

NET ZERO PATHWAY



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Introduction





Introduction Climate Change Management

Upholding good governance, transparency, and accountability, driving toward a sustainable low-carbon economy



BBGI Public Company Limited recognizes that climate change is a global challenge that must be addressed seriously and continuously. The IPCC AR6 report clearly confirms that human influence has unequivocally warmed the atmosphere, ocean, and land, and that these changes have caused rapid and widespread changes in the global climate system. At the same time, the Company believes that climate change management should be systematically linked to business decision-making in line with the TCFD framework so that disclosures and management practices are transparent, verifiable, and practically applicable at the organizational level.

Net Zero Pathway Implementation Approach



TCFD

Link climate change management to business decision-making and elevate disclosures so that they are transparent, verifiable, and practically applicable at the organizational level.



Net Zero Pathway

Clearly define the implementation pathway, focusing on tangible greenhouse gas emission reductions, setting operational-level targets, reducing or offsetting impacts from all business activities, and supporting future climate adaptation through clear long-term planning.



Near Term Target

Set a target to reduce greenhouse gas emissions by 30% by 2030 from the 2022 base year.



Net Zero

Aim to achieve Net Zero by 2050, together with fostering an organizational culture that supports climate-related action at every level of the organization.



Technology and Innovation

Integrate technology and innovation to develop communities and support the transition to a low-carbon economy.



Alignment with Global Targets

Refer to Thailand NDC 3.0, which Thailand submits to the UNFCCC, including monitoring progress on the draft Climate Change Act of Thailand.



Transparency and Confidence

Closely monitor laws, public policies, and related regulations, while disclosing climate-related information in line with the TCFD framework to enhance transparency and stakeholder confidence on an ongoing basis.



Networks and Associations Joined by the Company



The Federation of Thai Industries (FTI)



Carbon Markets Club



National Science and Technology Development Agency



Thailand Carbon Neutral Network



Thai Ethanol Producers Trade Association



Governance



BBGI Climate Change Governance Structure

To ensure effective governance of climate-related matters, the Risk Management and Corporate Governance Committee, supported by the management team, oversees the identification, assessment, monitoring, and management of climate-related risks and opportunities. This includes both **transition risks** and **physical risks**, with regular monitoring of climate-related performance and integration of climate considerations into strategic planning and enterprise risk management. These processes support the Company's ability to adapt to climate-related changes, mitigate potential impacts, and pursue opportunities arising from the transition to a sustainable, low-carbon economy.



Roles, Responsibilities and Scope of ESG Risk Management Covering 6 Areas

- 1 Corporate Risk Management
- 2 Project Investment Risk Management
- 3 Business Continuity Management
- 4 ESG Risk Management
- 5 Climate Risk
- 6 Emerging Risks



The Company will establish a dedicated function responsible for regularly **monitoring and controlling greenhouse gas management**, such as calculating greenhouse gas emissions in accordance with international standards, coordinating with external organizations to verify greenhouse gas emissions, and the Company will encourage internal functions to implement measures related to greenhouse gas management.



The Company implements organization-wide **initiatives to support greenhouse gas (GHG) emissions reduction** and climate adaptation. Climate-related actions are integrated into the Company's sustainability strategy through comprehensive action plans covering environmental, social, and governance (ESG) priorities, including greenhouse gas management, climate resilience, and continuous improvement.



Climate-Related Management Incentives



BBGI integrates climate-related performance into its executive remuneration framework to reinforce accountability for the Company's climate strategy and decarbonization objectives. Climate-related Key Performance Indicators (KPIs) are incorporated into the annual performance evaluation of the Chief Executive Officer (CEO) and C-level executives.



Target for 2025

The Company has established a target to achieve a

7% reduction



in Scope 1 and Scope 2 greenhouse gas (GHG) emissions compared with the 2022 baseline.



Incentive Linkage

Achievement of this target is linked to the annual performance-based incentive program,

representing
2.5%

The performance will be evaluated and would reflect a year-end bonus.



Performance Monitoring

Performance against the climate-related KPI is monitored on a quarterly basis through the Company's sustainability performance management process.



Review & Oversight

Progress is reviewed by management and reported to the Board of Directors to support effective oversight of climate-related performance and the achievement of the Company's decarbonization objective.



Integrated into executive remuneration framework



Target: **7% reduction** in Scope 1 and Scope 2 GHG emissions (compared with 2022 baseline)



Applies to CEO and C-level executives



Incentive amount: **2.5%** The performance will be evaluated and would reflect a year-end bonus.



Monitored quarterly and reported to the Board of Directors

Climate Change Strategy





Scope of Assessment

We systematically assess potential climate-related risks and opportunities (**Scenario Analysis**) for our assets in line with the TCFD framework to evaluate the potential impacts of climate change on our business.

This approach covers key areas such as Corporate Level: **Strategy & Risk**), Business Units: **Operation**), and Financial: **Finance**).



