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ASE HOLDINGS

2021 TCFD Report

ASE HOLDINGS

TCFD Report
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Letter from the Chairman

The effects of climate change continue to pose real threats to mankind and the environment. Governments, businesses, NGOs and individuals are all driven by the harsh reality of climate impacts to direct immediate focus on actions and solutions to overcome these challenges. By and large, business activities contribute to a significant percentage of emissions and should therefore shoulder most of the responsibilities and act swiftly. At ASEH, our leadership in technology and innovation have not only propelled our growth over the last three decades, but are also strengths that we fully optimize to advance sustainability goals. Our sustainability strategy is guided by clearly-defined Environmental, Social and Governance (ESG) principles, and long term goals that enable us to manage business risks effectively and build a resilient future.

Transparency in reporting

Climate issues remain a key pillar of our sustainability strategy while disclosures on GHG emissions and pathways are integral to transparency in reporting. We began adopting the Task Force on Climate-related Financial Disclosures (TCFD) framework in 2018. In 2022, we will release our first TCFD report that documents our approach on the governance of climate-related risks, strategy for identifying climate-related risks and opportunities, risk management, and metrics and targets. We are on track to accomplish our low carbon mission through innovative planning and a system of rolling reviews, and by following science-based emission reductions that will accelerate our net zero transition.

Following the science

In 2020, we have completed GHG inventories covering Scope 1, 2 and 3 for all of ASEH' s manufacturing facilities worldwide. We have also established a target to reduce emissions for Scope 1 and Scope 2 by 35% by the year 2030 in line with the corporate target of "well below 2°C" . These targets are validated by the Science Based Targets Initiative (SBTi), an organization that helps companies reduce their emissions based on climate science. For many years, ASEH has been proactively disclosing climate and water information through the CDP platform, deemed as the gold standard for environmental reporting. We are very proud to be one of the few global companies in the semiconductor industry to have received recognition on the CDP Climate A and CDP Water A lists.

Leveraging green financing instruments

The use of green bonds and other sustainability linked financial instruments have gained popularity over the years as businesses seek to raise funds to support sustainability projects with social and environmental benefits. Advanced Semiconductor Engineering, Inc (a member of ASEH) issued a US$300 million three-year green bond through its subsidiary, Anstock II Limited in 2014, becoming the first in Asia to offer a corporate green bond. A second US$300 million green bond was subsequently launched in 2019. Proceeds from these green bonds were invested in initiatives including renewable energy usage, advancing new energy technologies, GHG emission reduction, waste material recycling and reuse, energy conservation and water management. In 2021, ASEH secured a sustainability-linked loan (SLL) from Standard Chartered Bank and HSBC Bank with the loan terms closely tied to the company' s overall ESG performance that focuses on GHG emissions, renewable energy, waste disposal and DJSI benchmarks. The favorable loan rates will also allow us to better leverage our ESG efforts to improve our bottom line and market share.

Collaborating and strengthening partnerships

Green transition is ASEH's key focus to combat climate change. As a global leader in semiconductor assembly and testing, we believe strongly in collaborative efforts across the industry to create value and, sharing our low carbon technologies and knowhow with the community. As the world navigates towards net zero, our customers are increasingly designing high performance products that are not only smaller and thinner, but also energy efficient. We pride ourselves in providing customers with sustainable manufacturing services to develop new products, and mitigating environmental impacts throughout the development process. ASEH is a pioneer in heterogeneous integration (HI), a process which integrates separately manufactured components together to provide better performance, higher functionality, and lower power consumption. HI is contributing to the advancement of sustainability goals and is an example where we combine sustainability concepts into our research, development and manufacturing processes. We participate actively in our customers' 'low-carbon transformation' and many carbon reduction or net zero initiatives. We also work with the value chain to support and promote products manufactured using clean energy. On the supplier front, we guide suppliers in conducting carbon inventory and pathways to reducing emissions. We have promulgated an incentive program in 2020, whereby suppliers are encouraged to submit low carbon and circular projects in collaboration with ASEH. The objective of the program is to promote supplier value and drive green transformation.

Our climate commitment

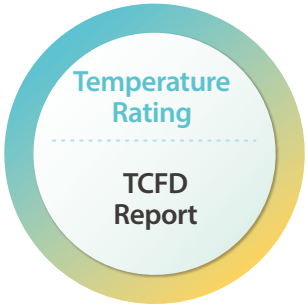
Innovation is the lifeline of technology companies like ASEH, and plays an important role in mitigating climate change. As such, we are taking swift actions through rigorous planning and systematic execution to research and strengthen our ESG policies. We are establishing comprehensive energy resources augmented by science based carbon reduction targets to help achieve net zero emissions. The net zero transition is not without its challenges; from complex and often disruptive technologies to the cost of implementation. Despite the challenges and disruptions, we remain committed to doing the right thing for our environment and will put in our best efforts to ensure a sustainable climate future.

Climate Performance and Honors

On the CDP Climate Change list for six consecutive years

Awarded CDP Water Security for two consecutive years

On the CDP Supplier Engagement Rating leader board for three consecutive years

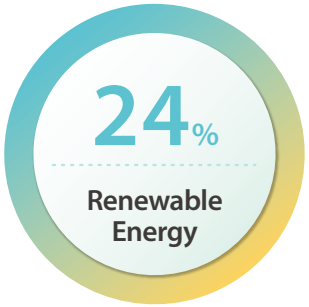


First company to conduct self-reviewing of temperature paths with AGTP methodology

Passed a compliance review by the Science Based Targets initiative

Water risk identification and assessment for all operations

Greenhouse gas inventory for all operations



Total energy consumption achieved through renewable energy or renewable energy certificates

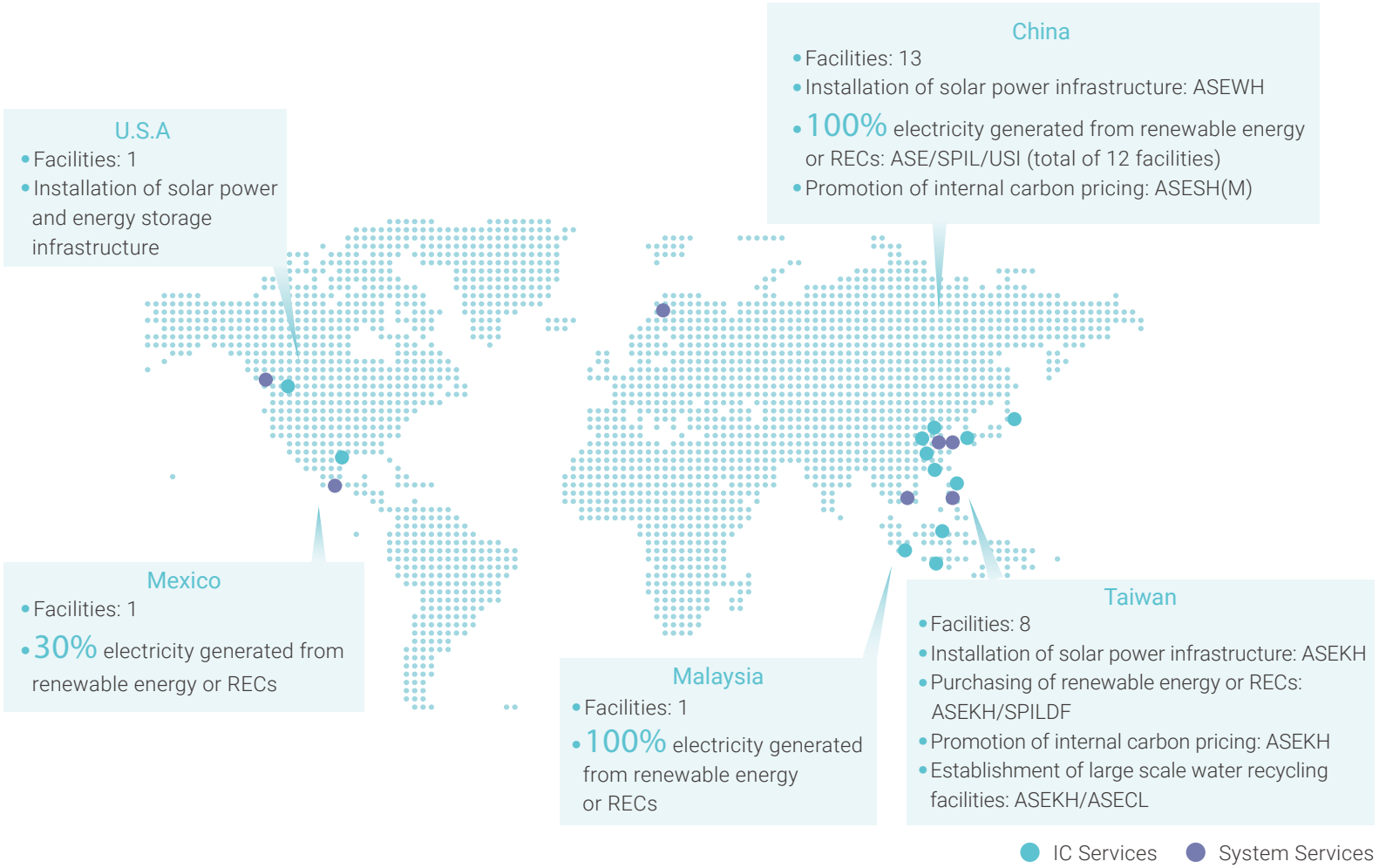
316 carbon reduction solutions to reduce greenhouse gas emissions

28 Low carbon and green building certifications & 12 Green factories

Demonstrating Leadership in Low-carbon Transformation

ASEH' s business operations are located in strategic regions globally including Taiwan, China, Japan, South Korea, Singapore, Malaysia, USA and Mexico. We believe in harnessing the strengths of the industry to accelerate the transition to a low carbon economy. Through close collaboration with our business partners and stakeholders, we hope that our leadership will rally the industry together to create a positive global impact. Electricity use contributes to the majority of carbon emissions in the semiconductor industry. Hence, we are focused on energy efficiency improvement projects and increasing the use of renewable energy. In addition, to fulfil renewable energy requirements promulgated by Taiwan's 'major electricity consumer' clause, we have already deployed plans in advance to achieve the goal by 2023.

Responsible actions



1 The TCFD reporting scope is consistent with the ESG report, and covers ASE (Advanced Semiconductor Engineering, Inc. and its subsidiaries), SPIL (Siliconware Precision Industries Co., Ltd.and its subsidiaries), and USI (USI Inc. and its subsidiaries).

2 100% electricity generated from renewable energy or RECs: ASE Kunshan/Suzhou/Weihai/Advanced Semiconductor (Shanghai)/Shanghai (Material)/ISE Labs China/Wuxi/Malaysia, SPIL Suzhou and USI Zhangjiang/Kunshan/Jinqiao/Shenzhen.

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Accountability and Responsibility

1.1 / Accountability and Responsibility
Climate-related Organizational Structure

1.1.1 Supervision at Management Level

ASEH established the Corporate Sustainability Committee (CSC) as the highest level of authority in the planning and supervision of sustainability-related strategies, and has entrusted the CSC with facilitating the accomplishment of sustainability management policies and the goals of the three key subsidiaries of ASEH. The CSC comprises ASEH' s directors and top management executives and is headed by the chairman of ASEH. The CSC oversees the performance of the company' s sustainability programs and reports the progress to the board of directors annually. ASEH aims to balance the company' s growth trajectory with an equal focus on creating positive social and environmental impacts.

The Corporate CSR Division was established to serve as the executive secretariat of the CSC. The Division assists with the integration of resources and expertise across all three subsidiaries to formulate top–down and horizontal implementation strategies. In addition, each subsidiary - ASE, SPIL and USI, has its respective Corporate Sustainability Committee established at the corporate level with multiple taskforces. Each committee is headed by a senior level executive and is tasked with identifying relevant issues for discussions throughout the year, the annual presentations of performance and results, and reviewing the progress of various short, medium and long-term sustainability objectives.

Climate Change Governance and Management Framework

1.1.2 High-Level Assessment and Management

To effectively review and oversee the overall sustainability-related opportunities and risks of ASEH, the CSC assigns a supervisory role to the CAO of ASEH. Because the CAO concurrently serves as a member of the Risk Management Committee and the Chief Risk Officer of ASEH, in addition to performing a rolling review of the company' s internal sustainability strategies and approaches, the CAO is also responsible for monitoring changes in the external environment and providing simultaneous feedback on the company' s risk management when analyzing sustainability-related opportunities and risks. On an annual basis, the CAO reports the progress of strategies and implementation status directly to the Board of Directors and Risk Management Committee, ensuring concise visibility of the environmental, social, and governance (ESG) risk management at ASEH and its subsidiaries.

1.2 / Accountability and Responsibility
Risk Management

1.2.1 Integrated management

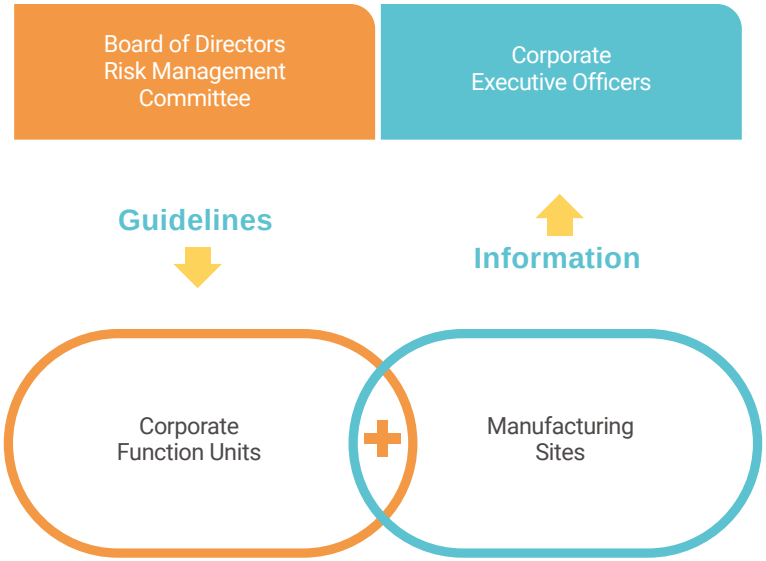
ASEH formulated its 'Risk Management Policies and Procedures' in 2020 to provide the highest level of guidance to managing risks. Risk management should form an integral part of ASEH' s management framework and incorporated into the company' s business strategies and organizational cultures. We conduct risk assessments on an annual basis, and formulate plans to tackle key risks covering management goals, organization and accountability, and risk management procedures. Risk assessments enable the company to identify, evaluate, supervise and control various risk exposures effectively so that risks arising from the company' s business activities can be controlled within acceptable ranges.

