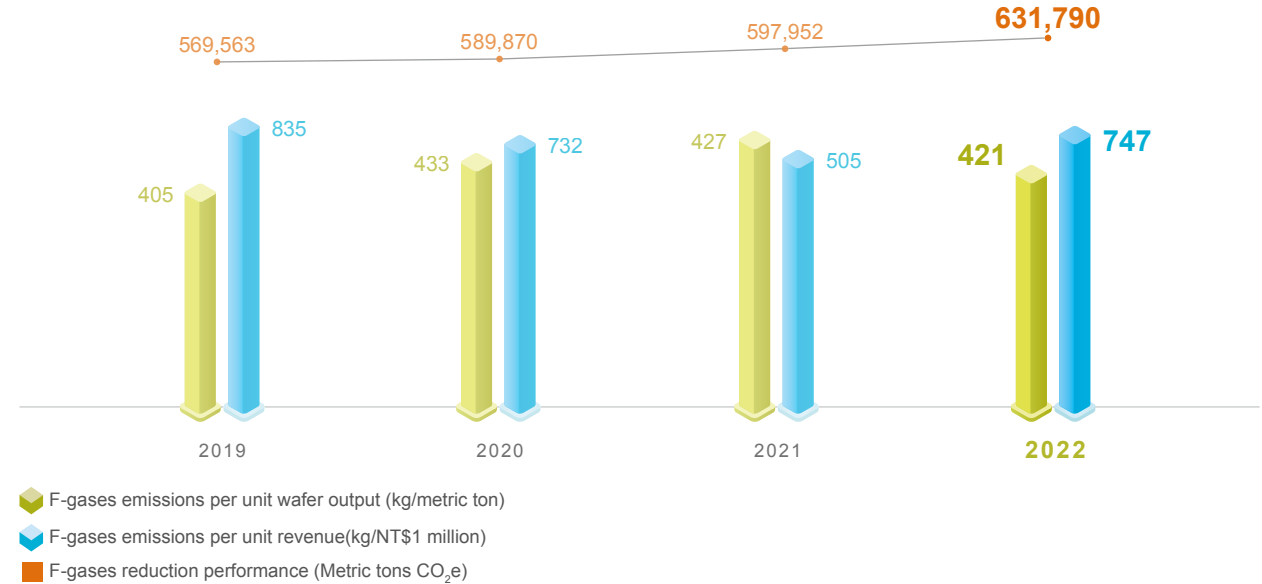
We have actively promoted voluntary reductions and participated in the annual voluntary reduction promotion plan of industrial greenhouse gases implemented by the Industrial Development Bureau under the Ministry of Economic Affairs. As Fluorinated Greenhouse Gases (F-gases) have the properties of high global warming potential ¹ and N₂O being one of the Company's main Scope 1 emissions, Nanya has actively planned and implemented GHG reduction plans for F-gases and N₂O. Nanya planned to purchase a high reduction rate local scrubber when planning the plant. Currently, the PFC Local Scrubber ² used in the thin film and etching processes is Burn Type, destroying F-gases through the high temperature generated by combustion. To reduce PFCs emissions, we established PFC reduction acceptance standards for local scrubber, in which CF₄ treatment efficiency must reach 90% and above, the reduction rate of C₃F₈, C₄F₆, C₄F₈, CHF₃, CH₂F₂, and SF₆ must reach 95% and above, and the reduction rate of NF₃ must reach 99% and above. After the local scrubber is installed, FTIR³ is used to test PFC reduction rate, in order to meet future reduction trends. Nanya was successfully implemented N₂O emission destruction in thin film process by the burned-type local scrubber, reducing 90% emission and above, and effectively lowers N₂O emission.

Note1: Global Warming Potential (GWP) is the warming intensity of the gases relative to carbon dioxide (set the CO₂'s GWP = 1). The high global warming potential referred in this article are the gases with a GWP value higher than 675. (Based on the GWP values of the IPCC Fourth Assessment Report (FAR))

Note2: Local Scrubber: local exhaust processor.

Note3: FTIR : Fourier-Transform Infrared Spectrometer

PFC emission trends in 2019-2022



Note: In the 2021 annual Sustainability Report, the data for PFC emissions per unit wafer output was incorrect, and the correct data is hereby provided.

Through purchasing Local Scrubber with high F-gases reduction rate when planning to build fabrication plants, and promoting programs on reducing the use of PFC in process, we aimed to reach a reduction rate of at least 90%. From 2019 to 2022, the reduction rates of F-gases used in process all reached a minimum of 93%, reducing a total of 2,389,175 metric ton-CO₂e emissions over four years, which is equal to 5,853 times the carbon absorption of Daan Forest Park in one year.

Note: According to the Bureau of Energy's website: Calculated using the CO₂ absorption of Daan Forest Park at 389 metric tons per year

Carbon Disclosure Project

We began participating in the non-profit organization Carbon Disclosure Project (CDP) in 2009, and disclose information on GHG emissions and reduction each year based on the principle of transparent disclosures. We rated at the leadership level in climate change between 2018 and 2022. In addition to disclosures of information on carbon emissions in the CDP and this report, Nanya Technology Corporation also actively discloses information on GHG emissions and reduction in the GHG report system of the Responsible Business Alliance (RBA), or provides information on carbon emissions of products to help customers establish the basis for calculating product footprint.

5-2 Energy and Resource Management

► Energy Management

Energy Structure

Nanya Technology Corporation mainly used purchased electricity (accounted for 89.5% of the Company's energy consumption), natural gas (accounted for 6% of the Company's energy consumption), and steam (accounted for 4.5% of the Company's energy consumption) in 2022. The Company also used diesel, but it accounted for less than 0.05%, so it was not included in statistics of energy consumption indicators. The Company began purchasing renewable energy in 2020, and purchase renewable energy (electricity) accounted for 0.95% of the Company's energy consumption in 2022. Nanya Technology Corporation's production capacity in 2022 decreased 3.05% compared to 2021, and revenue decreased 33.5% compared to 2021. The continued adoption of advanced processes led to an increase in energy consumption. Hence, Nanya Technology Corporation's total energy consumption (electricity + natural gas + steam) reached 831,862 MWh (3×10^9 MJ) in 2022, an increase of 0.68% compared to 2021, in which electricity consumption (including renewable and non-renewable) was 744,299 MWh (2.68×10^9 MJ), natural gas consumption was 50,030 MWh (1.8×10^8 MJ, 4,780,740 m³), and steam consumption was 37,532 MWh (1.35×10^8 MJ, 49,620 metric tons). In terms of emission intensity, electricity consumption per unit capacity was 0.68 MWh/NT\$1 million in 2022 (5% increase compared to 2021), natural gas consumption per unit capacity was 4.4 m³/NT\$1

million (5.3% increase compared to 2021), and steam consumption was 0.046 metric tons/NT\$1 million (16.2% decrease compared to 2021). The downward or steady trend in the past three years shows that Nanya Technology Corporation continues to improve its energy management.

Service life and environmental impacts of fossil energy have been the most important issues so efficient management is urgent. Purchased electricity, steam, and natural gas are main energy sources that Nanya Technology Corporation uses. Externally, other indirect energy consumption that generates greenhouse gas emissions includes raw materials transportation, production of raw materials suppliers, waste transportation/disposal, employee travel, and employee commuting. In order to mitigate the environmental impacts of greenhouse effect, when building fabrication plants, energy conservation is the base for the plans, such as adopting a dual-temperature chilled water system

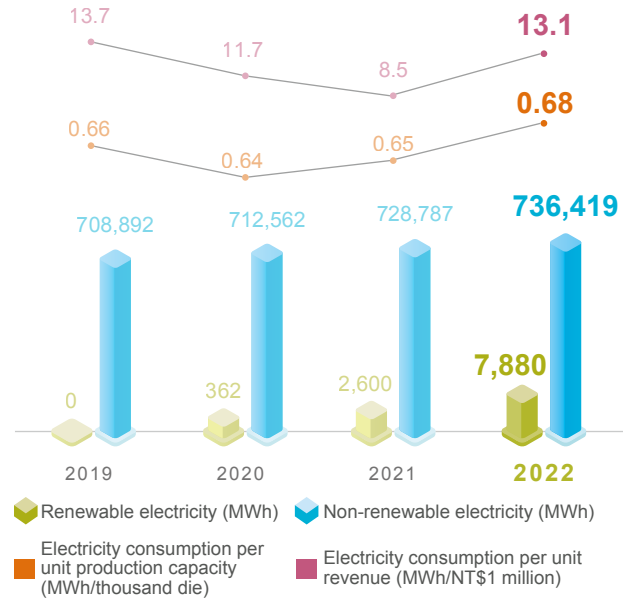
and waste heat recovery and utilization in freezers. Over the past years, we have constantly implemented various energy-saving technologies, using diverse thinking methods, such as automating equipment control, improving equipment efficiency, reclaiming energy for reuse, and improving production management, to reduce energy consumption. Meanwhile, we prioritize energy conservation equipment during the design of equipment installation and procurement. Moreover, the company promotes energy management programs in offices and public areas to reinforce the concepts of our employees in energy conservation. The company also continues to reduce the consumption of raw materials and increases the recycling amount of waste to mitigate the global impacts of greenhouse gases. Energy sources that Nanya mainly consumes are purchased electricity, natural gas, and a small amount of diesel. The company does not use internal energy.

Total energy consumption

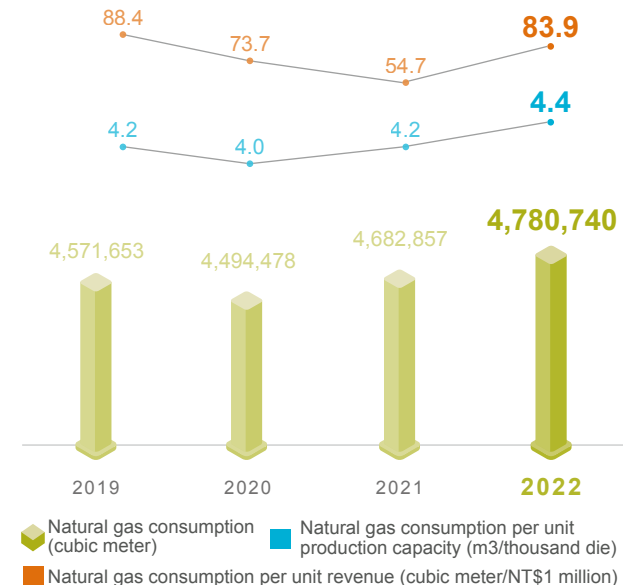
Unit: MWh

	2019	2020	2021	2022
Total renewable energy consumption	0	362	2,600	7,880
Total non-renewable energy consumption	794,681	812,350	823,679	823,982
Total energy consumption	794,681	812,712	826,279	831,862

