

NANYA

TCFD

NANYA 2021 TCFD

Task Force on Climate-related
Financial Disclosures

Table of Contents

<u>About this Report</u>	<u>3</u>	<u>Chapter 4 Climate Risk Scenario Analysis and Countermeasures</u>	<u>19</u>
<u>President's Message</u>	<u>3</u>	4.1 Scenario Analysis of Climate Risks for Nanya Operations	19
<u>Chapter 1 Climate Governance Framework and Functions</u>	<u>5</u>	4.2 Scenario Analysis for Supply Chain Climate Risks	25
1.1 Board Participation and Supervision	5	4.3 Scenario Analysis for Customer and Operational Downstream Climate Risks	27
1.2 Management Responsibility	6	<u>Chapter 5 Cultivation and Communication of Climate Change Awareness</u>	<u>28</u>
<u>Chapter 2 Climate Strategy</u>	<u>7</u>	5.1 Continued Development for Board of Directors and Management	28
2.1 Development of Low-carbon Products	8	5.2 Cultivation and Communication of Employee Awareness	28
2.2 Strategy for Green Technology and Production	9	5.3 Cultivation and Communication of Supplier Awareness	29
2.3 Adaptation to Climate Change Risks	11	5.4 Cultivation and Enhancement of Social Awareness	29
2.4 Partners in Sustainability	11	<u>Chapter 6 Metrics and Targets</u>	<u>30</u>
2.5 Climate Advocacy and Education	11	6.1 Climate Change Management Goals	30
<u>Chapter 3 Climate Change Risk Management Overview</u>	<u>13</u>	6.2 Climate Change Management Indicators	31
3.1 Nanya Technology Corporation Risk Management Framework	13	<u>Chapter 7 Future Outlook - Achieving Net Zero through Sustainability</u>	<u>32</u>
3.2 Climate Change Risk identification Process	15		
3.3 Outcome from Identification of Climate Change Risks and Opportunities	16	<u>Appendix - TCFD Indicator Reference Table</u>	<u>33</u>

About this Report

Nanya Technology Corporation (“Nanya”) is guided by the vision of “Best DRAM Partner for Smart World.” As the leading brand on sustainability in the Dynamic Random Access Memory (DRAM) industry, Nanya Technology contributes our innovative energies through a low-carbon strategy, advanced processes, low-carbon products and green production model towards the common goal of mitigating global warming and promoting the sustainable development of global industries.

In addition to compliance with international and government regulations, the Task Force on Climate-Related Financial Disclosures (TCFD) framework developed by the Financial Stability Board (FSB) was voluntarily introduced by Nanya in 2018, followed by formal registration as a supporter in 2021 and the release of Nanya’s first TCFD Report (“the Report”) in 2022. The Report sets out the methodology used by Nanya to identify and assess climate change risks during our operations and production processes, the potential risks associated with such risks, and the management measures taken to strengthen climate resilience.

The Report follows the TCFD framework and encompasses the entire value chain of Nanya products: Part one covers disclosure on the climate governance model and organizational strategies of the Board of Directors and management; part two covers the climate risk strategies and executive policies adopted by the Company; part three covers the organization and quantitative assessment process for climate change risks and opportunities; part four focuses on our mitigation and adaptation measures for climate change risk scenarios. Scenario analysis tools are used to assess the potential for actual impact on operations so that a response can be developed in terms of low-carbon operational management, adaptation to physical climate change risks, supply chain cooperation, as well as product and customer management; part five outlines the methods used by Nanya to cultivate and communicate climate change awareness among stakeholders; part six uses quantitative indicators and future goals to communicate the direction of Nanya’s low-carbon transformation.

The publication of this Report will hopefully give all stakeholders interested in climate action at Nanya a better understanding of climate change’s impact on our company as well as Nanya’s investment in strengthening climate resilience. We look to hearing your feedback on your own experiences so that we can all move forward into a future of climate sustainability together.

President’s Message

To all stakeholders concerned about climate change topics:

In 2021, Taiwan went through an unprecedented drought while several extreme climate disasters also ravaged other regions of the world. The challenges brought upon all of us by the climate change, has also brought consensus that the “Net Zero” emission control is now essential for all world citizens. To actively manage risks and opportunities, Nanya Technology has leveraged our comprehensive corporate governance and the risk identification procedure as the foundations to strengthen our climate resilience. We have implemented five strategies, including the innovative product R&D, green production model, climate change risks management, sustainability partnerships, and greater climate awareness.

Nanya adopted the TCFD framework in 2018. The Board of Directors governing the company through the Risk Management Committee and Corporate Sustainability Committee. The BOD supervised our operational risks in terms of “Governance”, “Risk Management”, “Strategy”, “Indicators and Goals”. A total of 34 risks and opportunities were identified in 2021. The biggest risk identified was the potential for higher operating costs due to the imposition of carbon levies under the international goals towards net zero; the biggest opportunity was the energy-efficiency benefits and business opportunities from high-performance, energy-efficient DRAM products. Nanya has formally committed to Science Based Targets (SBT) at the end of 2021, and has made a 25% reduction in greenhouse gas emissions by 2030 as our target.

Development of Eco-friendly DRAM Products

DRAM is a critical component for the smart age. Nanya has continued to innovate energy-efficient DRAM products for our customers. Through the supply of products with high efficiency and low power consumption, Nanya had helped end-user saving of 712 GWh in electricity in 2021. Meanwhile, Nanya continued to invest in the innovative development of 10nm-class process technology and next-generation products. DRAM process and product technology advancement will also give a major boost to the utilization of energy resources within the production line. The first generation of the 10nm-class technology process (1A) is expected to enter volume production in 2022. The second generation (1B) should begin its trial production in 2022. The 1B process should deliver energy efficiency improvement by more than 60%. New products under development will have drastic reduction in operating voltages and power consumption. The next generation of DDR5 and LPDDR5 products should see energy savings of 16-35% respectively compared to existing DDR4 and LPDDR4 products.

Strategy for Green Manufacturing

An operational model based on green production has been deployed by Nanya to reduce our environmental impact. Since 2017, we have completed 123 projects on reducing raw materials consumption by improving the utilization on the production line. In addition, by implementing highly energy efficient end-of-pipe equipment, an over 90% reduction on the emissions of greenhouse gases (GHG) has been achieved. Between 2017 and 2021, a total of 114 energy management projects were introduced through our energy management system, which have generated cumulative electricity savings of up to 58,850 MWh. Nanya also actively engaged in the renewable energy projects. We have used 10,400 MWh of green electricity in total between 2021 and 2022, and will use at least 25,000 MWh of green electricity annually from 2023 onwards for the next 10 years. Thanks to the green energy projects outlined above, the GHG emission intensity per unit of production at Nanya is now 37% lower than 2017.

Adaptation to Climate Change Risks Management

Nanya has actively engaged in the Climate Change Risks Management. This included hardening of infrastructure against typhoons, heat waves, earthquake, and epidemics to strengthen climate and disease resilience. To counter water shortages, we continued to improve the water recycling rate of our processes so that it reached 90.8% in 2021. A comprehensive emergency response plan for water droughts, earthquake, epidemics, and other nature disasters, were also devised to ensure continuity of operations. Nanya considers employees to be an important asset. To ensure workplace safety, we have conducted extensive industrial safety education, training, and drills for safety and epidemic across all organizations. As a result, there has no industrial accidents and epidemic casualty at Nanya since 2017.

Partners in Sustainability, Climate Advocacy and Education

Nanya has strived to become the “Best DRAM Partner for Smart World” and actively exerts a positive influence on the value chain as well. Sustainability audits have been carried out to assess our suppliers' climate change governance, and to ensure their climate resilience. Projects team up with suppliers and partners have generated 3,315 MWh of electricity savings in 2021. Nanya has actively invested in social engagement. Since 2018, we've taken part in “Earth Hour” for five years. Employees were mobilized by company leaders to raise climate awareness. To bring attention for young generations on the SDGs concepts, climate change and corporate ESG, Nanya has partnered with universities to launch Creative Design courses. These courses have helped more than 900 students reflecting and cultivated literacy on contemporary issues linked together with sustainability.

Nanya's accomplishments in sustainability have been widely recognized. Accolades in 2021 included our inclusion on the CDP Climate Change “A-List” and a Leadership rating in water security, as well as the National Enterprise Environmental Protection Award. These reflected not only that Nanya has proactively response to climate change but also how the Company is continuing to learn and move forward on the path to sustainable development. Climate change is now an issue that all mankind must face. Nanya will continue to strengthen our governance and to manage climate risks. Nanya will leverage our influence and work with all of our stakeholders. Together, we will bring about a sustainable, and low-carbon society.

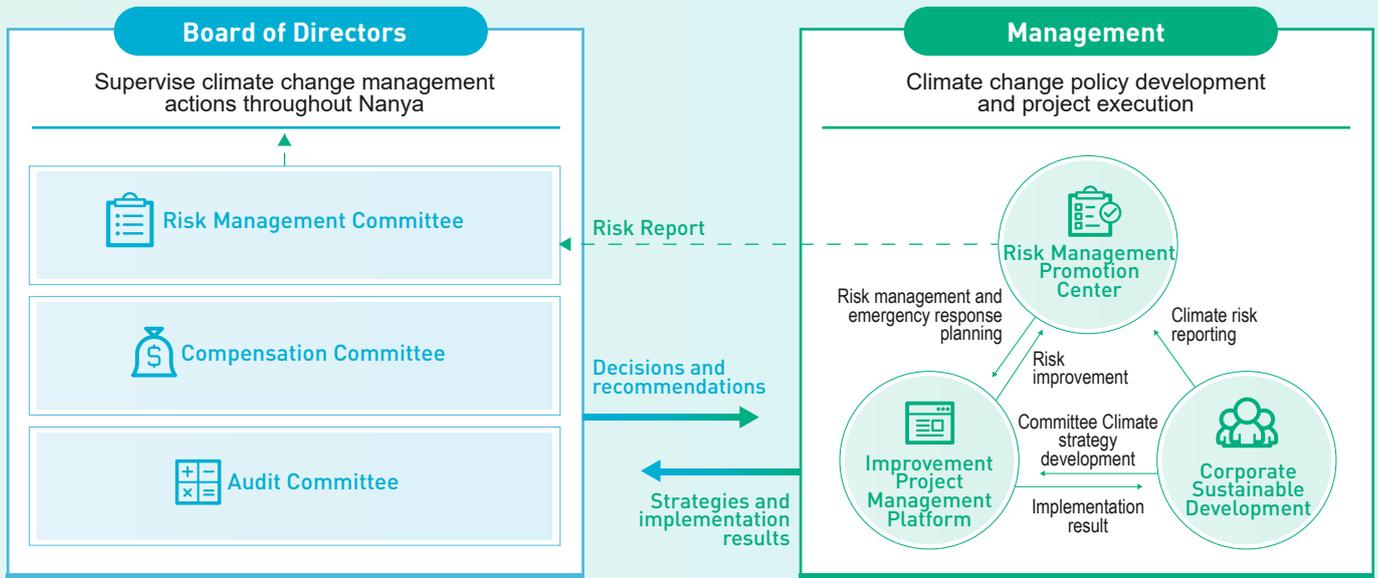
President




1 Climate Governance Framework and Functions

Climate change is now changing international socio-economic dynamics and the natural environment. Nanya has adopted a risk-management-based approach to implement climate change governance through two-way engagement between the Board of Directors and company management.

Nanya Technology Climate Change Management Framework

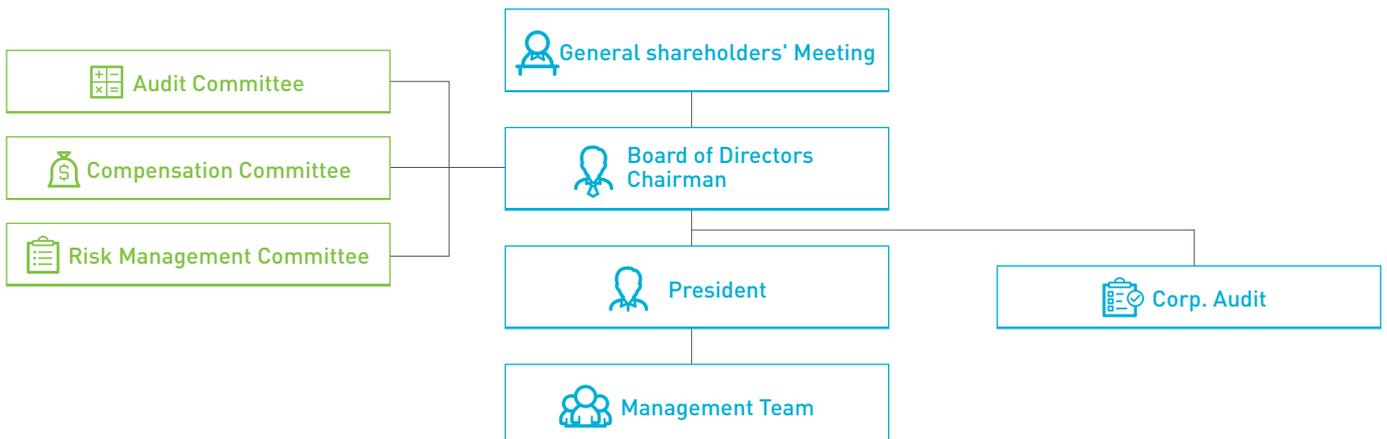


Note: The Improvement Project Management Platform encompasses Nanya's ISO 14001, ISO 50001 and other management Platonsism.

