

CH4

Environmental Sustainability

- 4.1 Climate Change
- 4.2 Greenhouse Gas Management
- 4.3 Energy Resources Management and Circular Economy
 - 4.3.1 Energy Management
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- 4.4 Air Pollution Control
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Material topic: Greenhouse Gas Emissions ¹						
Policy and Commitment	2023 Goals		Future Goals ²			Specific Actions
	Goal Description	Achievement Status	Short-term 2024	Mid-term 2025	Long-term 2030	
<ul style="list-style-type: none"> Focus on green product development, promote green production, increase the use of renewable energy, actively reduce energy consumption and process greenhouse gas emissions, and commit to achieving net zero emissions by 2050. 	<p>Nuvoton Taiwan</p> <ol style="list-style-type: none"> Implement energy-saving and carbon-reduction projects to continuously reduce greenhouse gas emissions by 20% compared to 2022. Install equipment to reduce fluorinated gas emissions—reduce fluorinated gas by 45% compared to the previous year. <p>Nuvoton Japan</p> <ul style="list-style-type: none"> Reduce greenhouse gas emissions by 40% compared to the base year (2020). 	<p>Nuvoton Taiwan</p> <p>All goals achieved</p> <ol style="list-style-type: none"> Reduce greenhouse gas emissions by 25%³ Reduce fluorinated gas emissions by 48% compared to the previous year. <p>Nuvoton Japan</p> <p>All goals achieved</p> <ul style="list-style-type: none"> Reduce greenhouse gas emissions by 41%. 	<p>Nuvoton</p> <ul style="list-style-type: none"> Reduce by 40%. <p>Nuvoton Taiwan</p> <ul style="list-style-type: none"> 2 additional fluorinated gas reduction units are planned for the process, aiming to achieve a 60% annual reduction compared to the baseline year. Update chiller hardware and use AI technology to intelligently control the air conditioning system to achieve energy savings. <p>Nuvoton Japan</p> <ul style="list-style-type: none"> Develop a plan for the introduction of solar power generation. 	<p>Nuvoton</p> <ul style="list-style-type: none"> Reduce by 45% <p>Nuvoton Japan</p> <ul style="list-style-type: none"> Introduce solar power generation 	<p>Nuvoton</p> <ol style="list-style-type: none"> Reduce by 50% Achieve net zero emissions by 2050 as a long-term reduction goal. 	<p>Nuvoton Taiwan</p> <ul style="list-style-type: none"> Purchase energy-saving and carbon-reduction equipment to reduce greenhouse gas emissions. <p>Nuvoton Japan</p> <ul style="list-style-type: none"> Choose energy-saving equipment when updating equipment to reduce greenhouse gas emissions. Optimize the output of the cogeneration plant system⁴ to reduce CO₂ emissions. Stop low-operation production lines.

Material topic: Energy Resource Use and Consumption						
Policy and Commitment	2023 Goals		Future Goals ⁵			Specific Actions
	Goal Description	Achievement Status	Short-term 2024	Mid-term 2025	Long-term 2030	
<p>Nuvoton's energy management policy focuses on four main aspects:</p> <ul style="list-style-type: none"> Comply with energy-related laws and regulations, with all employees participating in energy saving and carbon reduction, and strengthen management to reduce energy consumption. Implement an energy management system, conduct regular management reviews, and continuously improve energy performance. Launch digital transformation plans, introduce smart manufacturing systems, and optimize energy smart integration. Support the procurement of energy-saving products, continuously improve equipment efficiency, and strive to achieve energy-saving goals. 	<p>Nuvoton Taiwan</p> <ol style="list-style-type: none"> Complete power-saving projects: 1% annual power savings compared to the previous year (2022). Complete the installation of solar equipment to reach 8% of the contracted capacity. Complete the establishment of the ISO 50001 system. <p>Nuvoton Japan</p> <ul style="list-style-type: none"> Average annual energy resource usage intensity reduced by 1% compared to the previous year. 	<p>Nuvoton Taiwan</p> <p>All goals achieved</p> <ul style="list-style-type: none"> with power-saving projects set: 1.8% annual reduction compared to the previous year (2022). Completed the installation of solar equipment to reach 8% of the contracted capacity. Completed the establishment of the ISO 50001 system. <p>Nuvoton Japan</p> <p>All goals achieved</p> <ul style="list-style-type: none"> Achieved by stopping the production line of Building C in Uozu and reducing the power generation of the cogeneration system in Nagaokakyo. 	<p>Nuvoton Taiwan</p> <ul style="list-style-type: none"> Reduce electricity consumption by 2% compared to 2023. <p>Nuvoton Japan</p> <ul style="list-style-type: none"> Average annual energy resource usage intensity reduced by 1% compared to the previous year. 	<p>Nuvoton Taiwan</p> <ul style="list-style-type: none"> Reduce electricity consumption by 5% compared to the base year (2020). <p>Nuvoton Japan</p> <ul style="list-style-type: none"> Average annual energy resource usage intensity reduced by 1% compared to the previous year. 	<p>Nuvoton Taiwan</p> <ul style="list-style-type: none"> Reduce electricity consumption by 10% compared to the base year (2020). <p>Nuvoton Japan</p> <ul style="list-style-type: none"> Reduce average annual energy resource usage intensity by 1% compared to the previous year within five years from 2025. 	<p>Nuvoton Taiwan</p> <p>Nuvoton Taiwan(See section 4.3 Energy Resource Management and Circular Economy for details.)</p> <ul style="list-style-type: none"> Install green energy equipment. Establish an energy management system. Optimize system load reduction. Choose energy-efficient equipment when replacing old ones. <p>Nuvoton Japan</p> <ul style="list-style-type: none"> Establish and manage energy-saving themes and progress. Conduct monthly performance evaluations based on the annual energy plan.

¹ This material topic pertains to greenhouse gas emissions in Scope 1 and Scope 2.
² The base year is 2020.
³ According to Taiwan government regulations, the 2023 GHG emission inventory data is based on IPCC 2006/AR5, compared to the 2022 GHG emission inventory standard (IPCC 2006/AR4). According to these standards, the GHG emissions in 2022 were 72,125 tons of CO₂e, while in 2023, they were 54,244 tons of CO₂e, a reduction of 25% (including only Scope 1 and Scope 2).
⁴ Private power generation facilities using city gas as a heat source, providing both electricity and heat.
⁵ The base year is 2020.

Material topic: Climate Change

Policy and Commitment	2023 Goals		Future Goals ¹			Specific Actions
	Goal Description	Achievement Status	Short-term 2024 ····	Mid-term 2025 ····	Long-term 2030	
· Nuvoton is committed to reducing greenhouse gas emissions and increasing the proportion of renewable energy. The company has adopted the risk management methods recommended by the Task Force on Climate-related Financial Disclosures (TCFD), focusing on four core elements: "Governance," "Strategy," "Risk Management," and "Metrics and Targets." This approach helps identify significant risks and opportunities related to operations, promoting various climate change mitigation and adaptation actions to continuously reduce risks, enhance resilience, and create sustainable development opportunities.	Nuvoton Taiwan 1. Implement water-saving initiatives ² to reduce water usage by 1% annually compared to the previous year. 2. Implement energy-saving and carbon-reduction projects to continuously reduce greenhouse gas emissions ³ by 20% compared to 2022. 3. Establish a carbon inventory platform to monitor the carbon emission status of each machine in real-time.	Nuvoton Taiwan All goals achieved 1. Implement water-saving initiatives to achieve a 2.8% annual reduction in water usage compared to the previous year. 2. Implement energy-saving and carbon-reduction projects to continuously reduce greenhouse gas emissions by 25% compared to 2022. 3. Complete the Power BI inventory platform to monitor the carbon emission status of each machine in real-time	Nuvoton Taiwan 1. Promote water reduction initiatives - achieve a 2.7% annual reduction in water usage compared to 2023. 2. Install equipment to reduce fluorinated gas emissions - achieve a 16% annual reduction in fluorinated gas emissions compared to 2023. 3. Establish a carbon accounting system - formulate the 2024 plan and propose business requirements.	Nuvoton Taiwan 1. Complete risk assessments for operational sites reaching 100%. 2. Install equipment to reduce fluorinated gas emissions - achieve a 60% reduction in process fluorinated gases compared to the base year by 2025. 3. Establish a carbon accounting system - complete the setup by 2025.	Nuvoton Taiwan 1. Promote water reduction initiatives - reduce water usage by 10% compared to the base year by 2030. 2. Install equipment to reduce fluorinated gas emissions - achieve a 70% reduction in process fluorinated gases compared to the base year by 2030. 3. Establish a carbon accounting system - use carbon accounting to determine internal product carbon quantification by 2030.	Nuvoton Taiwan · Promote integration (Nuvoton Taiwan/ Nuvoton Japan) meetings (see section 4.1 Climate Change). · Water and energy-saving measures (see section 4.3 Energy Resource Management and Circular Economy).
	Nuvoton Japan · Reduce greenhouse gas emissions by 40% compared to the base year.	Nuvoton Japan All goals achieved · Reduce greenhouse gas emissions by 41% compared to the base year.	Nuvoton Japan · Reduce greenhouse gas emissions by 46% compared to the base year (2020).	Nuvoton Japan · Reduce greenhouse gas emissions by 51% compared to the base year.	Nuvoton Japan · Reduce greenhouse gas emissions by 55% compared to the base year.	Nuvoton Japan · Choose energy-efficient equipment when updating equipment to reduce greenhouse gas emissions. · Optimize the output of the cogeneration plant system to reduce CO ₂ emissions. · Stop low-operation production lines.

1 The base year is 2020.
 2 Refers to the recycling of wastewater after the activation of filter materials in the pure water system.
 3 Nuvoton Taiwan calculates greenhouse gas emissions: Before 2022, the IPCC 2006 AR4 version announced by Taiwan's Environmental Protection Administration was used; the 2023 emission factors use the IPCC 2006 AR5 version announced by the aforementioned public department in 2024, and after 2024, the IPCC 2019 AR5 version will be used for calculation.



Nuvoton (Global) Net Zero Carbon Reduction Roadmap (CO₂e)

Year	2020	2021	2022	2023	2024	2025	2030	2050
Scope 1	70,344	68,846	65,039	39,794	40,711	27,132	23,179	0
Scope 2	142,948	121,143	107,862	98,350	93,931	95,596	93,207	0
Scope 1&2	213,292	189,989	172,901	138,144	134,643	122,728	116,386	0

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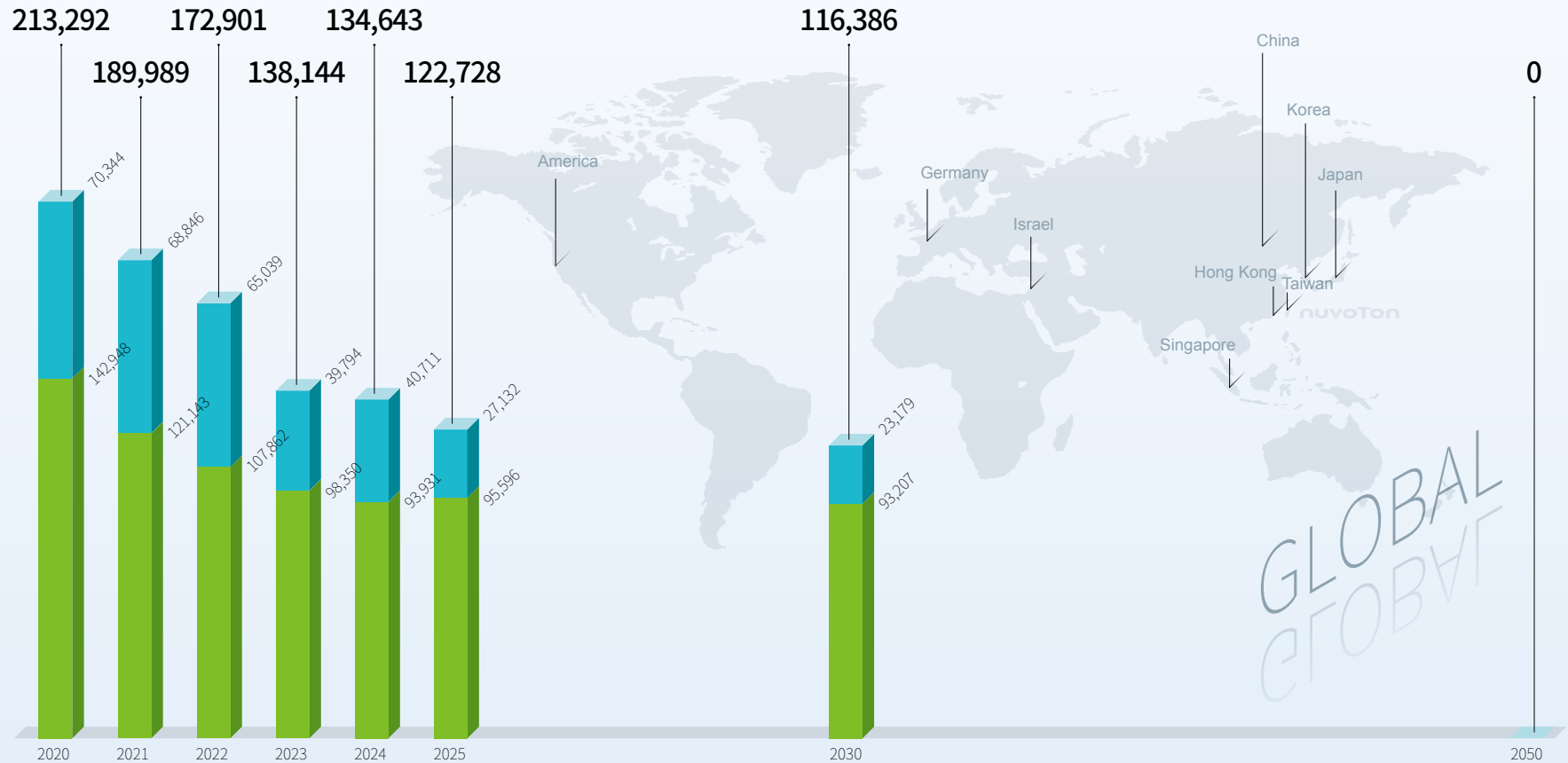
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Note 1 This chart shows the emissions and estimated values for all subsidiaries consolidated in the financial statements of Nuvoton.