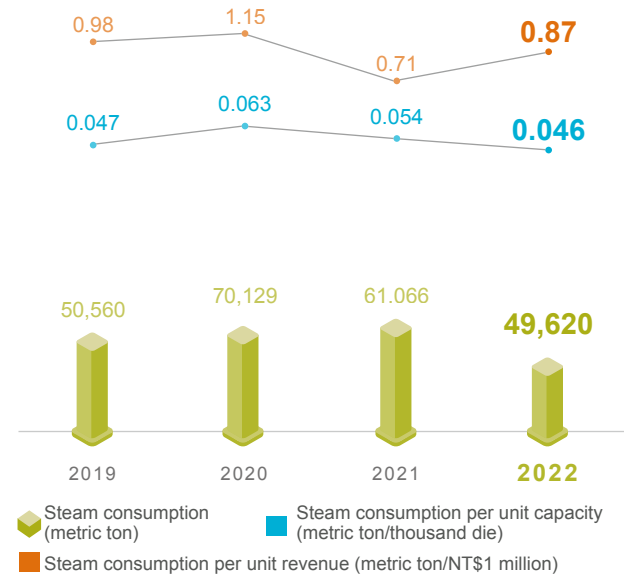
Energy costs from 2019 to 2022



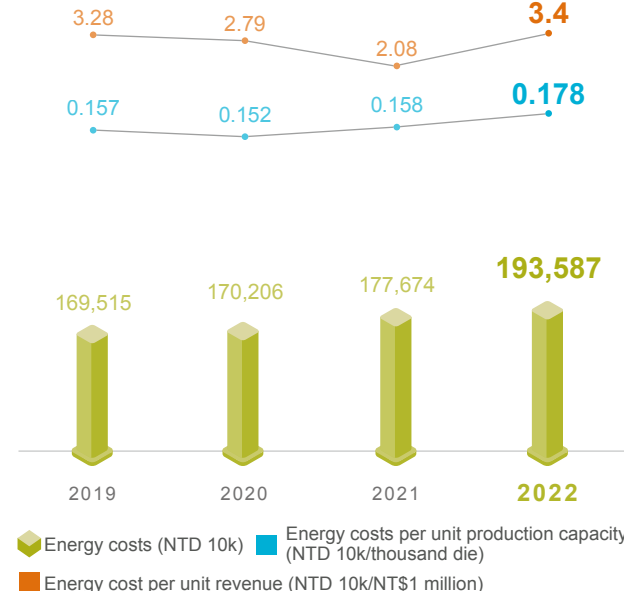
2019 to 2022 natural gas consumed



Steam consumption in 2019 to 2022



Energy costs from 2019 to 2022



Renewable Energy Use and Planning

Nanya carries out planning and implementation of renewable energy use in the following three phases.

Self-development evaluation and trial implementation

Nanya Technology Corporation purchased 362 T-RECs through the renewable energy trading platform in 2020, and also began evaluating available spaces in existing factories, planning the establishment of a solar power plant with installed capacity of 456.28 kW (to be completed in coordination with the expansion of the new factory in 2024). We are also installing 27.36 kW of solar panels on the rooftop of our new building, and completed construction in 2022. New factories in the future will also fully utilize land resources to install green energy facilities.

External cooperation

Nanya Technology Corporation is working with renewable energy selling enterprises to obtain more electricity, and is gradually expanding consumption based on regulatory requirements. In 2021, we used a total of 2,600 MWh (9.36×10^9 MJ) in renewable energy, and used 7,880 MWh (2.84×10^7 MJ) in 2022. Starting in 2023, we will gradually increase annual renewable energy use until we reach 25,000 MWh (9×10^7 MJ) or more.

Becoming aligned with international standards by achieving net zero emissions

In order for the percentage of renewable energy to reach 25-30% by 2030 to achieve the SBT or RE100, Nanya Technology Corporation will target the supply contracts of large renewable energy plants to further increase its renewable energy consumption.

Enhancing Energy Usage Efficiency

In order to mitigate the environmental impacts of greenhouse effect when building fabrication plants, energy conservation is the base for the plans, such as adopting a dual-temperature chilled water system and waste heat recovery and utilization in freezers. Over the past years, we have constantly implemented various energy-saving technologies, using diverse thinking methods, such as automating equipment control, improving equipment efficiency, reclaiming energy for reuse, and improving production management, to reduce energy consumption. Meanwhile, we prioritize energy conservation equipment during the design of equipment installation and procurement. Moreover, the company promotes energy management programs in offices and public areas to reinforce the concepts of our employees in energy conservation. The company also continues to reduce the consumption of raw materials and increases the recycling amount of waste to mitigate the global impacts of greenhouse gases.

Nanya implemented ISO 50001 Energy Management Systems and completed certification in 2018. We invested NT\$21.8 million in 2019 to establish the energy management system platform, and utilized the energy consumption real-time monitoring platform for statistical analysis of system equipment and smart energy conservation management. The platform helps manage and improve energy consumption of organizations and machinery groups, and promotes best practices of energy management and reinforces good management behavior.

Nanya Technology Corporation invested NT\$41.27 million and completed a total of 25 energy conservation management projects in 2022, and total energy conservation benefits reached 4,378 MWh/year (1.58×10^7 MJ/year); 28 energy conservation management projects (23 new projects and 5 ongoing projects) will be implemented in 2023 and are expected to provide energy conservation benefits reaching 5,055 MWh/year (1.82×10^7 MJ/year), all from reducing electricity consumption. We have constantly paid attention to issues on energy conservation and carbon reduction, and made an effort to implement related measures. At the High-Tech Energy Conservation and Carbon Reduction Forum held by the Taiwan Semiconductor Industry Association (TSIA), we joined in the declaration of voluntary energy conservation and carbon reduction. We also received the Excellence Award in the Smart Energy Savings Competition of New Taipei City in 2019. At the 2021 Taiwan Corporate Sustainability Awards, we received the Climate Leadership Award for our energy conservation and carbon reduction project for the second consecutive year. Furthermore, we separated ourselves from other companies with excellent environmental protection performance in 2022 under the themes “energy-efficient memory” and “green manufacturing”, and led Taiwan’s DRAM industry in winning the Silver Award in the National Enterprise Environmental Protection Award from the Environmental Protection Administration, Executive Yuan for the second consecutive year.

Action plans

2022

Description

- 11 projects to improve equipment efficiency, 8 projects to save electricity consumed by lighting, and 6 projects for equipment energy conservation management.
- Total energy conservation: 4,378 MWh/year.

Number of projects
25

Carbon reduction (metric tons CO₂e)
2,229

Plans for 2023

Description

- 5 projects to improve equipment efficiency, 5 projects to save electricity consumed by lighting, and 18 projects for equipment energy conservation management.
- Total energy conservation: 5,055 MWh/year.

Number of projects
28

Carbon reduction (metric tons CO₂e)
2,573

Energy consumption real-time monitoring platform



Note 1: Electricity CO₂e emission is based on the electricity carbon emission factor = 0.509 kgCO₂e/kWh, published in 2021 by the Bureau of Energy, Ministry of Economic Affairs

Note 2: Based on the Energy Product Unit Heating Value Table updated in 2020 by the Bureau of Energy for unit conversion, 1 kWh = 860 kcal = 3.6 megajoules; 1 MWh = 3,600 megajoules.

Note 3: 1 cubic meter of natural gas = 10.465 kWh (Based on the Energy Product Unit Heating Value Table updated in 2020 by the Bureau of Energy for unit conversion, 1 kWh of electricity = 860 kcal; 1 cubic meter of natural gas = 9,000 kcal)

Note 4: Natural gas used in plants is steam with a saturation temperature of 132.88°C. According to the table of saturated steam, 1 metric ton of steam = 650,500 kcal/metric ton = 756.4 kWh (1 kWh = 860 kcal).

Water Resource Management

Due to the effect of global climate change, rainfall has become polarized in Taiwan, resulting in floods and water shortages occurring at the same time. As an important member of the semiconductor industry, Nanya has monitored the risk of water shortage caused by global climate change, and understands the effect of climate change and water resources on operations. Nanya continues to implement water conservation measures and strives to recycle and reuse water to reduce its impact on the environment and the risk of water shortage. Nanya Technology Corporation launched the Alliance for Water Stewardship (AWS) – International Water Resource Management Standard Certification Project in 2022, comprehensively enhancing water resource management functions with the goal of obtaining platinum level certification in 2023.

Our efforts in water resource management has gained the recognition of the CDP, which is an international environmental evaluation indicator. Nanya was ranked at the leadership level “A-” in Water Security in 2021 and leadership level “A” in 2022. Nanya was recognized for its efforts in climate change and water resource management for global sustainability in 2022 with the “Water Resource Management Leadership Award” in the 15th TCSA.

Nanya's main strategies for water resource management are as follows, all strategies and requirements cover all operations, research and development, production and other bases; relevant water use, water conservation and risk assessment of water use are gathered in the board of directors for reporting and review every year.

Actively manage indicators, conserve water in operations, and fully utilize water resources.

Assess the risks and opportunities under climate change, and mitigate the impact of water shortage.

Communicate with stakeholders so that they will take water resources seriously and implement water conservation.

Implement wastewater classification treatment and multiple recycling measures to maximize the efficiency water resources.

Comply with laws and regulations, continue to strengthen water treatment facilities, and reduce the risk of environmental pollution.

Water Resources Structure

Nanya's total water withdrawal was 3,388 thousand m³ in 2022, in which Taoyuan Canal is the main source of water, accounting for approximately 96.6% (3,274 thousand m³), followed by well water at approximately 1.8% (60 thousand m³), tap water at approximately 0.8% (26 thousand m³), and rainwater at approximately 0.8% (28 thousand m³). Our production capacity in 2022 decreased 3.05% compared to 2021, and revenue decreased 33.5% compared to 2021. Due to the decrease in production capacity, total water withdrawal decreased 2% compared to 2021. In terms of water use intensity, water consumption per unit production capacity was 3.11 metric tons/thousand die in 2022 (up 1.1% compared to 2021), and water consumption per unit revenue was 59.5 metric tons/NT\$1 million (up 47.3% compared to 2021). Ultra-pure water consumption for the year was 3,578 thousand m³ in 2022 (up 1.7% compared to 2021), ultra-pure water consumption per unit production capacity was 3.29 metric tons/thousand die (up 4.9% compared to 2021), and ultra-pure water consumption per unit revenue was 62.8 metric tons/NT\$1 million (up 53% compared to 2021).

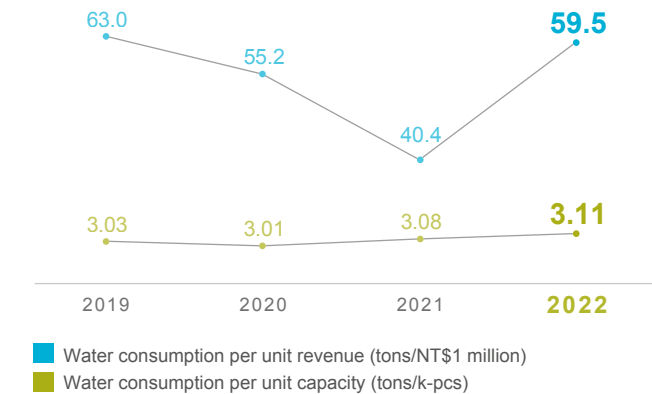
Nanya water consumption

Unit (thousand m³)

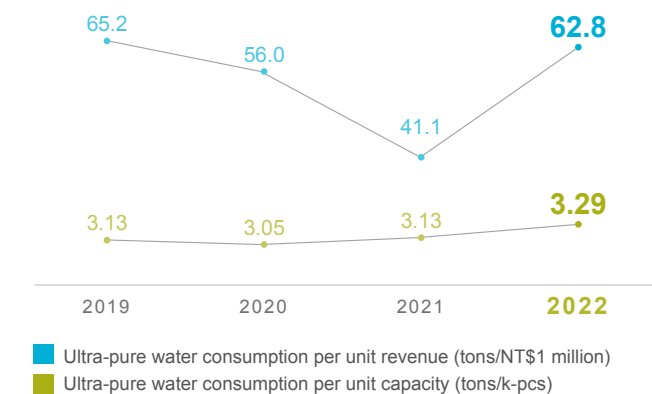
	2019	2020	2021	2022
Water withdrawal (A)				
	3,258	3,369	3,456	3,388
Water discharge (B)				
	2,634	2,705	2,718	2,695
Water consumption (A-B)				
	624	664	738	693
Changes in water storage¹				
	0	0	0	0