1.1 Board Participation and Supervision

Nanya Technology Corporation's board of directors complies with related laws and resolutions of the shareholders' meeting in its operations. Our directors maximize the interest of shareholders based on sustainability principles. The main duties of the board of directors are to ensure information transparency and legal compliance, appoint senior management supervisors, formulate earnings distribution proposals, and supervise and provide guidance for the Company's operations. The board of directors supervise and provide guidance on climate change related topics as well. The Nanya board was convened 6 times in 2021 to discuss matters such as the purchase and installation of renewable energy, participation in international carbon reduction initiatives, and performance in sustainability assessments.

In recent years, Nanya used the "Corporate Governance 3.0 -Sustainable Development Roadmap" proposed by the Financial Supervisory Commission (FSC) as a guide to make continuous improvements to sustainability governance. Nanya introduced the TCFD in 2018 and became an official supporter in 2021. The Risk Management Committee was also established in 2020 to strengthen the functionality of the board and develop a more comprehensive response to emerging risks and opportunities on climate change and other topics.



Functional Committees of the Board of Directors

The Nanya board of directors has three subordinate functional committees. The committees help the board carry out its duties and also serve the following functions on climate change topics:

Functional Committees of the Board of Directors

Risk Management Committee



To review risk management policies and their structure, risk appetite and tolerance. This includes the transformation (regulations and market) and physical (hazard) risks brought by climate change. To report on the status of risk management in management operations to the board of directors.

Audit Committee



Supervise the Company's business operations and financial status. Assist the directors carry out their supervisory duties, as well as carrying out its mission under the relevant laws and international standards. (e.g., Renewable Energy Development Act and Greenhouse Gas Management Act).

Compensation Committee



Establish and periodically review director and manager performance evaluation and remuneration policies, systems, standards, and structures. Salary adjustments, bonuses and other compensation for senior company executives take into account their contribution and performance in the economic, environment and social aspects so that executive compensation is linked to climate change governance.

The Board of Directors' Risk Management Committee engages in risk identification, review and management on ① Climate change, ② International political-economic trends, ③ Laws regulations, and ④ Disease. The Board of Directors' Audit Office cooperates with the board of directors on audits to ensure that resolutions of the board are implemented and followed through. The Risk Management Promotion Center headed by the President was set up to cooperate with the board on risk management for climate change and other topics. The Risk Management Promotion Center has overall responsibility for all climate change risks including the setting of management indicators and target management. It is also responsible for making topical reports to the Risk Management Committee.

1.2 Management Responsibility

Nanya set up three main management platforms to respond to the latest trends, opportunities and challenges. Each platform is headed by business managers and regular meetings are held to examine their performance and progress as part of the management cycle for climate change policy.



Sustainable Development Committee

A Sustainable Development Committee chaired by the President has been established by Nanya. Meetings are held quarterly and progress reports are made to the board of directors by business managers. At the same time, a Sustainable Development and Risk Management Group was set up under the President's Office responsible for the planning and management of action plans at Nanya. In addition to climate change assessments, trends and initiatives, the group also draws up climate change promotion strategies and targets, consolidates and supervises their progress and results, and ensures the effectiveness of horizontal and vertical communications within the organization so that sustainable development can be put into practice. All risk management under the climate change strategy are submitted to the Risk Management Steering Center for climate change risk assessment.

2021 Results: Membership of SBT initiative, National Enterprise Environmental Protection Award, and Green Factory certification.



Risk Management Steering Center

Responsible for the promotion and supervision of each risk management group's activities and overall risk management. The President shall serve as the director of the center and convene quarterly meetings to review the operational performance and business continuity plans of each risk management group to ensure the applicability, suitability, and effectiveness of their ongoing operations. The Risk Management Steering Center has overall responsibility for climate change risks. It assesses management risk issues within the climate change strategy, draws up management indicators and targets, and makes special reports to the Risk Management Committee.

2021 Results: Management reviews were conducted for 180 risk items including climate change compliance risk, low-carbon energy transformation and other emerging risks, as well as physical risks due to natural disasters.



Improvement Project Management Platform

Environment, Safety and Health (ESH) Division manages and evaluates GHG emissions in terms of company GHG emissions and product carbon footprints based on domestic/overseas legislation, board resolutions and related standards. It also works with Facility Division and the Factory Office to implement and promote energy conservation, carbon reduction, water conservation and waste reduction projects. We have also established the ISO 14001 environmental management platform and ISO 50001 energy management platform. Project review meetings are regularly convened to enforce low-carbon operations and green production.

2021 Results: 33 energy conservation projects (energy savings of up to 7,585 MWh) and 38 raw material improvement plans (annual savings of up to NT\$84,800,000) were implemented. Inclusion in CDP's A List for Climate Change and rating of A- (Leadership) for water security.

2 Climate Strategy

Nanya is concerned about global climate change and has identified related risks and opportunities. We strive to implement low carbon transformation and jointly work towards net zero emissions together with stakeholders. As the leader of Taiwan's DRAM industry, Nanya responds to the goal of foreign governments and Taiwan's government to achieve net zero emissions by becoming a manufacturer that uses green technologies. We support the Paris Agreement through our own actions and have committed to achieving net zero emissions through five key strategies for promoting low-carbon transformation and climate adaptation.

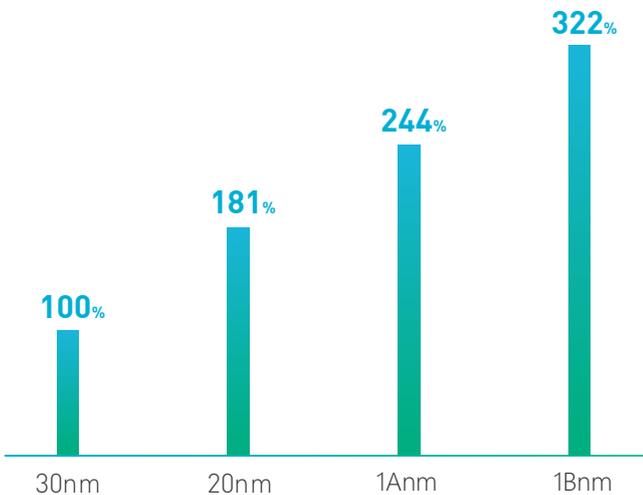
Nanya Climate Strategy Framework



2.1 Development of Low-carbon Products

In keeping with our core ideal of “innovation”, Nanya leveraged our extensive R&D experience and outstanding technical team to make the successful transition to innovative R&D and technological independence in 2017. Nanya’s first generation 10nm-class process technology(1A) completed its product validation process in 2021 and is expected to start volume production in 2022. We were the first Taiwanese company to develop our own 10nm-class DRAM technology and prove that Taiwan’s is now among the world leaders in DRAM technology development. The second generation (1B) is under development as well. Trial production is expected to start in 2022 with mass production to begin in 2025. Development on the 3rd generation 10nm-class technology process (1C) is scheduled to begin in 2025. Nanya R&D and improvements for every generation of process technology greatly increases the unit output per wafer. Our 20nm-class process technology increased its unit output per wafer by more than 80% compared to 30nm one. In the future, every generation of the 10nm-class process technology should increase unit output per wafer by more than 30%. The 1B process technology is expected to more than double the unit output per wafer compared to the 30nm one and help the factor make more efficient use of energy resources during production.

Growth in die per wafer (compared to 30nm-class process technology)



Demand from 5G communications, artificial intelligence (AI) and smart phone memory upgrades means that next-generation memory products (e.g., DD5 and LPDD5) will become the preferred type of next-generation memory if they can provide low voltage, low power consumption and faster transmission rates. A comparison of DDR5 and LPDDR5 against DRR4 and LPDDR showed a reduction of 16-35% in average power rating but a doubling in bandwidth/speed. Being able to handle high-speed transfers while using less energy will bring very significant energy savings for the customer. A comparison with products from the 30nm process showed that Low Power products and 20nm advanced process products sold by Nanya in 2021 reduced power consumption by more than 712.17GWh, the equivalent of reducing CO2 emissions by 357,000 tons.

R&D Policy for Low Energy Consumption Products



NTC continues to develop advanced manufacturing processes, so the energy consumption of new generation products developed with new processes is reduced by 15% compared with the previous generation.



NTC cooperates with major chip customers, adopting the method of multi chip package (MCP) to reduce back-end assembly and testing as well as energy consumption.

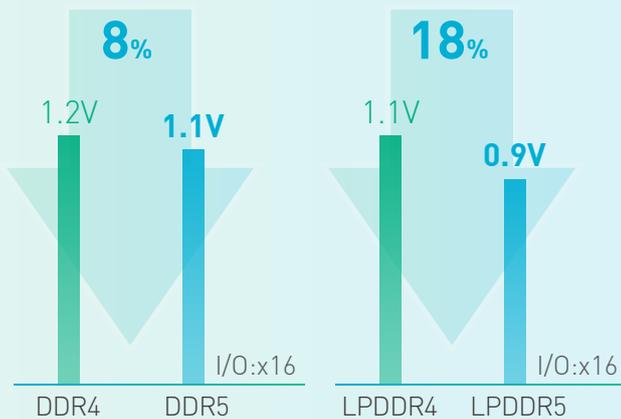


NTC strengthens the development of low energy consumption product lines and enlarges product portfolios in order to satisfy the need of various mobile devices and electronic products.

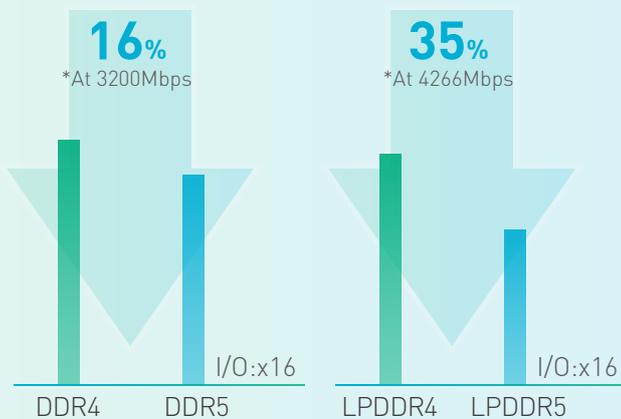
2.2 Strategy for Green Technology and Production

DDR5&LPD5 provided specifications that save more electricity with high bandwidth/high speed

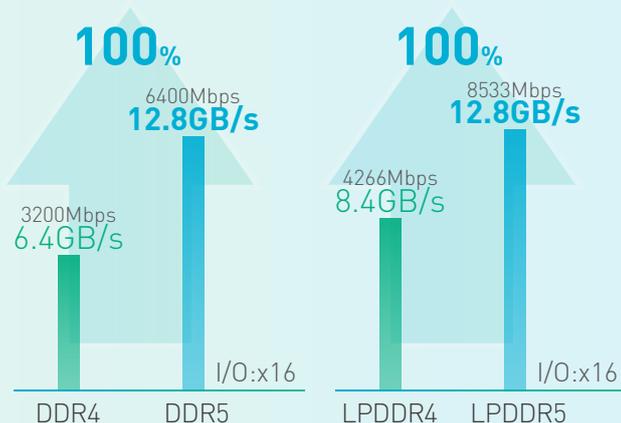
Voltage



Average Power Consumption



Bandwidth/Speed



Nanya proposed our SBT promise in 2021 and submitted the SBT targets for Nanya's existing operating locations for review in January 2022. We plan to focus on carbon reduction in the following four areas to reduce energy consumption and carbon emissions from our business and production processes. These will lower the environmental impact of our production operations and alleviate the impact of climate change on Nanya.

Process Improvements

Nanya assembled an AI technology application team in 2019, began gradually implementing AI technologies in the work scenarios of each unit in 2020, and link together smart systems, such as the wafer yield analysis system, smart production scheduling system, and general image monitoring and management system in 2021. By the end of 2021, we completed the development of 70 smart applications that improved product yields and machine utilization, reduce consumption of raw materials, and boosted the overall efficiency of the production line. These translated in to annual benefits worth up to NT\$330 million. We will continue to improve technologies and expand applications in 2022, and promote even more advanced AI technologies in each application unit to comprehensively improve the manufacturing performance of factories. The development of new AI applications should increase annual by 10% each year. Total cumulative benefits over five years (2021~2025) will reach up to NT\$2 billion.

Nanya is continuing to make improvements through the ISO 14001 environmental management platform, Green Product R&D platform, and other management systems. A dedicated organization sets annual targets for raw material reduction and conducts regular reviews of the Company's overall performance in raw material reduction. Reduction plans are focused mainly in four areas: development of new process formulas, shortening process times, extending operating cycles, and reducing process consumption. A total of 38 raw material usage improvement proposals were carried out in 2021 worth up to NT\$84.84 million a year. These also effectively reduced the GHG emissions of Nanya.