Note 2 The values for 2024-2050 are estimates.

Note 3 The calculation of greenhouse gas emissions is based on the operational control approach, using the formula: activity data × emission factor × GWP value. The GWP values for 2020-2022 are based on the IPCC 2006 AR4 version, for 2023 they are based on the IPCC 2006 AR5 version, and the estimated data for 2024-2030 are based on the IPCC 2019 AR5 version.

Nuvoton is committed to achieving net zero emissions by 2050 as an overall environmental goal. The company has established three major environmental protection strategies: “Cherish Resource Use,” “Reduce Pollution Emissions,” and “Develop Green Products.” By promoting green production, increasing the proportion of renewable energy, improving energy performance, optimizing equipment efficiency, and reducing pollutant emissions, Nuvoton actively implements various greenhouse gas and energy resource reduction measures at its sites in Taiwan and abroad. To address the impacts of climate change, Nuvoton continues to identify significant potential and actual risks and opportunities posed by climate change to its operations and promote various climate change mitigation and adaptation projects.

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- Recycle secondary wastewater to the cooling tower through the DI activated carbon system.
- Promote waste classification and reduction, increase the reuse rate of hazardous waste, and enhance waste recycling and reuse rates.
- Install additional recycling machines to increase the recycling volume of waste sulfuric acid.
- Install smart meters for high-energy-consuming equipment in wafer manufacturing plants.
- Prioritize the purchase of energy-saving products when replacing old equipment.
- Continue planning and implementing various energy-saving and carbon reduction projects.

02 

- Establish a carbon inventory platform to monitor the carbon emission status of each machine in real-time.
- Introduce smart manufacturing systems to optimize energy smart integration.
- Increase the installation rate of solar panels.
- Install equipment to reduce fluorinated gas emissions at the process end, with annual increases in reduction capacity.
- Enhance leak protection in chemical storage areas of warehouses.
- Continue planning and implementing various energy-saving and carbon reduction projects.



▲ Expansion of solar panels in the parking lot of the Yanshin Plant



▲ Installation of solar power systems in the plant area

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- Adopt carbon reduction concepts in the product design phase, with volume or power consumption lower than the previous generation of products.
- Set overall carbon footprint reduction targets for green product production.



4.1 Climate Change

Environmental Management Policies and Goals

Nuvoton adopts “Cherish Resource Use,” “Reduce Pollution Emissions,” and “Develop Green Products” as the three main axes of its environmental protection strategy to gradually move towards a low-carbon transition. By taking concrete actions to mitigate environmental pollution risks in the production process and adhering to environmental regulations and relevant international standards, Nuvoton continues to fulfill its commitment to “becoming a sustainable green enterprise.” Nuvoton has established an environmental management system (ISO 14001) to promote environmental management policies and has formed an environmental protection committee to regularly review issues of stakeholder concern, regulatory compliance, and continuous environmental improvement plans.

In addition, Nuvoton has established an occupational safety, health, and environmental protection committee, under which specific functional teams are formed to develop reduction targets and policies for major environmental issues and implement various energy-saving policies to achieve reduction goals. To address the challenges and opportunities brought by climate change, Nuvoton continuously operates its environmental safety and health management system with the spirit of P-D-C-A (Plan-Do-Check-Act) and deepens the disclosure of environmental phase goals and strategies to meet stakeholder expectations, with the long-term goal of achieving net zero emissions by 2050.

Starting in 2023, Nuvoton has been promoting communication meetings between Nuvoton Taiwan and Nuvoton Japan to integrate the consensus of Taiwan and Japan sites, including formulating common promotion goals and directions; sharing energy-saving and carbon-reduction solutions with each other to achieve global goals; and initiating carbon reduction inventory in the supply chain, requiring suppliers to conduct carbon inventories and reductions accordingly.

Biodiversity

Nuvoton has always placed great importance on biodiversity. All production sites and office locations worldwide are situated in government-permitted industrial development zones and are not established in any environmental conservation areas. This ensures that the natural ecosystem’s original balance is not disturbed and that activities do not negatively impact the environment. At the same time, we strictly comply with environmental protection regulations, ensuring that wastewater, exhaust gases, and waste generated during production meet regulatory requirements. We actively participate in various environmental and ecological protection initiatives.

Specifically, in November 2023, Nuvoton Taiwan collaborated with the Wild Bird Society and organized 43 colleagues and their friends and family to gather at the Hengshan Citrus Orchard in Hsinchu County. This cooperation aimed to remove species that threaten biodiversity, such as Mikania micrantha, and restore the diversity of native aquatic plants.



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The goal of this work is to protect the area’s ecosystem and provide a suitable environment for biodiversity. Our volunteers actively participate in plant removal, plant protection, and environmental monitoring tasks to ensure the smooth progress and substantial results of the work.




Nuvoton continuously supports biodiversity and strives to reduce environmental impacts. These efforts not only demonstrate our company’s commitment to ecological protection but also reflect our emphasis on biodiversity. Nuvoton will continue to collaborate with relevant organizations and actively participate in various environmental

protection activities through exchanges between industry, government, academia, and research units. Nuvoton will also continue to evaluate various projects during forestry bureau activities and plan them accordingly, combining local design stages to reduce environmental footprints and impacts, contributing to a more eco-friendly Earth.

At the same time, we will continue to comply with environmental regulations to ensure that our company’s activities do not negatively impact the environment, continuously practicing corporate social responsibility and striving to create a better future.



Three Major Environmental Protection Strategies and Actions in 2023

			
Actions	<p>Cherish Resource Use</p> <ol style="list-style-type: none"> 1. Recycle secondary wastewater from the DI activated carbon system to the cooling tower. 2. Increase the recycling volume of waste sulfuric acid and reduce the use of alkaline neutralizing agents in wastewater. 	<p>Reduce Pollution Emissions</p> <ol style="list-style-type: none"> 1. Install on-site combustion scrubbers to treat exhaust from 23 reaction chambers, reducing particulate matter concentration and fluorinated greenhouse gas emissions. 2. Increase the dedicated recovery of sulfuric acid etching machines by 2 units, reducing the discharge of waste sulfuric acid. 	<p>Develop Green Products</p> <ol style="list-style-type: none"> 1. Implement green product design by adhering to carbon reduction concepts during the design phase. Set targets for volume (Die size or package size) or power consumption to be reduced compared to the previous generation of products to minimize environmental impact during production or end-use. 2. Additionally, set an overall carbon footprint reduction target for green product production: -38% (1.18 → 0.73) (kg CO₂/die).
Results	<ol style="list-style-type: none"> 1. Recycle 300 tons of water per year. 2. Save 34.2 tons of alkaline neutralizing agents per year. 	<ol style="list-style-type: none"> 1. Reduce fluorinated process gas emissions by 25% compared to the previous year. 2. Reduce particulate matter emissions by 40%. 3. Reduce waste sulfuric acid emissions by approximately 17.1 tons per year. 	<ol style="list-style-type: none"> 1. Eight new product series released in 2023 have reduced volumes by up to 77%, achieving the overall carbon footprint reduction target for product production on schedule: -38% (1.18 → 0.73) (kg CO₂/die).

Nuvoton Taiwan 2023 Environmental Management Goals and Results

Item	Year 2022	Year 2023	2023 Reduction Target	2023 Actual Reduction
Electricity	72,294 mWh	71,853 mWh	1.0% / Year	Achieved 1.8% / Year
Greenhouse Gas(Scope 1 and 2)	72,112t-CO ₂ e	54,244t-CO ₂ e	20%	Achieved 25%
Waste Volume	813 tons per year, reuse rate 73%	727 tons per year, reuse rate 66%	Reuse rate 75%	Not achieved <small>Note</small> Reuse rate 66%, reduction of 86 tons
Total Water Withdrawal	414 million liters	402 million liters	1% per year	Achieved 2.8%/per year

Note Due to the upgrade of waste treatment equipment in 2023, the processing efficiency increased, leading to a rise in weight. As this waste was not reused, the reuse rate decreased.

Environmental Management System Implementation

管理系統	Year Implemented		External Verification Passed	Year Passed
ISO 14001 Environmental Management System	2008 (Nuvoton Taiwan)	2009 (Nuvoton Japan)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	2023
ISO 14064-1 Organizational Greenhouse Gas Emissions	2009 (Nuvoton Taiwan)	Nuvoton Japan is expected to implement in 2024.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	2023
ISO 14067 Carbon Footprint Verification	2022 (Nuvoton Taiwan)		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	2022
ISO 45001 Occupational Health and Safety Management System	2008 (Nuvoton Taiwan)	2009 (Nuvoton Japan)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	2023
ISO 50001 Energy Management System	2023 (Nuvoton Taiwan)	Nuvoton Japan is expected to implement in 2025.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	2023





Climate-Related Financial Disclosures

According to the 2023 Global Risks Report published by the World Economic Forum (WEF), extreme weather and climate action failure have been identified as mid-to long-term focal points. Since the Paris Agreement set the goal to limit global warming to 1.5 ° C, governments around the world have successively declared net-zero targets and actively formulated regulations to strengthen climate change responses. Addressing the impacts of climate change has become a global issue that requires joint efforts. Nuvoton understands the importance of the interactive impact of climate change on corporate sustainable operations and has adopted the risk management methods recommended by the Task Force on Climate-related Financial Disclosures (TCFD). This involves identifying significant risks and opportunities to operations based on the four core elements: "Governance," "Strategy," "Risk Management," and "Metrics and Targets." Nuvoton promotes various climate change mitigation and adaptation actions to continuously reduce risks, enhance resilience, and create opportunities for sustainable development.

STEP 1

Risk Identification

Every year, based on the climate risks and opportunities announced by the TCFD, and referencing climate-related risks and opportunities mentioned in peer sustainability reports while considering international trends, the company compiles climate risks and opportunities related to its operations and business.



STEP 2

Risk Assessment

Evaluate the impact of each climate risk and opportunity on the company's development strategy and finances, serving as the basis for judging the degree of financial impact on planning.



STEP 3

Risk Treatment

After identifying significant climate risks and opportunities, control measures will be formulated for these items to achieve a reduction in the likelihood of risk occurrence and the degree of impact on the company.

The types of response strategies the company adopts include:

- 1 Risk Avoidance: Cease activities that generate risk
- 2 Risk Reduction: Reduce the likelihood and impact of risk occurrence
- 3 Risk Transfer: Transfer the loss when the risk occurs
- 4 Risk Acceptance: Accept the loss when the risk occurs



STEP 4

Risk Monitoring

The company compiles the results of risk identification, significant risks and opportunities judged by risk assessment, and the response strategies formulated by risk treatment, and reports them to the company's Sustainable Development Committee as the basis for formulating overall climate risk and opportunity policies, as well as for setting monitoring indicators and targets.