Biodiesel

BBGI Biofuel Company Limited ("BBGI-BI")

Biodiesel or methyl ester can be produced from both palm oil and other vegetable oils through a process called Transesterification. In this process, methyl ester is reacted with crude glycerin to obtain biodiesel or methyl ester as the main product, and crude glycerin as a by-product. These by-products can be further used as raw materials in various industries, such as animal feed, pharmaceuticals, and cosmetics.



→ Bioethanol



BBGI Bioethanol Company Limited (Chachoengsao) (BBGI-PS)
BBGI Bioethanol Company Limited (Kanchanaburi) (BBGI-BP)
BBGI Bioethanol Company Limited (Khon Khean) (BBGI-NP)

Bioethanol produced by the Group is derived from biomass or renewable feedstocks through a fermentation process, followed by distillation and dehydration. It is a clear, colorless, flammable liquid that is fully miscible with water and various organic solvents. Owing to its versatile properties, bioethanol can be used across a wide range of applications. The Group's bioethanol products are categorized into two grades:

- **Fuel Alcohol** – Anhydrous ethanol with a minimum purity of **99.5% v/v**, primarily used as a blending component for gasoline to produce gasohol for spark-ignition vehicles.
- **Industrial Alcohol (IAA)** – Ethanol that meets applicable industrial quality standards and is used as a raw material or ingredient in a wide range of industrial applications, including chemicals, pharmaceuticals, personal care products, food processing, and other downstream industries.

Relevant Departments



Corporate Level:
Strategy & Risk



Business Units:
Operation



Financial:
Finance

BBGI Climate Change Strategy

Relevance of The TCFD Standard regarding climate-related risks and opportunities for Companies



Physical Risks Scenario Analysis

Risk Type	Physical Risks	Business	Indicator	Climate Scenario	Time Horizons	Tool
Acute	Flood	Biodiesel, Ethanol	Rainfall	IPCC SSP1-2.6*, SSP5-8.5**	Short term: 2026 -2029	- Climate Change Knowledge Portal
	Water Scarcity	Biodiesel, Ethanol	Rainfall / Water use supply		Medium term: 2030	
					Long term: 2050	- Aqueduct (World Resources Institute)
	Cyclone	Biodiesel, Ethanol	Wind speed		Short term: 2026 -2029	- ThinkHazard! (Global Facility for Disaster Reduction and Recovery)
	Landslide	Ethanol	Rainfall		Short term: 2026 -2029	
	Earthquake	Biodiesel, Ethanol	Acceleration (PGA)		Short term: 2026 -2029	
Chronic	Rising Average temperatures	Biodiesel, Ethanol	Mean temperatures		Short term: 2026 -2029	- Climate Change Knowledge Portal
					Medium term: 2030	
					Long term: 2050	

Remarks:

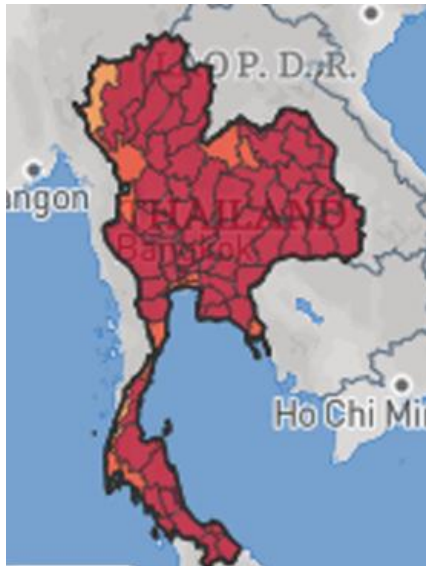
*SSP1-2.6: A low emission scenario that stay below 2 oC (Estimated increase temperature by 2100 = 1.8 oC)

**SSP5-8.5: High emission scenario (Estimated increase temperature by 2100 = 4.4 oC)

Physical Risks: Define Baseline in Thailand by ThinkHazard!

The assessment indicates high exposure to multiple climate-related physical hazards, particularly flooding and cyclones, while water scarcity presents a moderate level of risk that may affect operational resilience.

River Flood: High



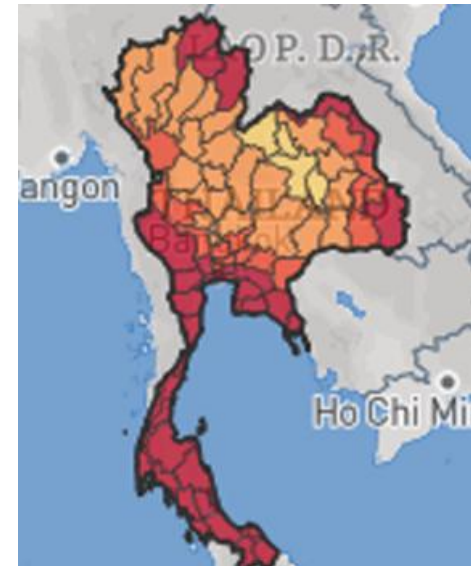
Urban Flood: High



Water scarcity: Medium



Cyclone: High



BBGI Climate Change Strategy

Physical Risks: Define Baseline by ThinkHazard!