Flue Gas Treatment

Nanya is supporting the GHG reduction initiative of Taiwan Semiconductor Industry Association by actively reducing direct GHG emissions from production processes. End-of-pipe local scrubbers have been progressively installed for process equipment to decompose GHG gas molecules and greatly reduce the dissipation of GHG into the atmosphere. The fluorinated GHG reduction rate for acceptance of local scrubber was set by Nanya as over 90% for CF₄, over 95% for C₃F₈, C₄F₆, C₄F₈, CHF₃, CH₂F₂, and SF₆, and over 90% for NF₃. The reduction rate for N₂O used in the thin-film process was also set as 90% to effectively reduce N₂O emissions. The reduction equipment installed by Nanya current reduces GHG emissions by 560,000 tons CO₂e annually. Flue gas treatment equipment will be installed throughout all new factories built by Nanya in the future to minimize our environmental impact.

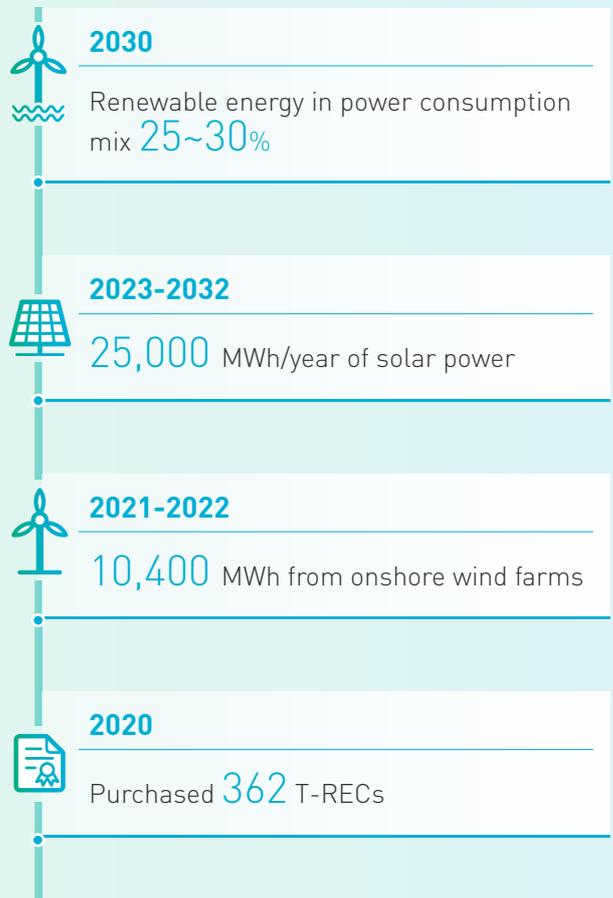
Renewable Energy Use

Nanya has been actively planning and progressively implementing the use of renewable energy. In 2020, Nanya supported government policy and conducted an inventory of usable areas at our sites. We obtained 362 T-RECs from Taiwan's renewable energy certificates market and conducted a feasibility study on the installation of a 440kW photovoltaic system at our existing plant. Nanya also collaborated with renewable energy vendors to use a combined total of 10,400MWh of onshore wind power in 2021 and 2022. In 2022, we signed a 10-year contract with a solar power provider to purchase 250 GWh of renewable energy. Nanya will therefore use at least 250GWh of renewable energy a year from 2023 onwards. To meet the carbon reduction targets of SBT and connect with international initiatives such as RE100, a working group was set up by Nanya to plan for further large-scale introduction of renewable energy use. We now aim to meet the target of 25-30% renewable energy by 2030.

Enhancing energy usage efficiency

Approximately 80% of Nanya's GHG emissions originate from electricity use. Validation of the ISO 50001 energy management system was completed by Nanya in 2018. The platform enabled a systematic review of energy usage within the Company and verification of reductions. A variety of energy-saving technologies have been introduced by our sites including dual chilled water systems, heat recovery and reuse from freezers, equipment automation, efficiency upgrades to equipment, as well as improvements to production management and scheduling to date.

Nanya Technology Corporation Renewable Energy Blueprint for the Next Decade



2.3 Adaptation to Climate Change Risks

Nanya has devised measures to adapt to rising temperatures, increase in non-rainy days, and increase in precipitation. Comprehensive emergency response plans for natural disasters have also been prepared for site operations, assets and equipment, as well as the storage and transportation of raw materials. Temperature increases will lead to power outages and greater power consumption. Nanya has invested NT\$370 million into building a backup power supply to stabilize the power supply quite of our site. The ISO 50001 platform and smart management system are also being used to prove energy efficiency. An increase in non-rainy days will increase the frequency of droughts. Nanya is therefore introducing aggressive water conservation measures and water reclamation to strengthen our ability to adapt. Our process water recovery rate has now reached 90.8% and we also back water cisterns, flood retention ponds, and wells. A water shortage emergency response organization was also set up in partnership with nearby Formosa Plastics Group sites to facilitate the emergency transfer of water sources within the organization during droughts; an increase in rainy days may lead to flooding of our site. The design of all infrastructure within the Nanya site took the parameters of past extreme weather events into account and also incorporate green building design features such as water-permeable paving. The risk of flooding up until the middle of the century was therefore assessed to be slight. Drains however still need to be cleaned regularly to ensure proper drainage. We will continue to conduct rolling reviews on whether further capacity upgrades will be necessary based on the latest scientific data and the state of site operations.

2.4 Partners in Sustainability

Nanya is working with our supplier partners to build a low carbon, sustainable supply chain by focusing on three areas: supply chain risk management, cooperation and exchange, and improving sustainability. In terms of risk management, a sustainable supply chain management process has been put into place by Nanya to manage supply chain risks and strengthen the sustainability performance of suppliers through regulations, risk investigation, field audits/improvement measures, and supplier capability development; in terms of cooperation and exchange, "Sustainable Supply Chain Seminars" are held on a regular basis during which we promote our sustainable supply chain management strategy and share issues important to Nanya with suppliers; in terms of improving sustainability, Nanya not only actively engages in internal energy conservation and carbon reduction initiatives but also expects suppliers to participate as well by setting renewable energy, electricity conservation, and energy conservation targets for suppliers. These include renewable energy accounting for 3% of total energy consumption by 2025, establishing GHG inventory mechanism by 2030 as well as cutting electricity consumption and carbon emissions by 10% and 20% respectively in 2030 compared to 2020. Nanya hopes to work with our supply chain partners to forge a low-carbon sustainable supply chain and fulfill our duty as citizens of planet Earth together.

2.5 Climate Advocacy and Education

As a responsible corporate citizen, Nanya Technology Corporation considers ESG to be an important commitment of companies, and continues to dedicate efforts to sustainable development. We actively take part in domestic and overseas sustainability initiatives and assessments to highlight our efforts and ambitions on sustainability topics. These included joint promotion of TCFD, SBT, Taiwan Alliance for Net Zero Emission, as well as continued participation in the DJSI and CDP international assessments. These initiatives and assessments have led to domestic and international recognition of Nanya's sustainability performance. It also showed that Nanya has successfully balanced the pursuit of business performance with ESG development. The promotion of climate change is not just the responsibility of certain units or personnel within the company. Nanya hopes that all employees can become involved as well. Workshops and internal training courses were therefore used by Nanya to give employees a basic understanding of current climate change topics and the Company. Nanya also communicated with suppliers, customers and society on climate change. These included connecting with suppliers through supplier symposiums, informing customers about our green and carbon reducing activities through the Sustainability Report, and cooperating with schools to set up courses on climate change and sustainability. Internal and external communication were employed to enhance the overall level of climate/carbon reduction awareness and culture throughout Nanya.

Key Milestones from Climate Transformation at Nanya



- Conducted life cycle assessment of products
- Conducted Scope 3 inventory of GHG
- Defined green product management rules

2017

- Introduction of visualized energy management platform
- Introduction of AI application system and talent development plan
- Participation in CDP survey for disclosure on carbon management and water security

2019

- Signed contract for supply of 10,400MWh in renewable energy
- Commitment to SBT carbon reduction target
- Devised energy conservation rules for equipment

2021

2018

- Established Sustainable Development and Risk Management Group
- Introduction of ISO 50001 Energy Management System
- Introduction of TCFD framework
- Internalization of sustainability performance by supplier assessment

2020

- Establishment Board of Directors' Risk Management Committee
- Hosting of supply chain conference
- Launched supply chain energy-conservation project
- Purchase of T-RECs

2022

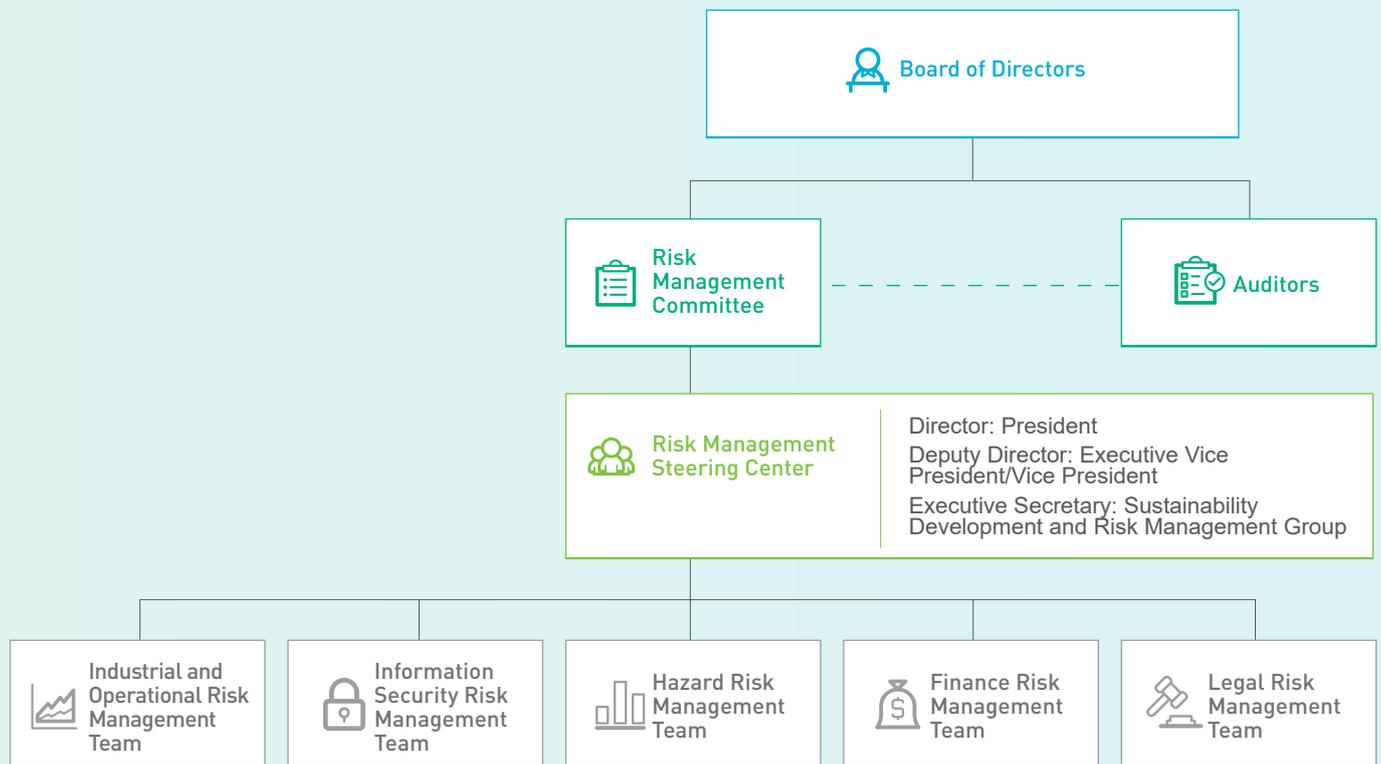
- Signed contract for supply of 250 GWh in renewable energy
- Publication of TCFD Report
- Subsidized employee purchases of electric scooters

3 Climate Change Risk Management Overview

Nanya has a full range of corporate governance capabilities. A sound risk management framework is used to control operating risks and mitigate loss. In response to the new challenges brought by climate change topics, Nanya devised a climate change strategy based on internal/external factors. This enabled the identification of climate change risk based on existing foundations but also built on them for the identification of climate change risks and opportunities. Related measures were also proposed to complete the management cycle.