We manage risks through designated departments and functions ("risk functions") across our organization. We have introduced a top-down ERM approach to strengthen the risk management between top management and the rest of the organization, and ensure the sound management of corporate-wide risks. Each year, the key risks identified by the company' s top management are evaluated through our ERM process, enhancing the efficiency and effectiveness of the decision-making process across the organization. We have also established preventive, early warning and emergency response mechanisms, and put in place crisis management and business continuity plans that mitigate, transfer or avoid risks. We believe that the company has effectively kept the respective climate risk scenarios under control through our comprehensive risk management policies.

1. This table contains an overall description of risks, a description of risk characteristics (scenario and impact), and existing risk management activities (including mitigation strategies/control measures).
2. The risk level is based on the frequency of occurrence and the level of impact.

Our ERM process is as follows: identification of corporate risks and operational risks and ranking the risks on the risk registers[1], identification of key risks according to risk levels[2] and control effectiveness and mapping these risks according to responses. Using the correlation analysis method, we can then determine if there are any correlation among major risk factors. Further risk mitigation plans may be formulated to reduce the remaining risks where necessary. A list of key risks and response plans will be presented to top management and the progress of the plans will be monitored periodically.

Risk Management Organization Scheme



1.2.2 Identification and Assessment

Based on our internal timelines for management goals, we consider anything less than three years as short-term; three to five years as medium-term; and anything more than five years as long-term. Short-term or immediate risks arise from energy efficiency, raw material costs, climate and product-related regulations and extreme weather events, including extreme temperature changes, tropical cyclones, droughts etc. Mid-term risks include voluntary agreements, GHG emission costs, low-carbon technology transitions, changes in customer preferences and energy saving buildings. Lastly, carbon taxes, low-carbon energy or market demands, and incremental changes in climate parameters, including average temperature or rainfall changes, high ecosystem vulnerability and land use etc are classified as long-term risks. Tackling climate change and water security involve physical and transition risks for businesses. To that end, ASEH carefully assesses the impact of regulations, law suits, technology, market and business reputation on risks, and at the same time, analyzes risk opportunities in resource efficiency, energy sources, products and services, market resilience etc.

ASE Holding will conduct a survey on the risks and opportunities related to climate change and water through questionnaires distributed to key department heads. The survey will explore the extent of the impact of each risk and opportunity to the company. Going forward, we will continue to assess the impact of climate risks on our operations on a rolling basis, and develop countermeasures and management plans.

At the same time, we will evaluate and analyze the water resource data and financial information of our facilities worldwide by referencing the water data from the World Resources Institute (WRI), and design a water assessment tool to have a better understanding of the strengths and weaknesses of each facility in response to climate risks and opportunities.

ASEH's survey on the risks and opportunities of climate and water revealed some risks related to voluntary agreements or regulations and standards. In particular, the company's SBTi and net zero targets, as well as the executive KPI targets on GHG emissions and water withdrawal intensity present an immense degree of challenge. On the other spectrum, climate transition creates opportunities in areas such as energy resource recycling, low carbon transition, green buildings and value chain engagement. To that end, ASEH has embarked on plans to achieve our low carbon mission and circular economy goals. Overall, the survey results enable us to direct focus on important environmental issues more effectively.

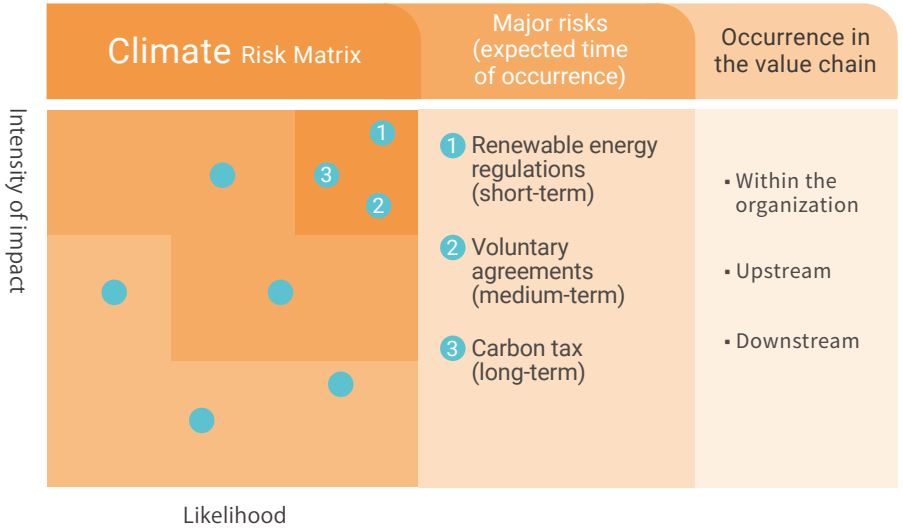
Risk Management Process

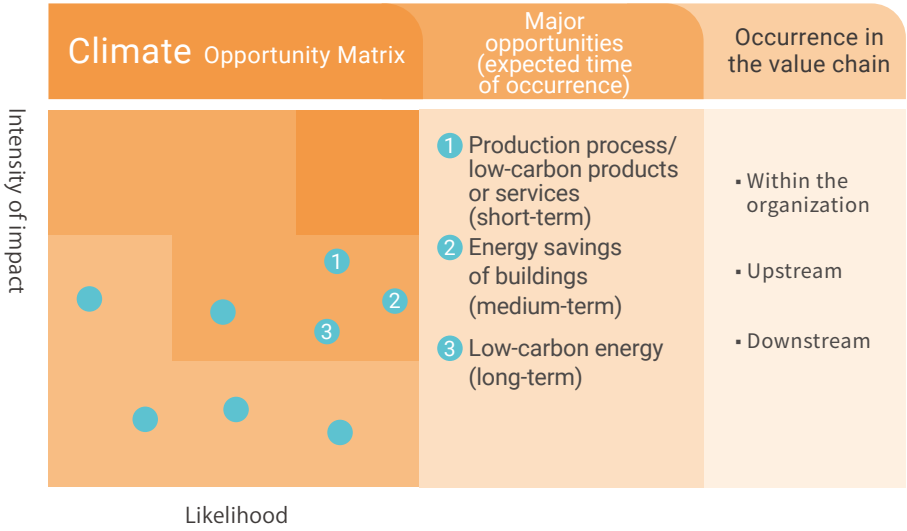
Risk questionnaires are used to gather exposure information to identify risks/events that might adversely affect the achievement of ASEH's business objectives.

Risks are assessed from three perspectives:
1. Likelihood
2. Impact (on finance, business continuity, and reputation)
3. Control effectiveness

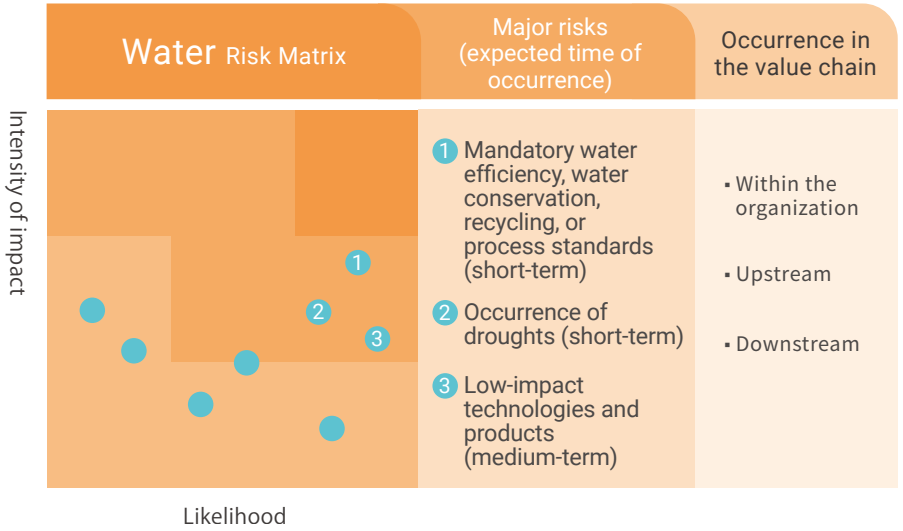
Identify and evaluate possible responses to risk, and the evaluation criteria include:
1. Cost of implementation
2. Effectiveness (degree to which a response will reduce impact)
3. Feasibility (difficulty)
4. Duration

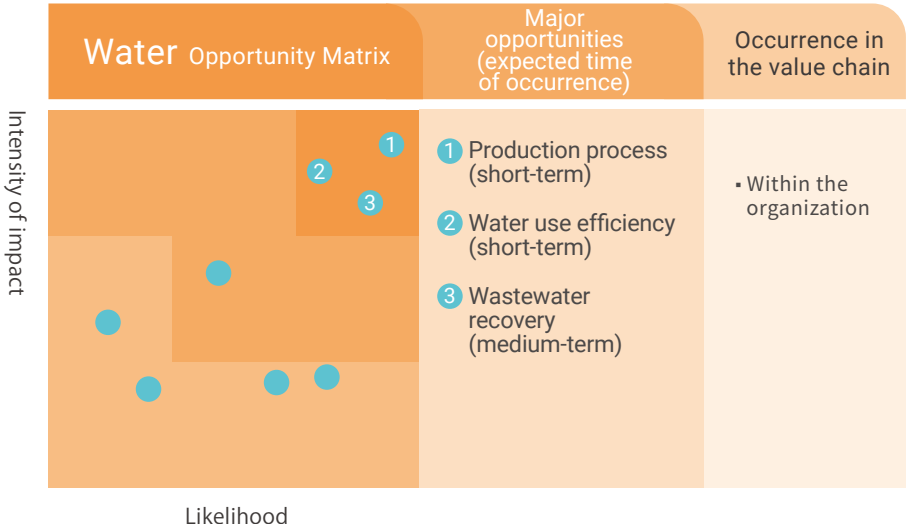
Climate Change and Opportunities Matrix





Water Risks and Opportunities Matrix





1.2.3 Response and Actions

ASEH' s Environment and Green Innovation Taskforce has always adopted a flexible management approach in its role as a CSC coordinator tracking electricity consumption, water withdrawals, waste production and other parameters via the environmental performance dashboard. We have also created a 'Green Solutions Sharing Platform' to promote sustainable design in new product development from the efficient use of material, development and selection of low-carbon footprint materials, to establishing hazardous material management systems and process designs with higher energy and water efficiency. In addition, our technical exchange seminars on the environment enable us to build strategic consensus and facilitate greater technology exchange. Going forward, we will mobilize teams of experts to provide consultation services and improvement recommendations, and develop support systems for larger facilities to mentor smaller facilities to enhance the company' s overall eco-efficiency.

Financial Impact Analysis of Risks and Opportunities

Major risks and opportunities arising from climate change			Potential impact on operations or finances	Management approach
Risks	Risk 1	Renewable energy regulations	• Increased direct costs • Litigation or fines • Restricted growth	• Manage and centralize the procurement of renewable energy to meet regulatory requirements and reduce costs through the establishment of a renewable energy procurement platform for ASEH' s three major subsidiaries. (ASE Inc., Spil, and USI) • Establish the management targets for Taiwan facilities to comply with the 2023 major electricity consumer clause in advance. • Establish a global renewable energy target with plans for renewable energy usage to account for 42% of total electricity consumption by 2030.
	Risk 2	Voluntary agreements	• Increased indirect costs • Increased capital expenditure • Increased R&D costs	• Establish carbon reduction targets and obtain SBTi validation. Publicly disclose carbon reduction progress and achievements for public scrutiny. • Adjust KPI on a rolling basis in response to short/medium/long term reduction targets and net zero emission pathways according to the availability of viable technology and international carbon market system. • Establish a net-zero carbon reduction management platform to control the renewable energy use rate and carbon reduction achievement rate of facilities. • Establish GHG emission intensity targets (GHG emissions per unit of revenue generated) and incorporate these targets into the executive performance-based incentive scheme, ensuring cohesive actions from the top and across the organization to reduce carbon emissions.
	Risk 3	Carbon tax	• Increased indirect costs • Restricted growth	• Introduce internal carbon pricing in stages to facilitate internal carbon reduction actions and reduce external carbon costs. • When supply chains are subject to carbon taxes, the cost incurred may be passed through to customers increasing procurement costs. ASEH requires suppliers to integrate cost management into set carbon reduction targets.

Major risks and opportunities arising from climate change			Potential impact on operations or finances	Management approach
Opportunities	Opportunity 1	Production process/ low-carbon products or services	• Increased competitiveness • Recovery of technology investment • Value chain cooperation	• Increase demand for sustainable products and cooperate with the value chain for low-carbon product R&D and production. • Introduce resource recycling and material flow management to reduce carbon emissions along the production chain. • Expand the low-carbon market by investing in technology from the perspective of product and service life cycles.
	Opportunity 2	Energy saving buildings	• Decreased carbon pricing costs • Carbon asset management • Climate change adaptation	• Build low-carbon and green facilities and introduce clean production to reduce carbon emissions of capital goods and carbon operating costs. • Strengthen the resilience of climate disaster adaptation to sustain operations and reduce disaster losses.
	Opportunity 3	Low-carbon energy	• Increased brand value • Decreased carbon pricing costs • Increased market demand	• Increase low-carbon energy use rate, or use clean energy to produce low carbon footprint products. • Reduce reliance on traditional fossil fuel power plants and pursue the decoupling of economic development from carbon emissions.

Major risks and opportunities arising from water safety			Potential impact on operations or finances	Management approach
Risks	Risk 1	Mandatory water efficiency, water conservation, recycling, or process standards	• Increased direct costs • Brand damage	• Establish water withdrawal intensity targets (water withdrawals per unit of revenue generated) and incorporate these targets into the executive performance-based incentive scheme ensuring cohesive actions from the top and across the organization to enhance water resource use efficiency. • Implement water recycling during production or build large-scale water recycling plants. • Establish a monitoring and reporting system to track compliance immediately or periodically.
	Risk 2	Occurrence of droughts	• Reduced production capacity • Water supply interruption	• Establish emergency response management at all facilities to initiate emergency response actions according to different levels of water supply conditions. • Implement internal water allocation to reduce non-essential water use within facilities. • Build large-scale water storage tanks or provide regional water supply support, Re-direct production capacity when necessary. • Build a large-scale water recycling plant in key facilities to extend and stabilize the water supply during production.
	Risk 3	Low-impact technologies and products	• Restricted growth • Increased R&D costs	• Develop or source sustainable materials that consume less water and cause less pollution. • Introduce low water consumption manufacturing processes or technologies.
Opportunities	Opportunity 1	Production process	• Increased market demand • Increased brand value • Increased competitiveness	• Improve the water recovery rate during production and use materials or processes that consume less water to reduce water scarcity.
	Opportunity 2	Water use efficiency	• Climate change adaptation • Improved operating efficiency	• Improve water use efficiency and minimize water supply interruptions caused by droughts or heavy rains. • Reduce regional water withdrawal pressure by recycling water.
	Opportunity 3	Wastewater recovery	• Return on technology investment • Community relations	• Introduce water recycling technology together with environmental education to enhance social capital based on sustainability education. • Reduce withdrawal of raw water and explore other potential sources of renewable water.