Note1: Changes water storage = Water storage on 2022/12/31 – Water storage on 2022/1/1

Run chart of 2019-2022 water consumption



Run chart of 2019-2022 ultra-pure water consumption



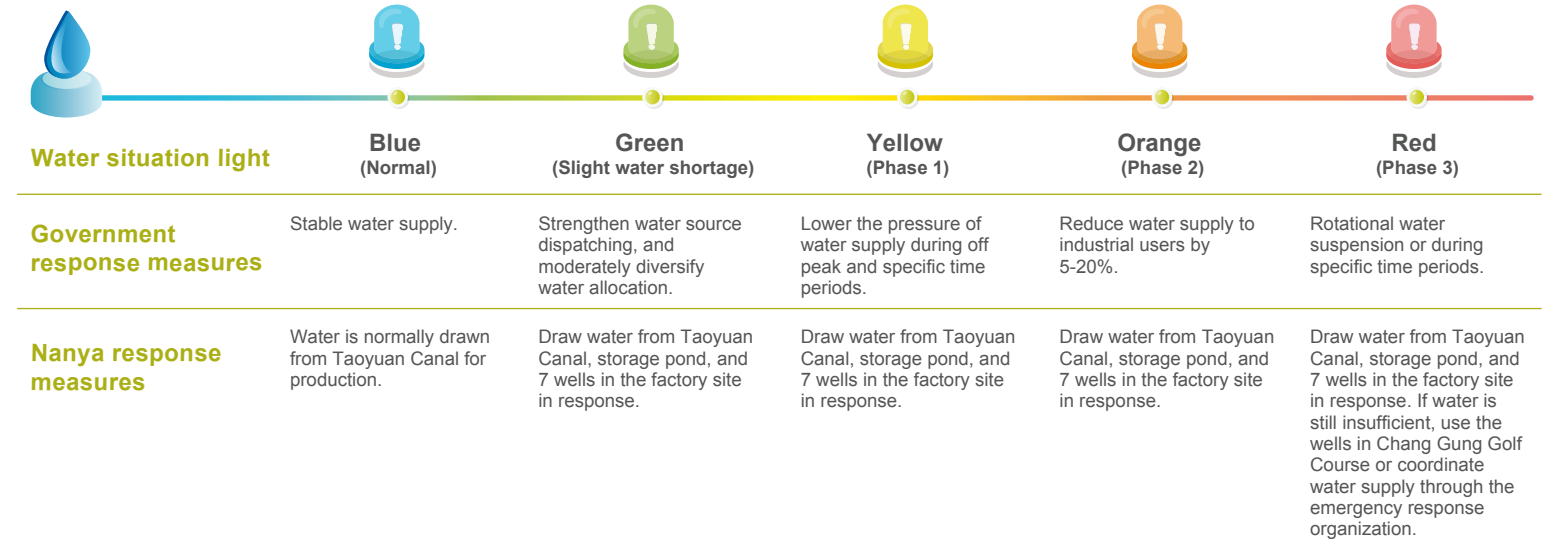
Water Resource Risk Management

Our main water source comes from the Shihmen Reservoir, and is channeled and processed through the Taoyuan Canal before being supplied as production water. The gravity flow is used to independently channel water without affecting the ecology of water resources and any other purposes of usage. In addition, rainwater harvesting can supply production water and tap water for household use. Currently, Nanya Technology Corporation (NTC) has only one production plant located in New Taipei City, Taiwan. Taiwan's rainfall is unevenly distributed between regions and seasons, which often results in regional and seasonal droughts. Nanya Technology Corporation has used the WRI Aqueduct, tools for simulating water resource scenarios, to analyze the geographical location of the plant. The water source is the Taoyuan Canal of Shihmen Reservoir, which supplies 96.5% of water. The water stress assessment result was "low", meaning that it is a non-water stress area. Furthermore, Nanya Technology Corporation's water source Shihmen Reservoir supplies approximately 800 thousand m³/day. The Company's daily water consumption is approximately 10 thousand m³. Hence, the effect of Nanya Technology Corporation's operations on regional water use is 1.25%. Other operating bases include Taiwan Hsinchu Design Center and overseas design centers and sales offices (including San Jose, USA, Houston, USA, Burlington, USA, Dubbindorf, Germany, Shenzhen, China, and Tokyo, Japan). As an office, there is no production activity, and there is no risk related to affecting operations. We established a standard process and procedures and examined water resource related risks through the environment management framework and company operational risk management framework, implementing related improvement measures and formulating emergency response plans, which are periodically examined in quarterly meetings of the Sustainability Promotion Center and Risk Management Promotion Center.

To reduce the risk of short-term water shortages inherent in the geographical location, we have continuously promoted water-saving measures, and committed ourselves to water recycling to strengthen our adaptability. The amount of water needed by production is huge so water shortage will cause

production interruptions, affecting the output and delivery. To mitigate immediate impacts caused by short-term water shortages, a cistern with a capacity of 43 thousand m³ and two detention basins each with a capacity of 4.06 thousand m³ have been built in the plant to effectively harvest rainwater during the rainy season. Moreover, Nanya Technology Corporation and the adjacent factories of the Formosa Plastics Group have cooperated to set up an emergency response organization for water shortages. When water shortages occur, the members of the emergency response organization can urgently deploy water resources to support each other. Therefore, no production losses have occurred owing to water shortages.

Nanya drought response mechanism



Water Conservation

In addition to the design of water-saving processes, the Nanya's water management chiefly emphasizes water reduction and recycling. Currently, the main directions promoted are as follows, the implementation of water conservation covers all operations, research and development, production and other bases.



Nanya actively implements water conservation measures and plants currently have acid-alkaline waste water, hydrofluoric waste water, and organic waste water recovery systems. Along with the implementation of various water saving measures, the process water recycling rate reached 92.9% in 2022. In 2022, the water recycled and reused from waste water recovery systems, process recovery systems, waste water from pure water processes, and rainfall harvesting methods totaled 5,700 thousand m³, accounting for 168% of the Company's water consumption. In 2022, the equipment improvement and expansion of the FAB 3AN hydrofluoric wastewater recovery system be completed, with an investment of 37.39 million yuan, which can increase the recycled water volume by another 430 CMD. In the future, to coordinate with the expansion plan of plant area, an estimate of NT\$430 million has been invested in building new hydrofluoric waste water COD and total nitrogen treatment systems, which not only will solve the problem of excessively high hydrofluoric waste water COD and total nitrogen, but also recover the waste water at the same time. It is estimated that additional 1 thousand m³ of waste water will be recovered daily. The system was completed in 2022 and will be operational in 2023.

Note: Nanya's process water recycling rate is calculated using the formula specified by Hsinchu Science Park Bureau, the same as peers in the industry.



Cooperation and Communication

Besides implementing internal water resource management and evaluation, Nanya is also actively implementing water conservation measures and water recovery and reuse, and participates in the industry association for water conservation related guidance and experience sharing.

Government

- Participate in the semiconductor industry association, periodically attend "water resource diversification management and cooperation platform" meetings of the Water Resources Agency, and engage in exchanges, communication, and cooperation in water resource related policies.
- Attend meetings and coordinate and communicate with the Irrigation Agency and North Region Water Resources Office, and cooperate with the government's emergency response plan when there is a water shortage, in order to most effectively utilize water resources, mitigate the impact of water shortages in water supply areas, and achieve stable and balanced water supply.



Companies and the general public

- Nanya shares its water management experience through participation in various events, such as the green factory visit co-organized with the Industrial Development Bureau in 2021, during which we shared our water management and water conservation results with visiting government officials and companies.



Suppliers

- Suppliers are required to sign the Commitment to Corporate Social Responsibility. Water resource management items are planned in the supplier risk assessment questionnaire and TCFD physical risk identification are carried out to compile an inventory of suppliers' water resource risks, and ensure that they have water resource management measures and an emergency response plan when there is a water shortage. On-site audits are conducted for high risk and key suppliers, and guidance is provided to improve their deficiencies. We also share, exchange, and provide guidance to suppliers for water management and conservation measures through supplier meetings, in order to improve their water management measures. In November 2022, the third "Nanya Technology Sustainable Supply Chain Seminar" be held continuously, inviting experts and nearly 20 senior executives of concerned suppliers to jointly invest in the sustainable development of enterprises. In 2022, all first-tier suppliers (including suppliers of concern) have completed the sustainability risk assessment (282 questionnaires were sent, and 100% were returned). In the future, we will gradually provide water-saving understanding and counseling for manufacturers with high water management risks and high water consumption. (It is expected to complete 12 manufacturers in 2023)



Local residents

- Nanya Technology Corporation formed an Environmental Quality Supervision Committee with the local community when it was first established, and commissions a third party to conduct surveys of surrounding ecology, hydrology, and air quality. Survey results are reported to the Environmental Quality Supervision Committee.
- Nanya learns about issues that community residents are concerned about through the Environmental Quality Supervision Committee, and includes the issues in its periodic evaluation of ISO 14001 Management Systems.
- To ensure that the water quality of effluent is normal and eliminate concerns residents may have about effluents from Nanya, we have established an effluent water quality real-time monitoring system that is linked to the Environmental Protection Bureau, jointly monitoring the water quality of effluents in real time.



Raw Materials Reduction and Reuse

Raw Materials Reduction

Nanya regularly reviews the rationality and appropriateness of raw material use. Moreover, we reduced the use of raw materials by streamlining the manufacturing process. The responsible organization of the company set implementation goals for raw material reductions every year, and periodically reviewed the performance of reductions in the entire company's raw materials. Accumulative 24 entries in improvement proposals regarding the consumption of raw materials were completed in 2022, including formula development of new processes, reductions of process time, extensions to use cycle, and reductions of process consumption. Among improvement plans in 2022, improvement to the photoresist verification and management method for the lithography effectively improved photoresist usage efficiency, and reduced consumption of photoresist SHB1736/SH114A by approximately 47 kg (6%), which was the greatest benefit.