3.1 Nanya Technology Corporation Risk Management Framework

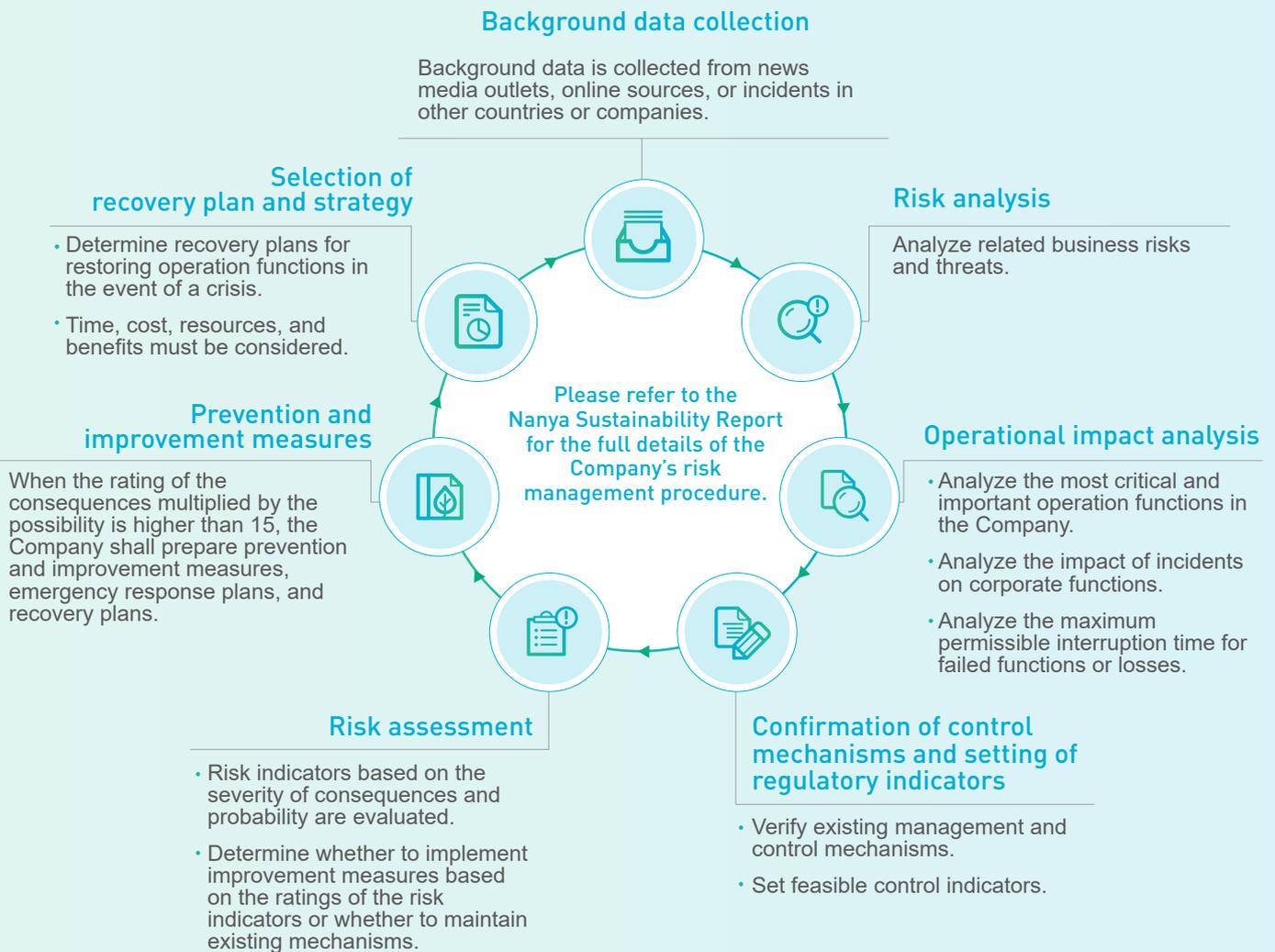
Nanya Technology Corporation's risk management systems are used to identify and analyze risks currently faced by the Company, establish suitable risk limits and control procedures, and supervise compliance with various risks and risk limits. Through the establishment of the Board of Directors' Risk Management Committee and the Risk Management Steering Center, compliance with the relevant ISO mechanisms, potential risk and opportunities for the Company in the five dimensions of industry and operations, cybersecurity, threats, finance, and legal affairs are identified. Effective risk control is enforced to ensure continuity of operation as well as the creation of value for shareholders, employees, customers and society in order to realize the sustainability goals of the Company.



In accordance with the mechanisms and values of the ISO 31000 Enterprise Risk Management (ERM) Guidelines, Nanya formulated risk management policies and procedures in combination with the long-term goals of our business strategy to serve as guiding principles. We shall annually review emerging risks in the near three to five years and follow them up. Through long-term planning and promotion, we aim to establish risk awareness among all employees and further internalize that awareness in daily management to ensure the continuity of Company operations.

The Company abides by the principles, framework and spirit set forth in ISO 22301 in devising the "Emergency Response Procedure." These are implemented through the emergency response mechanism and measures of the ISO 9001, ISO 14001, ISO 50001, ISO 27001, and OHSAS 18001 management systems. For shortages in raw materials that affect production output by more than 10% (e.g., Natural disasters caused by climate change), public system anomalies, automation system anomalies, anomalies in outsourced production, and mass returns by customers after product sales, sound and substantive measures and improvement plans have been put into place.

Nanya will continue to conduct regular renewals every quarter to conduct lowering the potential impacts of hurricanes. As a refinement of our standard procedure, Nanya regularly conducts emergency response drills including one site-wide emergency evacuation drill and two firefighting drills every year. These ensure the validity of emergency response measures and minimize the level of risk.



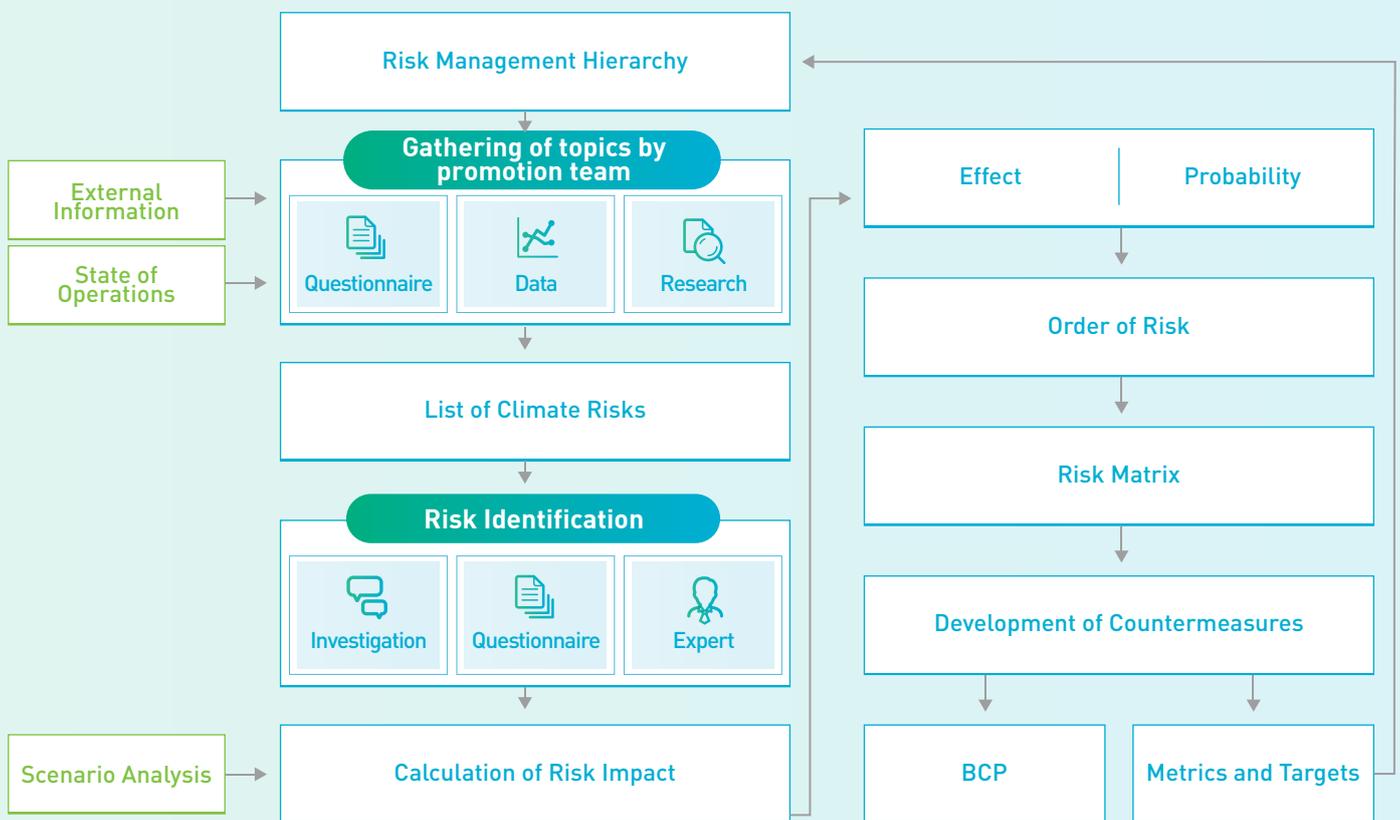
3.2 Climate Change Risk identification Process

Climate change topics are now a risk factor in areas such as industry operations, finance, legal affairs, and site operations. As climate change involves knowledge across multiple disciplines such as basic science and socio-economics, risk identification was carried out separately in the form of workshops and the conclusions submitted to the Risk Management Steering Center. Management reviews as well as emergency response drills were then carried out during regular meetings. The Company will continue to promote climate change education and literacy in the future to instill climate risk awareness throughout the organization.

Nanya Technology is gradually incorporating climate change risks into our Enterprise Risk Management (ERM) system in accordance with the TCFD Guidance on Risk Management Integration and Disclosure, and Committee of Sponsoring Organizations of the Treadway Commission (COSO).

By inventorying and gathering information on external environmental changes and the state of internal operations, five strategies were devised by Nanya for responding to climate change risks. Identification of related risks and opportunities was also carried out. The identification process was as shown in the diagram below:

Risk Management Hierarchy



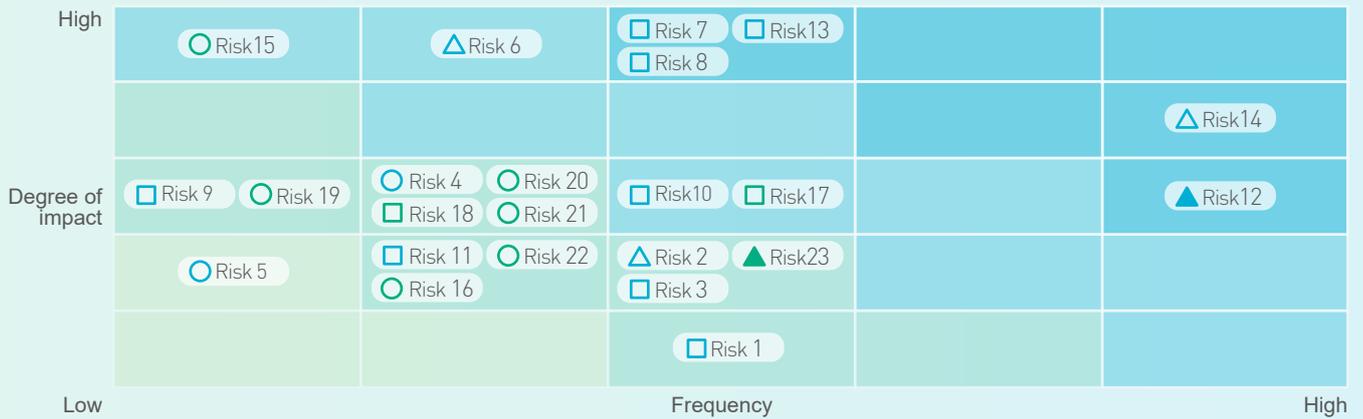
Dealing with climate change requires professional knowledge of the field. The corporate sustainability organization was therefore initially charged with the identification of climate risks and worked with external experts to compile a list of climate risks. Workshops were then convened for employees with a background in public relations, finance, environmental protection, utilities, products, supply chain and marketing to discuss the items on the list of risks and calculate the impact of each risk through the use of scenario analysis and other tools. Finally, risks were then categorized based on the findings. Corresponding management measures were then proposed for each category of risk for continuous follow-up.

<p>5 items</p> <p>Fields (supply chain, products and customers, finance, investor and public relations, factory operations)</p>	<p>34 items</p> <p>23 risks and 11 opportunities</p>	<p>4 items</p> <p>TCFD workshop and training</p>
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3.3 Outcome from Identification of Climate Change Risks and Opportunities

Following the strategy outlined in Chapter 2 and the climate change risk and opportunity identification process described in section 3.2, a total of 23 climate change risks and 11 derived opportunities were identified for 2022. Of these, 5 were high-risk factors requiring immediate improvement. These were mainly transition risks related to “government regulations and customer requirements.” Planning was required for a further 4 risks linked to the physical and transition risks on supply chain, factory operations, and public reputation. The remainder were all low-risk factors or items awaiting observation and evaluation. Nanya will continue to monitor any trends or changes related to these risks. The most important of the 11 opportunity factors was customer demand for energy-saving, high-performance products.