No.	Company Name	Location		Business	Think Hazard Evaluator							
		District	Province		River Flood	Urban Flood	Coastal Flood	Earthquake	Landslide	Tsunami	Cyclone	Water scarcity
1.	BBGI Biodiesel	Bang Pa-In	Phra Nakhon Si Ayutthaya	Biodiesel	H	H	N/A	L	VL	N/A	M	M
2.	BBGI Bioethanol (Chachoengsao)	Phanom Sarakham	Chachoengsao	Ethanol	H	M	N/A	L	VL	N/A	M	L
3.	BBGI Bioethanol (Bo Ploy)	Bo Ploy	Kanchanaburi	Ethanol	H	H	N/A	L	L	N/A	M	L
4.	BBGI Bioethanol (Nam Phong)	Nam Phong	Khon Kaen	Ethanol	H	H	N/A	L	VL	N/A	VL	VL

Risk Score color Key by Think Hazard

High

Medium

Low

Very Low

Physical Risks (Flood): Define Climate change projection by



Climate Change Knowledge Portal
For Development Practitioners and Policy Makers

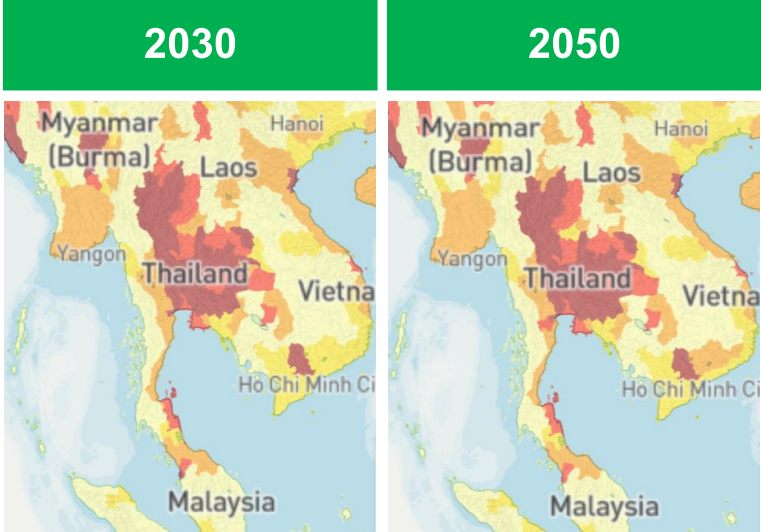
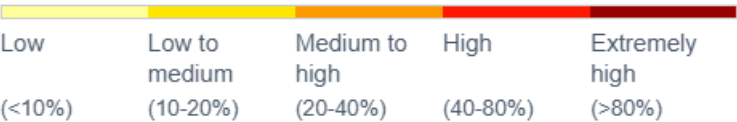
No.	Company Name	Location		Business	SSP1-2.6		SSP5-8.5	
		District	Province		2030	2050	2030	2050
1.	BBGI Biodiesel	Bang Pa-In	Phra Nakhon Si Ayutthaya	Biodiesel				
2.	BBGI Bioethanol (Chachoengsao)	Phanom Sarakham	Chachoengsao	Ethanol				
3.	BBGI Bioethanol (Bo Ploy)	Bo Ploy	Kanchanaburi	Ethanol				
4.	BBGI Bioethanol (Nam Phong)	Nam Phong	Khon Kaen	Ethanol				

Legend and Hazard Score for
SSP1-2.6 and SSP5-8.5 scenarios

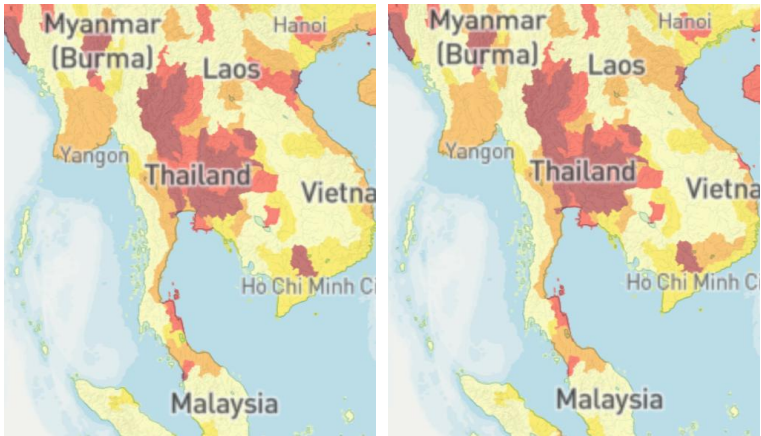
Category		Change in Average Largest 5-Day Cumulative Precipitation
3	Significant Increase	> 10%
2	Moderate Increase	> 5%
1	Slight Increase	> 0%
0	No Change	0%
1	Slight Decrease	< 0%
2	Moderate Decrease	< -5%
3	Significant Decrease	< -10%