Performance of raw material consumption improvement proposals in 2022

Extensions to use cycle	Formula development of new processes	Reductions of process consumption
3 items including the extension of the hydrofluoric acid tank acid replacement cycle, and extension of the gas cylinder replacement time.	Reduced the use of 10 items, including photoresist, chemicals, and special gases, through process simplification and the development of high speed processes and formulas.	Reduced the use of 11 items, including photoresist, special gases, chemicals, and grinding fluid, through process optimization and improving production performance.
Number of cases 3	Number of cases 10	Number of cases 11
Benefits 2,368,872 (NTD / year)	Benefits 18,933,574 (NTD / year)	Benefits 11,319,348 (NTD / year)
Benefits 32,621,794 (NTD / year)		

Plans and measures	Reduction (metric ton/year)
Waste sulfuric acid, hydrogen peroxide, ammonia water: Process optimization	355
Waste hydrofluoric acid reduction: Extension of acid replacement cycle	30
Waste slurry	13
Waste photoresist reduction: Process optimization	2
Total reduction	400

Use and output of raw materials

Input

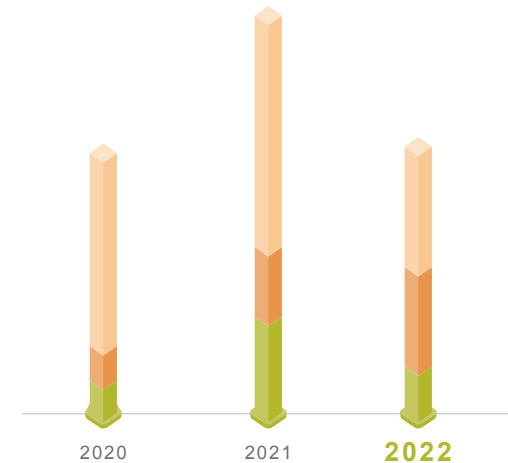
	Consumption	Renewable	Non-renewable
Raw wafers (thousand slices-12-inch)	781		
Process chemicals (metric ton)	54,462		
Process gases (million M ³)	6,741		
Electricity (million kWh)	744		
Clean water (1,000 m ³)	3,388		
Packaging materials for wafers (metric ton)	96	27%	73%



Output

	Output volume
Raw wafers (thousand slices-12-inch)	809
Greenhouse Gas Emissions (Metric ton-CO ₂ e)	440,954
Volatile organic compounds (metric ton)	17.3
Sulfide (metric ton)	1.656
Nitrogen oxides (metric ton)	10.497
Volume of waste water (1,000 m ³)	2,695
General industrial wastes (metric ton)	6,383
Hazardous industrial wastes (metric ton)	17,598
Electronic waste (metric ton)	4.2

Improved performance of raw material consumption



- Reductions of process consumption
- Formula development of new processes
- Extensions to use cycle

Recycling and Reuse

Recycling inside plant

Ratio of using recycled materials as production materials

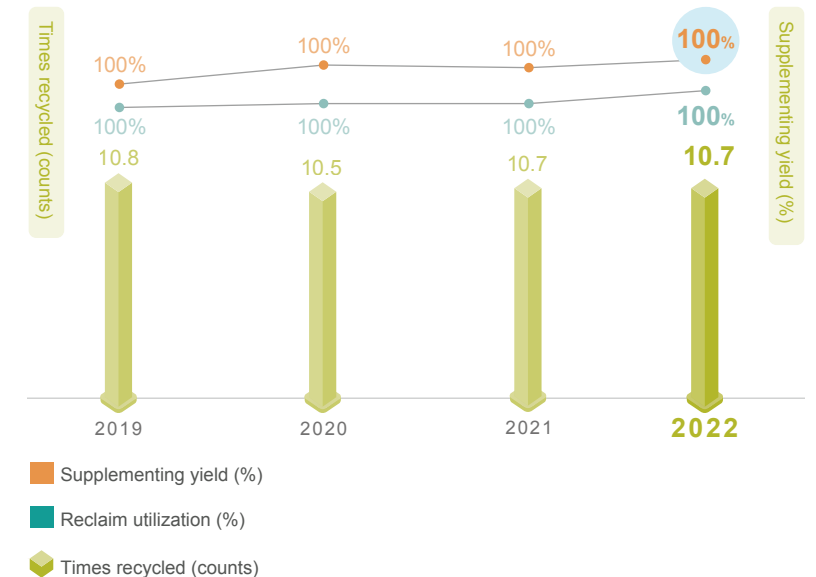
When using renewable raw materials in the production process, it is necessary to use monitor wafers to monitor process conditions. The used monitor wafers can be reproduced and used repeatedly; each monitor wafer can be repeatedly used 8-11 times (varies with the process used). This not only reduces the cost of purchasing whole new monitor wafers, but also reduces the amount of waste generated.

Starting in 2017, the supplementing yield of each supplier is used as an important

indicator for allocation. Besides considering the price quotations of suppliers, high supplementing yield wafers will increase the quantity of wafers reclaimed and increase the percentage of reclaim wafers used for production.

We periodically reviewed defective items with suppliers, and asked suppliers improve their process conditions and modify specifications. In 2020, suppliers adjusted process methods so the discard condition that etching numbers of wafers were incorrectly read after step rings were polished was improved. This increased the average supplementing yield from 80% to 87%, and recycling rate increased from 77% in 2019 to 79% in 2021 and further to 82% in 2022 due to the stability of supplementing yield.

Supplementing yield and utilization of reclaim wafers in 2019-2022



Product testing and reclamation of delivery packaging materials

Packaging materials for product shipments to outsourced testing facilities or packaging facilities, such as cartons, outer cartons, cushioning materials, and wafer cassettes, were all reclaimed as many as possible to be reused within the company. Moreover, wafer cassettes used by raw material for wafer were also recycled and reused in product shipments, and the reuse rate of these cassettes were nearly 100%. The aforementioned practices reduced the consumption of product packaging materials and waste output to minimum levels. This approach could reduce the consumption of approximate 15,000 pieces of brand-new 12-inch wafer cassettes every year, equivalent to reducing the consumption of 69 tons of plastics.

Reduction in product packaging materials

In response to the action of recycling and reductions, the company's own warehouses of finished products started with recyclable packaging materials. Reusable packaging materials used in supplementing finished products were recycled to be used in product exchanges for customer complaints, product storage, and commissioned work to reduce the times of application and purchase, further achieving the action of recycling for reuse and reductions of packaging materials. In addition, the cost of packaging materials used could be reduced. Although the saved amount was small, it made a difference to overall environmental maintenance and resource recycling. The performance is as follows:



Recycling Outside Plant

Nanya Technology Corporation outsources the disposal of 100% of the waste it generates. The waste is processed into industrial raw materials, construction materials, or other raw materials, including usage as fuel for incinerators. The percentage of waste that was recycled in 2022 reached 92.1%, in which 97.4% of hazardous waste was recycled.

List of waste generated by Nanya that is recycled externally

After collecting low concentration waste isopropanol liquid in the factory, it is processed by the concentration system into high concentration waste isopropanol liquid, which is recycled and reused to make industrial grade isopropanol.

After collecting waste photoresist in the factory, it is recycled and reused to make industrial grade PGMEA and EBR.

After collecting waste sulfuric acid in the factory, it is recycled and reused to make industrial grade sulfuric acid.

After collecting waste phosphoric acid, the recycling company increases its purity to make industrial grade phosphoric acid.

After collecting waste ammonium sulfate, the recycling company uses it to make industrial grade ammonium sulfate.

After collecting waste ammonium fluoride/hydrofluoric acid, the recycling company uses it to make sodium hexafluoroaluminate.

After collecting waste hydrofluoric acid, it goes through the chemical treatment system to generate calcium fluoride inorganic sludge, which can be recycled to make the raw material for industrial flux or cement.

After collecting waste liquid containing copper, it goes through electrolysis in treatment equipment to generate foil, which is recycled and reused to make copper wires.

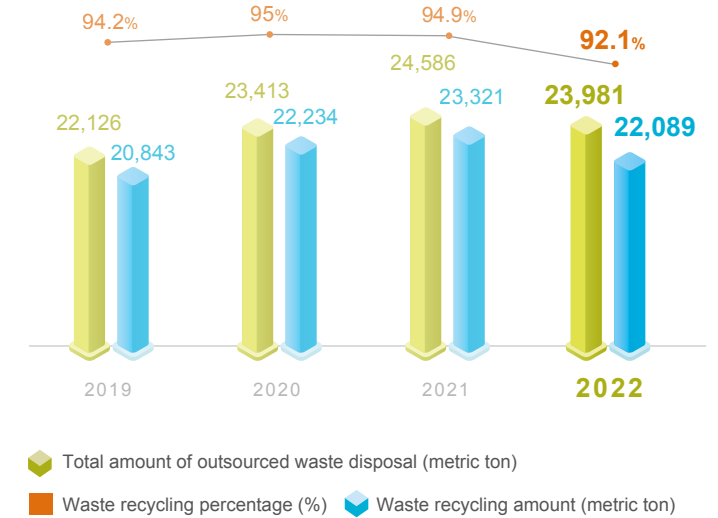
After collecting organic wastewater, it goes through the biological treatment system and generates organic sludge, which can be made into raw materials for ready mix concrete and construction materials after thermal treatment.

After collecting waste SOD, the recycling company uses it to make lacquer thinner.

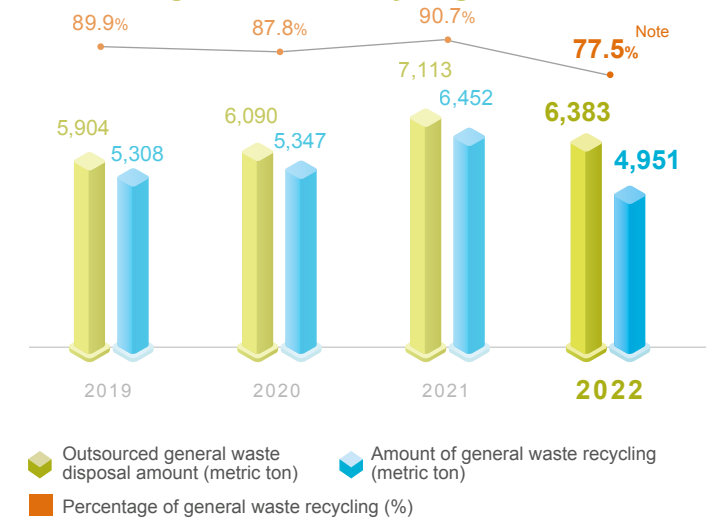
The inorganic sludge consisting of river sand generated from filtering water is provided to brick factories to make bricks for construction.

Summary of outsourced recycling and reuse of waste generated by Nanya

Total amount of outsourced waste disposal

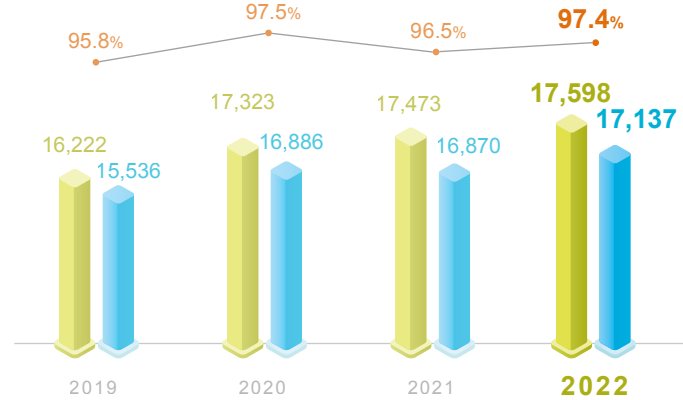


Amount of general waste recycling



Note : The reason for the decrease in general waste recycling percentage was due to heat recovery from organic sludge, which was listed as recyclable waste in 2021, but it was incinerated and not recycled in 2022.

Hazardous waste recycling amount



Outsourced hazardous waste disposal amount (metric ton)
 Hazardous waste recycling amount (metric ton)
 Hazardous waste recycling percentage (%)

Note: The reason for the decrease in general waste recycling percentage was due to heat recovery from organic sludge, which was listed as recyclable waste in 2021, but it was incinerated and not recycled in 2022.



Nanya circular economy –
Video of treatment and reuse of waste liquid containing copper

Ecological Protection

Nanya Technology Corporation's production location is in Taishan Nanlin Science Park, which is on a low-altitude hill. Most trees in the area were artificially planted for landscaping, and the forests in surrounding areas are mainly secondary. There are no habitats being protected or rehabilitated where the factory is located and in surrounding areas. Even so, the Company still attaches great importance to ecological resources in surrounding areas, and conducts thorough investigation and impact assessments of the surrounding ecological environment in the development and operations of its factory. We also proposed mitigation and avoidance strategies, in order to avoid and reduce the potential impact of development and operations on biodiversity.