Nuvoton Climate Change Management Framework (TCFD)

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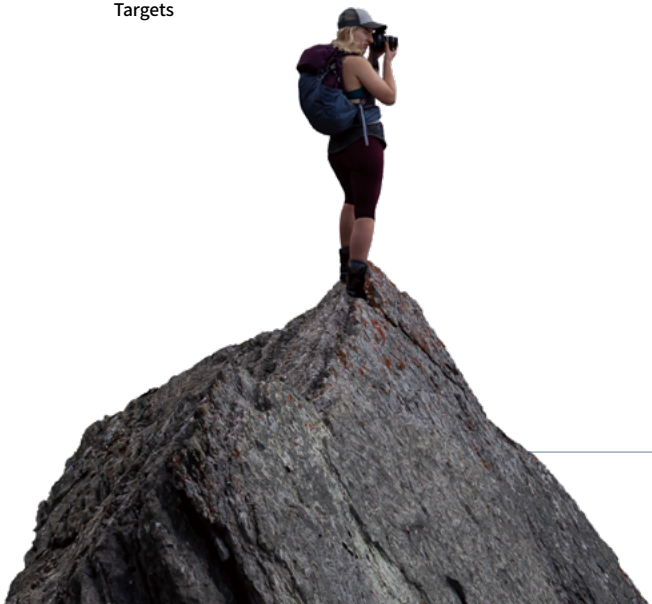
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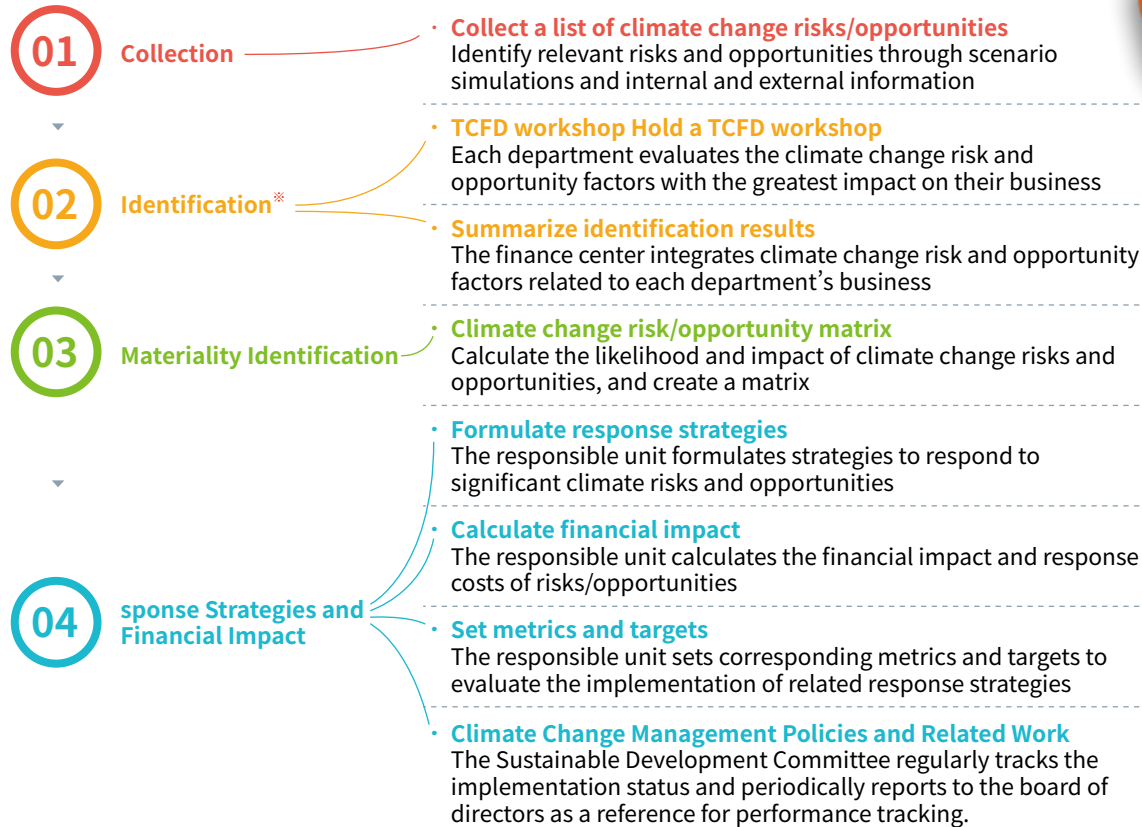
Aspect	Strategy and Actions	2023 Implementation Status
 Governance	<ul style="list-style-type: none"> The board of directors is the highest supervisory unit for climate change management, responsible for reviewing annual risk management reports, implementation reports, and audit reports to ensure the effective implementation of climate-related risk management systems. The Sustainable Development Committee is responsible for implementing and managing climate change risks and opportunities, reporting annually to the board of directors on corporate governance and sustainability operational risk issues (including climate change issues), risk assessments, and control measures. The board makes decisions on important issues. The Finance Center is responsible for identifying and assessing climate change risks and opportunities, regularly organizing climate change discussion meetings, and convening the risk management team to identify physical risks, transition risks, and opportunities related to climate change. They guide the proposal of corresponding improvement measures and targets. 	<ul style="list-style-type: none"> The Sustainable Development Committee reports annually to the board of directors on company issues related to climate change, including carbon emissions, water resources, power supply risks, natural disasters, and regulations. The chairman of the Sustainable Development Committee reports quarterly to the board of directors on greenhouse gas emissions, reduction measures in various scopes, and related environmental issues and activities.
 Strategy	<ul style="list-style-type: none"> Identify short-, mid-, and long-term climate-related risks and opportunities based on the TCFD framework (defining management periods: short-term is within 3 years, mid-term is 3-6 years, long-term is more than 6 years) Actively develop solutions to reduce the operational and financial impacts caused by climate change, aiming to enhance organizational climate resilience Introduce scenario analysis to understand the impact of climate change on Nuvoton 	<ul style="list-style-type: none"> Each unit identifies the results of climate risks and opportunities Gradually introduce scenario analysis in 2023 to identify the impact of climate change on Nuvoton
 Risk Management	<ul style="list-style-type: none"> Identify climate change risks and opportunities following the TCFD framework Plan and implement related response plans based on the results of climate risk identification Incorporate climate risk identification and assessment into the company's risk management process 	<ul style="list-style-type: none"> Evaluate the financial qualitative impact of significant climate-related risks and opportunities identified by each unit Use processes such as identification, assessment, treatment, and monitoring to manage potential climate risks

Aspect	Strategy and Actions	2023 Implementation Status		
 Metrics and Targets	<ul style="list-style-type: none"> Set climate change-related management indicators Disclose greenhouse gas emissions and assess impact Set climate change management targets and review the achievement and performance of these targets 	<p>In 2023, the following future targets for risks were set:</p> <table border="0"> <tr> <td style="vertical-align: top;"> <p>Nuvoton Taiwan</p> <ul style="list-style-type: none"> Promote water reduction: Reduce water usage by 10% by 2030 compared to the 2020 baseline year Install fluorinated gas reduction equipment: Reduce fluorinated gas emissions by 70% by 2030 compared to the 2020 baseline year Supplier greenhouse gas emission management: Establish and collect baseline greenhouse gas emissions and reduction targets from major suppliers, aiming for a 15% reduction by 2030 compared to the 2020 baseline year Use of natural gas boilers and local scrubbers for fluorinated gas treatment: Save energy, including 150,000 kWh/year, and install 2 natural gas fluorinated gas treatment units Increase energy-saving equipment: Replace energy-consuming motors, adjust production supply power (high-pressure air supply pressure), use LED lighting, etc., to reduce greenhouse gas emissions with a target of 1% annual reduction compared to 2022. Diverse energy use: Achieve 1% of total electricity consumption from solar power by 2024 </td> <td style="vertical-align: top;"> <p>Nuvoton</p> <ul style="list-style-type: none"> Monitor government incentive policies: Continuously monitor government incentive policies and inform relevant departments of specific details to evaluate and utilize these incentives Digital transformation: Reduce labor costs for product development through digital transformation <p>Complete by 2025</p> <ul style="list-style-type: none"> Establish a carbon accounting system: Create a carbon accounting system for each product through internal carbon emissions statistics and store sufficient carbon credits to achieve sustainable operations Increase energy-saving equipment: Including LED lighting to reduce greenhouse gas emissions, with a target of a 21.85% reduction based on the 2022 baseline year For more details, please refer to the TCFD report "Climate Change Related Metrics and Targets" </td> </tr> </table>	<p>Nuvoton Taiwan</p> <ul style="list-style-type: none"> Promote water reduction: Reduce water usage by 10% by 2030 compared to the 2020 baseline year Install fluorinated gas reduction equipment: Reduce fluorinated gas emissions by 70% by 2030 compared to the 2020 baseline year Supplier greenhouse gas emission management: Establish and collect baseline greenhouse gas emissions and reduction targets from major suppliers, aiming for a 15% reduction by 2030 compared to the 2020 baseline year Use of natural gas boilers and local scrubbers for fluorinated gas treatment: Save energy, including 150,000 kWh/year, and install 2 natural gas fluorinated gas treatment units Increase energy-saving equipment: Replace energy-consuming motors, adjust production supply power (high-pressure air supply pressure), use LED lighting, etc., to reduce greenhouse gas emissions with a target of 1% annual reduction compared to 2022. Diverse energy use: Achieve 1% of total electricity consumption from solar power by 2024 	<p>Nuvoton</p> <ul style="list-style-type: none"> Monitor government incentive policies: Continuously monitor government incentive policies and inform relevant departments of specific details to evaluate and utilize these incentives Digital transformation: Reduce labor costs for product development through digital transformation <p>Complete by 2025</p> <ul style="list-style-type: none"> Establish a carbon accounting system: Create a carbon accounting system for each product through internal carbon emissions statistics and store sufficient carbon credits to achieve sustainable operations Increase energy-saving equipment: Including LED lighting to reduce greenhouse gas emissions, with a target of a 21.85% reduction based on the 2022 baseline year For more details, please refer to the TCFD report "Climate Change Related Metrics and Targets"
<p>Nuvoton Taiwan</p> <ul style="list-style-type: none"> Promote water reduction: Reduce water usage by 10% by 2030 compared to the 2020 baseline year Install fluorinated gas reduction equipment: Reduce fluorinated gas emissions by 70% by 2030 compared to the 2020 baseline year Supplier greenhouse gas emission management: Establish and collect baseline greenhouse gas emissions and reduction targets from major suppliers, aiming for a 15% reduction by 2030 compared to the 2020 baseline year Use of natural gas boilers and local scrubbers for fluorinated gas treatment: Save energy, including 150,000 kWh/year, and install 2 natural gas fluorinated gas treatment units Increase energy-saving equipment: Replace energy-consuming motors, adjust production supply power (high-pressure air supply pressure), use LED lighting, etc., to reduce greenhouse gas emissions with a target of 1% annual reduction compared to 2022. Diverse energy use: Achieve 1% of total electricity consumption from solar power by 2024 	<p>Nuvoton</p> <ul style="list-style-type: none"> Monitor government incentive policies: Continuously monitor government incentive policies and inform relevant departments of specific details to evaluate and utilize these incentives Digital transformation: Reduce labor costs for product development through digital transformation <p>Complete by 2025</p> <ul style="list-style-type: none"> Establish a carbon accounting system: Create a carbon accounting system for each product through internal carbon emissions statistics and store sufficient carbon credits to achieve sustainable operations Increase energy-saving equipment: Including LED lighting to reduce greenhouse gas emissions, with a target of a 21.85% reduction based on the 2022 baseline year For more details, please refer to the TCFD report "Climate Change Related Metrics and Targets" 			



Climate Change Related Risk and Opportunity Identification Process

- To effectively manage climate-related risks and opportunities, the company's finance center includes climate change-related risks within the scope of overall corporate risk management tracking. This involves focusing on climate risks that may impact operations, including international regulatory norms and extreme weather events, estimating financial impacts and management costs, adjusting management mechanisms, and proposing response strategies to enhance the company's operational resilience.
- All departments jointly conduct climate risk assessments, comprehensively evaluating the potential impacts of related risks on operational processes. Through education and training, employees' awareness of global risk trends and climate change is enhanced, guiding them to identify potential climate-related risks and opportunities, and assess their likelihood, impact, and influence (for evaluation criteria, see the TCFD report).
- To establish a climate risk management mechanism and propose response strategies, the company convenes two meetings for consolidated risks and opportunities, attended by department supervisors or colleagues familiar with departmental business processes. They address high-risk and high-severity risks identified by each department and formulate appropriate management strategies (e.g., reduce, transfer, accept, or control).