Physical Risks (Water Stress): Define Climate change projection by AQUEDUCT

No.	Company Name	Location		Business	SSP1-2.6		SSP5-8.5	
		District	Province		2030	2050	2030	2050
1.	BBGI Biodiesel	Bang Pa-In	Phra Nakhon Si Ayutthaya	Biodiesel				
2.	BBGI Bioethanol (Chachoengsao)	Phanom Sarakham	Chachoengsao	Ethanol				
3.	BBGI Bioethanol (Bo Ploy)	Bo Ploy	Kanchanaburi	Ethanol				
4.	BBGI Bioethanol (Nam Phong)	Nam Phong	Khon Kaen	Ethanol				



SSP1-2.6



SSP5-8.5

Physical Risks

Time Horizon	Short Term	Medium Term	Long Term
	0-1 Year	1-5 Year	> 5 Year

Physical risks arise from the direct effects of climate change and weather variability on BBGI's operations, supply chains, and assets. Because BBGI's core feedstocks

Risks		Driver Description	Business Implications	Time Horizon
Acute	Flood	Increasing intensity of monsoon rainfall and tropical storm systems may affect cassava, sugarcane, and oil palm cultivation areas in Thailand, potentially disrupting agricultural productivity and feedstock supply	• Crop damage and field access disruption reduce cassava /sugarcane/palm oil feedstock supply to ethanol & biodiesel BU • Flooding of low-lying production or storage sites risks plant downtime and inventory loss • Transport network disruption delays feedstock delivery and product distribution	Short - Medium
	Water Scarcity	Short, intense dry spells superimposed on chronic water stress, often linked to El Niño cycles affecting the Mekong and Chao Phraya basins	• reduction in cassava root yield and sugarcane juice content, raising feedstock procurement cost for ethanol BU • Reduced river/irrigation water availability disrupts plant process-water supply	Short - Medium

Physical Risks (Continued)

Time Horizon	Short Term	Medium Term	Long Term
	0-1 Year	1-5 Year	> 5 Year

	Risks	Driver Description	Business Implications	Time Horizon
Chronic	Rising Average Temperatures	Progressive warming trend across Thailand's agricultural regions, affecting crop suitability zones and growing-season length	- Gradual shift in optimal cassava/sugarcane/palm oil cultivation zones may require feedstock sourcing realignment over the long term - Increased cooling and energy load at production facilities raises operating costs - Potential long-term yield decline in current sourcing regions absent adaptation (improved varieties, irrigation)	Long
	Changing Precipitation Patterns	Structural shift in monsoon timing, intensity, and seasonal distribution, altering planting and harvest cycle reliability	- Reduced predictability of cassava/sugarcane/palm oil harvest timing complicates feedstock procurement planning and working-capital management - Greater feedstock price volatility flows through to ethanol and biodiesel input costs	Long

Transition Risks Scenario Analysis

Transition risk scenario analysis was conducted using the IEA STEPS and NZE scenarios to assess the resilience of the business under both a policy-driven baseline pathway and a net-zero transition pathway. This approach enables the company to evaluate a range of potential climate-related risks and opportunities under different levels of transition ambition.

Risk Type	Scenarios	Description	Source	Time Horizons
Transition	STEPS	Reflects current policies and stated ambitions, representing the likely direction of the energy system under existing policy frameworks.	International Energy Agency (IEA) World Energy Outlook (WEO)	Short term: 2026 -2029 Medium term: 2030 Long term: 2050
	NZE	a pathway for the global energy sector to achieve net zero CO ₂ emissions by 2050		

Remarks:
STEPS: Stated Policies Scenario
NZE: Net Zero Emissions by 2050

Transition Risks

Time Horizon	Short Term	Medium Term	Long Term
	0-1 Year	1-5 Year	> 5 Year

Transition risks arise from the process of adjustment toward a lower-carbon economy, encompassing changes in policy, technology, markets, and stakeholder sentiment.