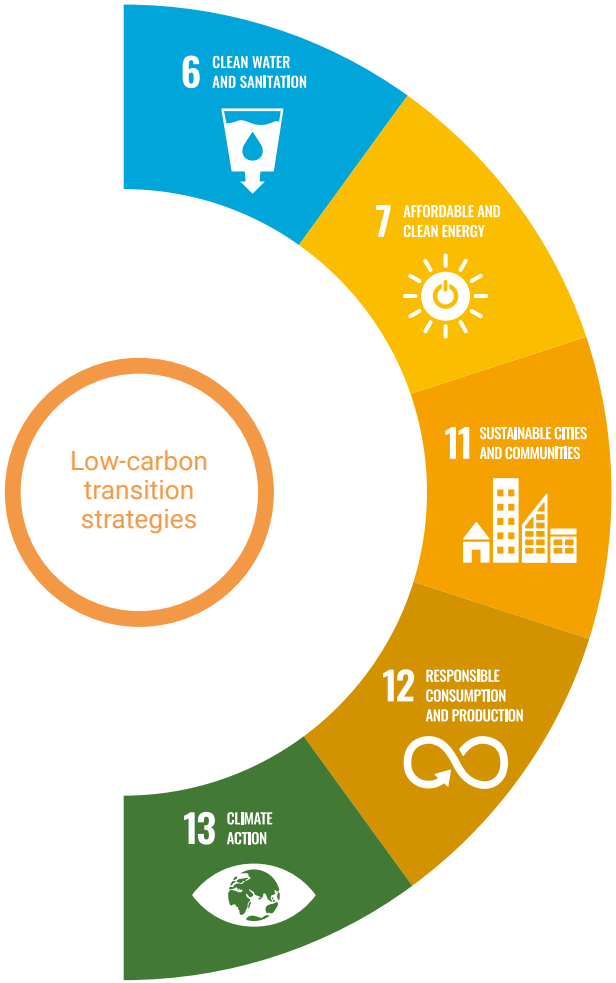
1.3 / Accountability and Responsibility
Resilience Strategy

At ASEH, we are focused on establishing a clear low-carbon strategy that incorporates an international management framework to strengthen our internal systems, improve production models through responsible actions, co-create green values with our value chain partners, and track and review our performance. We are also tapping on various opportunities arising from climate challenges to demonstrate our leadership in sustainability and meet stakeholder expectations through the .sharing of our low-carbon solutions with the global market.

1.3.1 Low-carbon Sustainability Mission

In response to global climate challenges, uncertainties in the energy supply, and risks related to supply shortages of water, raw materials and other resources faced by businesses, ASEH has formulated a five prong strategy to achieve low-carbon transition through low-carbon energy resource diversification, smart green factories, climate products and services, sustainable lifestyles, and innovative technology and investments., In addition, we actively support five UN sustainable development goals namely Clean Water and Sanitation, Affordable And Clean Energy, Sustainable Cities And Communities, Responsible Consumption And Production, and Climate Action. We aim to work closely with our value chain partners and the community to expand our climate leadership through responsible actions at all our facilities worldwide and innovative collaboration across the industry, to create a circular economy and achieve sustainable development goals.

Low-carbon strategies



Sustainable Lifestyle
- Traceless diet
- Carpooling/green transportation
- Promoting low-carbon culture

Clean water and sanitation

By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater.

Innovative Technology and Investment
- Carbon capture technology
- Material cycle R&D
- Sustainable finance

Affordable and clean energy

By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology.

Smart Green Factories
- Low-carbon and green facilities
- Smart management
- Energy and resources recycling

Sustainable cities and communities

Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning.

Climate Products and Services
- Sustainable manufacturing
- Product lifecycle assessment
- Innovative collaboration across the value chain

Responsible consumption and production
- By 2030, achieve the sustainable management and efficient use of natural resources.
- By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse.

Low-carbon Energy Resource Diversification
- Clean energy
- Renewable energy
- Energy storage

Climate action
- Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.
- Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning.

1.3.2 Water Resource Management

To assess the water risk and identify the baseline water stress of our facilities worldwide, we collaborated with a team of expert consultants to apply the Aqueduct risk assessment tool, developed by the World Resource Institute (WRI). A region is considered to be at extremely high risk of water depletion when its water stress exceeds 80%, and at high risk of water depletion when its water stress measures between 40%–80%. In 2019, we performed climate-related water risk analyses on eight main facilities in Taiwan, using data published by the Taiwanese authorities to replace data in the original database, and by factoring in the context of each facility' s water management to bridge the gap in the database. In 2021, when we performed water risk analysis on all our other facilities worldwide, we included NASA' s climate information to close the gap between domestic and foreign databases. The analysis was also integrated the water consumption data of each facility to assess a facility' s vulnerability to water shortages and thus connecting regional risks to the actual operational risks .

At the same time, we have developed water risk analysis tools as well as incorporated training and education at all facilities to manage our water risks of our facilities. These actions help us to determine risks related to local water supply and demand and, and analyze the tolerance level of key facilities so as to effectively respond to water risk. Besides strengthening our capabilities in the emergency deployment of water supply and improving water efficiency, we are also focusing on our supply chain to build up our water resilience. Our suppliers are bound by the guidelines in the ASEH supplier code of conduct that includes implementing water management plans by recording, classifying, monitoring water usage and discharge, and seeking more effective ways to save water and prevent pollution.

1.3.3 Entity and Transition Scenario Analysis

Transition Scenario

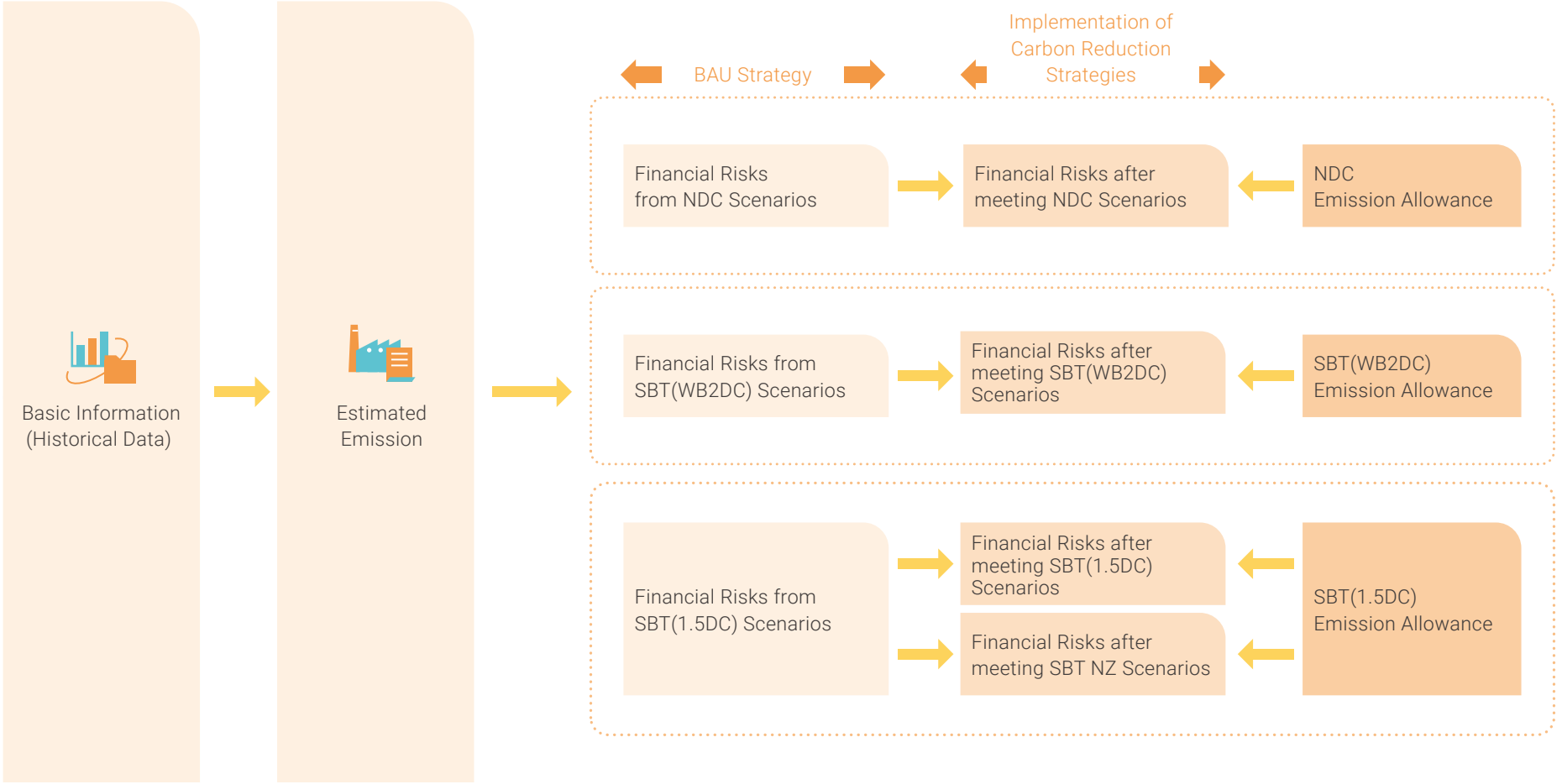
Addressing climate change involves transition risks for businesses, which are grouped into four categories legal[1], technology, market[2] and business reputation[3] risks. In order to explore and assess the financial impacts on transition risks, ASEH based its analysis on the Nationally Determined Contribution (NDC[4]), SBT Well-below 2°C (WB2DC[5]) and SBT 1.5°C (1.5DC[6]) criteria to develop three transition scenarios. From the basic data[7], we are able to estimate potential future emission levels, explore business as usual (BAU[8]) risks, and analyze the transition costs required to achieve the carbon reduction strategies in the three scenarios. By comparing the risks with our BAU strategy, we hope to have a deeper understanding on the potential financial impacts of different strategies under different scenarios.

1. Legal risks mainly affect business operating costs and capital expenditure items.
2. Market risks affect the expected revenue of an enterprise.
3. Business reputation risks affect the estimation of the market value of an enterprise.
4. Nationally Determined Contributions (NDC) assesses the legal risks in Taiwan.
5. SBT(WB2DC) refer to the climate ambition to achieve global temperature at less than 2°C.
6. Implementation of the Paris Agreement's 1.5°C target (SBT_1.5DC) is the most stringent transition scenario.
7. The basic scenario is a combination of ASEH' s climate policy and strategy, as well as the climate actions that have been implemented by the company and those that are in progress.
8. The CO_2 emissions baseline (business as usual, BAU) is a scenario in which no GHG reduction requirements are adopted at all.

Financial Impact Estimation

Rigorous procedures and methodologies are essential for transparency in climate-related financial disclosures and to that end, ASEH has classified climate scenarios into transition risks and physical risks. Transition scenarios include NDC, SBT well-below 2˚C (WB2DC), and SBT 1.5˚C (1.5DC) and are based on risk conditions including government regulatory, market and business reputation. In tandem, we also take into consideration net-zero emission targets (SBT_NZ) to estimate financial impacts.

Scenario Analysis Model



External Scenarios	Description	Scope of Application	Risk Category	Emission Source	Strategic Scenarios
NDC	Based on the current NDC targets proposed in Taiwan	Taiwan	• Legal risks • Market risks • Business reputation risks	Scope 1 + Scope 2	• NDC
SBT(WB2DC)	Based on the achievement of the SBT WB2DC condition	Worldwide			• SBT(WB2DC)
SBT(1.5DC)	Based on the achievement of the SBT 1.5DC condition	Worldwide			• SBT(1.5DC) • SBT NZ

Based on SBT WB2DC, SBT 1.5DC and NDC scenarios at ASEH's Taiwan facilities, permissible emissions levels were assessed for the years in 2025, 2030, 2040 and 2050, while emissions were estimated in the BAU scenario.

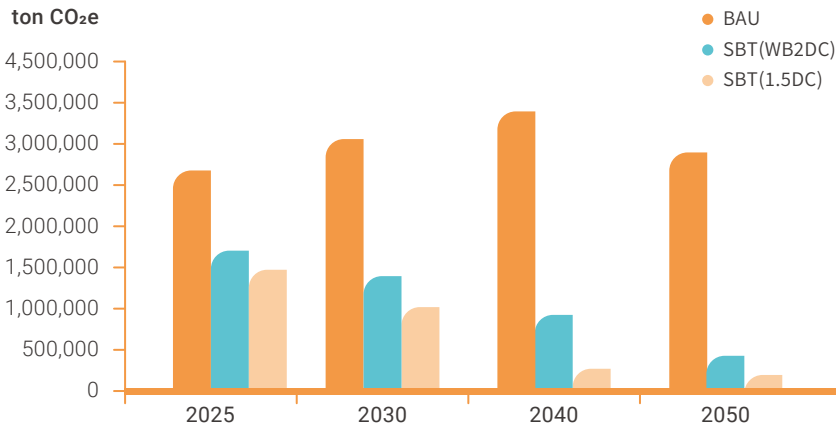
Worldwide SBT scenarios

Assessing the emission allowance based on SBT WB2DC and SBT 1.5DC, and estimating the carbon emissions under in the BAU scenario[1]. Although our global electricity consumption has risen over the past five years, it is estimated that total carbon emissions would continue to decrease annually. This is largely due to the continuous reduction in carbon emissions from our Taiwan facilities' electricity usage, which is the biggest contributor to the group' s total emissions.