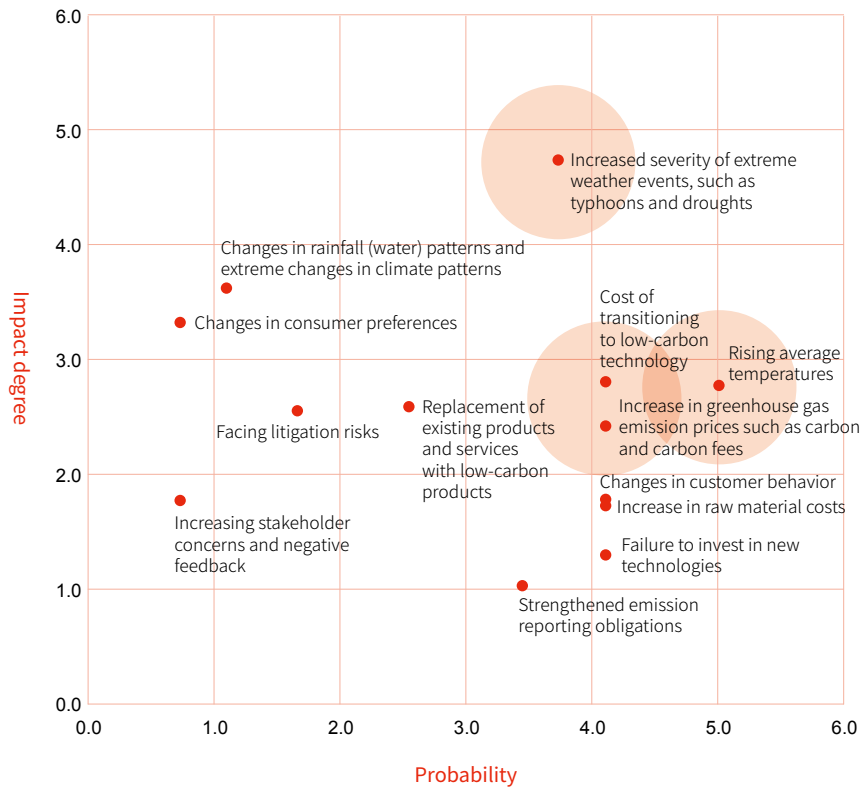


※ NuvoTon follows the TCFD guidelines and references four climate change scenarios to identify climate-related risks and opportunities. Transition risks and opportunities use Taiwan's Nationally Determined Contribution (NDC) and IEA NZE 2050; physical risk scenarios are assessed using the global warming scenarios SSP 3-7.0 and SSP 5-8.5 from the IPCC Sixth Assessment Report to develop response strategies.

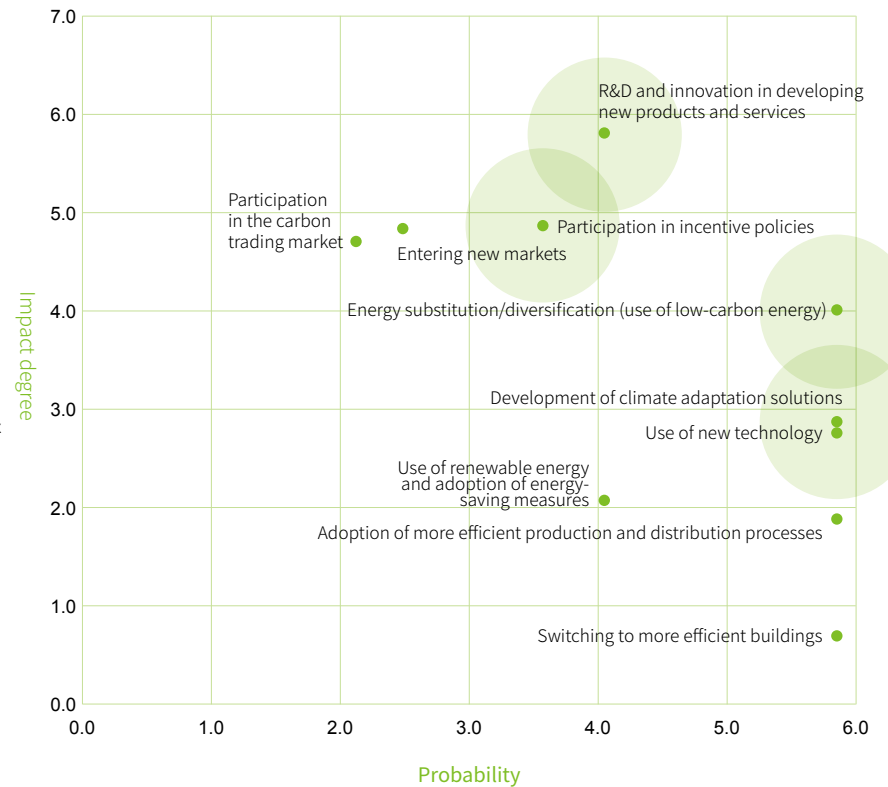




Climate Change Related Risk Matrix





Climate Change Related Opportunity Matrix



Identification and Response to Climate Risks and Opportunities

Nuvoton identifies climate risks/opportunities for regions (Taiwan and Japan), categorizing potential financial or operational impacts and formulating responses for each risk/opportunity.

Risk Aspects	Category	Risk Type	Occurrence Time*	Risk Description	Potential Financial or Operational Impact	Nuvoton Response	
<p>CH1 Sustainability Communication</p> <p>CH2 Green Products</p> <p>CH3 Excellence in Governance</p> <p>CH4 Environmental Sustainability</p> <p>CH5 Safe Workplace</p> <p>CH6 Social Prosperity</p>	 <p>Transition Risks</p>	Technology	Cost of transitioning to low-carbon technology	Short and Mid-term	Developing low-carbon products may increase R&D and production costs: additional R&D expenses are required to manufacture low-energy consumption products without reducing functionality; immature technology can lead to additional operational expenses. Differences in international energy-saving standards require product diversification, increasing operational costs. New technologies need process conversion, increasing costs for experiments, personnel training, and advanced equipment. If low-carbon products do not meet customer expectations, revenue may decrease. Low-carbon operations, such as using electric vehicles and energy-saving designs, also increase costs. Carbon taxes affect raw material costs, increasing operational expenses.	<p>Increased operating costs</p> <p>Decreased revenue</p> <p>Increased expenses</p>	<p>Conduct market demand surveys to understand the market demand for low-carbon products, ensuring product design meets consumer preferences. Improve design and production efficiency through digital transformation and AI technology, while enhancing supply chain management to increase resilience. For capital allocation, as capital expenditures for low-carbon transitions increase, it may be necessary to adjust capital allocation or seek new financing plans.</p> <p>Response cost 166 million</p>
		Policies and Regulations	Increase in greenhouse gas emission pricing	Short-term	Carbon taxes increase operating costs for enterprises, possibly requiring higher product prices, which can affect sales. In response to greenhouse gas policies, low-carbon raw materials and processes increase procurement costs. The global supply chain faces different climate policies in various countries, increasing supply chain uncertainty and risk.	<p>Increased operating costs</p> <p>Decreased revenue</p>	<p>Increase investment in low-carbon equipment to reduce greenhouse gas emissions. At the same time, enhance supply chain resilience through diversification and sourcing alternative raw materials to reduce raw material cost risks, and establish stable supply chain relationships to withstand price fluctuations.</p> <p>Response cost 524 million</p>
	 <p>Physical Risks</p>	Immediate	Increased severity of extreme weather events such as typhoons and droughts	Short-term	Drought-induced government water restrictions reduce factory capacity, leading to decreased revenue. Water-saving measures are needed, and production may be limited if insufficient. Alternative water sources or reuse may be necessary, increasing costs. Raw material supply is affected, increasing procurement costs. Limited water supply to the site may suspend services. Extreme weather damages machinery and equipment, increasing maintenance and operational costs. Supply chain disruptions affect revenue, and reputational damage may reduce customer trust and investment.	<p>Increased direct costs</p> <p>Increased operating costs</p> <p>Decreased revenue</p> <p>Decreased opportunities to obtain capital</p>	<p>Enhance drought response capabilities: expand water storage and treatment facilities, strengthen supply chain management, regularly assess climate-vulnerable suppliers and improve their resilience. Increase operational resilience using climate monitoring technology for early warning, enhance building and infrastructure durability, and ensure business continuity.</p> <p>Response cost 296 million</p>
		Long-term	Rising average temperatures	Short and Mid-term	Rising temperatures increase health and safety risks, such as heat stroke and infectious diseases, leading to higher labor costs and product price fluctuations. At the same time, high summer temperatures increase air conditioning electricity consumption, leading to higher operating costs.	<p>Increased operating costs</p>	<p>Increase investment to improve the working environment and employee health and safety, and regularly assess global warming risks to optimize human resource management.</p> <p>Response cost 110 million</p>

* Definition of time frames: Short-term: 2024, Mid-term: 2025, Long-term: 2026-2030.

Introduction

CH1 Sustainability Communication

CH2 Green Products

CH3 Excellence in Governance

CH4 Environmental Sustainability

CH5 Safe Workplace

CH6 Social Prosperity

Appendix

Risk Aspects	Category	Type	Occurrence Time	Opportunity Description	Potential Financial or Operational Impact	Nuvoton Response
	Resilience	Energy Substitution/Diversification	Short and Mid-term	Increase the use of diverse energy sources, such as solar and natural gas, to reduce operational interruption risks. Adopt low-carbon solutions to meet customers' low-carbon demands, enhance corporate image, and increase revenue. By establishing a low-carbon supply chain and adopting mature low-carbon technologies, reduce carbon emissions and related costs, increasing profitability.	Increased revenue Decreased operating costs Decreased business expenses	Install solar power systems and use natural gas equipment to reduce carbon emissions through diverse energy sources. Plan to increase the use of renewable energy and strengthen carbon management, including providing customers with carbon footprint reports and adding energy-saving devices. Achieve net-zero emissions through carbon reduction efforts and purchasing carbon offsets, increasing customer trust.
	Products and Services	R&D and Innovation in Developing New Products and Services	Short and Mid-term	Develop low-carbon products to enhance market competitiveness and revenue, meeting the increasing demand for energy-efficient and environmentally friendly products. Enter new markets, increase sales through the diversification of low-carbon products and technological innovation, and enhance corporate reputation and sustainability image. Additionally, the development of low-carbon technologies helps reduce production costs, especially in the automotive and industrial sectors.	Increased operating revenue Decreased operating costs	Increase investment in R&D and innovation, focusing on the development of low-carbon products and improving energy efficiency. Collaborate with suppliers to choose low-carbon raw materials, enhance the environmental standards of products and the supply chain, and meet market demand for low-carbon products. Increase the visibility of low-carbon products by expanding sales channels and strengthening marketing, adhering to sustainability principles, and enhancing brand image.
	Market	Participation in Incentive Policies	Mid-term	By reducing greenhouse gas emissions and promoting low-carbon products, the organization can receive government subsidies and tax incentives. Additionally, companies that meet climate change action standards are more likely to receive preferential financing from financial institutions, reducing financing costs while enhancing corporate image and reputation.	Reduced operating costs Increased opportunities to obtain capital	Continuously track and plan to apply for government incentive policies, formulate and implement carbon reduction targets and strategies. Conduct greenhouse gas inventories, communicate with stakeholders to reach consensus, and identify and manage sustainability risks, meeting financial institution assessment standards to strengthen sustainability management plans.
	Products and Services	Development of Climate Adaptation Solutions	Short and Mid-term	Strengthen operational and supply chain resilience by introducing business continuity plans (BCP/BCM), prioritizing the production of key products to ensure stable supply. This helps enhance customer trust and reputation, thereby increasing revenue. Additionally, systematically managing supplier and customer relationships further reduces operating costs.	Increased operating revenue Reduced operating costs	Establish BCP/BCM systems, select suppliers that meet standards, and increase development and evaluation costs. Introduce and obtain ISO14064 and ISO50001 certifications, increasing maintenance and IT construction costs, and investing necessary IT and human resources.