Biodiversity management organization and policy

Nanya Technology Corporation pays attention to and shoulders the responsibility of biodiversity. We formulated a biodiversity policy and reported it to the Sustainable Development Committee and Board of Directors (Chapter 2 Sustainable Governance and Organization of this report). The biodiversity policy is as follows:

To not carry out operating activities in important biodiversity locations or its nearby areas in Taiwan and overseas

If operating activities are near biodiversity areas, we implement mitigation measures (avoid, minimize, restore, and offset)

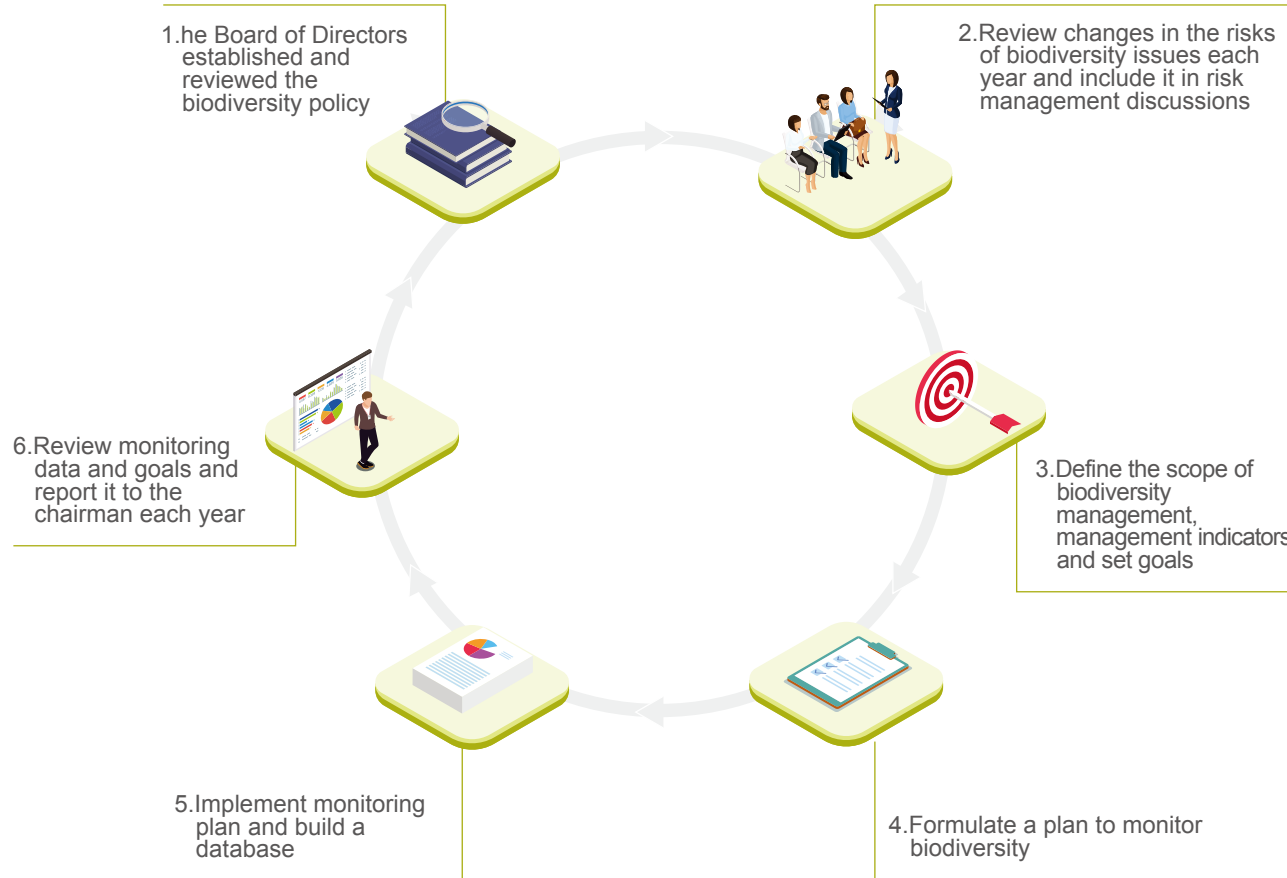
Work together with external partners in implementing the biodiversity policy

Conduct ecological surveys of the surrounding areas of operating activities



Biodiversity Management Cycle

Biodiversity management cycle

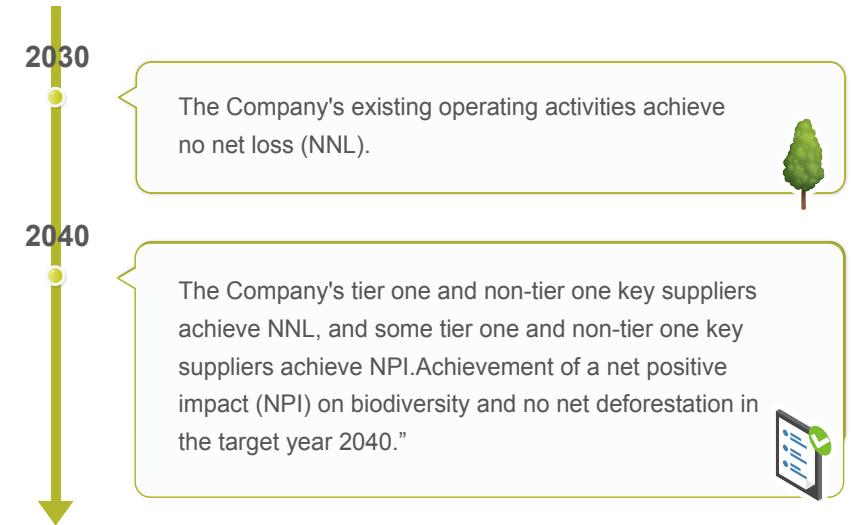


Biodiversity risk assessment (impact of stakeholders on operations, impact on sustainable development, and survey of risks of concern)

When determining the materiality of Nanya Technology Corporation's biodiversity issues to sustainability, results indicated that stakeholders do not have any risks that impact the Company's operations and sustainable development with respect to biodiversity and are not effectively monitored. Still, Nanya Technology Corporation began commissioning an ecological monitoring company a decade ago to conduct an ecological survey on production sites and nearby areas affected by operating activities, in order to show our concern and sense of responsibility towards biodiversity management.

Biodiversity Goals

Nanya Technology Corporation set biodiversity goals for the Company in 2030, and 2040, in hopes of having a greater positive impact on biodiversity in the overall supply chain.



When selecting quantified indicators for judgments in biodiversity management, we selected and use two indicators for monitoring and managing biodiversity, specifically Shannon's diversity index or Shannon-Wiener Index and Pielou's evenness index, in which the average diversity index of the past 3 observations during the same period in previous years multiplied by 0.9 is used as the biodiversity goal for the following year, and used to determine if NNL or NPI was achieved. Meanwhile, an evenness index of 0.8 is used to determine if biological distribution meets evenness goals, and further determine mitigation measures for the ecological impact of the Company's operating activity cycle in the following year.

NNL: The diversity index uses the average of the past 3 observations during the same period in previous years as the biodiversity goal. If the observed value is not lower than the goal, then it is deemed to achieve NNL.

NPI: The diversity index uses the average of the past 3 observations during the same period in previous years as the biodiversity goal. If the observed value is higher than the goal, then it is deemed to achieve NPI.

Nanya Technology Corporation fully understands that its operating activities may impact biodiversity, and thus spent nearly NT\$10 million each year on environmental and ecological monitoring services between 2013 and 2022 according to the biodiversity management cycle that we established. We commissioned a professional ecology company to conduct air quality (including noise and vibration), wastewater monitoring (including effluents and river water), groundwater sampling, traffic, and an ecological survey (not only includes production bases, but also extends 500 m outward) during our operations. Surveys are conducted on a quarterly basis during normal operations, and changed to monthly surveys during construction periods. Categories of the ecological survey include plants on land, mammals, birds, reptiles, amphibians, and butterflies.



■ Nanya Technology Corporation's production bases and extended areas nearby

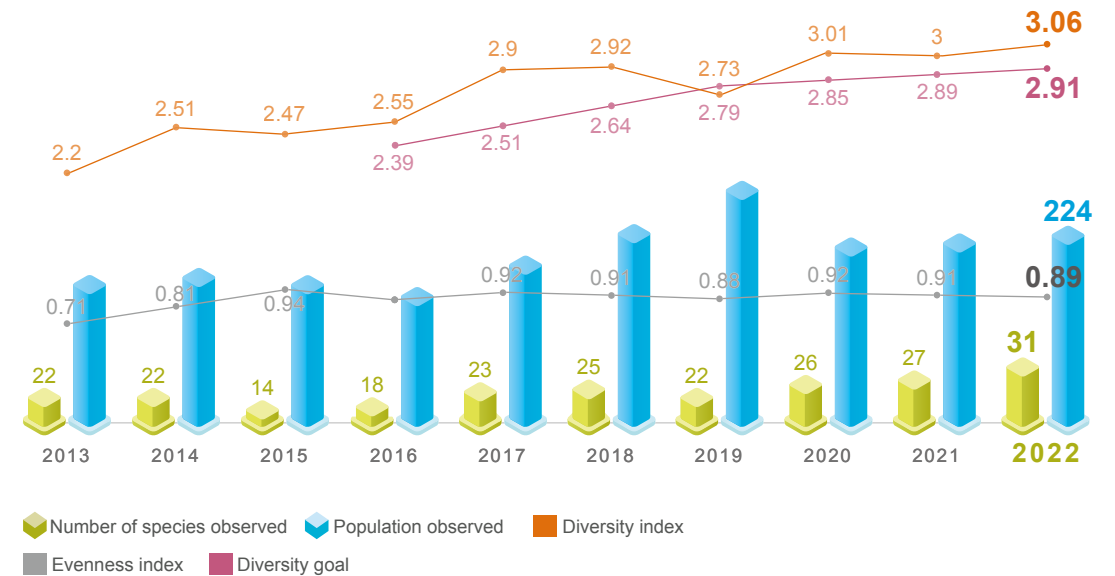
We use the bird observation trends in ecological survey data as an example (observations every July in 2013-2022 were used to draw the chart of observation values)

In the project site, a total of 224 birds of 31 species were observed in July 2022 (2 protected species were observed, including 1 *Spilornis Cheela*, a category 2 protected species, and 8 *Urocissa caerulea*, a category 3 protected species; protected species accounted for 7%), the diversity index was 3.06 and evenness index was 0.89, which were higher than the goals for diversity index to reach 2.91 and evenness index to be greater than 0.8; we also set the target diversity index for July 2023 at 3.02.