Risks		Driver Description	Business Implications	Time Horizon
Policy & Legal Risk	Biofuel Blend Mandate Changes	Government revision of mandatory ethanol and biodiesel blend ratios under Thailand's energy policy framework	Downward revision of blend mandates would directly reduce domestic offtake volume for ethanol and biodiesel BUs	Long
	SAF Mandate & Incentive Timeline	Pace and certainty of Thai and regional SAF blending mandates, incentive structures, and certification requirements (ICAO CORSIA, ISCC EU/PLUS)	Delay or weakening of SAF mandate timelines directly affects the investment and payback period	Medium

Transition Risks (Continued)

Time Horizon	Short Term	Medium Term	Long Term
	0-1 Year	1-5 Year	> 5 Year

Risks		Driver Description	Business Implications	Time Horizon
Technology Risk	Electric Vehicle (EV) Adoption	Accelerating EV penetration in Thailand's passenger and commercial vehicle fleet, supported by government EV incentive schemes and falling battery costs	- Structural long-term decline in gasoline and diesel demand reduces the addressable market for blended ethanol and biodiesel - Compresses the terminal value assumptions underpinning ethanol/biodiesel BU capacity investments	Short - Medium
	Battery & Energy Storage Cost Decline	Continued cost reduction in battery storage technology, accelerating grid-scale and behind-the-meter electrification across transport and industrial applications	Indirect pressure on long-run liquid fuel demand growth assumptions across all transport-fuel BUs	Medium - Long

Transition Risks (Continued)

Time Horizon	Short Term	Medium Term	Long Term
	0-1 Year	1-5 Year	> 5 Year

Risks		Driver Description	Business Implications	Time Horizon
Technology Risk	Feedstock & Fermentation Process Innovation	Advances in feedstock genetics, fermentation yield optimization, and enzymatic conversion technology across the global ethanol industry	- Competitors achieving higher fermentation yields per tonne of feedstock could erode BBGI's relative cost position - Underinvestment in process R&D risks long-term margin erosion versus best-in-class global benchmarks	Medium - Long
Market Risk	Feedstock Commodity Price Volatility	Climate-linked volatility in global corn, soybean, and sugarcane/ethanol prices and domestic cassava/molasses pricing, compounded by competing food, feed, and industrial demand	- Direct margin compression risk for ethanol and biodiesel BUs when feedstock costs rise faster than regulated or contracted product pricing - Increases working-capital and hedging requirements for feedstock trading BU	Short - Medium

Transition Risks (Continued)

Time Horizon	Short Term	Medium Term	Long Term
	0-1 Year	1-5 Year	> 5 Year

Risks		Driver Description	Business Implications	Time Horizon
Reputation Risk	Stakeholder Perceptions	- Increasing stakeholder expectations for climate action, sustainability performance, and ESG transparency. - Climate-related performance is becoming a key consideration in investment and purchasing decisions.	Insufficient management of community concerns may damage corporate reputation, reduce stakeholder trust, and affect the company's social license to operate.	Short - Medium

Opportunity

Time Horizon	Short Term	Medium Term	Long Term
	0-1 Year	1-5 Year	> 5 Year

Opportunity		Driver Description	Business Implications	Time Horizon
Policy & Legal	Sustainable Aviation Fuel (SAF) Expansion	Growing SAF mandates and aviation decarbonization efforts increase demand for sustainable aviation fuels.	- Revenue diversification - New growth opportunities - Participation in emerging low-carbon aviation markets	Medium - Long
	Rising Demand for B24 Biodiesel from Energy Transition Policies	Government policies promoting cleaner fuels, together with increasing demand from the transport and logistics sectors seeking lower-carbon fuel alternatives.	Potential increase in biodiesel sales volume from higher blending requirements, strengthened market position in low-carbon fuels, and improved revenue stability from policy-driven demand growth.	Medium - Long
	Growth in Low-Carbon Energy Demand	Energy transition policies support continued demand for renewable transportation fuels.	- Increased sales volumes - Strengthened market position for biofuels. - BBGI may generate additional revenue through carbon credit development from renewable energy, biogas, sustainable agriculture, and other emission reduction initiatives.	Short - Medium

Risk Management





The risk management process of BBGI Public Company Limited adopts the principles of COSO Enterprise Risk Management (COSO ERM) and applies them within the Company. The process is developed and implemented by the Board of Directors, management, and all employees across the organization to identify, analyze, assess, and prioritize risks that may affect the achievement of the objectives of business processes at the functional or organizational level, including establishing approaches and measures for risk control, risk management, and risk monitoring, in order to manage risks within the level acceptable to the organization and provide assurance in achieving the established objectives. Risk management is a continuous process linked to the strategic planning process. The determination of the Company's risks in each year is analyzed and compiled from various factors as follows:

1



1. Consideration of the organization's 5-year long-term business strategic plan and risk factors relating to projects or key plans that may cause the performance of each function not to achieve its objectives



2



2. Analysis and compilation of trends in the economic situation of the world and Thailand in any dimensions that may affect the Company's operations



3



3. Analysis of impacts on the Company's annual operating results arising from changes in various internal and external risk factors



4



4. Issues and comments from meetings of the Board of Directors, the Risk Management and Corporate Governance Committee, and the Audit Committee, including recommendations from internal and external assessors



5



5. Results of risk management, remaining risk factors (Residual Risk), obstacles, or Lessons Learned following risk management in the past year





The Company has classified risks into 4 groups (SOER), namely Strategic Risk (Strategy), Operational Risk (Operation), Financial Risk (Financial), and Reputation Risk (Reputation), with details as follows:

1

Strategic Risk



Refers to changes in the business environment that affect the organization's ability to operate in a manner that achieves its strategic objectives or its ability to implement strategy in both the short and long term, such as changing global trends, technology, competitors, and government policies. Investment risks arising from changes in the business environment may affect long-term goals or plans, such as volatility in oil prices, changes in government policy, and economic conditions.