Climate Change Risk Matrix



▲ Already occurred | △ Occur within 3 years | □ Occur within 3 to 10 years | ○ Occur within 10 to 20 years
 Definition for degree of impact: Over NT\$500 million | NT\$100 ~ 500 million | NT\$10 million ~ 100 million
 Under NT\$10 million | No impact

Transition risk

- R1 Supplier investment in low-carbon transition and passing on of costs
- R2 Taiwanese suppliers passing on the costs from mandatory use of renewable energy
- R3 Taiwanese suppliers passing on the costs from mandatory carbon taxes
- R4 Taiwanese suppliers passing on the costs of increased electricity costs due to changes in government energy policy
- R5 Penalties imposed on suppliers due to inability to comply with new climate change regulations
- R6 Customer requirement for quota on renewable energy use
- R7 Customer requirement to join specific international carbon reduction initiatives
- R8 Customer requirement for Nanya's product carbon footprint to meet certain standards
- R9 Effect of Nanya's climate change performance on investor interest
- R10 External interest in Nanya's climate action
- R11 Change to profitability from subsidiary's investment energy conservation and carbon reduction
- R12 Mandatory quotas set for use of renewable energy
- R13 Change to national energy planning
- R14 Implementation of carbon tax (levy)

Physical risk

- R15 Risk to suppliers from increasing frequency of natural disasters
- R16 Increase in insurance costs in response to climate change disasters
- R17 Increased demand for energy due to rising temperatures
- R18 Power shortages due to rising temperatures
- R19 Factory operations being disrupted by flooding or equipment damage due to increased frequency of typhoons and storms.
- R20 Production operations disrupted by water shortage due to increase in days with no rain
- R21 Production operations disrupted by increased water turbidity
- R22 Increase in frequency of industrial safety accidents among employees due to increased frequency of climate-related disasters
- R23 Increase in frequency of commuting accidents among employees due to increased frequency of climate-related disasters

Transition risk

Effect	Countermeasure
R14 Implementation of carbon tax (levy) <ul style="list-style-type: none"> Increase operating costs by NT\$40 million to NT\$140 million due to government costs (-) 	Derived Opportunities : 2 3 6 10 <ul style="list-style-type: none"> Implement SBT plan for carbon reduction action. Realize the targets through reduced use of energy resources, renewable energy use, and innovations in production processes and products. Promote improvement projects through the ISO management platform based on carbon reduction strategies developed by the management.
R12 Mandatory quotas for use of renewable energy <ul style="list-style-type: none"> Increase operating costs by NT\$70 million due higher cost of electricity (-) Reduce the Scope 2 GHG emissions by approximately 12,550 tonnes (+) Diversify sources of electricity supply(+) 	Derived Opportunities : 3 6 10 11 <ul style="list-style-type: none"> Set up task force to evaluate renewable energy market Equip new factories with a certain ratio of renewable energy
R7 Customer requirement to join specific international carbon reduction initiatives <ul style="list-style-type: none"> Realizing SBT increases operating costs by approximately NT\$300 million(-) Increased opportunities for customer engagement (+) Reduce GHG emissions by approximately 120,000 tons and save NT\$12 million to NT\$36 million in carbon costs.(+) 	Derived Opportunities : 2 4 5 7 11 <ul style="list-style-type: none"> Use publicly available information and business channels to learn about customer requirements and work with customers to achieve the target Join international initiatives such as SBT and set reduction targets Participate in seminars hosted by customers and share our own accomplishments
R8 Customer requirement for Nanya's product carbon footprint to meet certain standards <ul style="list-style-type: none"> Increase in R&D and operating costs (-) Planning constraints for production capacity (-) Company is favored by the customer for investment in low-carbon production (+) 	Derived Opportunities : 1 2 7 9 <ul style="list-style-type: none"> Maintain R&D focus on low-carbon products and reduce the power consumption of products Implement SBT plan for carbon reduction action. Realize the targets through reduced use of energy resources, renewable energy use, and innovations in production processes and products.
R13 Change to national energy planning <ul style="list-style-type: none"> Expenditure on electricity may increase by NT\$330 million to NT\$500 million (-) Increase in uncertainty over electricity use (-) Reduce electricity emission factor (+) 	Derived Opportunities : 2 3 <ul style="list-style-type: none"> Implement energy management plan to increase energy efficiency Diversification of electricity supply to spread risk of purchasing electricity from Taipower
R6 Customer requirement for quota on renewable energy use <ul style="list-style-type: none"> Increase in operating costs (-) More variables in production planning (-) Decrease in Scope 2 GHG emissions (+) 	Derived Opportunities : 3 <ul style="list-style-type: none"> Continue to communicate with customers and do our best to meet their requirements Set up task force for introduction of renewable energy
R10 External interest in Nanya's climate action <ul style="list-style-type: none"> Inability to satisfy stakeholder expectations may damage corporate reputation and result in lost sales (-) Improved media exposure and image (+) 	Derived Opportunities : 4 5 <ul style="list-style-type: none"> Investment in low-carbon green production and performing well in ESG evaluations such as CDP and DJSI Provide transparent disclosure of sustainability actions at Nanya through a public platform

Physical risk

Effect	Countermeasure
R15 Risk to suppliers from increasing frequency of natural disasters <ul style="list-style-type: none"> Natural disasters may disrupt production for suppliers(-) Production operations at Nanya affected by increased uncertainty over supply (-) 	Derived Opportunities : 6 7 <ul style="list-style-type: none"> Conduct hazard analysis on climate change risks for Taiwan sites Conduct SAQ questionnaire survey with suppliers to ensure that suppliers are capable of withstanding natural disasters and identify high-risk vendors for counseling/improvement. Develop and rehearse emergency response plans for the supply chain Host supply chain forums to share the results of energy conservation, carbon reduction, and adaptation.
R17 Increase in energy consumption due to rising temperatures <ul style="list-style-type: none"> Cost of electricity consumption to increase by approximately NT\$39 million ~ NT\$54 million by the middle of the century (2050)(-) 	Derived Opportunities : 2 3 8 <ul style="list-style-type: none"> Introduction of ISO 50001 and implement energy management plan Upgrade air conditioners and chillers with smart technology and optimize scheduling. Adopt green building indicators during factory design to improve insulation against external heat and reduce sensitivity of electricity consumption to weather changes.

Note: (+)indicate the positive impact, (-) indicated the negative impact

Opportunities Derived from Climate Change

Opportunities	Effect
<p>1 Customer preference for products with low power consumption and advanced processes</p> 	<ul style="list-style-type: none"> • Increase in sales of products with low power consumption and high unit price • Introduction of advance processes guaranteed certain level of customer support
<p>2 Implement energy conservation plan</p> 	<ul style="list-style-type: none"> • Increase efficiency of electricity use and control of electricity costs reduced power consumption by 58,000 MWh in the last five years and saved more than NT\$130 million • Reduce cumulative GHG emissions by 29,116 tons, the equivalent of reducing carbon costs by NT\$2.0 ~ 8.7 million.
<p>3 Use of alternative energy</p> 	<ul style="list-style-type: none"> • Every kwh renewable electricity usage can help avoid about 0.5kg GHG emission and saving expense on carbon fee on 0.05-0.15NTD • Risk spreading on power consumption(Price and stability)
<p>4 Participate in sustainability evaluations and inclusion in related indices</p> 	<ul style="list-style-type: none"> • Stabilization of investor structure • Improve the sustainability image of the Company and secure the support of stakeholders • Learn from sustainability trends and use them as the basis for internal reforms
<p>5 Media exposure from outstanding performance in green production</p> 	<ul style="list-style-type: none"> • Improved image in society and the media • More opportunities for stakeholder collaboration
<p>6 Supplier investment in green production</p> 	<ul style="list-style-type: none"> • Reduce the carbon footprint of Nanya products • Improve the carbon management ability of suppliers
<p>7 Supplier engagement</p> 	<ul style="list-style-type: none"> • Increase in opportunities and scope for supplier engagement • Increased influence of activities
<p>8 Green buildings</p> 	<ul style="list-style-type: none"> • Enhance climate adaptation resilience (water conservation, thermal insulation, flood resistance) • One of the environmental impact assessment indicators for new site developments
<p>9 Co-develop low-carbon products with customers</p> 	<ul style="list-style-type: none"> • Secure product and sales channels • Increased opportunities for customer cooperation
<p>10 Product applications expanded by emerging topics such as electric vehicles, renewable energy, and smart grid</p> 	<ul style="list-style-type: none"> • Increase in scope of memory product applications drive growth in demand for data bits • Improve the carbon reduction benefits of Nanya product applications
<p>11 Issue green bonds or obtain loans linked to sustainability</p> 	<ul style="list-style-type: none"> • Investing in green product increases sources of capital • Reduction in interest costs

4 Climate Risk Scenario Analysis and Countermeasures

Nanya is strengthening our ability to manage climate change risks by focusing not only on our own operations, but also by evaluating the climate changes that the upstream and downstream parts of the value chain (including suppliers, customers, and downstream operations) may face. The information is then used as the basis for planning on climate risk mitigation and adaptation in order to reduce its effects and impacts.

4.1 Scenario Analysis of Climate Risks for Nanya Operations

Transition risk

The imposing of carbon tax (fees) is a common way of internalizing the external costs of GHG during global efforts to mitigate climate change. Cost is used to pressure GHG emitters into agreeing to reducing their carbon emissions. Nanya used three scenarios to analyze the impact of carbon tax (fees) on future operations. The carbon tax in Taiwan is expected to be around NT\$100 ~ \$300 per ton of CO₂e emissions. The impact on operations will therefore be less than 0.2%. At the same time, the global nature of Nanya's operations meant that we also assessed the carbon tax (levy) scenario published by the International Energy Agency (IEA) in its World Energy Outlook (WEO). The impact of carbon taxes (levies) on company revenues will be far greater if the targets of the 2°C (Announced Pledge Scenario (APS) and 1.5°C Net Zero Scenario (NZE) are to be met.

The use of low-carbon energy therefore shows the greatest potential for reducing GHG emissions. A scenario analysis was therefore conducted by Nanya based on the use of low-carbon energy and the carbon reduction path of SBT. In the scenario where national targets and international carbon reduction targets are both achieved, the impact on Nanya revenues will be around 1% ~ 2.1%. If this is compared against the impacts of carbon taxes (levies) and renewable energy use however, assuming that high carbon taxes (levies) will be imposed then we can see that early investment in low-carbon electricity such as renewables will reduce costs and reduce the impact on operations.

Scenario Analysis of Transition Risks for Nanya Operations

Impact on revenues in 2030 (%)	Assessment method	Impact on revenues in 2030 (%)	Assessment method
<div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> <p>Imposition of carbon tax (levy)</p> <p>National target 0.07-0.2% Estimate based on NT\$100 ~ NT\$300 per ton of carbon</p> <hr/> <p>2°C Target 1.9-2.5% Estimate based on IEA WEO 2021 APS of US\$100 per ton of carbon</p> <hr/> <p>1.5°C Target 2.3-2.9% Estimate based on IEA WEO 2021 NZE of US\$130 per ton of carbon</p> </div> <div style="width: 48%;"> <p>Using Low-carbon Energy</p> <p>National target 1-1.2% Investment in renewable energy required for 10% reduction compared to 2020</p> <hr/> <p>SBT°C Target 1.2-1.7% Investment in renewable energy required for 25% reduction compared to 2020</p> <hr/> <p>SBT 1.5°C Target 1.6-2.1% Investment in renewable energy required for 42.5% reduction compared to 2020</p> </div> </div>			

Physical risk

To understand the physical disaster risks brought by climate change, Nanya referred to the Taiwan Climate Change Projection Information and Adaptation Knowledge Platform (TCCIP) and analyzed the climate data from the future climate model. Nanya's operating locations and water catchments were analyzed to determine the operating risk for Nanya in the middle of the century (2040 ~ 2060) using the climate data for scenarios RCP 2.6 ~ RCP 8.5. This included the impact of increased temperatures, increased rainfall, and increase in non-rainy days.

Mid-Century Risk	Potential Impact	Operational and Financial Impact
RCP2.6		
<ul style="list-style-type: none"> Average temperature increased by 1.2°C Average duration of heat wave increased by 2.7 fold 	<ul style="list-style-type: none"> 3% increased in electricity consumption by air conditioning Increased load on factory and Taipower electrical systems 	<ul style="list-style-type: none"> Impact on higher electricity tariffs on revenue is less than 0.1% UPS and diesel generators have been installed as backup to ensure continuity of production
<ul style="list-style-type: none"> 15% increase in average maximum rainfall Average days of heavy rain increased by 0.09 days 	<ul style="list-style-type: none"> Increased flooding Construction delays due to industrial safety incidents 	<ul style="list-style-type: none"> Factory is located on high ground so is immune to large-scale flooding from rain that impact on operations or production. The factory has defined construction guidelines so increased frequency of rainfall may impact on construction progress.
<ul style="list-style-type: none"> Average days of no-rain increased by 1.2 days 	<ul style="list-style-type: none"> Impact on operations from water shortages or rationing 	<ul style="list-style-type: none"> The factory now has a fully-fledged emergency response plan for water resources that can be implemented in the event of a water shortage.
RCP8.5		
<ul style="list-style-type: none"> 1.9°C increase in average temperature Average duration of heat wave increased by 3.9 fold 	<ul style="list-style-type: none"> 5% increased in electricity consumption by air conditioning Increased load on factory and Taipower electrical systems 	<ul style="list-style-type: none"> Impact on higher electricity tariffs on revenue is approximately 0.1% UPS and diesel generators have been installed as backup to ensure continuity of production
<ul style="list-style-type: none"> 19% increase in average maximum rainfall Average days of heavy rain increased by 0.12 days 	<ul style="list-style-type: none"> Increased flooding Construction delays due to industrial safety incidents 	<ul style="list-style-type: none"> Factory is located on high ground so is immune to large-scale flooding from rain that impact on operations or production. The factory has defined construction guidelines so increased frequency of rainfall may impact on construction progress.
<ul style="list-style-type: none"> Average days of no-rain increased by 2 days 	<ul style="list-style-type: none"> Impact on operations from water shortages or rationing 	<ul style="list-style-type: none"> The factory now has a fully-fledged emergency response plan for water resources that can be implemented in the event of a water shortage.