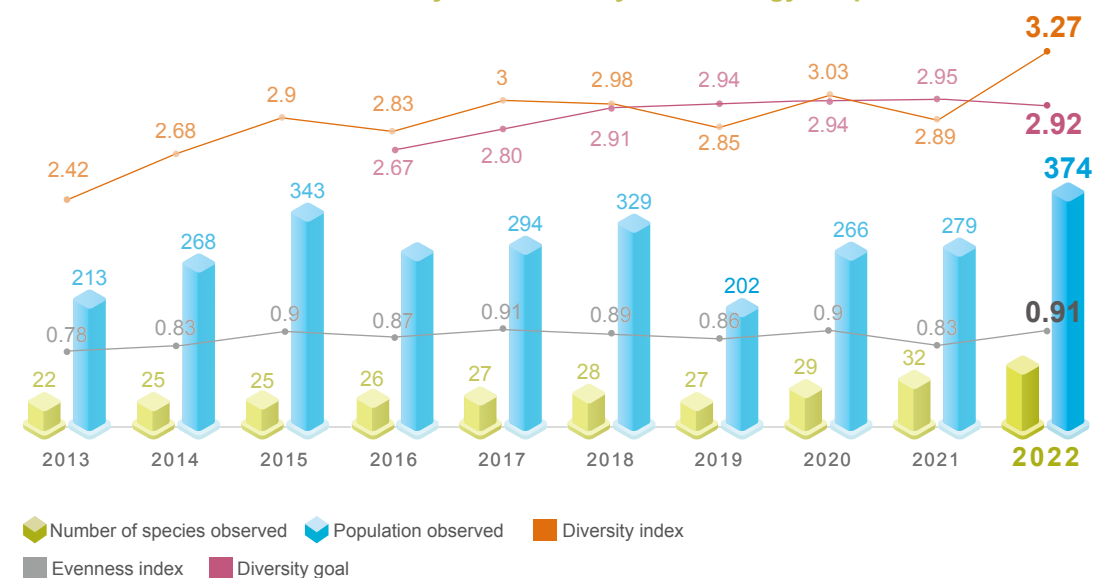
In nearby areas, a total of 374 birds of 37 species were observed (in which 2 protected species were observed, including 4 *Spilornis Cheela*, a category 2 protected species, 1 *Accipiter trivirgatus*, a category 2 protected species, and 8 *Urocissa caerulea*, a category 3 protected species; protected species accounted for 8%), the diversity index was 3.27 and evenness index was 0.91, which were higher than the goals for diversity index to reach 2.92 and evenness index to be greater than 0.8; we also set the target diversity index for July 2023 at 3.06.

We believe that the bird ecology observed in July 2022 due to operating activities of Nanya Technology Corporation meet NNL and NPI. This example describes how Nanya Technology Corporation uses biodiversity management cycle, ecological observation data analysis, and recommendations from a professional ecology company for rolling biodiversity management.

Bird observation trends at the project site of Nanya Technology Corporation



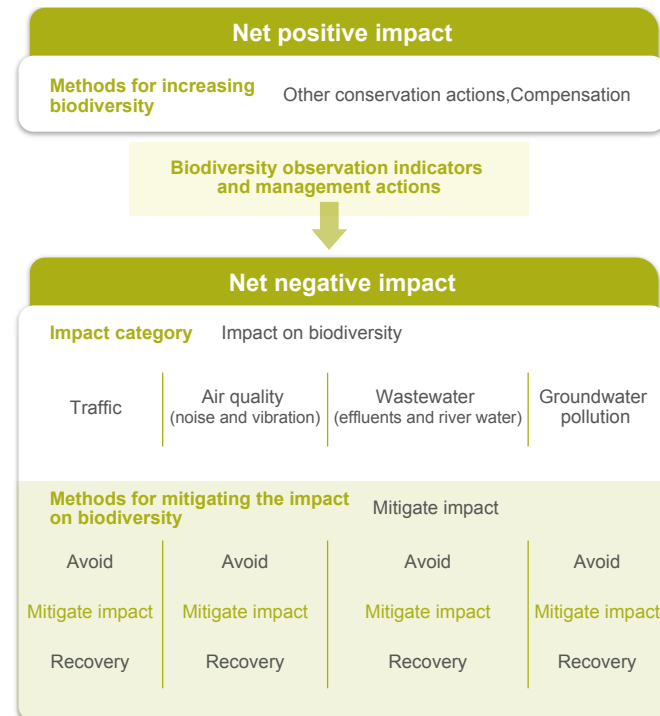
Bird observation trends in nearby areas of Nanya Technology Corporation



Measures to mitigate impact on biodiversity

Nanya Technology Corporation applies the biodiversity impact management framework to manage and mitigate its impact on biodiversity and ecosystems. The mitigation hierarchy includes avoid, minimize, restore, and offset. “Avoid” and “minimize” are the Company’s most important measures. For example, the Company has analyzed the impact of the new factory development plan on surrounding plant ecology, habitats, and water environment, and taken measures to avoid and mitigate impact. If operations or development will still damage the ecosystem after taking measures to avoid and mitigate impact, the Company will take “restore” measures in the damaged areas, and will take “compensate” measures (e.g. forestation, setting up an environmental trust fund and transferring it to the government or non-profit organizations to improve or restore the environment) if restore measures still cannot reduce losses, in order to compensate for the impact on biodiversity.

Biodiversity impact management framework



Based on the biodiversity impact management framework, Nanya Technology Corporation formulated measures to avoid and mitigate impact on plant ecology, animal ecology, and aquatic ecology in the site of the production plan and nearby areas during the construction and operation periods. We increased the ecological monitoring frequency to once a month, in order to intervene in a timely manner when an impact occurs.

Plant ecology



Construction period impacts

- Plants in some construction areas were removed and result in a decrease in population.
- The construction causes dust to cover the surface of leaves, and may result in poor plant growth.

Operation period impacts

- Traffic flow causes dust to cover the surface of leaves, and may result in poor plant growth.

Avoid

- Plan the route of transportation vehicles in advance, and ensure that the vehicles transport gravel and heavy machinery according to the route to limit the area affected by dust.
- Vehicles used to transport gravel must be covered by canvas or dust cloth.

Mitigate impact

- Plant native or endemic plants in the form of a multiple layered forest.
- When transportation vehicles enter and exit the construction site, they must first go through a washing station to reduce dust.
- Cover gravel with canvas or dust cloth during temporary storage, so as to prevent dust and the growth of invasive plants.
- Water plants on both sides of the planned route to reduce the impact of dust on plant growth.

Animal ecology



Construction period impacts

- Disturbance from noise and vibrations, nighttime lighting, construction vehicles, personnel activities, and waste impact the original habitat and land animals active in the construction area.

Operation period impacts

- There was no significant impact on surrounding animals during the operation period.

Avoid

- Domestic waste generated by construction workers must be collected in a covered storage facility or properly wrapped and disposed of, in order to prevent it from being eaten by wild animals, or causing secondary damages due to spilling in the transportation process.
- Avoid using vehicles in poor condition that generate high noise.
- The use of chemical agents is prohibited and manual grass cutting and rat traps are used for environmental protection, in order to poisoning and killing wild animals.

Mitigate impact

- Low landscape fixtures are used to limit the range of lighting for trails, automatic sensors are installed and a timer is set to turn of the lights at night, reducing the disturbance caused by light to nocturnal animals.

Aquatic ecology



Construction period impacts

- If wastewater with relatively high sand content or domestic wastewater generated by construction personnel is directly discharged into nearby water bodies, it will contaminate the water.

Operation period impacts

- If wastewater and waste is directly discharged or disposed near water bodies, it will impact the water ecology of surrounding areas.

Avoid

- Construction waste water is prohibited from being discharged into rivers, and waste is prohibited from being placed on river banks.
- Muddy water generated from construction at construction sites and soil resource sites must be prevented from flowing into surrounding low-lying areas and further affecting the water ecology in the areas.
- Set up pipelines for centralized discharge of rain water collected from roads during the operation area.
- Wastewater discharge must comply with regulations of the Environmental Protection Administration.

Mitigate impact

- Periodically monitor the water quality and ecology of surrounding water environments during the construction period, in order to lower the impact of local water quality on water ecology to nocturnal animals.

Cooperation with External Partners

It is necessary to work together with external partners to have a positive impact on biodiversity. Hence, the Company is actively working with ecological monitoring companies and NGOs to better understand the impact of NTC's operations on biodiversity, and formulate more effective methods to manage biodiversity.

Cooperation with ecological monitoring company



Nanya Technology Corporation began working with a professional ecology company in 2008, and it helps the Company conduct surveys on ecological resources, such as animal and plant ecology in water and on land. Ecological monitoring is conducted on a monthly basis during the factory development period, and conducted on a quarterly basis during the operation period; the ecological company recommends response measures for abnormal situations. The Company conducts comprehensive reviews and formulates improvement measures based on recommendations from the ecology company, in order to lower the impact on biodiversity.

Cooperation with NGOs



Nanya and CommonWealth Magazine jointly supported the Tamsui River Convention in 2020, and also worked with the NGO – The Society of Wilderness in co-organizing ecological environment conservation activities, such as removing Mikania micrantha from Wugu Wetland, organizing parent-child camps (understanding the rich ecology in areas surrounding the factory), and admiring swallow and understanding the biodiversity of Wugu Wetland. The activities allow participants to understand the relationship between the Company and biodiversity in surrounding areas, and improve employees' understanding and awareness of the ecological environment.

5-3



Environmental Pollution Prevention

Based on the environmental protection and commitments of environmental impact assessment, the company regularly monitors environmental impact factors, such as air quality, noise and vibration, the quality of surface water and groundwater, traffic flow, and the ecosystem within the scope of development to truly appreciate its impacts on the environment. There has been no violation of environmental regulations since 2014. In addition, Nanya (Nanya) has checked with the competent authorities that Nanya's developing areas are not at an environmentally sensitive location or a location with specific purposes. In the Environment, Safety and Hygiene Policy, Nanya has made every effort to promote various measures to reduce waste and recycle resources to comply with relevant requirements of regulations as well as to respond to the commitments to environmental protection-related requirements signed by the company. Moreover, Nanya annually evaluates waste that can be reduced and recycled, and the types and amount of recovered waste water, drafts annual plans and goals, and includes the plans into the annual budget and work plan.

Air Pollution Control

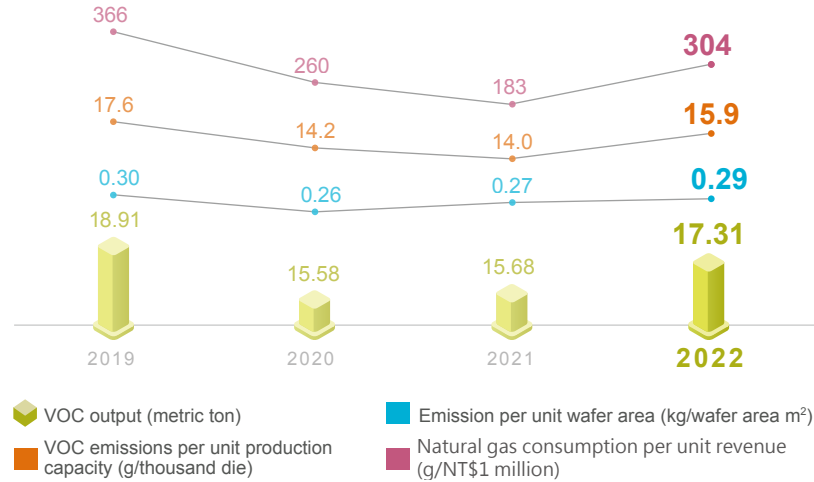
Since the plant was set up, we have put great emphasis on pollution control. Not only have we effectively reduced material consumption and lowered the concentration of waste gas emission, but also have used air pollution control equipment in compliance with statutory standards, including local scrubber, acid/alkaline scrubbers, the VOC zeolite rotor concentration equipment, and post-combustion machinery. Testing proved that the pollutant emission standards set forth in environmental protection regulations of the government were all met (lower than) over the years. Furthermore, the Company does not have any ODS emissions. To continue to maintain the best performance of treatment equipment, every equipment is maintained and inspected periodically. The operators receive complete training and education are to maintain the system in good operation and ensure that the waste gases emitted do not endanger the environment.