2

Operational Risk



Refers to risks affecting operations, including impacts on production, as well as risks in raw material management in terms of quantity and quality, personnel, work systems, and the lack of good process controls, which may result in errors in work processes and affect business objectives.

3

Financial Risk



Refers to risks arising from changes in financial and economic conditions and oil prices, such as fluctuations in exchange rates, interest rates, liquidity, and tax rates, including risks related to the management of operating cash flow.

4

Reputation Risk



Refers to risks arising from operations that affect the organization's image and reputation, including risks related to the environment (Environment Risk) both inside and outside the plant area, and safety and health risks (Safety and Health Risk). This also includes risks that may arise from fraud and corruption or from non-compliance with laws and regulations, as follows:



Fraud and Corruption Risk

Refers to risks arising from actions or omissions in the performance of duties, or abuse of authority in one's position, violations of laws, ethics, regulations, or Company policies, for the purpose of seeking undue benefits in various forms, such as soliciting, accepting, offering, or giving assets, including any other benefits, to government officials or any other persons doing business with the Company, etc.



Compliance Risk

Refers to risks arising from operations that do not comply with laws or various regulations, such as the regulations of the Stock Exchange of Thailand.



BBGI Climate Risk Management

The Company implements a risk management process through four key steps, as follows:

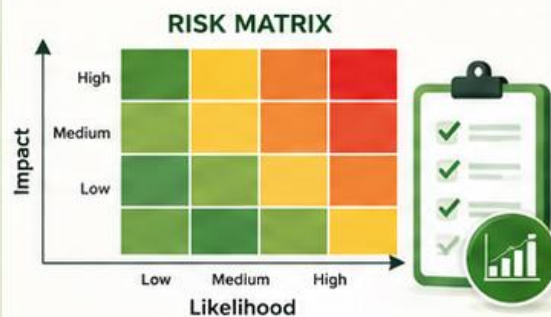
01 Risk Identification



Identifying potential events that may occur and could adversely affect the achievement of the Company's objectives and strategic goals.



02 Risk Assessment



Assessing risks by evaluating both **Impact and Likelihood** using a **Risk Matrix** approach to ensure appropriate risk prioritization.



03 Risk Response



Establishing appropriate risk mitigation measures to reduce the likelihood and/or impact of risks. Risk response strategies are selected to ensure that residual risks remain within the Company's defined **Risk Appetite**.



04 Risk Monitoring and Reporting



Conducting regular monitoring, situation assessment, analysis, and management of risks under respective responsibilities. Risk status, progress, and emerging risk trends are **reported to management and relevant Board committees** on an ongoing basis to support informed decision-making.



A disciplined risk management process strengthens our resilience and supports sustainable value creation.