Countermeasures for transition risks:

To mitigate the threat posed by transition risks to Nanya operations, we are applying our own expertise and influence to implement carbon reduction measures in our operations and production processes in order to reduce our GHG footprint and environmental impact. Nanya announced our commitment to SBT in 2021 and submitted the SBT targets for existing operating locations for review in January 2022. The four carbon reduction strategies of process improvements, end-of-pipe removal, enhancing energy usage efficiency, and use of renewable energy have since reduced our GHG emissions per unit capacity in 2021 by 37% compared to 2017. On the whole, Nanya is using SBT to align ourselves with international trends, reduce our GHG emissions, and mitigate the impact and losses caused by transition risks due to climate change.

GHG emissions per unit capacity

kg CO₂e/thousand die

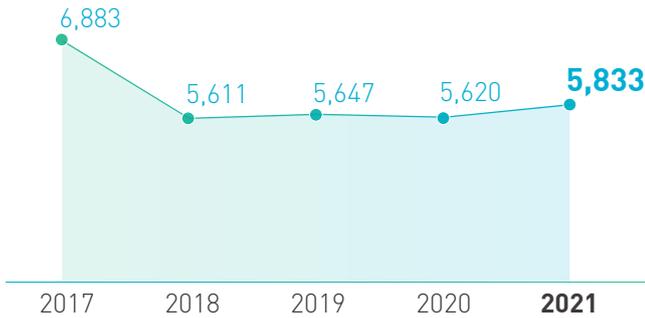


Note: The calculation of production capacity was based on the output of Good Electronic Chip (GEC). The output of each product was converted using the die count for 4Gb products and calculated using per thousand dies (k-pcs) as unit.

In terms of process improvements, Nanya has proposed 123 projects to improve use of raw materials since 2017. Process gas usage per unit capacity went from 6,883m³ to 5,833m³ between 2017 and 2021, a decrease of 15.3% over four years. Chemical usage per unit capacity also dropped by 38.2% compared to four years ago.

Process gas usage per unit capacity

m³/kpcs



Chemical usage per unit capacity

Metric tons/kpcs

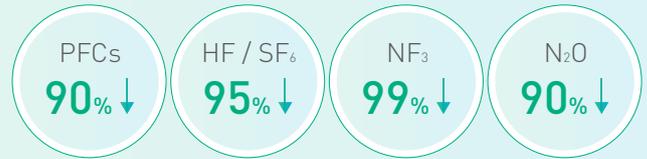


In terms of flue gas treatment, local scrubbers for fluorinated GHGs were purchased and installed by Nanya during factory construction. Emissions of fluorinated GHG from processes were on average reduced by more than 93% between 2018 and 2021, translating to a reduction of 2,276,676 tons CO₂e in emissions over a four year period. Reduction equipment with a reduction performance of over 90% was installed in the film process machinery to reduce N₂O emissions.

In terms of enhancing energy usage efficiency, Nanya has obtained ISO 50001 energy management system certification. The platform enabled a systematic review of energy usage within the Company and verification of reductions. A variety of energy-saving technologies have been introduced by our sites including dual chilled water systems, heat recovery and reuse from freezers, equipment automation, efficiency upgrades to equipment, as well as improvements to production management and scheduling to date. A total of 114 energy conservation projects were introduced between 2017 and 2021 to save more than 58850 MWh in electricity.



Local Scrubber

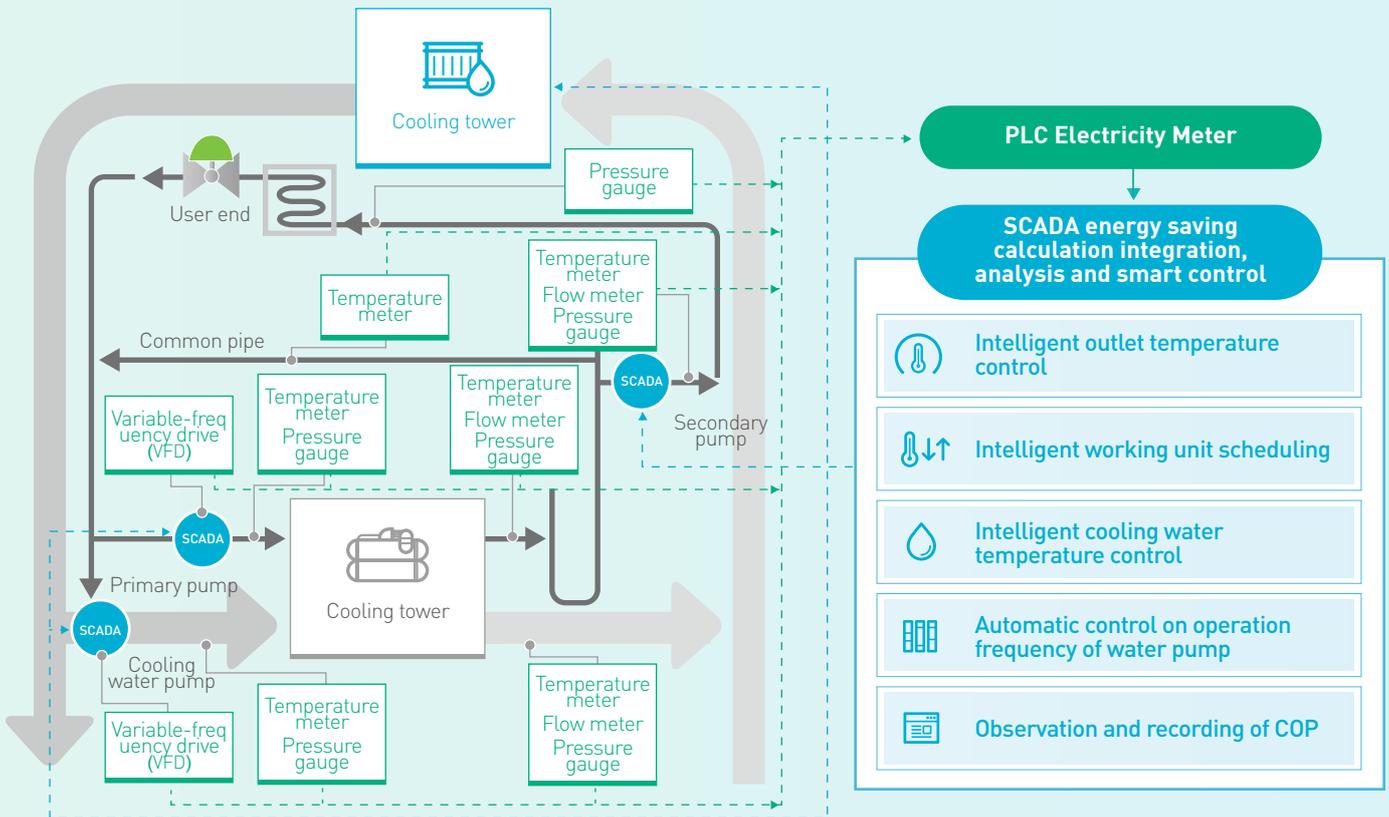


Energy consumption real-time monitoring platform

The energy consumption real-time monitoring platform was set up by Nanya in 2019 to carry out smart energy conservation management. A hierarchical management structure was adopted to facilitate the statistical analysis of systems and equipment at each node. Total investment amounted to NT\$21.8 million. Real-time monitoring of visualized data enables effective management and improvement of energy consumption by each unit and machine group.

AI-Controlled Air Conditioning System

Nanya introduced smart management systems for air conditioning equipment as they consumed the most electricity (20% of total electricity consumption). Big data analysis and modeling was then used to optimize the scheduling and configuration of compressors, chilled water flow and related refrigeration equipment based on external temperature conditions. Nanya began collecting AC operating data in 2017 and analyzing their potential for improvement. Work commenced in 2019 and once the upgrades were completed in 2020, the electricity consumption of the chilled water system was reduced on average by 18.17% and saved up to 1550 MWh a month.



The planning and implementation of renewable energy targets at Nanya can be divided into the following three phases.

Phase 1: Self-development evaluation and trial implementation. Nanya 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 (completed in coordination with the expansion of the new factory). We are also installing 27.36 kW of solar panels on the rooftop of our new building, and expect to complete construction in 2022. New factories in the future will also fully utilize land resources to install green energy facilities.

Phase 2: External cooperation. Nanya is working with renewable energy providers to obtain more electricity, and is gradually expanding consumption based on regulatory requirements. In 2021, we used a total of 2,600 MWh in renewable energy, and expect to use 7,880 MWh or more of renewable energy in 2022. Starting in 2023, we will gradually increase renewable energy use until we reach 25,000 MWh or more.

Phase 3: International Integration and Net Zero. The percentage of renewable energy used must reach 25 ~ 30% by 2030 to achieve the SBT or RE100. Nanya Technology Corporation will focus on wheeling contracts of large renewable energy providers to increase our renewable energy usage even further.



Countermeasures for Physical risks

In terms of physical risks, Nanya has devised and implemented measures for adapting to rising temperatures, increase in non-rainy days, and increase in precipitation. Comprehensive emergency response plans for natural disasters have also been prepared and would site operations, assets and equipment, as well as the storage and transportation of raw materials. The adaptation measures for rising temperatures, increase in non-rainy days, and increased precipitation are explained below.

Adaptation Measures for Warming

Rising temperatures will increase the stress on electricity grids forcing the power utility to reduce the voltage or frequency. Even tiny changes in power may impact on sophisticated semiconductor production processes however. To maintain our yield and the stability of production lines, Nanya invested around NT\$370 million to deploy 23 DUPS systems as part of our backup power supply plan. Regular maintenance and testing are also conducted to ensure that our factories have a reliable electricity supply. Hot weather will also increase the use of energy. In response, Nanya is continuing to improve energy efficiency through the ISO 50001 platform and smart management system. Nanya's main production and operating locations are currently green factories. New factories built by Nanya in the future will adopt green building standards as well by strengthening building insulation and factory energy efficiency. These will reduce the sensitivity of electricity supply to weather changes.



Nanya's existing and future sites will have green factory and green building marks

Adaptation Measures for Drought

An increase in non-rainy days will increase the frequency of droughts as well. Factory production requires a large amount of water and Nanya currently uses between 9,500 to 11,000 tons of water each day. A water shortage will disrupt production and impact on output/delivery time. The Aqueduct tool for evaluating water resources from the World Resources Institute (WRI) indicated that water source represents a low to medium risk area in the short-term. To avoid short-term water shortage risks due to the natural environment, Nanya will continue to promote water saving measures and recycle water in order to improve our ability to adapt. Process water recovery rate has now reached 90.8%.

Nanya has devised comprehensive emergency response plans to mitigate the immediate impacts of short-term water shortage and guarantee our factory's water supply. A cistern with a capacity of 43,000 tons, two detention basins each with a capacity of 4,060 tons, and seven wells have been built on-site to effectively harvest rainwater during the rainy season. Moreover, Nanya 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 deploy water resources to support each other on an emergency basis. With the proper support measures we can continue to operate for 40 days without external resupply. TCCIP scenario analysis showed that even if the average number of continuous non-rainy days increased by 1.2 to 2 days in the future, their impact on company operations is still in the acceptable range. Strong typhoons may however increase water turbidity. Shihmen Reservoir in our catchment has now been upgraded so the probability of turbid raw after a storm has been reduced. Our own internal water treatment capability is rated for 10,000 NTU (nephelometric turbidity unit) so can handle most situations. Nanya will continue to upgrade our use and management of water resources to prepare for the uncertainties of climate change.

Nanya process wastewater recycling System



Acidic and alkaline wastewater system



Organic wastewater recycling system



Hydrofluoric wastewater recycling system



Adaptation to Heavy Rains and Flooding

Increased number of rainy days may result in on-site flooding. The current design of Nanya's site infrastructure is based on past extreme weather events with a certain amount of safety margin. Planning of drains for example used the maximum precipitation in the last 25 years plus a 20% safety margin. When combined with permeable paving of green building design, flood risk by the mid-century remains low. Regular cleaning of the drains is however necessary to ensure their proper function. In the future, we will continue to conduct rolling reviews on the latest scientific data and the operational state of the site to determine whether the drains need to be widened.

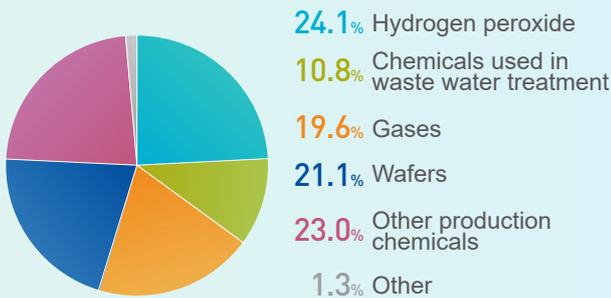
Please refer to Nanya Sustainability Report **Chapter Green** for more information on Water Management.