Opportunities



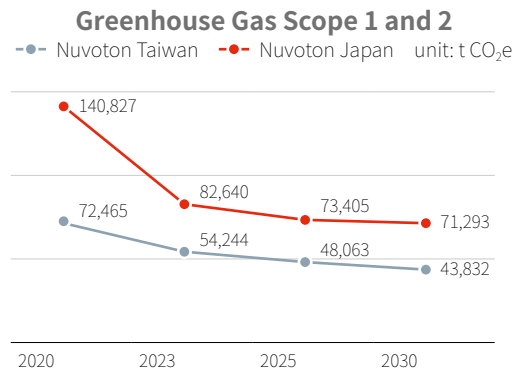
Climate Change Response Strategies

To address the risks and opportunities brought by extreme climate, Nuvoton, with the vision of “Invisible Champion enriching human life with green semiconductor technology,” actively launches various carbon reduction actions and establishes greenhouse gas reduction targets within the group. The company has formed an energy-saving and emission reduction team to build a green low-carbon operating model and, through continuous technological innovation and R&D capabilities, enhance the green manufacturing process (green semiconductor technology) and improve green products. For more details, please refer to the [TCFD report](#) “3. Climate Change Response Strategies.”



Net Zero Path

Nuvoton Taiwan and Japan have set reduction targets for Scope 1 and Scope 2 greenhouse gas emissions. For Nuvoton Taiwan, the total Scope 1 and Scope 2 emissions are to be reduced to 48,063 t CO₂e by 2025 and 43,832 t CO₂e by 2030. For Nuvoton Japan, the total emissions are to be reduced to 68,683 t CO₂e by 2025 and 65,792 t CO₂e by 2030.



Carbon Reduction Strategy

- Green Manufacturing Process:** Install equipment that effectively handles greenhouse gases and develop renewable energy
- Green Operations:** Introduce carbon pricing, improve energy efficiency, and reduce supplier carbon emissions
- Green Products:** Develop sustainable products and miniaturize chip sizes



Strategic Axes

Description (For detailed content, please refer to the strategy section of the [TCFD report](#))



Green Products

From design, production, transportation, and usage to disposal stages, Nuvoton is committed to creating environmentally friendly green products through corresponding actions. For details, please refer to [2.2 Green Manufacturing “Development of Green Products.”](#)



Low-Carbon R&D and Investment

Nuvoton continues to invest in advanced processes, significantly reducing chip size through process improvement, enhancing resource utilization, and reducing energy consumption and greenhouse gas emissions, thereby lowering the overall carbon footprint of products. The following targets are set:

- Short-term:** Compared to 2023, the number of products using advanced processes in 2024 will increase by more than 50%
- Mid-term:** Compared to 2023, the number of products using advanced processes in 2025 will increase by more than 60%



Green Product Carbon Footprint

To enhance the recognition of low-carbon products and services, Nuvoton calculates the carbon footprint of green products (CFP) based on ISO 14067, reducing the environmental impact of green products. This approach aims to mitigate climate change by reducing greenhouse gas emissions while increasing corporate revenue growth. In 2023, the total reduction in the carbon footprint of green products was -38% (1.18 → 0.73) (kg CO₂/die).



4.2 Greenhouse Gas Management

Nuvoton, based on its safety, health, and environmental policy, continues to promote the reduction of energy resource usage and carbon reduction measures. Following the introduction of carbon fees, this will further enhance the economic benefit estimates of related carbon reduction efforts. In the future, Nuvoton will evaluate setting an internal carbon pricing better than carbon fees to improve the feasibility of implementing carbon reduction measures. Nuvoton commits to reducing global Scope 1 greenhouse gas emissions by 73% by 2025 and by 77% by 2030 compared to 2020 levels.

In 2023, Nuvoton implemented several measures to reduce greenhouse gas emissions (corresponding power-saving measures are detailed in [4.3.1 Energy Management](#)). Consequently, according to third-party verification, the total Scope 1 and Scope 2 greenhouse gas emissions for Nuvoton in 2023 were 138,144 t-CO₂e, a reduction of 35,728 t-CO₂e (20.5%) compared to 2022. The total Scope 1 emissions in 2023 were 39,794 t-CO₂e; the total Scope 2 emissions were 98,350 t-CO₂e; the total Scope 3 emissions were 724,911 t-CO₂e (for other data, see [Appendix I](#), Environmental Data, and [Appendix VI, TWSE/TPEx-Listed Companies Climate-related Information](#)).

	2022	2023	compared to the previous year
Scope 1	65,039	39,794	38.8%
Scope 2	108,820	98,350	9.6%
Total	173,859	138,144	20.5%
Scope 3	N/A	724,911	N/A



Nuvoton Taiwan

Since 2009, Nuvoton Taiwan has established a greenhouse gas inventory mechanism by following ISO 14064-1 greenhouse gas inventory standards and the “Guidelines for Greenhouse Gas Emission Verification and Registration” issued by the Environmental Protection Administration. The company regularly inventories Scope 1 and Scope 2 emissions within the wafer fab and obtains verification from third-party verification agencies.

Nuvoton Japan

Since 2023, Nuvoton Japan has also obtained third-party verification following ISO 14064-1 standards, similar to Nuvoton Taiwan, to ensure the credibility and quality of inventory data and reports.

Carbon Reduction Action

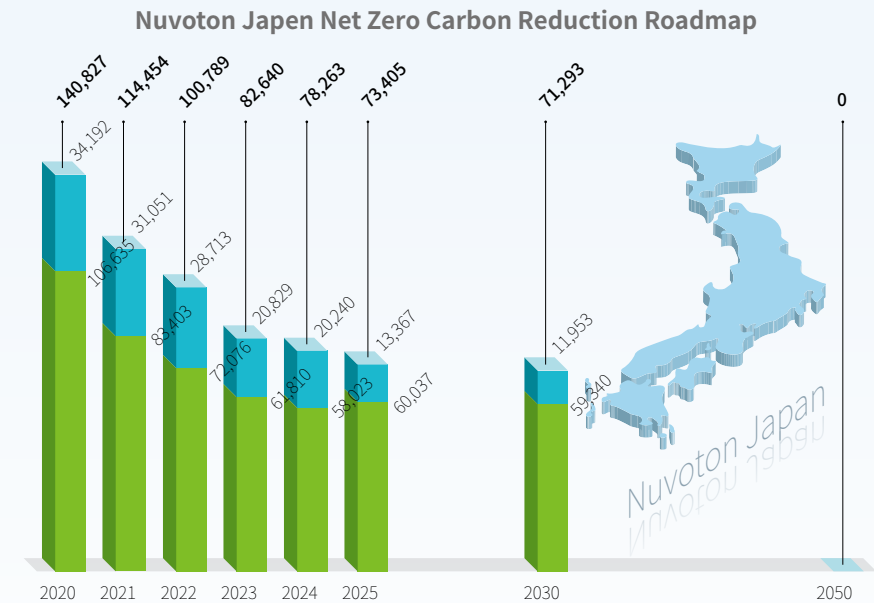
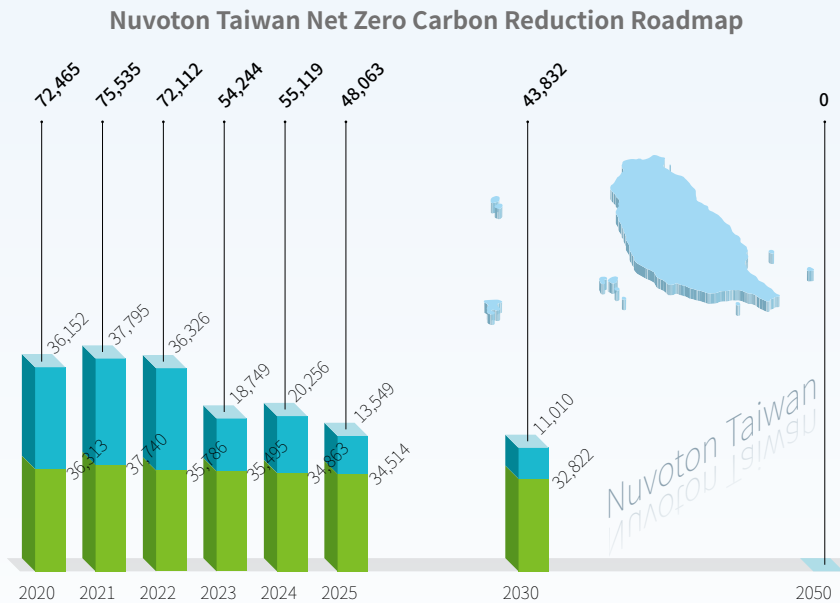
	Nuvoton Taiwan	Nuvoton Japan
 <p>Scope 1</p>	<p>Since the emissions from process gases at Nuvoton Taiwan account for more than 90% of the carbon emissions in this scope, reducing greenhouse gas emissions from processes is set as the main reduction target. The primary reduction strategy has evolved from substituting process gases for process optimization in the early stages to installing fluorinated gas reduction equipment at the process end in the current stage. In 2023, Nuvoton Taiwan completed the installation and formal operation of three pieces of fluorinated gas reduction equipment at the process end, improving the efficiency of the reduction equipment and planning to increase the number of units annually.</p>	<p>In 2023, reduced Scope 1 emissions by 27% through the cessation of production at the Uozu Plant C Building, reducing the output of the Nagaokakyo cogeneration plant, and upgrading the cooling units at the Arai plant from absorption to turbine.</p>
 <p>Scope 2</p>	<p>In 2023, there was a reduction of approximately 290 t-CO₂e compared to 2022. Additionally, Nuvoton continues to monitor greenhouse gas emissions throughout the product life cycle and conducts product carbon footprint inventories to track greenhouse gas emissions from raw materials and production stages.</p>	<p>All plants adopted LED lighting and energy-saving equipment or designs, resulting in a 14% reduction in Scope 2 emissions that year.</p>



Nuvoton Taiwan Net Zero Carbon Reduction Roadmap								
Year	2020	2021	2022	2023	2024	2025	2030	2050
Scope 1	36,152	37,795	36,326	18,749	20,256	13,549	11,010	0
Scope 2	36,313	37,740	35,786	35,495	34,863	34,514	32,822	0
Scope 1&2	72,465	75,535	72,112	54,244	55,119	48,063	43,832	0

Nuvoton Japan Net Zero Carbon Reduction Roadmap								
Year	2020	2021	2022	2023	2024	2025	2030	2050
Scope 1	34,192	31,051	28,713	20,829	20,240	13,367	11,953	0
Scope 2	106,635	83,403	72,076	61,810	58,023	60,037	59,340	0
Scope 1&2	140,827	114,454	100,789	82,640	78,263	73,405	71,293	0

Scope 3 emission sources by category in 2023		
Emission sources	Nuvoton Taiwan emissions (tCO ₂ e)	Nuvoton Japan emissions (tCO ₂ e)
Purchased goods and services	85,493	450,932
Capital goods	3,015	11,151
Fuel- and energy-related activities (Not included in activities covered by the G4-EN3 indicator)	7,134	13,426
Upstream transportation and distribution	158	1,425
Waste generated in operations	103	45
Business travel	244	643
Employee commuting	496	433
Downstream leased assets	1,068	155
Downstream leased assets	Not applicable	147,730
Investments	1,261	Not applicable
Subtotal	98,972	625,940
Total	98,972	724,911



Note 1 The calculation of greenhouse gas emissions is based on the operational control approach, using the formula: activity data * emission factor * GWP value. The GWP values for 2020-2022 are based on the IPCC 2006 AR4 version, for 2023 they are based on the IPCC 2006 AR5 version, and the estimated data for 2024-2030 are based on the IPCC 2019 AR5 version.

Note 2 The calculation of greenhouse gas emissions is based on the operational control approach, using the formula: activity data * emission factor * GWP value. The GWP values for 2020-2022 are based on the IPCC 2006 AR4 version, for 2023 they are based on the IPCC 2006 AR5 version, and the estimated data for 2024-2030 are based on the IPCC 2019 AR5 version.

■ Scope 1 ■ Scope 2

4.3 Energy Resource Management and Circular Economy

4.3.1 Energy Management

Electricity is the main source of energy consumption for Nuvoton. In 2023, renewable energy accounted for 0.17% of the total energy types used by Nuvoton Taiwan, and purchased electricity accounted for 96.39%*. To this end, through the P-D-C-A (Plan-Do-Check-Action) mechanism, Nuvoton aims to increase energy use efficiency and raise the proportion of renewable energy use. Various energy-saving and carbon-reduction projects have been actively launched, and the energy management system has been implemented. In 2022, the ISO 50001 energy management system was introduced and certified in 2023. Additionally, a digital transformation plan was initiated, introducing smart manufacturing systems to optimize energy smart integration; Nuvoton continues to support the procurement of energy-saving products and optimize equipment efficiency to achieve energy-saving goals.