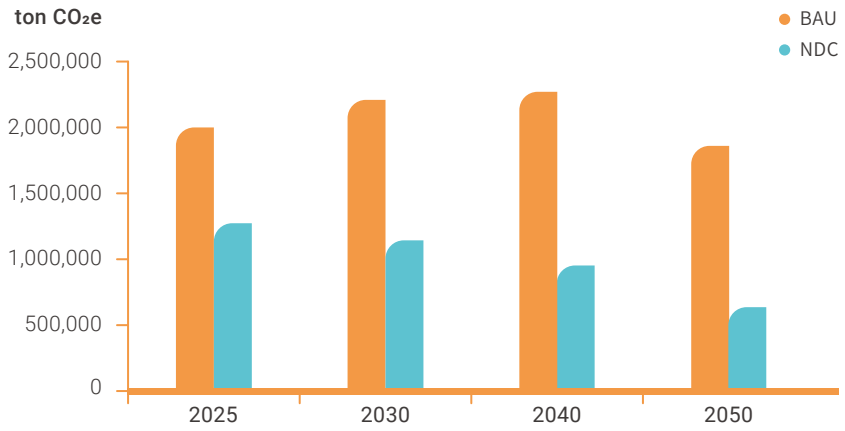
NDC scenarios of Taiwan's facilities

In response to local regulatory guidelines on energy usage, ASEH conducted assessments based on an energy use framework of 50% renewable energy and 50% natural gas, and factored in the company' s expansion footprints to estimate emissions in the BAU scenario and the permissible emissions in the NDC scenario.

Estimated emissions and targets for scenarios at all facilities worldwide



Estimated emissions and targets for scenarios of Taiwan facilities



1. Assuming a scenario where facilities do not implement carbon reduction nor do they purchase renewable energy.

ASEH engaged third party consultants to support us in assessing the potential financial impact of climate change by focusing on the worst-case scenario where no transition action was taken, and simulating scenarios that affect that affect regulatory policy, market, and business reputation risks. The scenario simulation included an estimation of carbon emissions under the basic scenario (factoring in the increase in carbon emissions due to facility expansions and a decrease in carbon emissions from local electricity usage) and estimation of carbon emission allowances(NDC, WB2DC and 1.5DC) with reference to international or local related cost factors, to determine potential medium to long term financial impacts. Analysis results show that the financial impact of the carbon tax and low carbon products in three scenarios of 2025, 2030 and 2040 will be approximately less than 0.2% of revenue in the absence of any carbon reduction actions.

Risks		Description	Cost Category
Regulations	Carbon Tax	Estimating the tax that may be levied in the future based on the three levels of carbon taxation under different scenarios • NDC: 3 USD/tCO_2e • WB2DC(SBT): 10 USD/tCO_2e • 1.5DC(SBT): 127 USD/tCO_2e	Operating cost
	Total Emission Limits and Carbon Penalties (Fines)	In terms of regulations and trends, there is a preference for carbon tax rather than carbon penalties (fines) or total emission limits	Operating cost
Technology	Renewable Energy Set-up Costs	The average annual amortized cost of setting up internal renewable energy infrastructure is not taken into consideration due to space constraints at facilities that limited the set-up on a large scale.	Capital Expenditure
	Renewable Energy Transfer Costs	Additional costs incurred from the renewable energy supplies through power purchase agreements (PPAs) with renewable energy providers.	Operating cost
	Renewable Energy Certificates	Costs from purchasing renewable energy certificates	Operating cost
	Energy Saving Costs	The cost of promoting energy saving projects is estimated at 1.1 NTD/kWh	Operating cost
	Energy Saving Benefits	The cost of energy saving is estimated at 3.23 NTD/kWh	Operating cost
Market	Revenue Risks of Green Products	• Green products are estimated to account for approximately 65% of our revenue, and the trend toward low-carbon products will be the focus of the future. • The total market value for the current semiconductor assembly market is approximately USD28 billion, and ASEH accounts for approximately 40% of the global market share (approximately USD12 billion in revenue), assuming that green products for low carbon assembly services account for 20% of the total assembly market. • Assuming that 10% annual increase in market share of green products and no low carbon product risk for remaining revenue products. • Assuming that market risks occurred in the following scenarios: a. NDC: Reduction in green product market revenue by 1% annually. b. SBT(WB2DC): Loss of half of the green products. c. SBT(1.5DC): Loss of all green products.	Expected Revenue
Business Reputation	Market Loss	The risk of business reputation loss is very low as ASEH' s SBT carbon targets have already passed SBTi' s review.	Market Loss

Physical Risk in Drought Scenario Analysis

Physical risks arise from threats to water supply and water quality. In the event of uneven or low rainfall in the future, water supply and the quality of water available may exert an impact on our operation. This may result in a decrease in production capacity or cause operational disruptions due to the inability to obtain sufficient water resources, and may also lead to operation losses due to an increase in the cost of expenses related to alternative water sources. Water related transition risks include reputational and regulatory risks. The former refers to potential future water-related conflicts and possible deterioration of the company's brand image, while the latter refers to risks due to future changes in water regulations which may lead to revocation of the facility' s operating permits and cause operational disruptions, or more stringent regulations and higher water prices that increase business costs.

In order to capture the water risks of our facilities worldwide, we adopted the Aqueduct water risk tool developed by the World Resources Institute (WRI) to analyze and identify the baseline water stress of each facility. An area is considered to be facing extreme water shortage when its water stress value is measured at 80%, followed by high water shortage areas with values ranging from 40% to 80%.

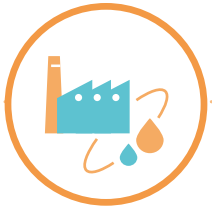
Water Withdrawal Sources

	Facility	Region	River Basin
ASE	Kaohsiung	Taiwan	Zengwen River
	Chungli		Da'an/Dajia River
	Wuxi	China Coastal	Yangtze River Delta
	Shanghai Material		Taihu
	Shanghai ISE labs		
	Japan	Japan	Mogamigawa
	Korea	South Korea	Hangang
	Singapore	Malay Peninsula	Malaysian Coast
	Malaysia	Malay Peninsula	Kuala Kurau/Muwei River
	ISE Labs	California	Wolf Creek
SPIL	Da Fong	Taiwan	Da'an/Dajia River
	Chung Shan		
	Zhong Ke		
	Chung Kung		
	Hsinchu		
	Changhua		
	Suzhou	China Coastal	Taihu

	Facility	Region	River Basin
USI	Nantou	Taiwan	Da'an/Dajia River
	Zhangjiang	China Coastal	Taihu
	Kunshan		
	Jingqiao		
	Shenzhen		China Coastal
	Shengxia		Taihu
	Mexico	Lerma River	San Diego Guadalajara

Since the methodology used in the Aqueduct tool to assess water risks is based on mapping river basins, the water stress indicator can only be used as a preliminary determination of the regional risk of the facility. As there was a lack of data for Taiwan, we used climate change data from NASA to bridge the Aqueduct data gap. Each facility' s water use information and the vulnerability of the facility when faced with water shortages were also integrated into the risk assessment. By effectively linking regional risks with the operational risks of our facilities, we were able to formulate a drought risk impact assessment framework that took into account 'regional water risks from climate change' and 'water use vulnerability' . To project the frequency of drought and the degree of impact in the area where our facilities are located, we selected the use of Aqueduct's WRI water pressure indicator and WRI drought indicator and NASA' s drought occurrence frequency indicator, impact level indicator and monthly water supply and demand correlation indicator. The WRI's monthly water stress indicator and the monthly water withdrawal of each facility can be used to further establish monthly water supply and demand correlations. The use of data from different climate sources allow us to customize our risk tools, and to make up for the lack of details and accuracy in the WRI database.

ASEH Water Risk Assessment



External Indicators

Internal Indicators

WRI External Indicators	Climate Change Localized Indicators	Water Resource Indicators
1 WRI Drought Indicators	3 Monthly Water Supply and Demand Correlation Indicators	6 Water Storage Tank Reserve Capacity Indicators
2 WRI Water Stress Indicators	4 Drought Frequency Indicators	7 Water Recovery Rate Indicators
	5 Impact Level Indicators	8 Water Consumption Indicators per Unit of Output
		9 Indicators of Business Operation Caused by Water Shortage
		10 Indicators of Property Damage Caused by Water Shortage

● Current Indicators ● Future Scenario Indicators[1]

Water Risk Scenarios Evaluate

Climate Scenario	Time Scale	WRI	NASA	SPI water shortage loss projection
OPT[2]	2030s, 2040s	SSP2 RCP4.5	RCP4.5	RCP8.5
BAU[3]	2030s, 2040s	SSP2 RCP8.5	RCP8.5	RCP8.5
PES[4]	2030s, 2040s	SSP3 RCP8.5	RCP8.5	RCP8.5

We based our scenario selection, based on TCFD' s recommendations in assessing favorable and unfavorable future water risk scenarios that factored in OPT (SSP2 RCP4.5), BAU (SSP2 RCP8.5), and PES (SSP3 RCP8.5) climate scenarios, and using then standardized precipitation index (SPI) to estimate losses from water shortages. The basis for assessing physical risks and transition risks from the threat of water shortages will then comprise of two sets of target timeframes (2030, 2040), three scenarios (OPT, BAU, PES) and data analysis for a total of six combinations, simulated from the last decade to 2050.

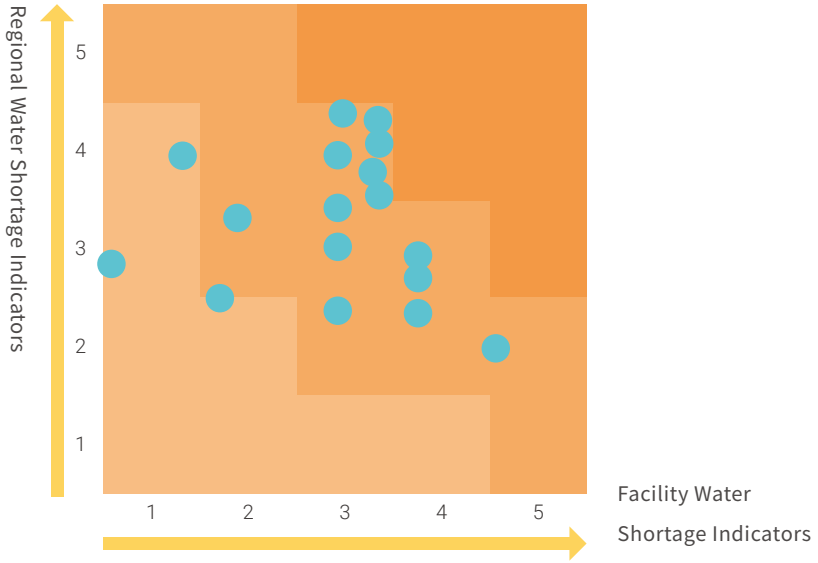
1. Future scenario indicators provide two sets of target times (2030, 2040) and three scenarios (OPT, BAU, PES), for a total of six combinations
2. Optimistic Scenario (OPT): Carbon emissions will peak and decline by 2040, with end-of-century global warming controlled at 1.1-2.6°C.
3. BAU: A scenario reflecting stable economic development and a steady increase in global carbon emissions, with end-of-century global warming controlled at 2.6-4.8° C compared to the base period (1986-2005).
4. PES: Reflecting the uneven economic development, rapid population growth, low GDP growth and relatively low urbanization, with global warming rising by 2.6-4.8° C at the end of the century.

The benchmark for water consumption at our facilities take into account indicators such as the reserve storage capacity, water recovery rate, water consumption per unit of output, water recovery system and past experiences to assess the water vulnerability. The study also considers the additive coefficients, including the business process and response mechanisms, as well as the actual ranking of the regional water supply capacity and the corrected results to present the specific climate risk of the facility. In addition, considering the uncertainty of groundwater availability under the climate change scenario and the potential regulatory risk that the government may strengthen the control of groundwater access in the future, groundwater sources are also included in the total water risk assessment.

According to the definition of IPCC, climate risk is a function of hazard, exposure, and vulnerability. The drought risk of each facility is presented as a two-dimensional matrix, with the vertical axis representing the regional water scarcity indicator, which reflects the hazard and exposure of the facility in the drought risk, and the horizontal axis representing the facility water indicator, which reflects the vulnerability of the facility to the drought risk. The results of the analysis show that the regional water shortage indicators for all of ASEH's facilities are roughly distributed between Level 2 and Level 4, while the water use indicators for the facilities differ significantly and are distributed between Level 1 and Level 5. Most of the facilities are concentrated in the low and medium risk areas, while the facilities in the high risk areas can be adjusted to the medium risk areas by increasing the recovery rate of produced water, establishing a water management system, increasing the backup water capacity, or reducing the reliance on groundwater sources.

In view of the increased emphasis on water management internationally, we will take advantage of our successful experience in carbon management to proactively enhance our water resource compliance and strengthen the ability to adjust to transformation risks, including proactively disclosing water resources-related indicators and targets, and periodic progress reports. We will also measure the financial impact based on the different scenarios, and integrate our management policies into the risk management system to increase investors' trust. We will also evaluate our water risks as part of financial reporting, according to standards used by the financial sector. To increase communication and earn trust from stakeholders, we continue to pursue endorsements from professional third party organizations on our management processes. ASEH seeks to maintain a leading position in the industry by taking a proactive approach to water risk management and developing advantageous opportunities.

Drought Risk Matrix



Climate Change Financial Impact Analysis and Decision-Making

ASEH financial impact assessments on climate change, based on the NDC scenario for our Taiwan facilities and the SBT_WB2DC and SBT_1.5DC scenarios for the rest of the facilities worldwide, provide us data for validation to drive our carbon reduction strategy in stages. At the current stage, we encourage new facilities to deploy renewable energy and set up a renewable energy platforms to coordinate the procurement of renewable energy and certificates so as to effectively reduce carbon emissions from the major emission source of externally purchased electricity.