Nanya Technology Corporation's main air pollutants include acid and alkaline waste gas and organic waste gas, and raw materials do not use trichloroethylene, so there are no HAPs emissions. Waste gases are channeled to suitable treatment processes and equipment based on their characteristics. Waste gases are channeled into local scrubbers after being generated on the process end. After removing specific substances, acidic or alkaline waste gases are concentrated in acid/alkaline scrubbers and released into the atmosphere after treatment. Organic waste gas is absorbed and concentrated by the zeolite rotor, and then imported into the post-combustion equipment to be directly broken down. The combustion efficiency rate reaches 99%, which substantially exceeds statutory standards. Moreover, the reduction rate of overall volatile organic gas emissions is kept above 90%, meeting the statutory requirements. Organic air pollutants released per unit product (emission intensity) was 0.29 kg VOCs/m² in 2022.

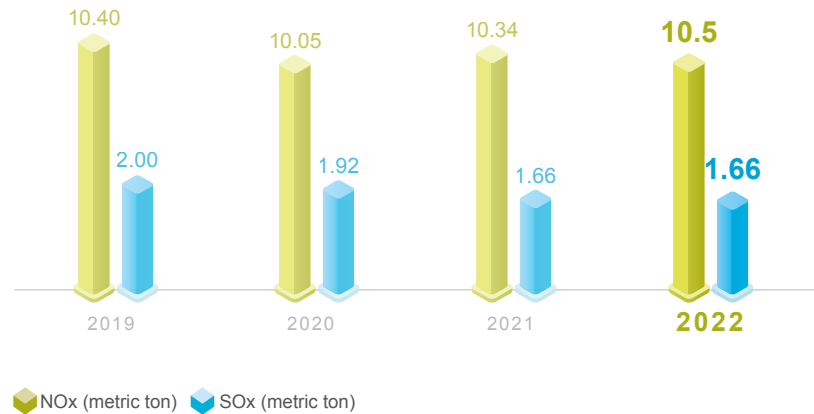
Flowchart of waste gas treatment



VOC emission trends in 2022



Other air pollutant emission trends in 2019-2022



Water Pollution Control

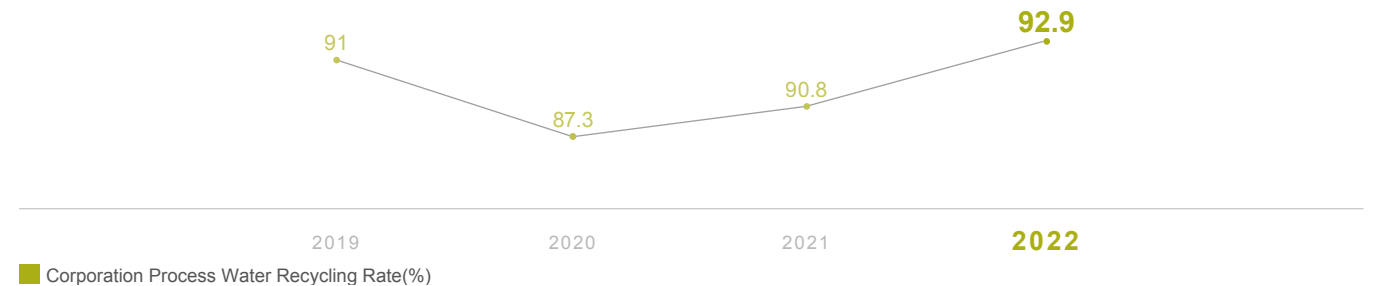
All wastewater generated by Nanya is collected according to property classification and channeled into proper wastewater equipment for treatment. To ensure that the quality of discharged wastewater is in line with regulations, we and the Environmental Protection Department have monitored the quality of effluents via synchronous connections. In addition, off-line sampling, analysis, and detection are outsourced every

quarter to improve the wastewater quality management and control. After water quality meets discharge standards, 100% of wastewater is discharged into Dake River after treatment and meets standards for Category D water bodies, which may be used for irrigation, Class 2 industrial water, and environmental conservation. The water eventually flows into Tamsui River and into the ocean. To avoid environmental pollution and ecological impacts owing to abnormal quality of wastewater, we have spared no effort to prevent and control water pollution, gradually upgrading and investing in wastewater treatment facilities. The in-plant wastewater treatment is carried out in over 20 different pipelines. The wastewater is mainly classified into organic wastewater, general acidic and alkaline wastewater, hydrofluoric wastewater, and high-concentration liquid waste that is outsourced for treatment. In relation to wastewater treatment, wastewater is classified and treated according to different properties. Other than following statutory standards, we also reuse recyclable wastewater that is treated by the recovery system to reduce the discharge amount of wastewater. The plant area is reconstructed on the open space of existing plant so no massive excavation of the peripheral vegetation of the designated land has been made. Wastewater is properly treated before being discharged into the Dake River. Discharged water bodies and relevant habitat are not designated as national or international conservation areas. Investigation shows that the wastewater discharging areas do not involve in affecting the habitat of protected animals or destroying the habitat.

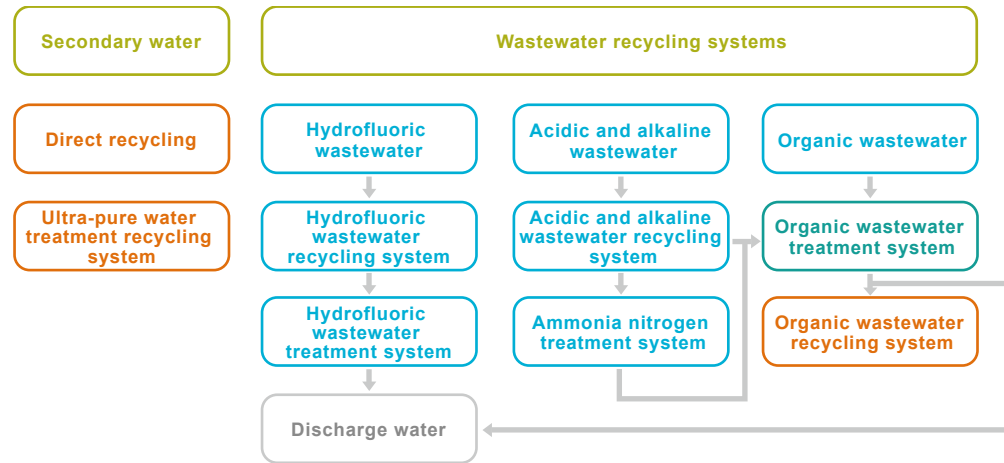
Total waste water discharge volume was 2,695 thousand m³ in 2022, down 0.86% compared to 2021; wastewater discharge volume per unit capacity increased 2.3%, revenue decreased 33.5% compared to 2021, while wastewater discharge volume per unit revenue increased 49%. In coordination with the expansion of FAB-3A-N by Nanya Technology Corporation in 2016, additional wastewater systems and recycling systems were installed. These systems were classified into the following types: acidic and alkaline, organic, and hydrofluoric acid (HF) wastewater systems. The original acidic and alkaline wastewater system was equipped with a reclamation system. In 2017, a reclamation system with reverse osmosis (RO) was added, which could increase 0.288 thousand m³ of reclaimed water per day. With the expansion of the new plant, the installation of additional organic wastewater reclamation system was completed in 2017, which could increase 1.5 thousand m³ of reclaimed water per day. In 2018, the installation of hydrofluoric wastewater reclamation system was completed, which could increase 0.5 thousand m³ of reclaimed hydrofluoric wastewater. Because of the increase in the reclamation volume of wastewater, the annual average process water recycling rate reached 92.9% Note1 in 2022. To coordinate with the expansion of a new factory, we have invested NT\$430 million in building new hydrofluoric wastewater COD and total nitrogen treatment systems. This not only will solve the problem of excessively high hydrofluoric wastewater COD and total nitrogen, but also will recover wastewater at the same time. It is estimated that additional 1 thousand m³ of wastewater will be recovered per day. The systems will be completed and begin operating in March 2023. In response to the decrease in sludge treatment plants and the ever stricter acceptable criteria, starting in 2017, additional isopropanol-concentration system had been built to reduce the load of wastewater COD. In addition, organic sludge dewatering equipment was added, which was completed in 2018, and the moisture content of sludge can be reduced from 84% to below 60%

Note: Nanya's process water recycling rate is calculated using the formula specified by Hsinchu Science Park Bureau, the same as peers in the industry.

Nanya Technology Corporation Process Water Recycling Rate in 2019-2022



Waste water recycling process by Nanya



Types and volume of wastewater discharged by Nanya

Total water discharge (thousand m³1)

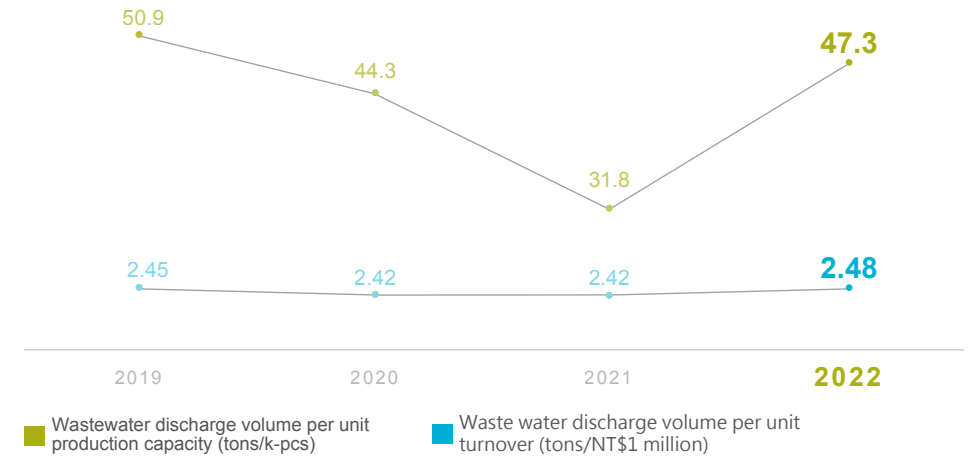
	2019	2020	2021	2022
Divided based on destination¹				
Fresh surface water	2,634	2,705	2,718	2,695
Groundwater, seawater, third party water ² , third party water supplied to other organizations ³	0	0	0	0
Total water discharge				
Freshwater (Total dissolved solids ≤ 1,000 mg/L)	2,634	2,705	2,718	2,695
Other water (Total dissolved solids > 1,000 mg/L)	0	0	0	0
Divided based on wastewater treatment level				
Not treated	0	0	0	0
Treated inside factory to comply with effluent standards of the Environmental Protection Administration	2,634	2,705	2,718	2,695

Note 1: 1 thousand m³ = 1,000 tons

Note 2: The destination of wastewater discharged by Nanya is Dake River (surface water), which is not located in an area with water stress.

Note 3: City government water supplier and sewage treatment plant, public and private utilities companies, and other organizations that participate in the provision, transportation, treatment, disposal, or use of water and sewage

Run chart of 2019-2022 waste water discharge



Testing results of discharged wastewater quality in 2022

	Minimum	Mean	Maximum	Compliant or non-compliant with standards
pH Statutory standards: 6-9	7	7.3	7.5	Compliant
Chemical oxygen demand (COD) Statutory standards:<100 (mg/L)	40.5	49.3	59.5	Compliant
Suspended solids(SS) Statutory standards:<30 (mg/L)	3.2	5.3	6.6	Compliant
Fluoride ion Statutory standards:<15 (mg/L)	8.63	10.6	13	Compliant
Ammonia nitrogen Statutory standards:<30 (mg/L)	1.75	7.3	9.35	Compliant

Waste Management

Waste Generate Structure

Nanya Technology Corporation generated a total of 23,981 metric tons of waste in 2022, and recycled and reused 22,089 metric tons of waste (including waste that was incinerated and used as energy or disposed of using other methods), accounting for 92.1% of total waste generated. Recycling and reuse of waste was 100% outsourced (none of the waste was recycled and reused in our own factory). In 2022, 5,799 metric tons of waste generated by Nanya Technology Corporation was directly

disposed, in which 3,907 metric tons was incinerated and used as energy, accounting for 16.3% of total waste generated; 1,052 metric tons of waste was directly incinerated, accounting for 4.4% of total waste generated; none of the waste was directly buried, but 105 metric tons of waste was solidified and then buried, accounting for 0.4% of total waste generated; 736 metric tons of waste was disposed of using other methods (including physical treatment and recycling, purification and reuse), accounting for 3.1% of total waste generated.