4.2 Scenario Analysis for Supply Chain Climate Risks

Transition Risk

Like Nanya, the operations of upstream suppliers may also be impacted by climate change policies and regulations such as implementation of carbon taxes (levies), mandatory use of renewable energy, and carbon tariffs on exports. Nanya is now actively inventorying and studying how such impacts affect suppliers. We started by evaluating leading Taiwanese suppliers for hydrogen peroxide, wafers, gases and chemicals as these were the main contributors to the carbon footprint of products and raw materials. Evaluation and analysis found that the impact of transition risks at each supplier on the operating costs of Nanya was negligible (less than 0.1%). Nanya will continue to issue requirements and cooperate with suppliers in order to effectively reduce our product carbon footprint.

Raw material procurement as a percentage of Nanya's carbon footprint



Revenue impact

Evaluation method

Major electricity user clauses for renewable energy

Less than **0.01%** | Supplier passing on the costs of complying with Taiwanese government's requirement that 10% of installed capacity should be renewable energy

Increase in market energy costs

Less than **0.05%** | Supplier passing on the costs from rising fossil fuel prices and changes in energy structure that increase market electricity costs by another 20 to 30%

Imposition of carbon levy

Approximately **0.01~0.03%** | Estimated from the current carbon tax of NT\$100 to NT\$300 per tonne with supplier passing on the costs Note 1

Investment in GHG reduction

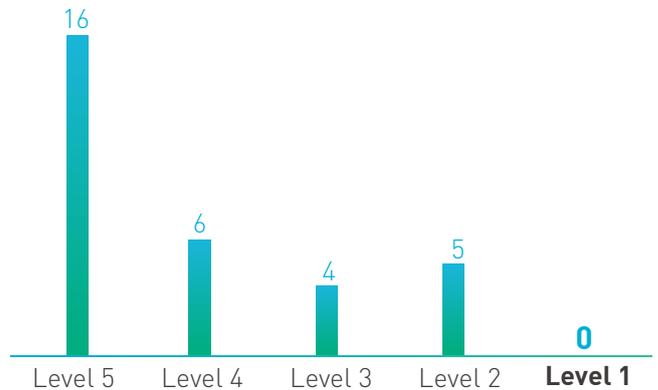
Less than **0.01%** | Estimate based on a minimum 25% reduction in GHG emissions by 2030 from suppliers participating in SBT targets Suppliers passing on of costs Note 2

Note 1: Comparable to the Taiwan NDC scenario.
Note 2: Comparable to the IEA APS scenario.

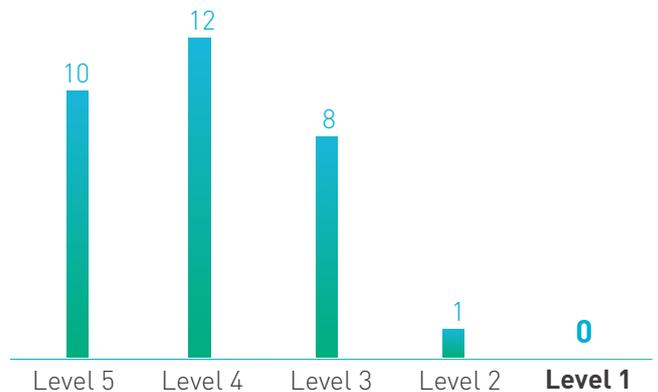
Physical risk

In addition to the transition risk that the supply chain will face, the increasing severity of natural disasters due to climate change may impact on supplier production and disruption of supply. Nanya is therefore working actively to establish the disaster potential of climate change at suppliers' operating locations. Nanya prioritized the assessment of our suppliers' production and supply locations (31 sites in total) in Taiwan. Cross-referencing with the IPCC AR5 RCP8.5 scenario database published by the Disaster Risk Adaptation (DR.A) platform of the National Science and Technology Center for Disaster Reduction (NCDR) found that 22 suppliers' production locations were at high risk of flooding and drought (Level 4 and 5). Nanya has now drawn up emergency response plans for high-risk supplier locations. The physical risks to Taiwanese suppliers from climate change were therefore assessed by Nanya to be low and should not disrupt production. In the future, Nanya will continue to manage the high-risk suppliers mentioned above. We will conduct climate change risk assessments for production locations outside of Taiwan in our supply chain as well to ensure the security of the overall supply chain.

Distribution of Supplier Flood Risk Level



Distribution of Supplier Water Shortage Risk Level



Countermeasures

Nanya is working with our supplier partners to build a low carbon, sustainable supply chain by focusing on three areas: supply chain risk management, cooperation and exchange, and improving sustainability.

Risk Management

Nanya Technology Corporation established a sustainable supply chain management process. We use regulations, risk surveys, on-site audits/improvement measures, and supplier capability development to strengthen suppliers' sustainability performance. To ensure that sustainability topics are being put into action by the supply chain, a "Nanya Technology Supply Chain Code of Conduct Questionnaire" is sent to key suppliers every year to provide a basis for sustainability risk management. The questionnaire looks at the potential impacts of suppliers in the economic, social and environmental aspects. The environmental aspect includes assessment on the potential impacts of climate change and GHG such as whether the vendor has implemented an environmental management policy, GHG management policy, energy management policy, and emergency response planning. High-risk suppliers are then picked out for on-site audits and mentoring.

Nanya has now compiled the Supply Chain Security Management Handbook and Supply Chain Security Emergency Response Management Procedure to govern internal risk assessment on interruption to supply of raw materials. Regular rehearsals of the emergency response management procedure are conducted as well to ensure that our inventory of raw materials and emergency backup suppliers are sufficient to cope with unexpected natural disasters. At the same time, the questionnaire is used by Nanya to conduct a risk assessment for all suppliers. Emergency response plans have now been drawn up for 22 high-risk production locations to ensure continuity of supply for Nanya in the event of natural disasters such as flooding and water shortages.

Cooperation and Exchange

Nanya regularly hosts the "Sustainable supply Chain Seminar" with experts, academics and supplier partners invited to attend. Nanya uses the seminar to promote our sustainable supply chain management strategy and share the topics of concern to Nanya with all suppliers. The annual supplier evaluation is used by Nanya to host a conference and discuss production-related requirements. Sustainability topics are also promoted at the conference. The outcomes of the annual evaluation are used to host a supplier award event as well. Top executives communicate Nanya's sustainability targets and requirements for the supply chain during the event.

Improving Sustainability

Nanya hopes that suppliers can join us in promoting energy conservation and carbon reduction initiatives as well. We inventoried the environmental impact and Scope 3 GHG emissions throughout the product life cycle. Looking at the product life cycle helped us identify emission hot spots in our raw material procurement. Priority was then given to communicating and coordinating with raw material vendors that are emission hot spots to discuss improvement projects, energy conservation plans, or proposals for introduction of renewable energy. During 2021, Nanya worked with 14 suppliers on the implementation of energy conservation projects that cut electricity consumption by more than 3,315 MWh. Suppliers have also shown their support for Nanya's low-carbon initiatives by investing in the use of renewable energy, or participating in international carbon reduction initiatives such as SBT and RE100. Investigations showed that our supplier partners will purchase more than 23,000 MWh of renewable energy by 2023. The joint environmental projects with suppliers outlined above will all make a contribution to the reduction of product carbon footprint.

Nanya is setting renewable energy, electricity conservation, and energy conservation targets for suppliers to accelerate improvements to the environmental performance of our supply chain. Suppliers are now expected to have 3% of their actual electricity usage come from renewable energy by 2025, Introduce GHG inventory mechanism by 2030, as well as cut their electricity consumption and carbon emissions by 10% and 20% respectively by 2030 compared to 2020. Nanya hopes to work with our supply chain partners to forge a sustainable, low-carbon supply chain and fulfill our duty as citizens of planet Earth together.

Please refer to Nanya Sustainability Report, **Chapter Responsible Procurement** for more information on Sustainable Supply Chain Management.

4.3 Scenario Analysis for Customer and Operational Downstream Climate Risks

Transition Risk

Many customers have begun seeking Nanya's support or cooperation on climate change topics in recent years. These include the setting of SBT, use of low-carbon energy, or supply of low-carbon products. Nanya studied and took an inventory of our customers' climate change strategy and potential requirements. Public disclosures through SBT, and RE100 and customers' sustainability reports were assessed and taken into consideration for Nanya's planning of our own low-carbon initiatives.

Customers participating in RE100	Customers with SBT (including commitment and set targets)
Number of customers	
8 customers	17 customers

Nanya's sales staff continuously communicates with the customer and sends the weekly projections of the customer's future demand forecast back to the Company. Demand forecasts reported by global sales are converted through the production and sales system into production plans. The Document Management System (DMS) and Customer Requirement System (CRS) then distribute the information to the relevant departments for assessment and implementation. Continuous adjustments are based on weekly feedback from sales staff to ensure customer expectations are met.

Physical Risk

Nanya conducts climate change risk assessments for delivery locations. The DR.Adatabase^{note} of NCDR was used to analyze the climate change risk level (flooding) of 18 shipping locations in Taiwan. 12 out of the 18 destinations were determined to be high risk. Nanya has now defined the Incoming and Outgoing Product Management Process and Rules Governing the Product Transportation, Storage, Packaging and Delivery. Emergency response plans have also been devised for scenarios (including natural disasters) where shipping may be impacted to ensure that Nanya products can be successfully delivered in our customers' hands. In the future, Nanya will expand the scope of our inventory, continue to cooperate with customer's requirements and monitor the conditions at the shipping location to ensure the intact delivery of our products.

Climate Change Risk Rating for Shipping Location

Unit: Vendors

Level 5	Level 4	Level 3	Level 2	Level 1
11	1	4	1	1

Note: The database was analyzed using the IPCC AR5 RCP8.5 scenario

Countermeasures

Our vision of becoming "The Best DRAM Partner for Smart World" guides Nanya's focus on the DRAM industry. We leverage our innovative R&D capability to develop advanced processes and products, enhance our low-power product portfolio, and upgrade packaging methods. We are continuing to supply high-performance, energy-efficient products in accordance with our R&D strategy of focusing on low-power products. Aggressive energy conservation and carbon reduction through green production processes also reduce the carbon footprint of the products we supply with flow-on benefits for the customer's end product. The energy efficiency of our products helped Nanya reduce our Scope 3 GHG emissions. The SBT reduction target of reducing GHG emissions per unit product by 27% will be achieved by 2030.

Nanya knows that climate change topics are of high concern to many customers. In addition to regular disclosures of related information through the sustainability report, we also participate in domestic/overseas initiatives or evaluations related to sustainable development or climate change such as TCFD, SBT, and Taiwan Alliance for Net Zero Emission. We are continuing to take part in international evaluations such as DJSI and CDP. Our comprehensive customer service management system provides customers with an up-to-date picture on the green carbon reduction initiatives of Nanya.

As a responsible corporate citizen, Nanya considers ESG to be an important corporate commitment and is continuing to focus on sustainable development. Domestic and foreign recognition of our sustainability performance showed that Nanya was able to balance its pursuit of business performance with the development of ESG. In terms of international recognition, Nanya was selected as a constituent stock of the highest DJSI World Index and Emerging Markets (ranked 1st in the global memory industry) in 2021; received the highest honor "A List Leadership Level" in the CDP Climate Change Evaluation for the second time. In terms of domestic recognition, Nanya received the National Enterprise Environmental Protection Award from the Environmental Protection Administration; Green Factory Certificate from the Ministry of Economic Affairs; Top Ten Sustainable Companies Award from the TCSA; Outstanding CSR Award from Global Views Monthly; and being selected for the CommonWealth Magazine Sustainable Excellence in Corporate Responsibility Award again.

5 Cultivation and Communication of Climate Change Awareness

5.1 Continued Development for Board of Directors and Management

Nanya's directors know that climate change is a potential risk topic and a global trend. Courses on climate change-related topics such as global risk trends and international carbon tax developments were therefore arranged by Nanya to enhance our directors' understanding of climate change and professional qualifications. In 2021, our directors undertook 109 hours of continuing education in total including 42 hours (38.5%) in climate change-related courses. [See Market Observation Post System for details](#)

Nanya actively participates in industry organizations such as the Net Zero alliance and TSIA's ESG initiative as well as international evaluations such as Dow Jones Sustainability Index (DJSI) and Carbon Disclosure Project (CDP) to stay on top of the latest international developments and standards. The industry information and feedback help Nanya enhance our expertise and governance on climate change.



Nanya Participates in Founding of Taiwan Alliance for Net Zero Emission



Nanya Promotes TSIA ESG Initiative

5.2 Cultivation and Communication of Employee Awareness

The promotion of climate change is not just the responsibility of the management or dedicated unit. Nanya hopes that all employees can be part of the effort too. Orientation training for new employees include courses on "Introduction to GHG Inventory and Carbon Footprint", and "Introduction to Green Product Management System and RBA" to provide employees with a basic knowledge of climate change topics and company actions. This will help employees take climate change into account in their work. At the same time, workshops and internal training courses on climate change are held at different times by the Company. The courses analyze and discuss the latest trends such as net zero, COP26 and carbon taxes to keep employees up to date. The Company updates employees on the latest business accomplishments through press release and e-newsletters as well. These help employees take pride in their company's performance and encourage them to play a party in mitigating or take a interest in climate change topics.