Climate Change Scenario Financial Impact Analysis

<table>
<tr><th>Scope</th><td>Taiwan Facilities</td><th colspan="2">Worldwide Facilities</th></tr>
<tr><td>Scenario</td><td>NDC</td><td>SBT(WB2DC)</td><td>SBT(1.5DC)</td></tr>
<tr><td rowspan="3">Simulated Strategy</td><td colspan="3">BAU Strategy</td></tr>
<tr><td colspan="3">Procuring renewable energy certificates</td></tr>
<tr><td colspan="3">Deploying renewable energy</td></tr>
<tr><td>Results of Analysis</td><td>The deployment of renewable energy infrastructure has the lowest financial risk, but is limited by the insufficient land space.</td><td>We developed two approaches to address the maturity levels of renewable energy markets in different countries:
• Procuring renewable energy certificates in mainland and overseas facilities
• Procuring renewable energy (including certificates) in Taiwan Facilities</td><td>Besides increasing the utilization proportion of renewable energy in Scope 2 emissions as a reduction strategy, we are also focusing on Scope 1 emissions using CCS technology for carbon removal.</td></tr>
</table>

02

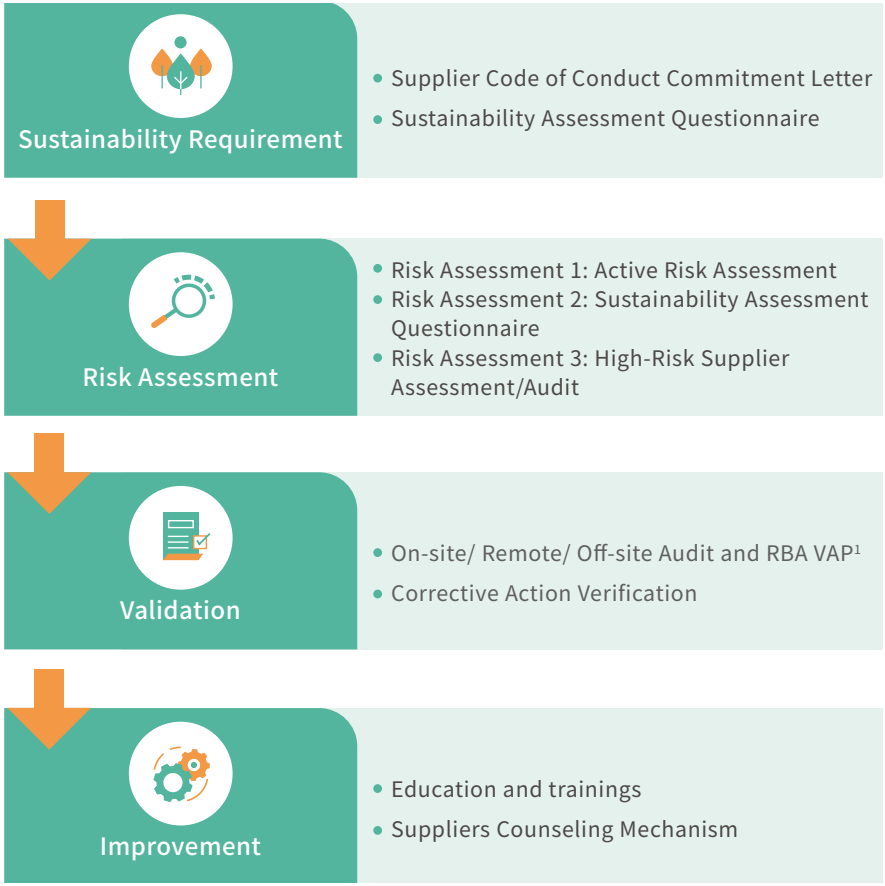
Sustainable Supply Chain Management

2.1 / Sustainable Supply Chain Management
Supply Chain Management Framework

As a premier service provider of semiconductor assembly and testing and a major consolidator of systems and technologies, it is our responsibility to exert a positive influence on the global electronics supply chain. The supply chain is an integral link supporting ASEH's core value and we regard our suppliers as long-term partners in the co-creation of a sustainable value chain. We are fully committed to responsible sourcing and developing supply chain technology in order to continuously provide reliable and first-class services to our customers.

To convey ASEH' s expectations to suppliers, we have formulated the 'Purchasing and Supply Chain Development Policy', 'Supplier Code of Conduct' and 'Supply Chain Management Strategy' to ensure that our suppliers provide safe working environments, treat their workers with respect and dignity, and conduct their business operations responsibly and ethically. Stable supplier partnerships allow ASEH to continuously improve supply chain resilience and fulfill our commitment to socially responsible procurement. Besides cost and quality, supply chain sustainability is also a key factor influencing our day-to-day procurement and drives our long term growth with suppliers.

Supplier Sustainability Management Approach



1. RBA VAP: Responsible Business Alliance Validated Audit Program

2.2 / Sustainable Supply Chain Management
Sustainability Risk Assessment

To assess the current status of supply chain sustainability development and risk management status, ASEH conducts an annual three-step supplier sustainability risk evaluation and analysis. This allows ASEH to identify suppliers that exhibit potentially high social, economic, and environmental risks. ASEH will provide support to deficient suppliers through periodic audits and guidance, to mitigate and control the risks effectively.

Risk Assessment 1 Active Risk Assessment

We conduct a preliminary assessment and analysis of potential risks based on the supplier' s location, procurement amount, type of product supplied and manufacturing process.

Risk Assessment 2 Sustainability Assessment Questionnaire (SAQ)

To ensure a more resilient and sustainable supply chain, all critical suppliers are required to complete the SAQ covering corporate governance, social performance and environmental dimensions. In particular, the environmental dimension will include (1) Environmental Management, (2) Carbon Management, (3) Water Resources Management, (4) Waste Management and (5) Circular Economy. To ensure effectiveness in the assessment and take into account the interests of small and medium suppliers, we have established various standards and requirements commensurate to the services rendered for critical and non-critical suppliers.

Critical Suppliers- The implementation of a management system is a basic requirement, with the sustainability management practices and performance included as assessment criteria; or the completion of the RBA SAQ.

Non-critical Suppliers- The focus is on management system requirements.

Risk Assessment 3 On-site audit/ Remote audit/ RBA VAP, RBA SAQ[1]

From the review and analysis of the questionnaire results, we are able to identify potential high-risk suppliers and take appropriate action to ascertain their risk status and reduce the risks.

Critical Suppliers- Implement on-site audits or request for completion of RBA Validated Audit Program (VAP).

Non-critical Suppliers- Request for completion of the RBA SAQ.

From the supplier surveys, we identified the following key environmental related risk factors: 'evaluation procedures for risks and impacts associated with climate change have yet to be established' , 'GHG inventory mechanisms have yet to be established' and 'systems and targets for water use reduction in water resource and water recycling management have yet to be established' .

1. RBA SAQ: The RBA Self-Assessment Questionnaire (SAQ)

2.3 / Sustainable Supply Chain Management
Low-carbon and Circular Supply Chain Management

To strengthen the sustainability of ASEH' s supply chain and tackle an evolving environment, we continue to invest in programs that enhance our suppliers' sustainability knowledge and standards through training courses, seminars and supplier outreach.

2.3.1 Low-carbon Guidance Program

We have allocated resources to support our suppliers in establishing GHG and product carbon footprint management systems that accelerate their efforts to meet emission regulatory requirements. In 2022, we will be collaborating with third party consultants on a medium to long term supplier low carbon guidance program which will be conducted both online and in-person. The program will not only support suppliers to attain ISO14064-1:2018 and ISO 14067 certification but also facilitate carbon inventory management across the supply chain. A thorough understanding of the supply chain GHG emissions and carbon footprint allows ASEH to step up its carbon reduction plans and increase our competitiveness.

2.3.2 ASEH Supplier Sustainability Awards

As part of our strategic efforts to build a stable and more sustainable supply chain, we established the Supplier Sustainability Award in 2017 ,which recognizes suppliers with outstanding performance in sustainability. In 2020, the award program was jointly organized by all three ASEH subsidiaries. In addition, a new supplier incentive program focusing on the company' s Low Carbon and Circular strategies was launched, and the number of participating suppliers expanded. The program encourages suppliers to submit sustainability partnership projects of between 1-3 year duration for review by ASEH and independent third parties. The submitted projects undergo a rigorous selection process based on the implementation timeframe and efficacy, and selected projects will be funded by the ASE Environmental Protection and Sustainability Foundation. One supplier project for Low Carbon and two supplier projects for the Circular category were selected eventually.

We are constantly refining our approaches to building a resilient supply chain and strengthening the bond between ASEH and our supply partners. We believe that a creative model with built-in incentives could accelerate the achievement of a circular economy and a low-carbon transition that allows ASEH to increase value and capture business opportunities. Recognizing the efforts of our suppliers through the awards will boost their commitment to sustainable development and encourage more suppliers to be proactive in advancing a sustainable future for the semiconductor industry. Going forward, every three years, we will select and fund unique sustainability projects that have the potential to demonstrate a high degree of positive influence and produce beneficial results.

03

Product R&D and Innovation

ASEH uses innovation to strengthen product value, improving the living convenience and social well-being of people during the smart era. At the same time, ASEH takes careful consideration of sustainable manufacturing by ensuring the integration of environmental protection and social innovation at the design stages of products, allowing us to continuously improve the energy efficiency of our products while also lowering the energy consumption of customers and reducing greenhouse gas emissions. Moreover, product eco-efficiency assessments are utilized in order to analyze the effects of product usage on human health and develop non-hazardous materials.

ASEH is committed to improving eco-efficiency and protecting the environment by enhancing raw material efficiency and resource recycling, and reducing GHG emission, wastewater discharge, waste generation, and chemical usage. By striving to develop and promote comprehensive, environmentally friendly services and manufacturing processes that consider the environmental impact at various stages of the product lifecycle from raw material procurement, design & development, manufacturing, and product use to product disposal, ASEH is enabled to provide the most environmentally friendly and green manufacturing services.

3.1 / Product R&D and Innovation
Customer Engagement

ASEH works closely with supply chain partners, including material and equipment suppliers, to encourage the formation of an industry cluster and the development of new technologies. ASEH also works together with key customers to develop new products and manufacturing technologies. ASEH has established a market analysis taskforce consisting of an internal team of R&D staff, research institutions, suppliers, equipment manufacturers, and customers. Through the taskforce, the company is able to regularly exchange views on the latest market developments with players in the industry, focus on new product and technology development to meet emerging market demands, set short, medium and long-term R&D targets, and allocate resources to priority projects.

Under the global trend towards net-zero carbon emission, products are also moving towards the qualities of light, small, high performance, and high efficiency. Hence, ASEH has invested heavily in heterogeneous integration and high level ultra-low energy-consuming packaging products. We work closely with key customers to develop silicon photonics products, including the heterogeneous integrated advanced packaging solution co-packaged optics (CPO), which integrates advanced optics and silicon wafers on a single packaging substrate with the goal of resolving next-generation bandwidth and power challenges. The solution not only increases bandwidth density and lowers costs, but more importantly can save energy consumption by 30% and improves energy efficiency.

Table of Customer Engagement Cases

Method of Engagement	Information Sharing	Information Sharing
Product	Data Center	GPU
Performance	Reduced energy consumption by 30% Reduced costs by 40%	Reduced energy consumption by 25%

ASEH is committed to providing eco-efficient and responsible services to our customers by integrating sustainability into all manufacturing processes, producing green products, and building a low carbon community. Because each manufacturing stage is closely interrelated, continuous efforts at every stage are required for improvement and technological innovation. In recent years, we have introduced the concept of material cycling to our customers, suppliers, and partners in the supply chain, with the goal of utilizing industrial symbiosis to create win-win situation for the economy and environment and achieving the visions of building circular campuses, full material cycling, and zero waste. We hope to implement these improvements and innovation efforts in all aspects of our operations to continue to provide customers with sustainable products.

3.2 / Product R&D and Innovation Sustainable Manufacturing

As a member of the semiconductor supply chain and a leader in packaging and testing, we strive to lower the environmental impact of our products while enhancing product value and providing our customers with sustainable products. Under the idea of "producing more with less", ASEH began to engage in industry-academia collaborations for the establishment of eco-efficient product models starting in 2015. Through the establishment of the eco-efficient product models, we are able to comprehensively evaluate the environmental impacts of a product throughout its entire life cycle from raw materials to product, and finally, disposal. Our hope is that while increasing product value, we can also realize our business philosophy of protecting the environment.

In addition, ASEH formulates Eco-design Guidelines at a product' s R&D stage. Whether in terms of material R&D and selection, product design, machine evaluation, manufacturing design or packaging design, the product shall be created based on the principles of achieving carbon and energy reduction goals to reduce the impact on the environment, safety, and health. To honor its commitment to green design, ASEH ensures that low-energy consumption and high packaging density are incorporated at the beginning stages of all designs, as well as simplifies and uses less materials in its manufacturing processes.

Sustainable Manufacturing Principles

	Material R&D and Selection	Product Design	Machine Evaluation	Manufacturing R&D and Design	Packaging Design
Action Plan	• Non-hazardous materials • Lower carbon footprint • Less operational energy consumption • Ecologically-compatible or biodegradable	• Product density maximization • Manufacturing station simplification • Material usage minimization • Low energy consumption • Component 3R design (Reduce; Reuse; Recycle)	• Higher energy consumption efficiency • High water consumption efficiency • Higher material usage efficiency	• Higher energy efficiency • Higher water efficiency • Waste minimization • Recyclable and reusable • Minimal chemical usage	• Simplification and small-volume packaging • Usage of green environmentally friendly recycle packaging materials

3.3 / Product R&D and Innovation
Product Life-cycle Assessments

ASEH has gradually incorporated the ISO 14067 product carbon footprint and ISO 14045 eco-efficiency assessments into our operations and has completed the review and evaluation of our five major packaging product series (i.e., BGA, Lead Frame, CSP, Flip Chip, Bumping). We extended the key material, “substrates” , and conducted an environmental impact analysis of each stage in product life cycles and sought to improve the hotspots. In addition, we have established databases and incorporated simulation algorithms for product research and development to increase product value while elevating eco-efficiency. We provide our customers a complete suite of manufacturing services as well as the development of energy-saving products such as wireless communication modules, POS machines, ATX power supplies that connect to multiple desktop outputs, motherboards, smart handheld devices, NAS systems, SSDs and server systems.

We continue to expand our product life cycle assessments and work with experts to utilize the evaluation software - SimaPro and the ReCiPe 2016 Midpoint(H) methodology to explore our products’ environmental impact across 18 aspects. For example, in Flip Chip packaging, we analyzed the degree of impact of using different wire materials in regard to each environmental aspect and found that products containing gold wires had a considerably significant environmental impact during the manufacturing stage. Therefore, we began to replace gold wires with copper wires, and are also attending to the development of non-wire bonding and other more advanced IC packaging technologies in order to help minimize environmental impact.

3.4 / Product R&D and Innovation
Carbon Reduction Performance

ASEH' s advanced packaging features smaller sizes and more simplified processes, which helps to reduce or eliminate material consumption. Our systems are compliant with the EU' s WEEE Directive and are easily disassembled prior to recycling, reducing waste generation. In addition, ASEH has continued to promote circular economy. Using "high value, low carbon, waste reduction, smart" as our focus, we integrated the concepts of circular economy and source improvement thinking into various operating activities, thus maximizing resource efficiency and achieving carbon reduction.