Nanya Technology Corporation's waste generated per unit wafer area was 22.02 kg/kpcs 4Gb eq in 2022, up 0.6% compared to 2021; outsourced hazardous waste disposal amount was 17,598 metric tons, and hazardous waste generated per unit capacity was 16.16 kg/kpcs 4Gb eq, up 3.6% compared to 2021. The treatment of 100% of our main hazardous industrial wastes (acidic waste liquids containing sulfuric acid, phosphoric acid, and hydrofluoric acid) was outsourced and reused used as industrial materials. The recycling rate of hazardous industrial waste reached 97.4% or 17,137 metric tons. The Company will continue to take measures to reduce waste and increase recycling in order to reach the sustainable development goal of effective recycling of wastes.

Furthermore, electronic waste generated by the Company is mainly discarded wafers and defective products. The total weight was 4.34 metric tons and all of the electronic waste was handled by an external contractor, achieving 100% recycling.

Waste Generated in 2022

Unit: Metric Ton

	Generated	Diverted from Disposal	Directed to Disposal
Hazardous waste			
Acidic waste liquid	15,206	14,582	624
Waste solvent	2,353	0	2,353
Container	10	1	9
Electronic waste	4	0	4
Other	24	0	24
Subtotal	17,598	14,583	3,015
General waste (Non-hazardous waste)			
Sludge	5,422	3,507	1,916
Packaging materials	309	0	309
Consumer waste generated by employees	384	0	384
Waste mixed metals	20	1	20
Waste mixed plastics	50	0	50
Other	198	91	107
Subtotal	6,383	3,599	2,785
Total	23,981	18,182	5,799

Note: In coordination with the update to the GRI content index, we compiled more detailed statistics and recategorized waste, which resulted in different recycling percentages compared with previous years, but the total tons of waste was not changed.

Note: There is a slight difference between the total output and the sum of the output of each detail, which is caused by rounding.

Waste Diverted from Disposal in 2022

Unit: Metric Ton

	Onsite	Offsite	Total
Hazardous waste			
Preparation for reuse	0	0	0
Recycling ¹	0	14,582	14,582
Other Recovery Operations	0	1	1
Subtotal	0	14,583	14,583
General waste (Non-hazardous waste)			
Preparation for reuse	0	1	1
Recycling ¹	0	3,598	3,598
Other Recovery Operations	0	0	0
Subtotal	0	3,599	3,599
Subtotal	0	18,182	18,182

Waste Directed to Disposal in 2022

Unit: Metric Ton

	Onsite	Offsite	Total
Hazardous waste			
Incineration (with energy recovery)	0	2,554	2,554
Incineration (without energy recovery)	0	9	9
Landfilling	0	24	24
Other disposal operations ¹	0	428	428
Subtotal	0	3,015	3,015
General waste (Non-hazardous waste)			
Incineration (with energy recovery)	0	1,353	1,353
Incineration (without energy recovery)	0	1,043	1,043
Landfilling	0	81	81
Other disposal operations ²	0	308	308
Subtotal	0	2,785	2,785
Total	0	5,799	5,799

Note 1: Other disposal methods for hazardous waste include physical treatment and chemical treatment.

Note 2: Other disposal methods for general waste refers to physical treatment (broken down and sorted).

Note: There is a slight difference between the total output and the sum of the output of each detail, which is caused by rounding.

The general industrial wastes and the hazardous industrial wastes of the Nanya are all managed by the Output Department in terms of storage, clearance, detections, and reduction promotions. In addition, the company periodically audits waste contractors to see whether the contractors follow the regulations of waste disposal to handle the waste clearance, in order to confirm the legality of the contractors, ensure that all wastes are well-processed or recycled, and prevent impacts on the environment again. Nanya Technology Corporation did not ship any hazardous waste to other countries in 2014-2022, and output of all hazardous industrial waste was outsourced to certified domestic waste disposal contractors; a total 48 certified domestic waste disposal contractors was commissioned in 2022.

Upstream



Impact sources

- Used large numbers of 53-gallon drums of chemicals.
- Used large numbers of small gas cylinders, resulting in more residual gases.

Mitigation measures

- Replaced 53-gallon drums with tank trucks to store and transport chemicals or recycled empty drums.
- Replaced small gas cylinders with large cylinders to reduce residual gases and numbers of cylinders.

Nanya



Impact sources

- Sources of raw materials and related materials contained hazardous substances.
- Used large numbers of acidic and alkaline chemicals.
- Used monitor wafers in large quantities.

Mitigation measures

- Through the establishment of Hazardous Substance Free (HSF) management system of materials, we ensured that the produced wafers, rear-end IC packaging, and DIMM module products would conform to the international regulations and related specifications of clients towards HSF management.
 - Completed 24 raw material consumption improvement proposals.
 - Recycled wastes in the plant, for example, copper sulfate waste liquid was directly converted to copper cakes for recycling.
 - Acidic wastes were outsourced for recycling, such as sulfuric acid and phosphoric acid.
 - Dummy wafers were recycled for 8-11 times.

Downstream



Impact sources

- Products required many packaging materials.
- Products contained hazardous substances.

Mitigation measures

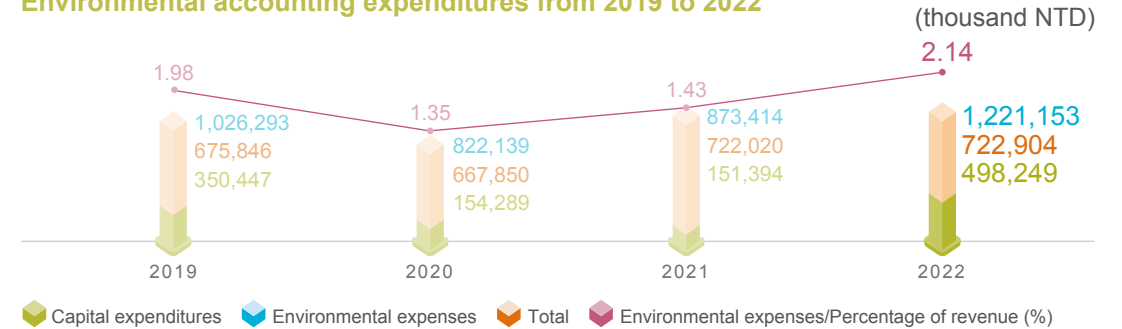
- Clients were encouraged to recycle packaging materials for Nanya to reuse.
- Waste electronic equipment had to conform to the EU's environmental protection directives, including WEEE, RoHS, and EuP.

Environmental Costs and Benefits

Nanya introduced the environmental accounting system in 2008 and the environment benefit accounting system in 2009, which was officially implemented in 2010. The introduction of the environmental accounting system made it possible to access information on the environmental expenditures, assess the benefits of the expenses, and provide the stakeholders with concrete and accurate environmental protection acts. Statistics are compiled for each category of environmental protection expenditures according to the rules established by the Environmental Protection

Administration, and are used for internal management, so that the public will understand the environmental protection efforts of enterprises. According to the consolidated statistics, the environment capital expenditure in 2022 was NT\$498,249 thousand, and the environmental expense was approximately NT\$722,904 thousand, totaling NT\$1,221,153 thousand. Environmental expenditures accounted for 2.04% of our 2022 consolidated revenue of NT\$56.952 billion.

Environmental accounting expenditures from 2019 to 2022



Environmental accounting expenditures in 2022 (thousand NTD)

Recurrent expenditures	Capital expenditures
Operating costs	
Pollution prevention expenses: air pollution, water pollution, and other pollution prevention costs	
564,617	498,249
Global environmental protection expenses: (1) Climate change prevention expenses (2) Other expenses related to global environmental protection	
27,842	0
Resource and energy conservation and recycling expenses: (1) increase the efficiency of resource use (2) costs of waste reduction, recycling, and reprocessing (3) Energy expenses saved	
111,683	0
Related costs from upstream and downstream of suppliers and customers (1) Green procurement (2) Expenses of providing products for environmental protection	
102	0
Management costs (1) Personnel environmental education and training costs (2) Expenses incurred in obtaining external verification (3) Expenses incurred in measuring environmental impacts (4) Other	
15,174	0
R&D costs expenses incurred in researching and developing products because of environmental protection	
0	0
Social activity costs expenses incurred in improving the environment such as nature protection, afforestation, and landscaping the environment	
788	0
Environmental taxation and fees (1) Expenses incurred by air pollution (2) Pollution prevention review fee and certificate fee	
2,698	0
Total	498,249
Total	1,221,153

Performance of promoting the ISO 14001 management solutions over the years

NT\$: thousand NTD

	2019	2020	2021	2022
Energy (electricity) conservation plan	64,934	52,397	18,166	11,680
Waste reduction program	3,360	234	3,759	0
Program of reducing consumption of process raw materials	5,221	6,865	4,973	8,233
Substantive benefits of industrial waste recycling	10,386	9,564	5,118	13,195
Electricity fees saved owing to low power consumption and advanced processes	697,553	888,574	969,353	1,081,896
Total benefits	781,454	957,634	1,001,369	1,117,026
Records of violating environmental protection regulations	0	0	0	0
Amount of fines for violation of environmental laws and regulations	0	0	0	0
Fines for violation of environmental laws and regulations not yet paid	0	0	0	0

Internal management system audit records in the last four years

ISO 14001 (2019~2022)

9 cases	Improvement was completed for 9 items, including environmental considerations form not updated, incorrect form version cited, and incomplete spot inspection records.	Case closing rate	100 %
7 cases	Improvement was completed for 7 items, including the environmental considerations form not updated or incorrect form version cited, management deficiencies at the waste storage site, management plan not periodically tracked, and follow up was not completed for new announced regulations.	Case closing rate	100 %
2 cases	Improvement was completed for 2 items, including management deficiencies at the waste storage site and management plan not periodically tracked.	Case closing rate	100 %
9 cases	Improvement was completed for 9 items, including labels in waste storage site not updated, inspection of environmental considerations incorrectly filled in, and significance evaluation incomplete or not updated.	Case closing rate	100 %

ISO 45001 (2019~2022)

13 cases	A total of 7 defects in integrity of filling in hazard identification forms, accounting for the majority of the defects, followed by 3 defects in failing to send staff to participate in consultations of workers; improvements were all completed.	Case closing rate	100 %
15 cases	A total of 7 defects in failing to comply with criteria for operations and site management, and problems in appropriateness of automated checklist content, accounting for the majority of the defects, followed by 4 defects in management of equipment cabinets for emergency response; improvements were all completed	Case closing rate	100 %
6 cases	Improvements were completed for incomplete hazard identification forms and regulation identification forms, as well as abnormal maintenance of environmental detectors.	Case closing rate	100 %
29 cases	Improvements were completed for hazards identification form incomplete, insufficient training, documents not updated, risk control measures inadequate, deficiencies in drills not included in amendments to regulations, and insufficient follow-up on abnormal events.	Case closing rate	100 %