Anticipate uncertainties



Make better decisions



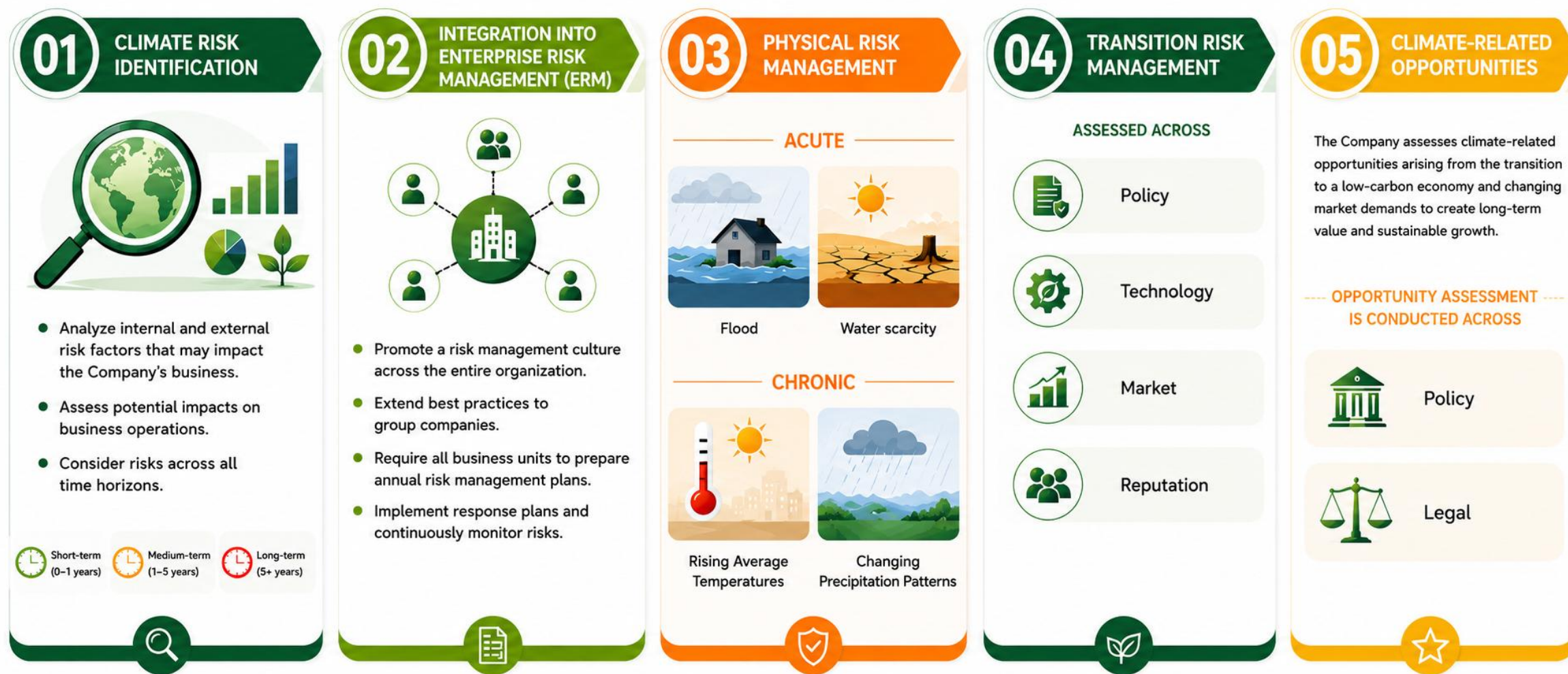
Enhance performance



Build trust and long-term value

BBGI Climate Risk Management

Climate-related risks and opportunities have been integrated into BBGI's Enterprise Risk Management (ERM) framework through a structured process of identification, assessment, management, and monitoring to enhance long-term business resilience