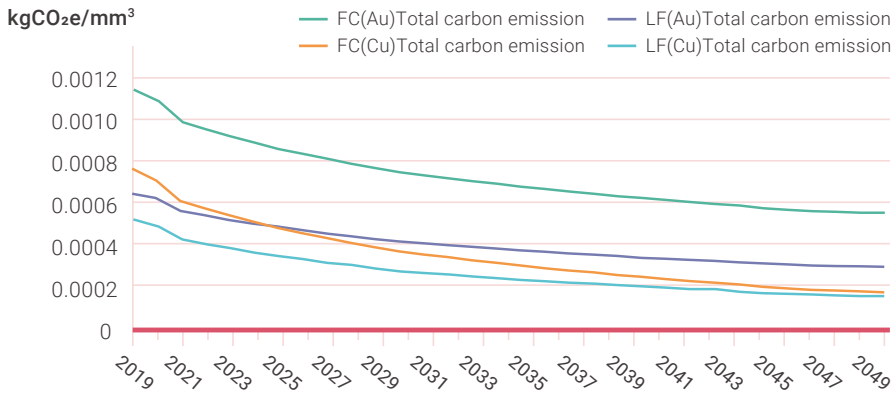
Because customers and stakeholders place high value on the carbon neutrality of products and net-zero emissions, ASEH has all along invested in carbon reduction and actively practiced energy transformation. In reducing the carbon emission of our manufacturing processes, we utilized the evaluations of products' life cycles to grasp the carbon emissions of our 5 major packaging products, and devised a plan to introduce renewable energy in stages to reduce product footprints. Furthermore, ASEH promotes carbon reduction in the value chain by collaborating with customers, suppliers, and partners to reduce the environmental impact of our products during packaging and testing development, thereby providing customers with products that are more advanced, energy-efficient, and environmentally friendly.

Regarding the carbon footprint reduction plan of packaging products, ASEH collaborated with academic institutions to estimate the carbon footprint coefficient of Taiwanese facilities from 2020 to 2050 by referencing documented quantified product carbon footprints, net-zero emission strategies, and other research papers. We then took into consideration the use of renewable energies in manufacturing, with the carbon reduction trends of Lead Frame and Flip Chip until 2050 being subsequently simulated as per 1 mm^3 of products produced.

Product Life Cycle Assessment Results

	Raw materials	Manufacturing
Flip Chip (Au)	48%	52%
Flip Chip (Cu)	19%	81%
Flip Chip (Ag)	23%	77%
Flip Chip (No)	17%	83%
BGA (Au)	38%	62%
BGA (Cu)	15%	85%
LF (Au)	44%	56%
LF (Cu)	32%	68%
CSP	92%	8%
Bumping	11%	89%

Assessment of Product Carbon Footprint

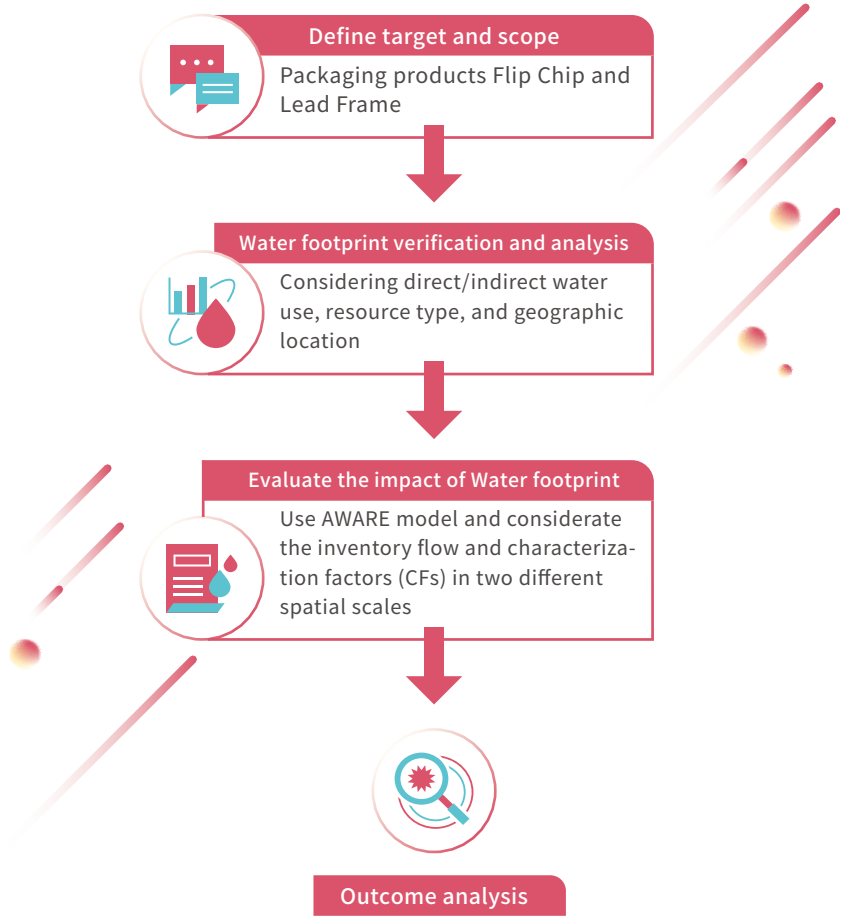


The results of the scenario hypothesis show that, with the increase in the proportion of renewable energy, the carbon footprint coefficient of electricity production has a significant downward trend. The carbon footprint hotspots of Flip Chip and Lead Frame products are all electricity input in the manufacture stage, it is estimated that the carbon footprint of products can be reduced by appropriately 24~37% under the scenario of 30% renewable energy use in 2030. But the carbon reduction effect will be gradually slowed down from 2040 onwards. Therefore, we plan to reduce the energy resource investment per unit of product in the manufacturing process of "developing or improving manufacturing process technologies" or "identifying the electricity hot spot during manufacturing process" in the future in order to further achieve product carbon reduction effect with the adoption of renewable energy. In the raw material stage, which has the second highest impact, we will first identify key raw materials and reduce the proportion of raw materials in our procurement by recycling the resources from waste products, thereby reducing the carbon emissions generated by key raw materials.

3.5 / Product R&D and Innovation
Water Shortage

Water crisis was listed as one of the top global risks in the World Economic Forum' s Global Risk Report (2021). The global water shortage is an immediate environmental problem, in respect to which natural hydroclimate and topographical constraints, abnormal rain, high population density, and rapid changes in land use and the socio-economic environment have made the supply of water resources increasingly difficult. Because the use and discharge of water resources is affected by regional factors such as the amount of water used, the location of water intake, the location of wastewater discharge, and local water usage conditions, the degree of water shortage varies between different countries and regions owing to differences in geographic location and climate. Hence, we collaborated with academic institutions to conduct a water scarcity analysis for our products, and evaluate the impact of different alternative materials, such between as copper and gold wires, on the water consumption and water scarcity footprint of our packaging products Flip Chip and Lead Frame. We took into careful consideration the inventory flow and characterization factors (CFs) in two different spatial scales to assess the water scarcity footprint of regional water resources. The results indicate that the raw material stage has the greatest impact on water scarcity, and the central issue is the indirect water consumption of raw materials. In the future, ASEH will strive to work with raw material suppliers located in low water scarcity footprint countries, In the manufacturing stage, the major contributor is the evaporation of cooling water in grid electricity of traditional fossil fuels. ASEH will implement renewable energy to reduce the impact.

Research Flowchart



04

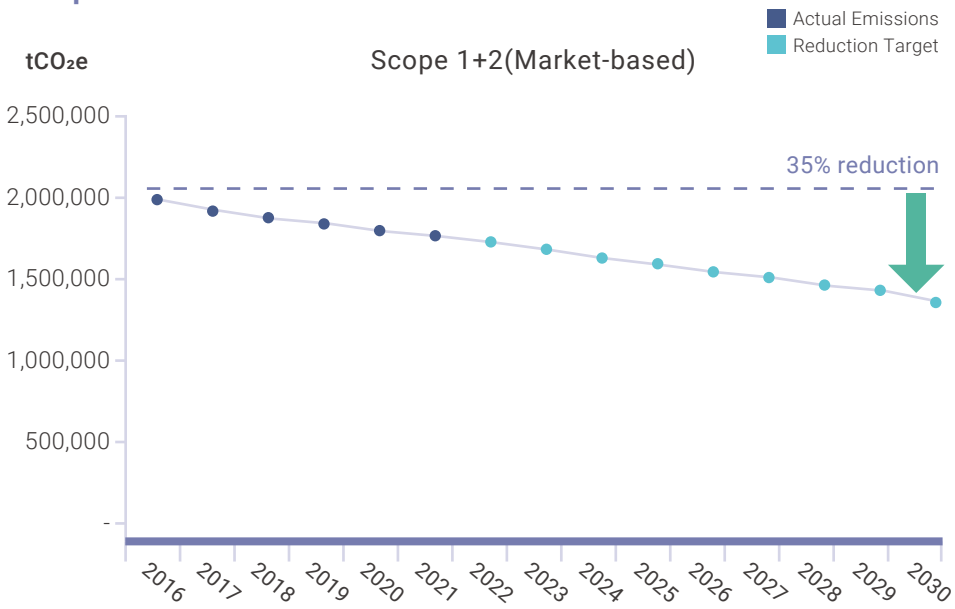
Moving Towards Net Zero Emissions

4.1 / Moving Towards Net Zero Targets Science-based Targets

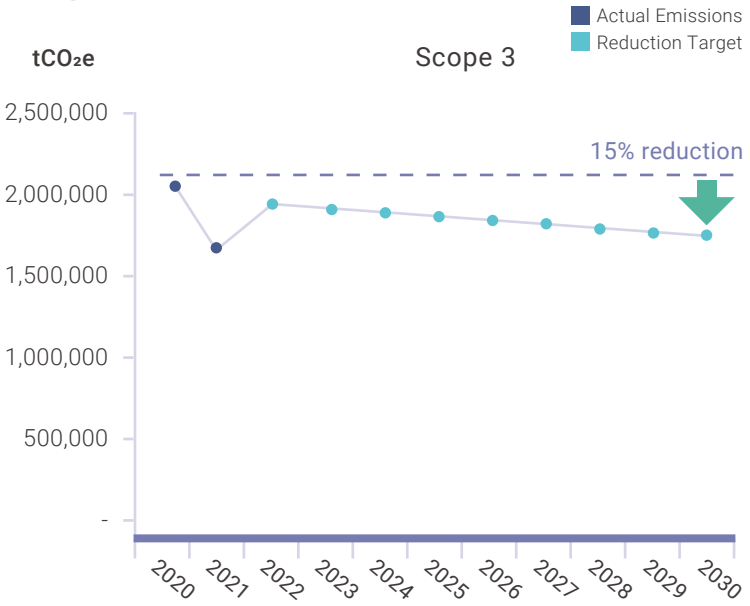
4.1.1 Targets and Reduction Plans

In 2021, ASEH unveiled its emission reduction targets in line with climate science at the ambition level of 'well below 2°C' , which was approved by the SBTi (Science Based Targets initiative). The SBTi has completed assessment of ASEH' s commitment on scope 1 and scope 2 emission reduction targets by 35% by 2030, using 2016 as the base year; and scope 3 emission reduction target by 15% by 2030 using 2020 as the base year. With respect to carbon management, we have established targets for greenhouse gas emission reduction, energy and resource recycling and renewable energy use. Benchmarks for greenhouse gas emission intensity and water resource efficiency were also incorporated into the KPIs for executive compensation. We will continue to expand the coverage of product lifecycle assessments, promote a circular economy, build low-carbon and green facilities, gradually introduce internal carbon pricing at our facilities, and align with trends in a low-carbon economy by supporting low carbon land, sea and air transportation. In addition, we' re also placing our attention on reducing the procurement of goods and services in emission hotpots. We actively collaborate across the value chain to design effective action plans through technology sharing, cross-industry collaborations and financial support for sustainability projects, enabling an integrated carbon management process.