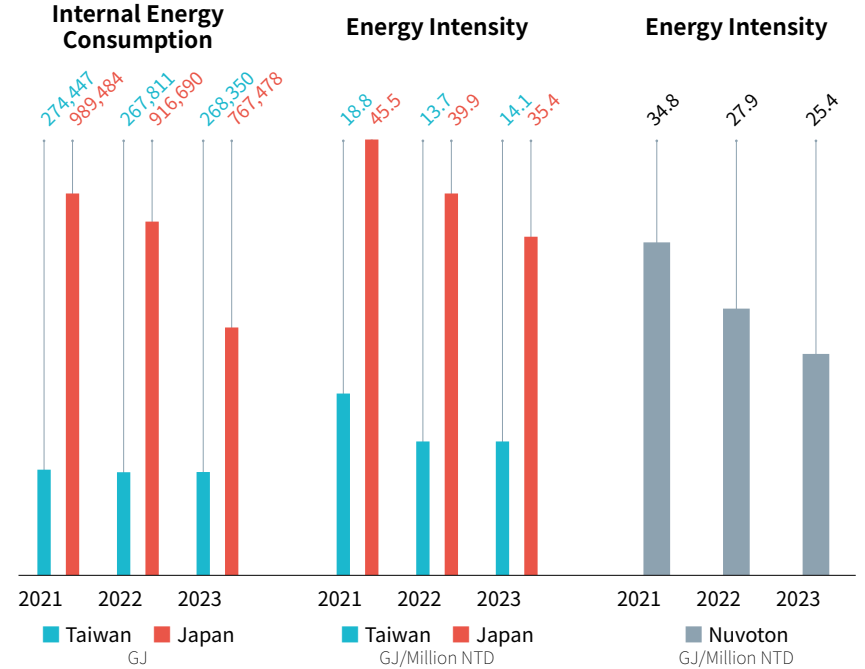
In 2023, Nuvoton Taiwan's energy reduction ratio decreased by 0.1% compared to the baseline year (2020), while Nuvoton Japan achieved a significant energy reduction ratio over the past three years, with a 26% decrease in 2023 compared to the baseline year (2020).

In 2023, energy-saving measures were undertaken in four main areas:





<p>Install green energy equipment</p> <p>Establish a solar power system, expected to generate 880,000 kWh/year</p> 	<p>Establish an energy management system</p> <p>Obtain ISO 50001 certification</p> 	<p>System supply load optimization</p> <p>Optimize HPA supply pressure (8.4 → 7.8 kgf/cm²), saving 182,000 kWh/year</p> 	<p>Prioritize energy-saving equipment when replacing old equipment</p> 
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* In 2023, the types of energy used by Nuvoton Taiwan included purchased electricity, gasoline, diesel, natural gas, and renewable energy, totaling 268,350 GJ. Of this, renewable energy accounted for 447 GJ, with purchased electricity being the majority at 258,670 GJ.

Nuvoton Internal Energy Consumption and Energy Intensity



Nuvoton 2023 Energy-saving and carbon reduction projects promoted

Item	2023 Target	2023 Actual Results	Future Goals
 <p>Solar renewable energy.</p>	 <p>In 2023, 8% of the contracted capacity for renewable energy was completed (annual production of 880,000 kWh).</p>	 <p>Starting in Q4 2023, regional power generation began, with a total of 120,000 kWh generated in 2023.</p>	 <p>Evaluating the addition of solar panels in the parking lot of the Tainan office.</p>

Introduction

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CH2 Green Products

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Appendix

Nuvoton 2023 Energy Saving Results¹

	Electricity Saving (kWh/year)	Energy Saving (GJ/year)
Solar Power Installation	880,000	3,168
Update High Vacuum Unit 1 to Variable Frequency Machine	87,600	315
Optimize HPA Supply Pressure (8.4 → 7.8 kgf/cm ²)	182,500	657
Replace Scrubber Fan with Energy-Saving Motor	10,000	36
Replace P5000, Lam Units with Energy-Saving Pumps 12 Units	112,500	408
Replace LP-P with 2 Energy-Saving Pumps	30,000	108
Change Hsinchu Plant Sign Projector Lights and Landscape Lights to LED	1,906	7
Change Explosion-Proof Lights to LED	25,000	90



Total electricity saving
1,329,506
kWh/year



Total energy saving
4,786
GJ/year

Nuvoton Japan 2023 Energy Saving Results

(Including Nagaokakyo, Uozu, Arai Plants)

- Nagaokakyo, Uozu: Use LED Lighting
- Arai: Equip North and South Chilled Water Secondary Pumps in C Building with High-Efficiency Motors, Stop Existing Heat Source Building Absorption Chillers, Cease Operation of Existing Heat Source Building Absorption Chillers, Switch to LED Lighting, Use Air Conditioning Timers in Facility Offices



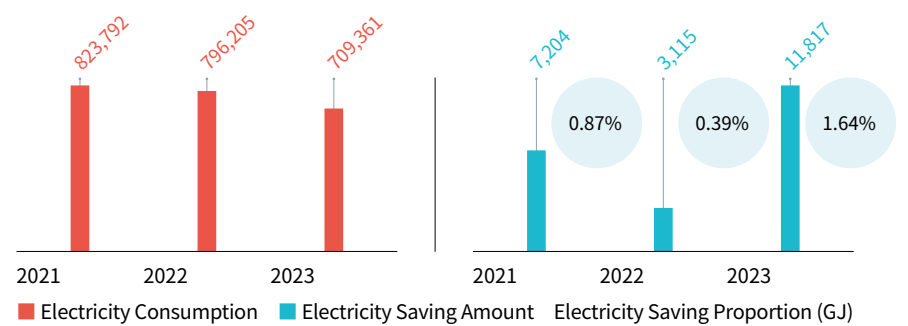
Total electricity saving
1,953,052
kWh/year



Total energy saving
7,031
GJ/year

¹ Energy saving is calculated at 3.6×10⁻³ GJ per kWh.

Electricity Saving Amount and Proportion Over the Past Three Years²

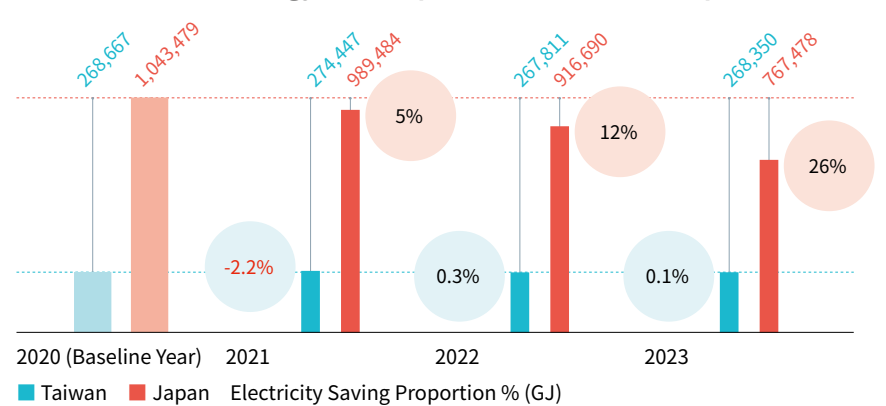


² The scope includes Nuvoton Taiwan and Nuvoton Japan. Annual electricity saving rate = annual electricity saving amount / (annual electricity saving amount + annual electricity consumption) * 100%

Mid- and Long-Term Energy Saving and Carbon Reduction Targets and Planned Corresponding Actions

Strategy and Content	Mid-Term Target (2025)	Long-Term Target (2030)
Use of Renewable Energy	Solar power generation of 880,000 kWh/year	Continue to evaluate potential sites for installation
Improve Energy Use Efficiency	Achieve a cumulative energy-saving rate of 5% compared to the baseline year (2020)	Achieve a cumulative energy-saving rate of 10% compared to the baseline year (2020)

Total Internal Energy Consumption and Reduction Proportion³



³ The reduction proportions for each year are compared to the baseline year of 2020.

4.3.2 Water Resource Management

In 2023, the distribution of water sources for Nuvoton’s water usage was 86% from municipal water supplied by the water company, and 14% from recycled rainwater and air conditioning condensate as secondary water. For Nuvoton Japan, the sources were 0.6% from municipal water, 1.0% from industrial water, and 98.0% from groundwater. The two main strategies for saving water are to prioritize reducing usage at the source and recycling usage at the end to reduce water resource consumption.

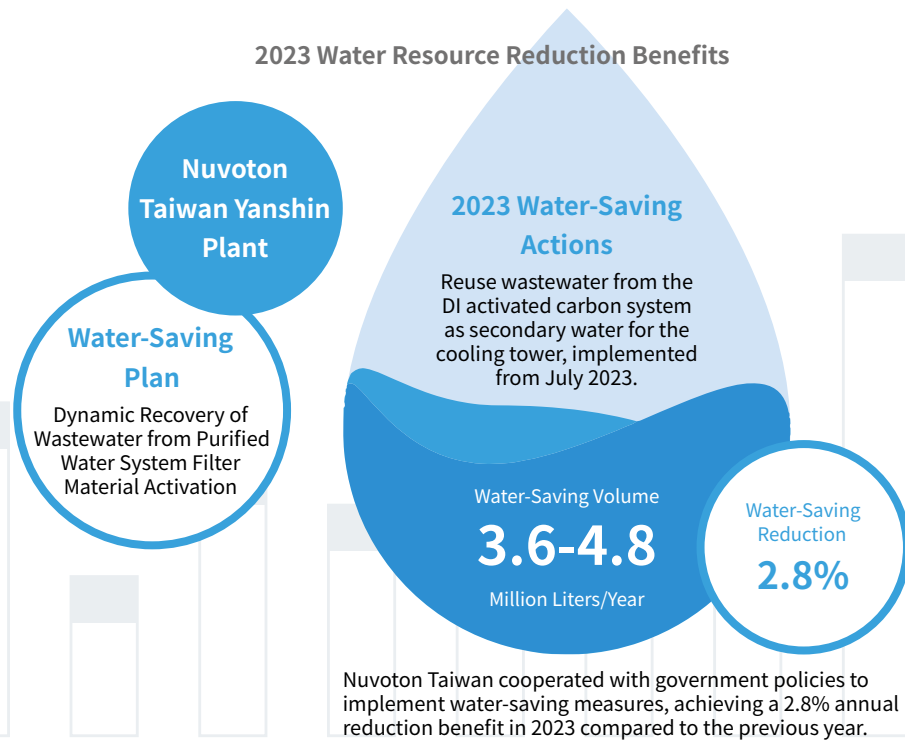
Nuvoton sets annual water usage targets and promotes related plans, regularly reviewing progress and benefits, and analyzing and improving items that do not meet targets. Regarding upstream impacts, Nuvoton Taiwan regularly inspects reservoir conditions monthly, and when the effective water volume falls to the warning level, an external water source search procedure will be initiated. Regarding downstream impacts, Nuvoton

Taiwan constantly monitors the standards of the Science and Technology Management Bureau, continuously monitoring related discharge data within the plant, and the management bureau regularly dispatches personnel for water sampling audits to ensure that discharged wastewater meets requirements. Nuvoton Taiwan cooperated with government policies to implement water-saving measures, achieving a 2.8% reduction in water usage in 2023 compared to the previous year.

Nuvoton Taiwan’s main production and operation site is located in the Hsinchu Science Park, with water sourced from the Baoshan Reservoir in Hsinchu. According to the “Aqueduct Water Risk Atlas” from the World Resources Institute, the total withdrawal and consumption percentages from areas with high or extremely high baseline water stress are zero, with no use of groundwater or seawater, indicating a low potential impact on local water use. The industrial and domestic wastewater generated by enterprises in the park is collected via sewer systems and sent to the park’s wastewater treatment plant. After treatment, the water quality exceeds national discharge standards and is released through dedicated pipes into the Keya River, with no impact on the ecological environment and water quality.

In 2023, Nuvoton’s total water withdrawal was 7,886 million liters; the total discharge volume was 3,637 million liters. All were reported in accordance with regulations, with no concerns about waste or wastewater leakage affecting the surrounding environment.

Wastewater primarily includes process wastewater and domestic wastewater. Process wastewater sources can be generally divided into cleaning, film formation, etching, development, and diffusion processes. Wastewater is categorized into acidic and alkaline wastewater, fluorinated wastewater, and grinding wastewater. Depending on their characteristics, treatments such as acid-base neutralization or adding calcium chloride to fluorinated wastewater, coagulation, and sedimentation are used to meet the standards for water pollution prevention measures. Regular biannual sampling and analysis confirm compliance before discharging into the Hsinchu Science Park wastewater treatment plant, which then discharges it into the Keya River. Domestic wastewater is directly discharged into the park’s wastewater treatment plant through sewers.