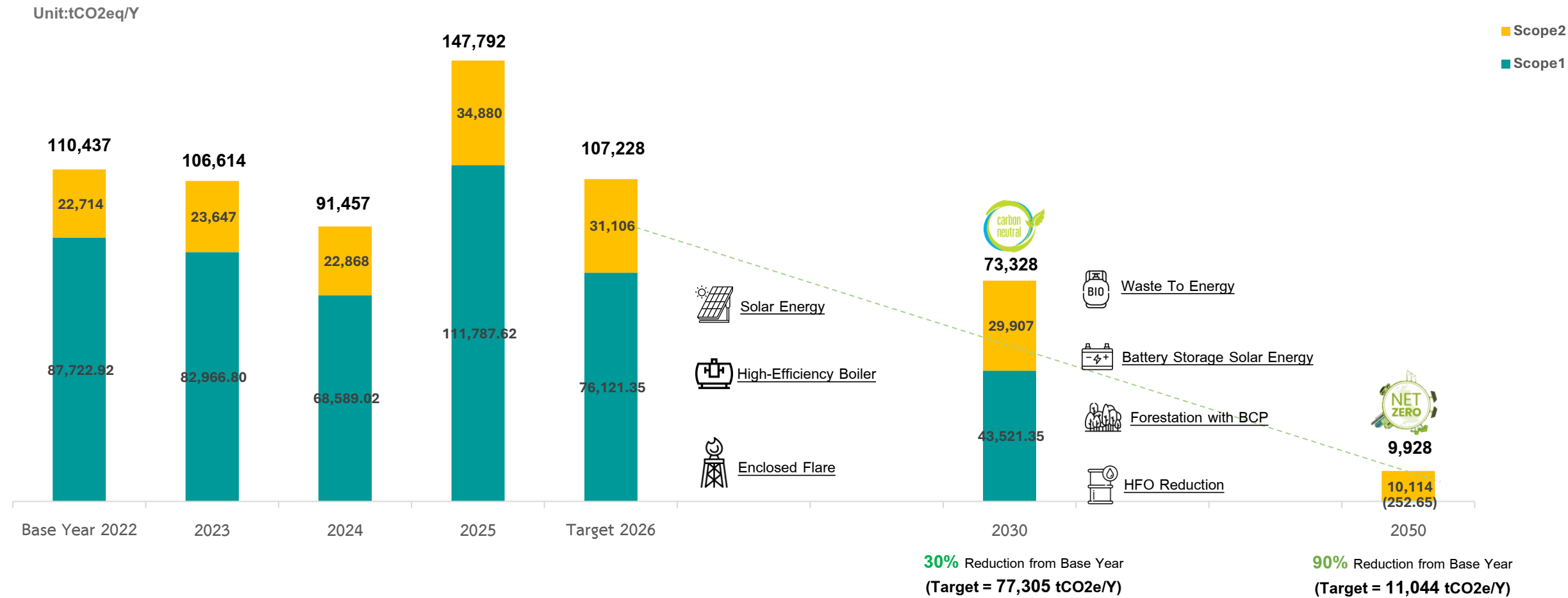
Metric and Target



Pathway to Net Zero in 2050

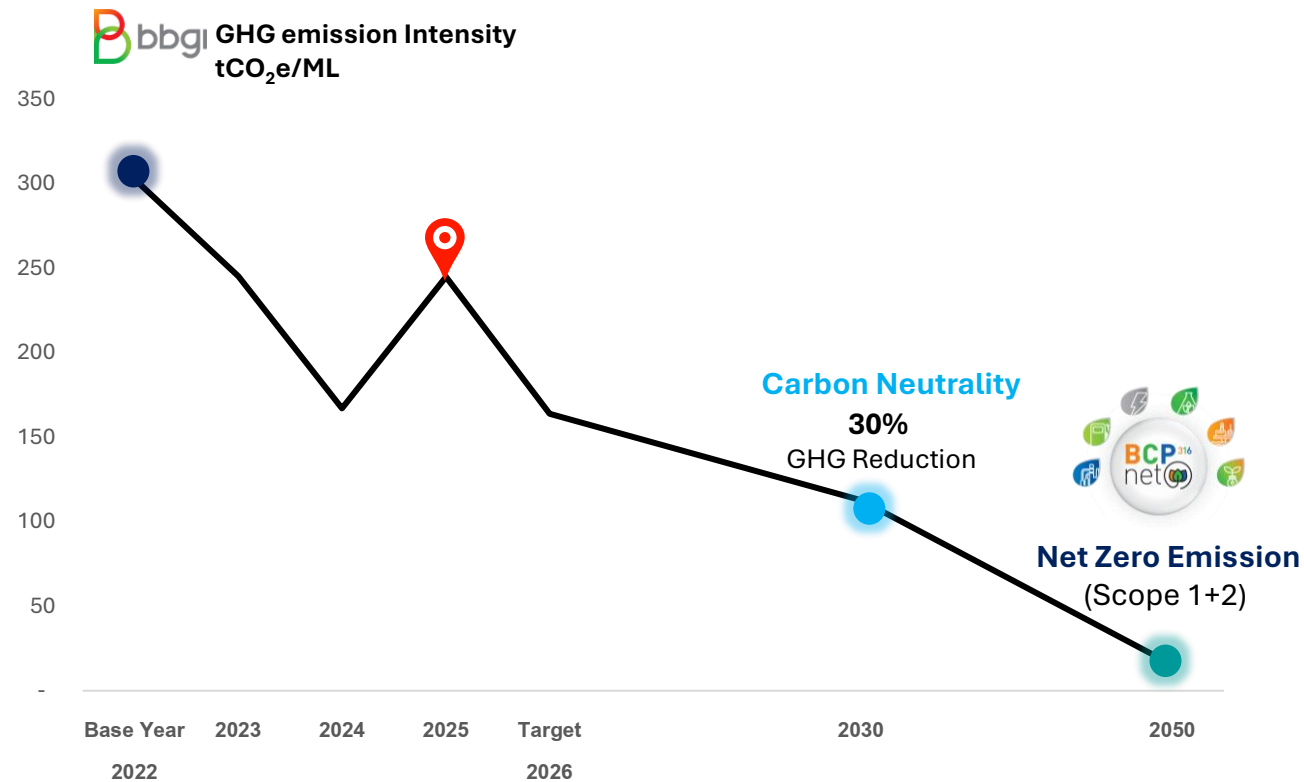


BBGI is committed to achieving energy self-sufficiency and net zero by harnessing renewable energy, driving energy efficiency across operations, and converting waste streams into productive energy sources.



Pathway to Net Zero in 2050

BBGI has established a decarbonization pathway to reduce GHG emissions intensity from the 2022 baseline. The Company aims to achieve Carbon Neutrality by 2030 and Net Zero emissions (Scope 1 and 2) by 2050 through renewable energy deployment, energy efficiency improvement, nature-based carbon removal projects, Waste-to-Energy initiatives and CCUS technologies. Progress is monitored regularly and overseen by management and the Board of Directors.



B Breakthrough Performance



Flare System : Implement Enclosed Flare systems.



Energy Storage: BESS to maximize solar utilization, 24-hour energy supply.



Renewable Energy : Solar Energy for Grid Electricity Reduction.

C Conserving Nature and Society



NATURE-BASED CERTIFIED CARBON CREDIT

Forestation with BCP



P Proactive Business Growth and Transition



Waste to Energy



Carbon Capture, Utilization, and Storage (CCUS)



Bio- Technology

NET Net Zero Ecosystem



 bangchak

 bcp

 bsgf

 KSL