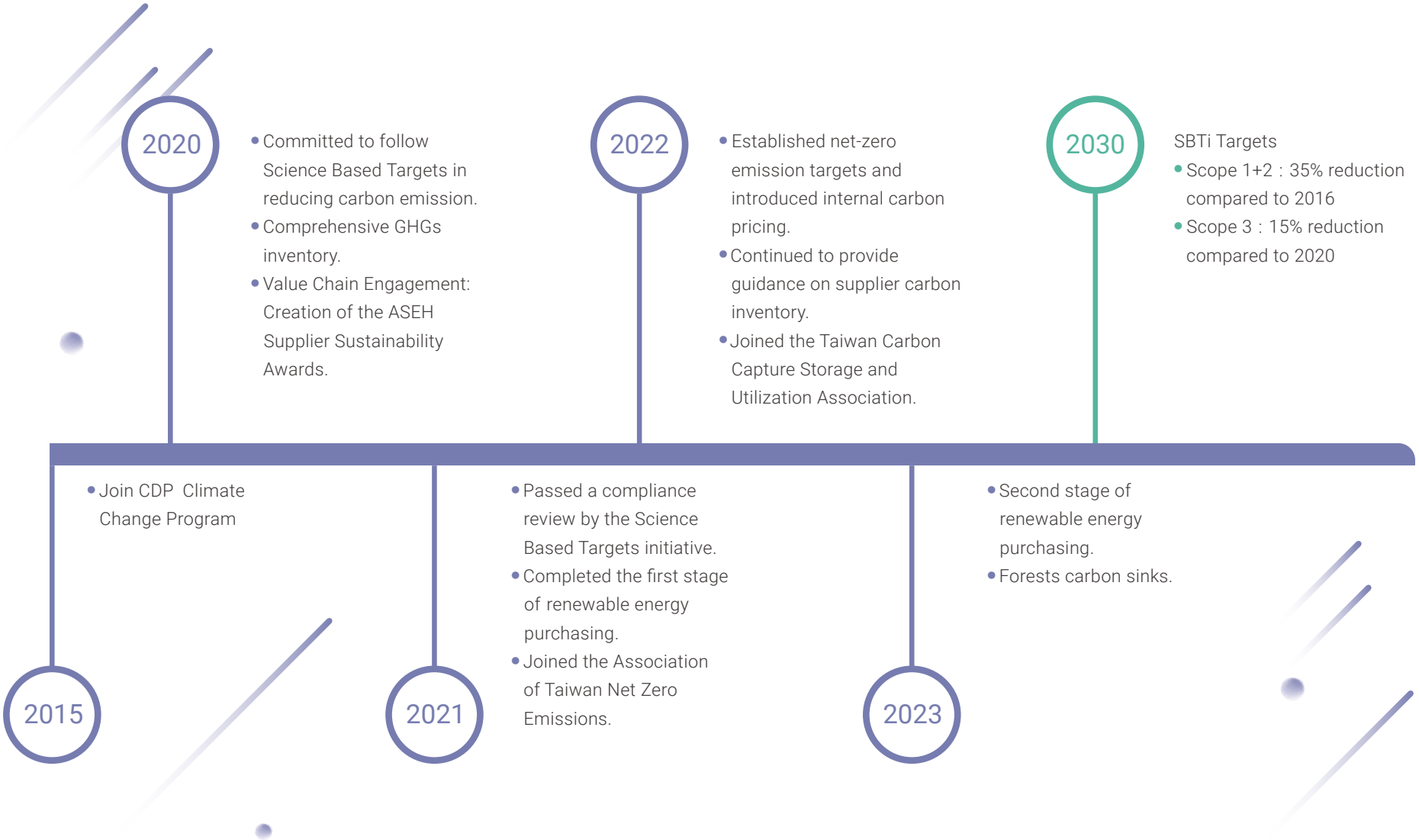
Scope1+2 Emission Path



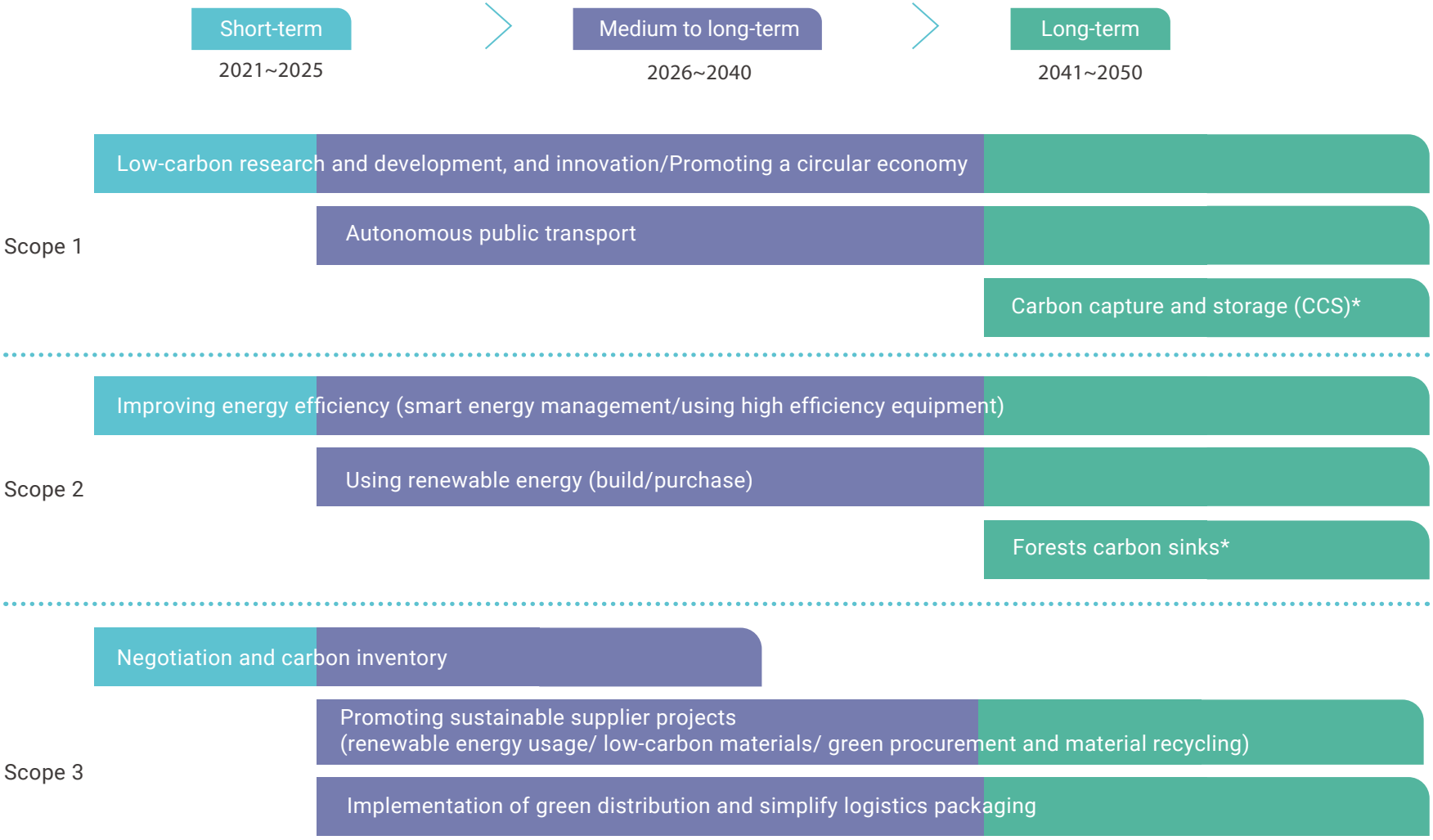
Scope3 Emission Path



Science Based Targets and Net-zero Emission Targets



Greenhouse Gas Scope1, 2, 3 reduction strategies

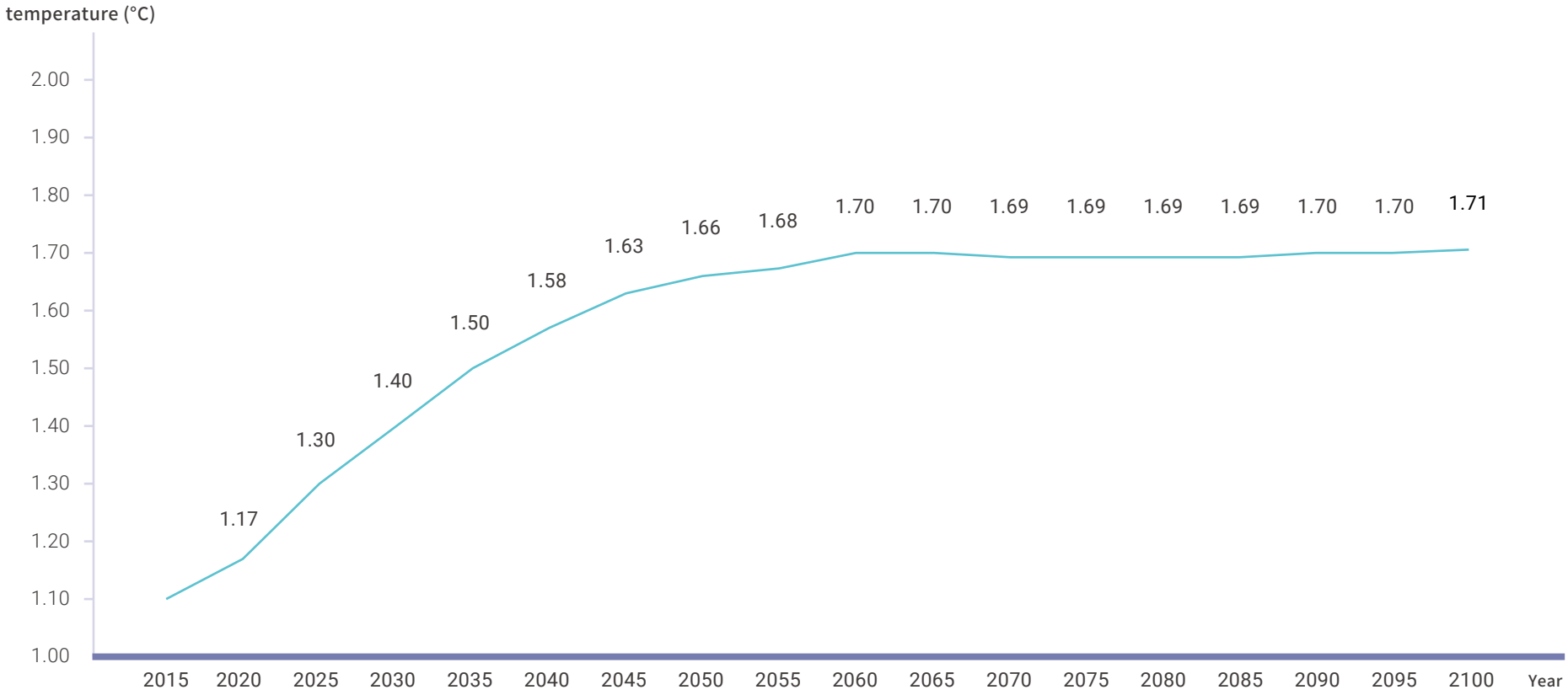


*Adjusting schedules on a rolling basis according to technology and feasibility

4.1.2 Emission Pathways

The temperature rating methodology is an open source framework established by the CDP and WWF based on a temperature rating concept introduced in 2018. Following the Paris Agreement, the investment community was in urgent need for a clear, science-based and unified standard to assess the carbon reduction ambitions of investment targets. Whereas AGWP (Absolute Global Warming Potential) is a measure of the impact of greenhouse gases on global warming, Shine et al. proposed the Absolute Global Temperature Potential (AGTP) model in 2005 to calculate the progression of temperature change. AGTP can be referred to as the contribution of warming in a given year after greenhouse gas emissions. As such, ASEH has adopted data from the Global Carbon Budget 2021 (Friedlingstein et al., 2021) to simulate the warming results of the AGTP model.

Warming Contribution

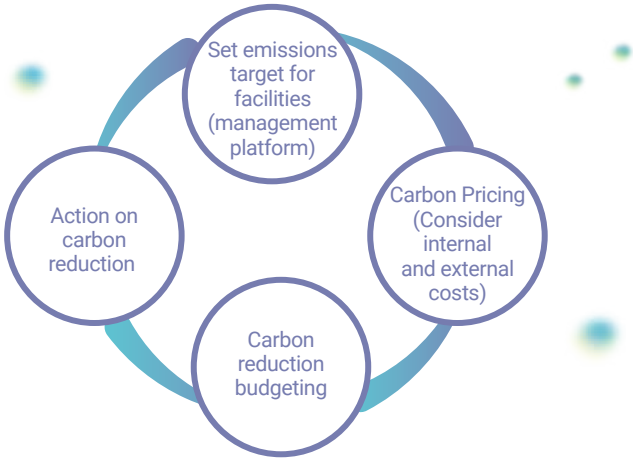


4.1.3 Renewable Energy Use

The main source of carbon emissions from our business operations comes from externally sourced electricity usage. In 2022, we have embarked on the first phase of renewable energy procurement for our facilities in Taiwan. We will successively commence large-scale renewable energy procurement for facilities in other regions according to the prevailing energy market conditions of each region. We aim to strengthen climate resilience by increasing low-carbon energy use and diversifying our electricity supply. Currently, 17 facilities worldwide are using energy sources from renewable electricity or certificates, of which 13 facilities are using 100% renewable energy. We continue to take aggressive actions towards a low-carbon transition through the strategic planning, deployment and procurement of renewable energy.

4.1.4 Internal Carbon Pricing

One of the many mechanisms applied by businesses to accelerate a low carbon transition is the concept of internal carbon pricing. In 2021, ASEH began strategically introducing carbon pricing in stages at the subsidiary companies to provide them a better understanding of the costs associated with emissions. The carbon pricing was based on a concerted effort to calculate greenhouse gas emissions throughout our operations and ascribe values to the data. In 2022, we will build a carbon management platform to set annual permissible emission targets for all facilities. The scheme will be launched first at ASE Inc' s facilities in Kaohsiung and Shanghai. The introduction of internal carbon pricing will help ASEH to motivate each site to pay greater attention and invest in activities to reduce carbon emissions. Going forward, we will expand our scope to build a comprehensive carbon risk management framework and work towards our carbon reduction goals.

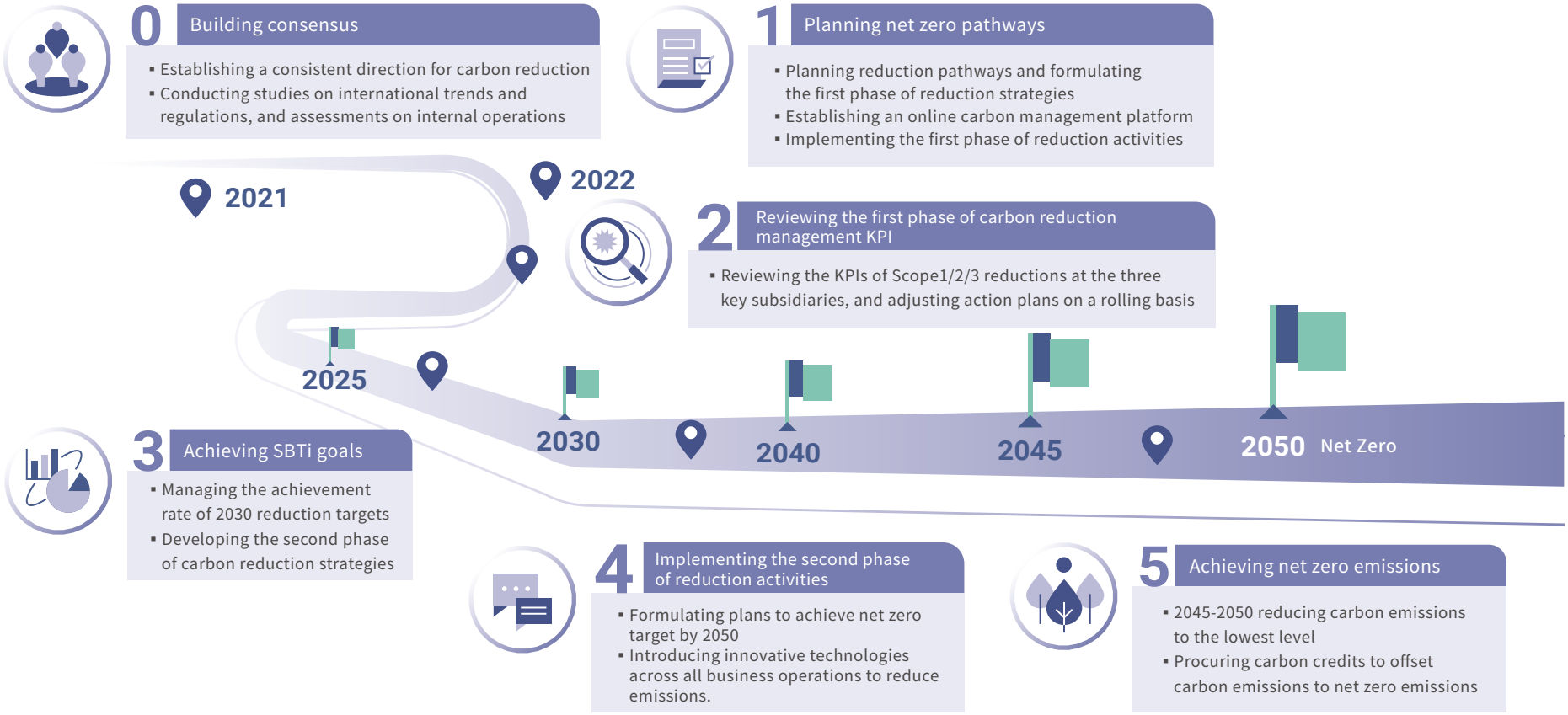


4.1.5 Green Factories

Reducing the carbon emissions of buildings is a critical step to slowing down climate change. We began our green building transition in 2012 and have transformed existing facilities to comply with green building standards. All new facilities and offices adopt green design concepts and are built according to international low carbon building standards. Quantifying and analyzing the lifecycle of buildings allow us to integrate low carbon concepts from the design stage and and transform every building into green buildings. We demonstrate leadership by promoting and publishing our analysis to motivate the industry to build a more sustainable industrial park together. In addition to green buildings, we have also integrated clean production in the manufacturing process to achieve Green Factory Certification, with accumulated carbon reduction benefits amounting to 2,745 tCO_2e. We continue to work towards obtaining certification for all new facilities.