Water Resource Usage

(For other water resource usage data, see [Appendix I Environmental Data](#))

Discharge Water Bodies (Nuvoton Taiwan Yanshin Plant ¹)	Unit	2020 (Baseline Year)	Year 2021	Year 2023	2023	Discharge Destination
Untreated (A)	Million Liters	20	17	15	15	Hsinchu Park Wastewater Treatment Plant
Secondary Treatment² (B)	Million Liters	298	302	297	302	Hsinchu Park Wastewater Treatment Plant
Third-Party Water³/Freshwater (A+B is the total discharge volume)	Million Liters	318	319	312	317	

Discharge Water Bodies (Nuvoton Japan)	Unit	2020 (Baseline Year)	Year 2021	Year 2023	2023	Discharge Destination
Untreated (A)	Million Liters	22	21	18	19	River Discharge (Side Ditch)
Secondary Treatment (B)	Million Liters	3,669	3,509	2,817	3,301	Sewer, River
Third-Party Water/Freshwater (A+B is the total discharge volume)	Million Liters	3,691	3,530	2,835	3,320	

To comply with the Science Park Administration’s new inclusion item in 2021 - NMP concentration standards, Nuvoton Taiwan actively evaluated suitable methods. In 2022, the verification of new raw materials on products was completed, and in 2023, they were put into use, continuously monitoring the NMP in discharge water, achieving a 100% pass rate.

Nuvoton Taiwan 2023 Discharge Water Quality⁴

Discharge Water Components	Unit	Inclusion Standards	2022 First Half	2022 Second Half	2023 First Half	2023 Second Half
Suspended Solids	mg/L	300	6	12	4	3
Chemical Oxygen Demand (COD)	mg/L	500	74	32	26	34
Fluoride	mg/L	15	7	3	5	3
Ammonia	mg/L	50	10	6	10	8
Nitrate Nitrogen	mg/L	50	1	0.5	3	0.5

1 Nuvoton Taiwan Discharge Water Bodies Only Include Hsinchu Yanshin Plant.
 2 Definition of Secondary Treatment: Remove residual, dissolved, or suspended components and substances in the water.
 3 Third-party water refers to the Hsinchu Science Park Wastewater Treatment Plant.
 4 This data only covers the Hsinchu Yanshin Plant. Due to different measurement units for inclusion standards in Taiwan and Japan.




4.3.3 Circular Economy


Nuvoton adheres to the “Safety, Health, and Environmental Policy” commitment and the goal of “not damaging the environment.” The waste management strategy focuses on “minimizing waste treatment and maximizing resource recycling” by reducing waste at the source, enhancing waste recycling and reuse, and reducing the environmental burden of production.

IC design R&D and wafer foundry production components are provided to customers for assembling and selling electronic products. Faulty electronic products, part replacements, or disposal are handled by the customers. For waste generated during the production of components, internal source classification and reduction management are implemented. Efforts include extending material usage, optimizing production operations, and recycling packaging materials. Continuous evaluation of waste recycling and reuse is conducted to reduce waste generation and increase resource recycling.

Nuvoton follows the “Waste Management Procedures” for waste classification, collection, storage management, waste declaration, and supervision and auditing of outsourced waste disposal. Internal management involves regular inspections to accurately grasp the output of each process, promote process improvements to reduce waste, and ensure regulatory compliance. External contractors are carefully selected from legally permitted waste disposal and recycling companies. Before outsourcing, the disposal and recycling methods of the contractor are verified for appropriateness through an investigation procedure. Regular audits of waste contractors are conducted to ensure the legality of outsourced waste disposal, fulfilling the responsibility for waste generation. In 2023, a total of 26 audits were conducted, with no cooperation termination due to regulatory violations or related issues, and there were no improper waste disposal incidents at Taiwan and Japan plants.



**Nuvoton Taiwan
Yanshin Plant
Related Measures**



**Explanation of 2023
Implementation
Progress**

- ▶ After the packaging and testing by contracted factories, the wafer boats are returned to the factory for recycling and reuse.

The recycling rate is
79%

- ▶ After unpacking incoming materials, outer boxes and EPE cushioning materials from the foundry FAB are recycled and reused by contracted factories for packaging.

The recycled
packaging materials
used amounted to
8,931kgs

- ▶ After “T&R” processing, the trays are returned to the factory for recycling and reuse.

- ▶ Empty boxes from scrapped defective products are recycled for use as void fillers in packaging for outbound shipments.

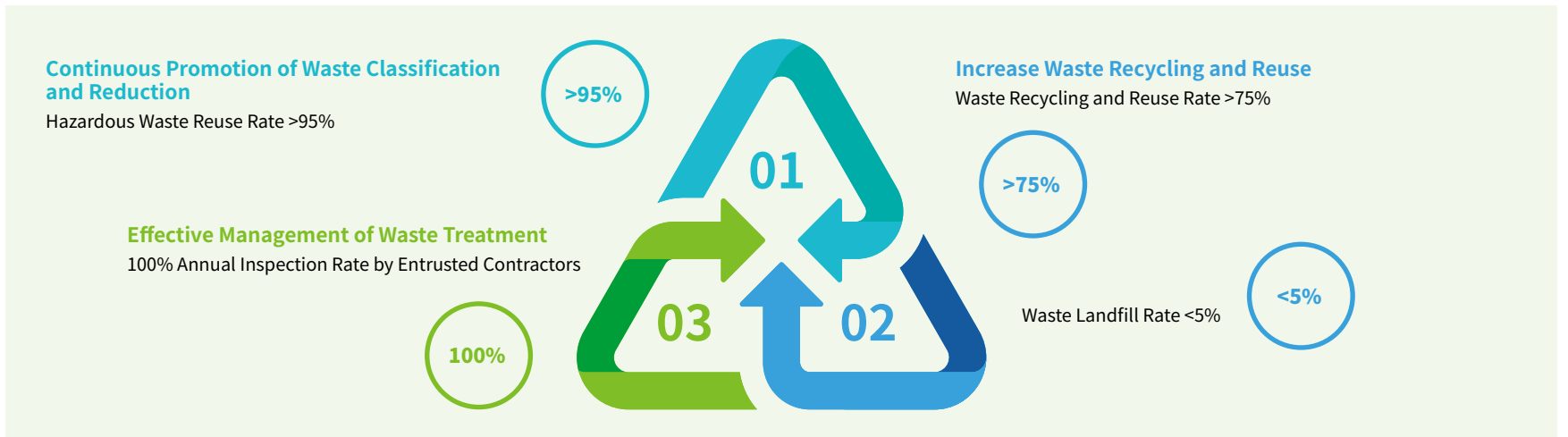







Nuvoton Taiwan no import or export of waste is conducted, and the priority for waste disposal is reuse. Waste that cannot be reused is incinerated or landfilled. In 2023, the total waste output was 727 tons, divided into 320 tons (44%) of general industrial waste (including recyclable waste and office-generated domestic waste) and 407 tons (56%) of hazardous industrial waste. The amount reused (including recycled resources) was 480 tons (66%), the incinerated amount was approximately 179 tons (25%), and the landfilled amount was 68 tons (9%). The unit product waste output was 0.090 kg/layer-wafer mask, an increase from 2022 due to the replacement of wastewater plant facilities and increased sludge production. To continue maximizing resource recycling through outsourcing, in 2023, two more production machines were added for waste sulfuric acid recycling, and an evaluation of inorganic sludge (CaF2 resource recycling) reuse was conducted, starting reuse in 2024.

The annual audit of waste contractors is based on the harmfulness of the waste, the amount generated, and the results of the previous audit scores. The severity of environmental impact risk and the level of processing risk probability are evaluated, and the audit frequency for waste contractors is determined using a risk matrix of severity and probability, along with regulatory requirements. An annual waste contractor audit plan is scheduled every 1 to 3 years, inspecting the operations of removal contractors and processing/recycling plants, and conducting real-time GPS tracking after waste removal to ensure proper waste treatment and effective control of waste processing risks.

Nuvoton Taiwan's future plans will continue to promote waste management, maintaining the same three major goals in 2024 as in 2023:



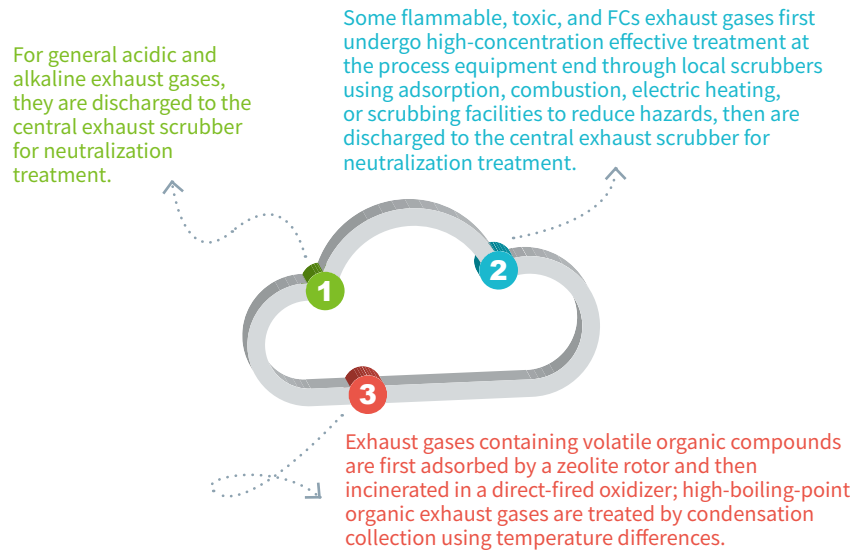
Plan	2023 Reuse Treatment Solutions					
	Nuvoton Taiwan Hsinchu Yanxin Plant			Nuvoton Japan		
2023 Reduction Benefits	H₂SO₄ Recovery Added 2 specialized sulfuric acid etching machines for recovery, increasing the reuse amount of waste sulfuric acid by approximately 17.1 tons/year	CaF₂ Sludge (Resource Circulation) Evaluation Changed from landfill treatment to reuse, increasing the reuse amount of sludge by approximately 60 tons/year	Waste Sulfuric Acid Recycled and diluted into industrial-grade dilute sulfuric acid for industrial use (not for drinking water treatment, medicine, or fertilizer additives) Recycled 304 tons	Organic Sludge Chemical additives, the waste treatment company will coagulate, precipitate, inorganicize, and recycle the materials. 0.6 tons	Waste Oil Thermal and material recovery, incineration residue used as road base material 18.9 tons	Waste Acid Material recovery, incineration residue used as road base material, neutralization for cement materials 33.6 tons
	Waste Hydrofluoric Acid Recovered and used as raw material for industrial-grade sodium fluosilicate, applied as a flux agent Recycled 57 tons	Waste Isopropanol Recovered and distilled into industrial-grade isopropanol Recycled 18 tons	Waste Organic Solvents Recovered and distilled into industrial-grade organic raw materials Recycled 38 tons	Waste Alkali Material recovery, incineration residue used as road base material 10.6 tons	Waste Plastics Thermal and material recovery Incineration → Residual road base material Crushing → Combustion aid 39.2 tons	Metals Material recovery, separated and recycled after crushing 3.6 tons
	Waste Chemical Drums Recovered, cleaned, and reused, or crushed and used as plastic or glass raw materials Recycled 7.5 tons	Recycled Photomasks Cleaned and pattern-removed, producing regenerated photomasks or optical materials Recycled 0.6 tons	Recycled Mercury Lamps Treated with mercury distillation equipment to vaporize and reuse mercury Recycled 0.2 tons	Glass, Concrete, and Ceramic Waste Material recovery, incineration residue used as road base material 0.3 tons	Special Pipelines Waste Oil, Waste Acid: Material recovery, incineration residue used as road base material 88.6 tons	Shavings Material recovery, incineration residue used as road base material 0.6 tons
	Recycled Mixed Hardware Including waste electronic components, scrap, and defective products: Recycled valuable and other metals after treatment Recycled 22.5 tons	Recycled Waste Waste paper, glass, scrap iron and aluminum, polystyrene, aluminum foil packaging, PET bottles, and waste plastics: Recycled by recycling companies Recycled 27 tons	General Waste Waste plastic, paper, and wood mixtures: Recycled through physical screening and treatment Recycled 5.7 tons			

Impact and Response to Waste

Nuvoton also values the actual and potential impacts of activities and processes on people, the environment, and society. On the manufacturing side, Nuvoton internally implements source classification and reduction management, and continuously evaluates waste recycling and reuse to reduce waste generation and increase waste resource utilization. In terms of waste reuse and disposal, in addition to carefully selecting legally authorized vendors, Nuvoton verifies the appropriateness of the removal, treatment, and reuse methods used by vendors before commissioning them, passing inspection procedures, and regularly auditing waste disposal vendors to maintain oversight.