Employee commutes generate air pollution and carbon emissions (Scope 3). To solve this problem, Nanya set up 4 employee shuttle bus routes as well as free shuttle services (available to employees, suppliers, and customers visiting the Company on business) at National Taiwan Sports University Station and Chang Gung Hospital Station on the Airport MRT. Ride-sharing is used to reduce the GHG footprint from private vehicles and employees are provided with a range of commuting options.

In 2022, Nanya and affiliates of Formosa Plastics Group partnered with an electric scooter company in Taiwan to launch the "Ride to be Green" program. A subsidy of NT\$10,000 was provided to employees for purchasing new electric scooters, and NT\$16,000 for upgrades. When local government subsidies are factored in that meant employees could pay just 60% of the market price on electric scooters, greatly reducing the cost of switching to low-carbon transportation. The initiative is expected to reduce carbon emissions by up to 8,000 tons (based on the EPA estimate of each electric vehicle reducing emissions by 2.3 tons).



Provide additional subsidy for employee to purchase electric scooter

5.3 Cultivation and Communication of Supplier Awareness

In order to respond to trends in corporate sustainability, enhance sustainability awareness in the supply chain, and expand our influence to the entire product value chain, the “Sustainable Supply Chain Seminar” was again held by Nanya in 2020. Academics from the Taiwan Academy of Corporate Sustainability (TACS) and key suppliers were invited to take part in the exchange on corporate sustainability topics. The sustainable supply chain management strategy of Nanya Technology Corporation was promoted during the seminar, and issues of concern were shared with suppliers. Suppliers shared the measures they implemented for environmental and social sustainability, so that other suppliers attending the event could learn from each other. Furthermore, an expert from the Taiwan Academy of Corporate Sustainability was invited to analyze supply chain management trends. Exchanges during the seminar allow us to jointly move forward on the path to sustainability together with suppliers.

2020

Sharing of sustainable supply chain trends, energy conservation accomplishments, new energy technologies

2021

Sharing of sustainable supply chain trends, Nanya's sustainable supply chain strategy, renewable energy planning of suppliers, and the outcomes of the foreign worker human rights project.

5.4 Cultivation and Enhancement of Social Awareness

Nanya actively participates in external events to expand our influence in sustainability. As a long-time supporter of Earth Hour, appeals from top executives and online/offline interactive games in the social media were used to encourage employees to conserve electricity and protect the environment. A total of 463 people took part in the event in 2022. Nanya collaborated with nearby schools to introduce the younger generation to climate change, UN SDGs and corporate sustainability. For example, we partnered with Ming Chi University of Technology on the “ESG Design Concepts” and “Co-Creative Design Challenge” to inspire student interest in contemporary environmental and socio problems, and cultivate their ability to affect change.



Collaboration with universities on creative design courses and challenges



6 Metrics and Targets

6.1 Climate Change Management Goals

Five strategies have been adopted by Nanya for managing climate change risks and opportunities so targets have been set for Development of Low-carbon Products, Strategy for Green Technology and Production, Adaptation to Climate Change Risks, Partners in Sustainability, and Climate Advocacy and Education.

On the mitigation level, the Paris Agreement set a goal of limiting global warming to below 2°C and no more than 1.5°C if possible. Nanya developed our climate strategy using international IPCC, AR6 and IEA WEO reports. Planning was ultimately based on SBT (scientifically based and in line with international trends) and targets were set based on the scenario of well below 2°C.. A green technology and production model will reduce annual Scope 1 and Scope 2 GHG emissions by 2.5%. The goal is a 25% cut in emissions by 2030 with 2020 being the baseline year; for scope 3, the goal is a 27% reduction emissions per unit product by 2030 on the condition that there is no increase in total emissions.

Scope 3 emissions encompass the product and supply chain aspects. Nanya has therefore set targets for product innovation and is investing in the R&D of 10nm-class process technology products. Our goal is to start volume production of Gen2 10nm-class products in 2025 in order to provide DRAM products with higher performance and lower power consumption. Our supply chain management targets and joint initiatives with supplier partners are also aiming for a 20% reduction in carbon emissions and 10% reduction in energy consumption in 2030 compared to 2020.

At the same time, Nanya is strengthen our plant facilities, improve our resilience to natural disasters, and set adaptation targets with business continuity and zero personnel losses as our goal. We also participate in DJSI, CDP, climate advocacy and education to raise the profile of these topics and respond to stakeholder expectations.

Strategy	Mitigation Goals	Target year	Target
 Development of Low-carbon Products	R&D Progress for Advanced Processes and Products	2025	1B nm process technology based product enters volume production
	Scope 3 Greenhouse Gases ^{Note 1}	2030	27% reduction per unit of product compared to 2020
 Partners in Sustainability	Supply chain reductions	2030	<ul style="list-style-type: none"> · 10% reduction in electricity consumption compared to 2020 · 20% reduction in carbon emissions compared to 2020
 Strategy for Green Technology and Production	Scope 1 Greenhouse Gases ^{Note 1}	2030	25% reduction compared to 2020
	Scope 2 Greenhouse Gases ^{Note 1}	2030	25% reduction compared to 2020
	Renewable Energy Usage	2030	25 ~ 30% of total electricity consumption
	Electricity Savings	2025	Cumulative total of 80 MWh since 2017

Strategy	Adaptation Goals	Target year	Target
 Adaptation to Climate Change Risks	Process Waste Water Recovery Ratio	2025	92%
	Business Interruption due to Natural Disaster	2025	0 cases
	Occupational Injury due to Natural Disaster	2025	0 cases
	Green Buildings	2025 ^{Note 2}	All factories are green buildings
 Climate Advocacy and Education	DJSI		Continued inclusion
	CDP		Maintain Leadership rating

Note 1: Scope is existing factory operations

Note 2: Depends on the commissioning date of new factories. All new factories are currently designed as green buildings.

6.2 Climate Change Management Indicators

Nanya looks to the latest international trends and stakeholder requirements when developing our climate change strategy (Chapter 2), and identifying related risks and opportunities (Chapter 3). A variety of indicators are set for each aspect for tracking purposes. Different management platforms such as the Innovation Committee, Sustainable Supply Chain Committee, ISO 14001, ISO 50001 and ISO 14064 are employed for promoting related strategies and action plans. Performance is tracked and managed using the PDCA cycle. These enhance Nanya's performance on each climate change indicator in order to reduce the effect of our overall supply chain on climate change, and vice versa.

Nanya has invested innovation resources towards the R&D of low-carbon products. Products based on the 20 nm-class process technology are now seeing robust development and making tremendous contributions to energy conservation for our customers. Products based on the 10nm-class process technology are now moving towards mass production; Nanya has already invested in green technology and production through the introduction of new equipment, process improvements, as well as energy conservation and renewable energy measures. Scope 1 and 2 GHG emissions began showing signs of decrease in 2021, and the GHG emissions per unit product dropped by 37% compared to 2017. Inclusive supply chain is now being promoted by Nanya with sustainability audits used to identify the climate change risks to the supply chain. Mentoring and improvements have been completed for 100% cases to ensure continuity of supply in the event of natural disasters or new regulations. We also use the opportunity to inventory supplier capabilities to prepare for joint advocacy of sustainable supply chains. Nanya has embraced green building and green factory standards in the construction of operating locations. Continued improvements in are being made to our ability to respond and adapt to natural disasters as well. Emergency response plans have been refined through sound science to ensure our operations and the safety of our employees are not disrupted by natural disasters.

Finally, Nanya is continuing to enhance our climate governance ability and qualifications. We participate in international initiatives and evaluations to keep track of the trends for key indicators and quantify the results of our action plans. Since 2019, Nanya has maintained a Leadership rating in the CDP climate change questionnaire and was chosen three times for inclusion in the DJSI.

Strategy	Mitigation indices	2017	2018	2019	2020	2021
 Focus on Development of Low-carbon Products	Development Progress for Advanced Processes and Products	20nm-class Production Process Enters Volume Production	-	-	-	Complete the verification of 10nm-class DRAM process and component technology reliability
 Strategy for Green Technology and Production	Scope 1 Greenhouse Gases (Metric tons CO ₂ e)	61,287	78,312	88,701	90,327	56,409
	Scope 2 Greenhouse Gases (Metric tons CO ₂ e)	315,141	369,904	390,021	379,417	373,639
	Scope 1+2	376,428	448,216	478,722	469,744	430,048
	GHG Emissions per Unit Product (Metric tons CO ₂ e/kpcs)	0.61	0.47	0.45	0.42	0.38
	Cumulative Electricity Savings (MWh)	10,842	14,714	27,148	51,265	58,850
	Renewable Energy Usage (MWh)	0	0	0	362	2,600
 Partners in Sustainability	Coverage of Supplier Sustainability Risk Assessment (%)	100	100	100	100	100
	Defect Improvement Rate (%)	100	100	100	100	100
	Scope 3 Greenhouse Gases (Metric tons CO ₂ e)	-	534,062	1,001,224	1,073,770	972,973
Strategy	Adaptation indices	2017	2018	2019	2020	2021
 Adaptation to Climate Change Risks	Water Recovery Rate (%)	78.1	86	91	87.3	90.8
	Business interruption due to natural disasters (days)	0	0	0	0	0
	Occupational injury due to natural disaster (cases)	0	0	0	0	0
	Green Factory Certification	-	-	-	-	Label Awarded
 Climate Advocacy and Education	DJSI	-	Emerging Markets Index	Emerging Markets Index	Bronze Class Medal in The Sustainability Yearbook published by S&P Global	Emerging Markets Index
	CDP Climate Change	-	-	A-	A	A
	CDP Water Management	-	-	F	A-	A-

7 Future Outlook - Achieving Net Zero through Sustainability

A complete climate change risk and opportunity management cycle has been constructed by Nanya using the TCFD framework. Analysis of the climate change risk and opportunity matrix found that the greatest risks for Nanya were regulatory requirements and customer expectations of the company against a background of net zero emissions. Nanya has in turns devised and put into action five strategies to open up corresponding opportunities.

True corporate sustainability can only be realized through co-prosperity with the Earth's environment. Nanya is leveraging our advanced process technologies, high efficiency, and energy-saving products to create energy savings and sustainable competitiveness., and engage in GHG mitigation through green production. Adaptation is also being implemented through energy management and water management to increase our climate resilience.

At the same time, Nanya is also leveraging our own experience and those of our suppliers to enhance our sustainability performance together. A comprehensive audit and mentoring framework are employed to strengthen their climate resilience, face the challenges of climate change together and realize joint advocacy. Everyone from our directors to all employees are also actively working to enhance the climate change capabilities of the Company. We actively reach out to society as well as to make a positive contribution.

This Report is the first time that Nanya has used a systematic disclosure framework to communicate the efforts made by Nanya in managing climate change topics to all stakeholders. Guided by the spirit of sustainability, Nanya is now partnering with the rest of society on net zero emissions so that we can become "the best DRAM partner" in the "smart generation" and "smart generation."



Nanya's entire crew join the Earth Hour event

Appendix

Appendix A - TCFD Indicator Reference Table

Recommended Disclosures	Corresponding Section of the Report	Page
Governance		
Board's oversight of climate-related risks and opportunities.	Ch 1.1 Board Participation and Supervision	5
	Ch 5.1 Continued Development for Board of Directors and Management	28
Management's role in assessing and managing climate related risks and opportunities	Ch 1.2 Management Responsibility	6
	Ch 5.1 Continued Development for Board of Directors and Management	28
Strategy		
Climate-related risks and opportunities the organization has identified over the short, medium, and long term	Ch3.3 Outcome from Identification of Climate Change Risks and Opportunities	16
Impact of climate related risks and opportunities on the organization's businesses, strategy, and financial planning	Ch 2 Climate Strategy	7
	Ch 3.3 Outcome from Identification of Climate Change Risks and Opportunities	16
	Ch 4 Climate Risk Scenario Analysis and Countermeasures	19
Scenario Analysis (including 2°C or worse scenarios)	Ch 4 Climate Risk Scenario Analysis and Countermeasures	19
Risk Management		
Processes for identifying and assessing climate-related risks	Ch 3.2 Climate Change Risk identification Process	15
Process for managing climate related risks	Ch 3.1 Nanya Technology Corporation Risk Management Framework	13
	Ch 3.2 Climate Change Risk identification Process	15
How processes for identifying, assessing, and managing climate-related risks are integrated into the organization's overall risk management	Ch 3.1 Nanya Technology Corporation Risk Management Framework	13
	Ch 3.2 Climate Change Risk identification Process	15
Metrics and Targets		
Disclose the metrics and targets used by the organization to assess climate related risks and opportunities in line with its strategy and risk management process	Ch 3.2 Climate Change Risk identification Process	15
	Ch 6 Metrics and Targets	30
Disclose Scope 1, Scope 2, and if appropriate, Scope 3 GHG emissions, and the related risks	Ch 3.3 Outcome from Identification of Climate Change Risks and Opportunities	16
	Ch 6.2 Climate Change Management Indicators	31
Describe the targets used by the organization to manage climate-related risks and opportunities and performance against targets.	Ch 2 Climate Strategy	7
	Ch 4 Climate Risk Scenario Analysis and Countermeasures	19
	Ch 5 Cultivation and Communication of Climate Change Awareness	28
	Ch 6.2 Climate Change Management Indicators	31

Appendix B –References

1. 2021 Nanya Technology Corporation Annual Report
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