4.2 / Moving Towards Net Zero Targets
Net Zero Targets

Transformation to Net Zero Milestones

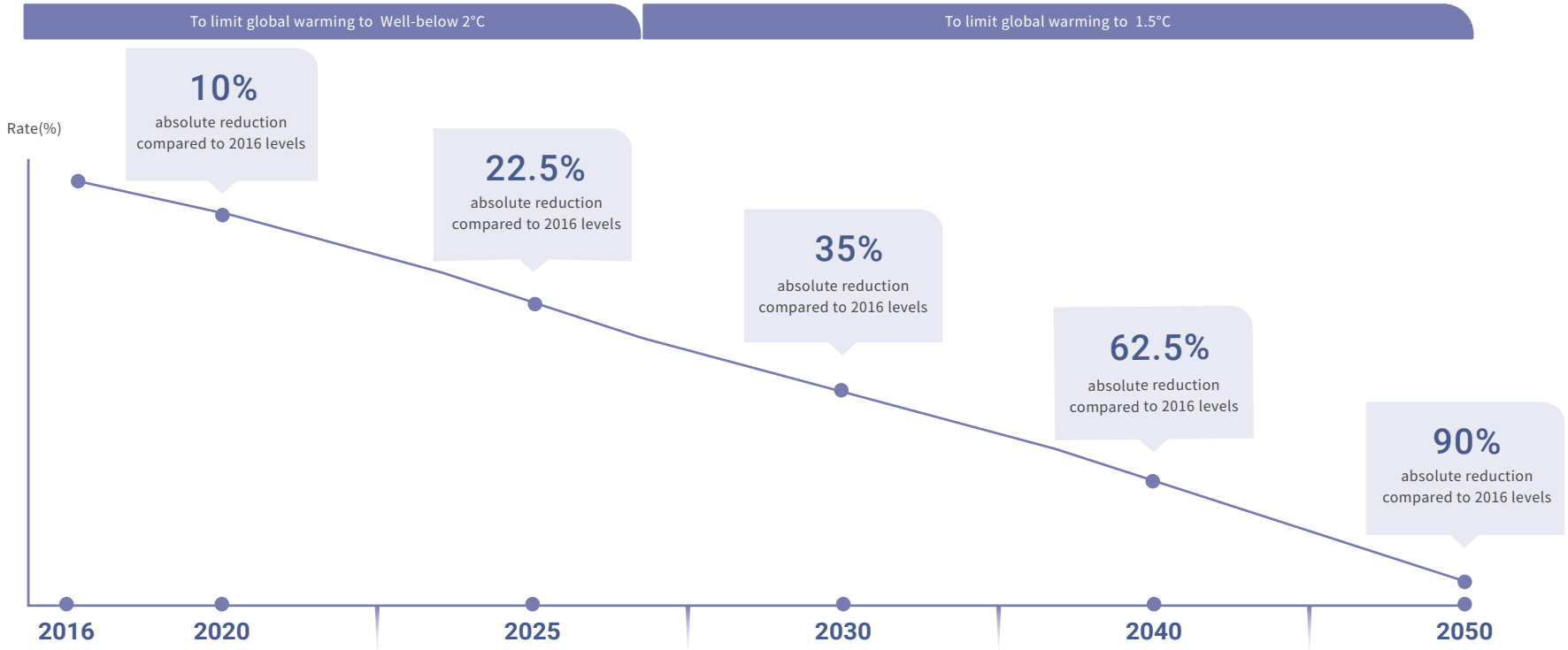


In 2021, ASEH began preparations to facilitate net-zero emissions by 2050, dividing our targets into two phases. The first phase is aimed at achieving current SBTi carbon reduction targets by 2030 while the second phase expands further in response to limiting global warming within 1.5° C after 2030. In accordance with the requirements of the SBTi Net-Zero Standard, we plan to reduce greenhouse gas emissions by 90% by 2050 from 2016 levels, with the residual emissions decreased through carbon sequestration or carbon credits offsets to achieve complete net-zero emission.

To reinforce our carbon reduction strategy, we will progressively establish a KPI system for carbon management at our subsidiaries and conduct periodic monitoring and reviews in 2022. We believe that the emergence of technologies or innovative methodologies viable for carbon reduction in the near future will enable us to accelerate our goal of limiting global warming to within 1.5°C. We will also continue to adjust our reduction strategies on a rolling basis and progress together with the citizens of the Earth towards net zero.

Roadmap to Net Zero Emissions

Scope1+2



2016 Base year

2020
- 100% renewable energy use or REC in China and Malaysia facilities
- Improving energy use efficiency with energy saving rate >2%
- Commencing large-scale renewable energy procurement
- Introducing the concept of circular economy to develop low carbon products

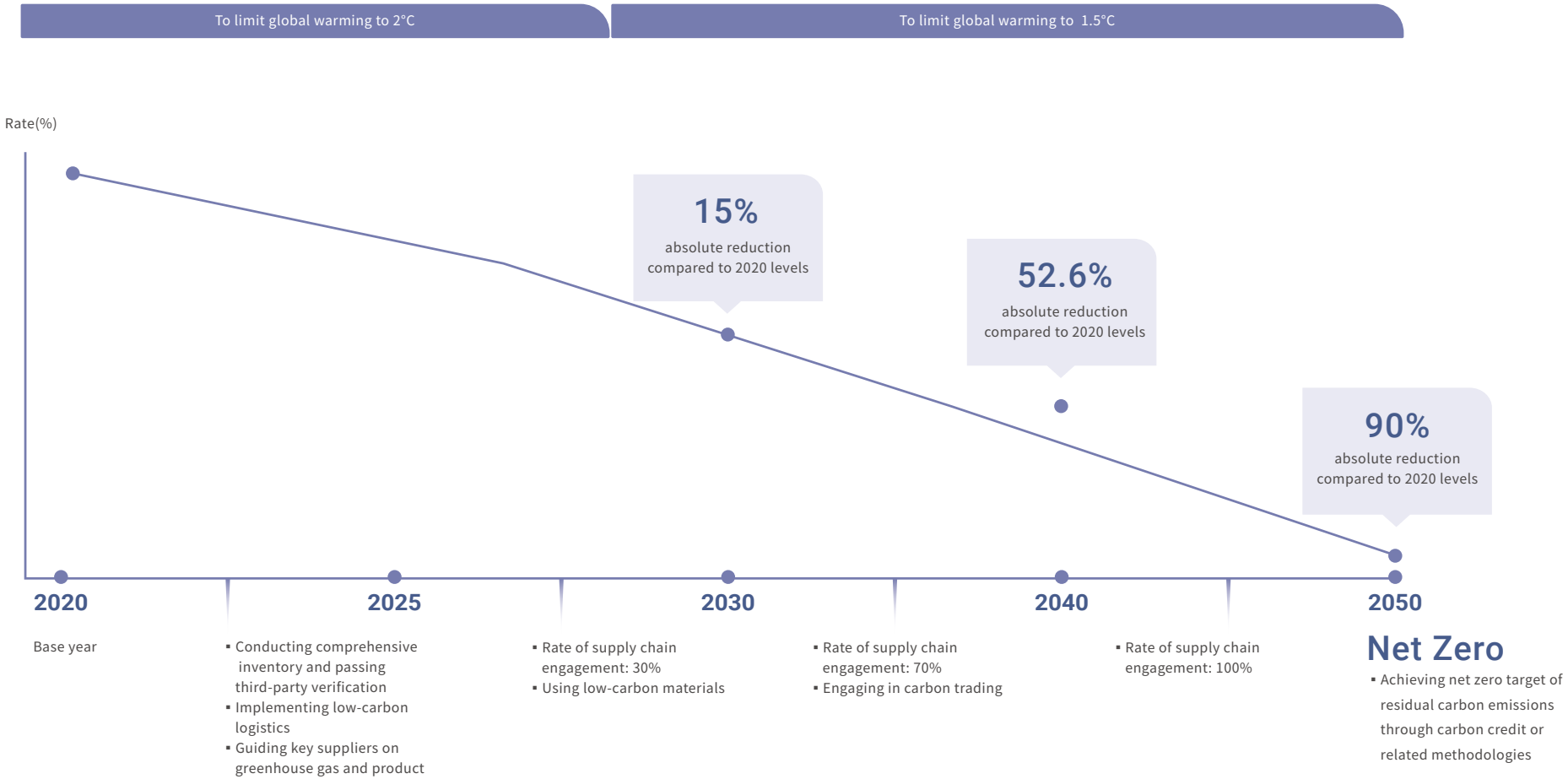
2025
- 100% of renewable energy use in offices within key facilities
- Using low-carbon materials or alternatives
- Electrification of business vehicles

2030
- 100% renewable energy use at production facilities worldwide
- Carbon capture technology cooperation and application

2040
- Engaging in forest carbon sinks and carbon credit

2050 Net Zero
- Achieving net zero target of residual carbon emissions through carbon credit or related methodologies

Scope3


To limit global warming to 2°C
To limit global warming to 1.5°C
Rate(%)
15%
absolute reduction compared to 2020 levels
52.6%
absolute reduction compared to 2020 levels
90%
absolute reduction compared to 2020 levels
2020
Base year
2025
▪ Conducting comprehensive inventory and passing third-party verification
▪ Implementing low-carbon logistics
▪ Guiding key suppliers on greenhouse gas and product carbon footprint inventories and passing third-party verification
2030
▪ Rate of supply chain engagement: 30%
▪ Using low-carbon materials
2040
▪ Rate of supply chain engagement: 70%
▪ Engaging in carbon trading
2050
▪ Rate of supply chain engagement: 100%
Net Zero
▪ Achieving net zero target of residual carbon emissions through carbon credit or related methodologies

05

Appendix

5.1 / Appendix Task Force on Climate-related Financial Disclosures index

Dimension	General industry index（2021 edition）	Comparing Section	Page No.
Governance	The board' s oversight of climate-related risks and opportunities.	Letter from the Chairman	01
		Accountability and Responsibility-Climate-related Organizational Structure -Supervision at Management Level	07
	Management' s role in assessing and managing climate-related risks and opportunities.	Accountability and Responsibility - Climate-related Organizational Structure - High-Level Assessment and Management	08
Strategy	The climate-related risks and opportunities the organization has identified over the short, medium, and long term.	Accountability and Responsibility - Risk Management - Identification and Assessment	11
	The impact of climate related risks and opportunities on the organization' s businesses, strategy, and financial planning.	Accountability and Responsibility - Risk Management - Response and Actions	12-14
	The resilience of the organization' s strategy, taking into consideration different climate-related scenarios,including a 2° C or lower scenario.	Accountability and Responsibility - Resilience Strategy - Entity and Transition Scena	18
Risk Management	The organization' s processes for identifying and assessing climate-related risks.	Accountability and Responsibility - Risk Management- Identification and Assessment	10
	The organization' s processes for managing climate-related risks.	Accountability and Responsibility - Risk Management- Integrated management	09
	How processes for identifying, assessing, and managing climate-related risks are integrated into the organization' s overall risk management.	Accountability and Responsibility - Risk Management- Identification and Assessment	10
Metrics and Targets	The metrics used by the organization to assess climate-related risks and opportunities in line with its strategy and risk management process.	Accountability and Responsibility - Risk Management- Identification and Assessment	10
	Scope 1, Scope 2 , and if appropriate, scope 3 greenhouse gas (GHG) emissions and the related risks.	Accountability and Responsibility - Risk Management- Response and Actions	12-13
		Moving Towards Net Zero Targets - Science-based Targets	37
	The targets used by the organization to manage climate-related risks and opportunities and performance against targets.	Moving Towards Net Zero Targets - Science-based Targets	37
		Moving Towards Net Zero Targets - Net Zero Targets	42

5.2 / Appendix Related Publishing

Corporate Sustainability Report:
https://www.aseglobal.com/en/pdf/aseh-2021-csr-en-final.pdf

20F:
https://ir.aseglobal.com/c/ir_exchange_us.php

Annual Report:
https://media-aseholdco.todayir.com/20220531103829441444626_en.pdf

Risk Management Policies and Procedures:
https://www.aseglobal.com/en/pdf/2020_aseh_risk_management_policies_procedures_en_v1.pdf

Environmental Responsibility Policy:
https://www.aseglobal.com/en/pdf/environmental-responsibility-policy-en.pdf

5.3 / Appendix References

- ISO 14040 international standard. Environmental Management-Life Cycle Assessment-Principles and Framework. International Organisation for Standardization.
- Science Based Targets Initiative. (2021). SBTi CORPORATE NET-ZERO STANDARD. Accessed from: https://sciencebasedtargets.org/resources/files/Net-Zero-Standard.pdf
- Hofste, R. W., Kuzma, S., Walker, S., Sutanudjaja, E. H., Bierkens, M. F., Kuijper, M. J., ... & Reig, P. (2019). Aqueduct 3.0: Updated decision-relevant global water risk indicators. World Resources Institute, 1-53.
- IPCC. Fifth Assessment Report (AR5), Climate Change: Action, Trends, and Implications for Business, Cambridge University Press, 2013. www.cisl.cam.ac.uk/business-action/low-carbon-transformation/ipcc-climate-sciencebusiness-briefings/climate-science.
- NASA Earth Exchange- Global Daily Downscaled Projections. (n.d.). NASA. https://www.nasa.gov/nex
- TCFD. (2017). The Use of Scenario Analysis in Disclosure of Climate-Related Risks and Opportunities.

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