4.4 Air Pollution Control

Committed to continuously reducing pollutant emissions, Nuvoton complies with government regulations and refers to international laws for air pollution control and emissions. Nuvoton’s main air pollutants are produced by the production process and include volatile organic compounds (VOCs), nitrogen oxides, sulfur oxides, ammonia, chlorine, hydrochloric acid, nitric acid, and phosphoric acid. The strategy for managing air pollutants involves first conducting source control, optimizing processes to reduce the concentration and volume of exhaust gases, and then treating them according to their characteristics. All air pollutant treatment systems operate 24 hours a day, year-round, with continuous monitoring to ensure normal operation. The following details the treatment methods for different types of exhaust gases in the air pollutant treatment system:



In addition to close monitoring within the plant, certified laboratories are commissioned annually to conduct testing, and the results are reported to the authorities. Testing items include non-methane hydrocarbons (NMHC), acidic and alkaline gases including sulfuric acid (H₂SO₄), hydrochloric acid (HCl), nitric acid (HNO₃), hydrofluoric acid (HF), phosphoric acid (H₃PO₄), and ammonia (NH₃). Over the years, Nuvoton’s actual test results show that the concentration of air pollutant emissions is lower than the exhaust emission standards.

Air Pollutant Emissions

Nuvoton Taiwan

Unit: kg

Type	2020 (Baseline Year) Emissions	2021 Emissions	2022 Emissions	2023 Emissions
Nitrogen Oxides	3,032	2,895	3,141	3,357
Sulfur Oxides	1,428	1,459	1,521	885
Volatile Organic Compounds (VOC)	2,280	3,140	3,243	2,740
Particulate Matter (PM)	274	270	288	300
Others	0.05	0.07	0.07	0.05

Nuvoton Japan

Unit: kg

Type	2020 (Baseline Year) Emissions	2021 Emissions	2022 Emissions	2023 Emissions
Nitrogen Oxides	39,150	69,570	8,720	11,700
Sulfur Oxides	1,890	8,970	15,080	1,460
Volatile Organic Compounds (VOC¹)	-	-	-	-
Particulate Matter (PM) g/Nm₃ (Average Density²)	0.0047	0.0034	0.0048	0.0057
Others	-	-	-	-

- 1 Due to the process not using VOCs, there are no relevant statistical data.
- 2 The reporting of particulate matter in Japan is done according to different units compared to Taiwan.

Nuvoton Process Emissions	Air Pollution Prevention Measures
General Exhaust Gases	Cooling exhaust from equipment, some may contain air pollutants
Acidic and Alkaline Exhaust Gases	Treated through scrubber towers with water washing
Organic Exhaust Gases	Adsorbed and concentrated using a zeolite rotor, then desorbed at high temperature and incinerated
High-Boiling-Point Organic Exhaust Gases	Condensed and then adsorbed using activated carbon

4.5 Hazardous Substance Management

Nuvoton’s hazardous chemical management includes the construction of an exposure assessment model for chemical management, evaluating the risk levels of chemical use. Management methods require an application from the using unit, which must be reviewed and approved by the safety and health management unit. Necessary safety, health, and environmental protection measures must be confirmed before acceptance and use.

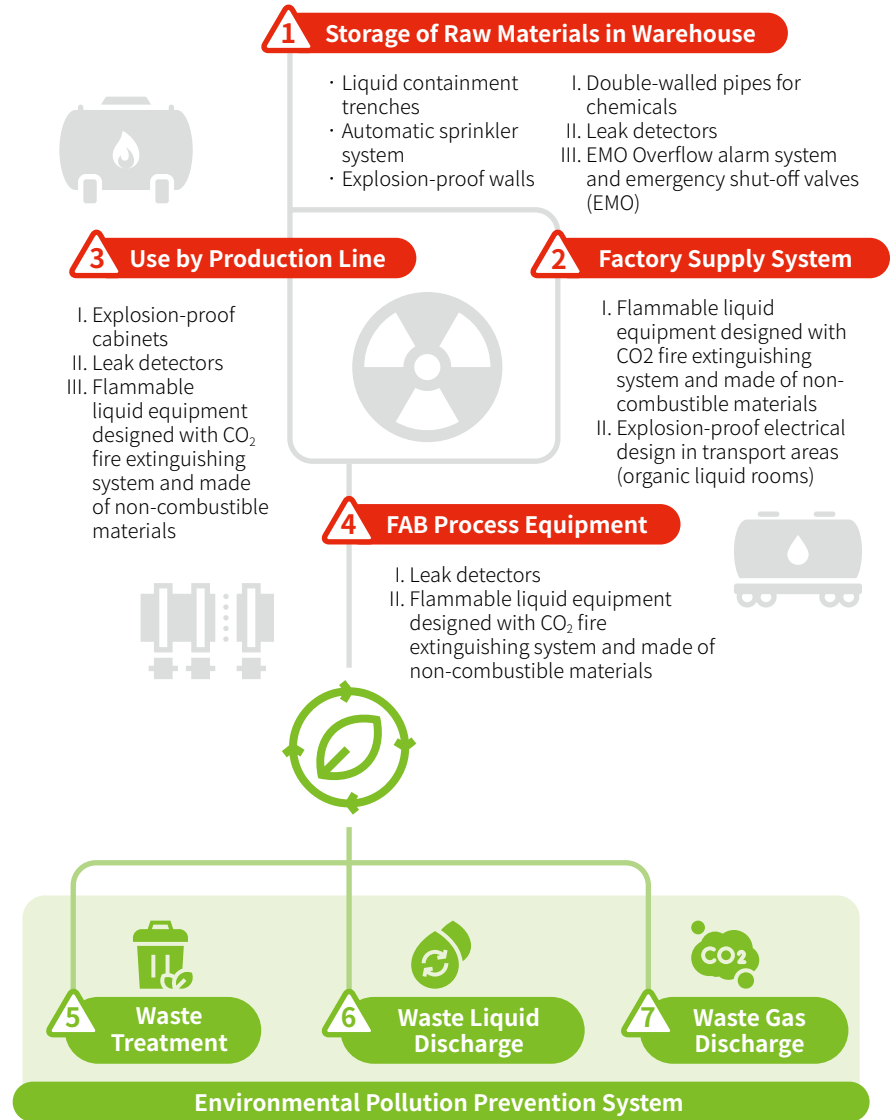
In terms of hazardous substance management, Nuvoton strictly complies with international regulations and customer requirements, such as the “Hazardous Substance Process Management Standard” (QC 080000), the “EU Restriction of Hazardous Substances Directive” (RoHS), the “Registration, Evaluation, Authorization, and Restriction of Chemicals” (REACH), and the California Proposition 65, to ensure that the hazardous substance content of Nuvoton products meets international environmental regulations and customer green product requirements, avoiding environmental pollution and harm to human health.

To reduce the use of hazardous substances and minimize the impact on employee health, Nuvoton prioritizes the evaluation of low-hazard chemicals. NMP is widely used in semiconductor processes, but due to its reproductive toxicity, Nuvoton Taiwan has vigorously pursued a plan to replace NMP with less harmful substances since 2022. New chemical tests and product verifications were conducted, and the project officially went online in August 2023. It is estimated that NMP usage will be reduced by 99% annually by 2024.

4.5.1 Safety protection of chemical supply systems

In terms of chemical substance management, Nuvoton ensures compliance with regulations and environmental, safety, and health requirements from the procurement and storage environment monitoring of raw materials, the safety protection of supply systems and equipment facilities, to the pollution prevention design for pollutants, toxic substances, and waste disposal. This ensures the safety and health of employees, avoids environmental pollution, and upholds the commitment to reducing the impact and harm of company operations on the natural environment and human beings.

Safety Protection of Chemical Substance Supply System



Introduction

CH1 Sustainability Communication

CH2 Green Products

CH3 Excellence in Governance

CH4 Environmental Sustainability

CH5 Safe Workplace

CH6 Social Prosperity

Appendix

Nuvoton regularly reports its operations as required by central authorities and strengthens risk control to prevent potential accidents, prioritizing employee health and safety while providing environmentally friendly manufacturing services. Nuvoton imposes extended controls on chemicals with high health hazards and increased environmental burden risks, including bioaccumulative, persistent pollutants, carcinogenic, mutagenic, and reproductive toxic substances, as well as toxic and concerning chemicals.

2023 Management Actions

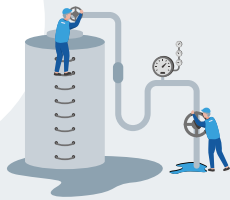
Work Items

Regulations are identified by dedicated personnel. If there are changes in regulations applicable to the company, the relevant units will be notified to take appropriate measures.

Specific Actions

Monthly inspections of containers and packaging labels.

Nuvoton Taiwan Operation of Joint Defense Organizations



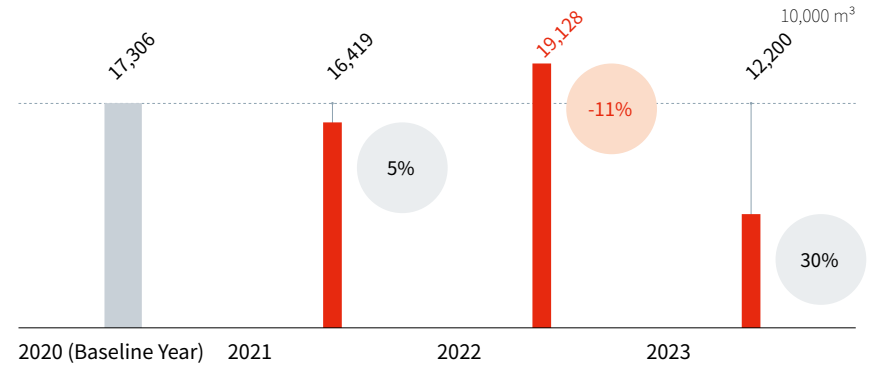
- 1 Annually plan 3 joint defense organization drills and collaborate with at least 6 support equipment sessions at neighboring plants to strengthen familiarity with emergency response equipment and procedures.
- 2 In 2023, the Hsinchu City Environmental Protection Bureau conducted an unscripted gas leak drill at the plant, which received high praise from the regulatory authorities.



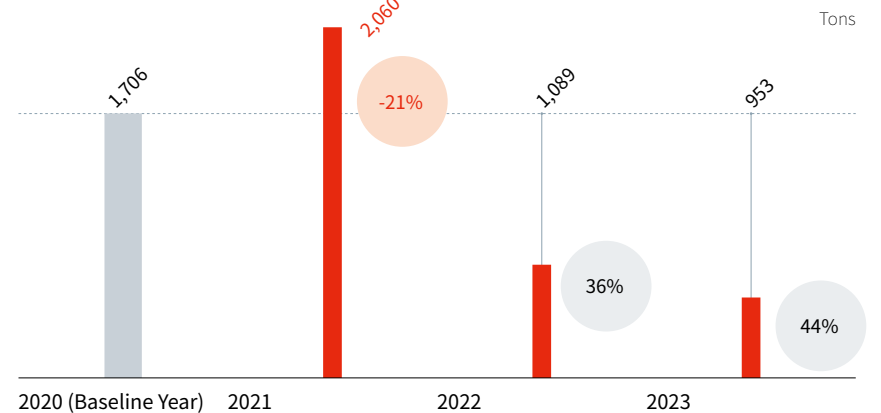
4.5.2 Key Chemical Raw Materials

Nuvoton has identified the use of nitrogen and sulfuric acid as relatively important factors affecting the carbon emissions throughout the product life cycle. Therefore, these two chemical raw materials are listed as primary targets for long-term monitoring and reduction, with 2020 set as the baseline year. Active reduction efforts have been promoted, resulting in a 30% reduction in nitrogen usage and a 44% reduction in sulfuric acid usage by 2023 compared to the baseline year.

Nitrogen Reduction in the Past Three Years[※]



Sulfuric Acid Reduction in the Past Three Years[※]



※ The scope of the survey includes Nuvoton Taiwan and Nuvoton Japan. For more data on nitrogen and sulfuric acid usage, see [Appendix 1 Environmental Data](#).