



Bangchak Climate Strategy

Task Force on Climate-Related Financial Disclosures (TCFD)

Report 2022

Introduction



As a Leader in Energy Transition, Bangchak Corporation is taking on the challenge of guiding our sector toward a sustainable future and openly disclosing our progress towards low carbon economy transition.

Bangchak Corporation Public Company Limited comprises of our Refinery and Trading Business (BCP), our Marketing Business (BCP), our Green Power Business (BCPG), Bio-based Products Business (BBGI) and our Natural Resource Business and Business Development business. Under our Natural Resource business, we operate oil and gas exploration through BCPR. We also have the Bangchak Initiative and Innovation Center (BiiC) to provide innovation on new energy solutions and businesses (see next page for more details).

In 2022, Bangchak Corporation pledged to achieve net zero greenhouse gas (GHG) emissions in our Net Zero Roadmap. Despite our company’s continued expansion, we outlined our strategy to attain net zero emissions by 2050 and set the target to Carbon neutral by 2030 compared with base year 2019.

This TCFD report explains how climate change can affect our business as well as how we can successfully move to a lower-carbon economy and prepare for a warming planet. Our knowledge of the problems caused by climate change is constantly changing therefore we will adjust our mitigation strategies as necessary in the future. The performance of this report covers all of the subsidiaries in Bangchak Corporation, except for the Metrics and Targets section that covers only refinery, trading and marketing business under BCP. The time period covered by this report is calendar year 2021.

For more information on Bangchak Corporation please see:

[Resource Center | Bangchak Corporation](#)

[Bangchak and Sustainability | Bangchak Corporation](#)

This report has been prepared in line with the TCFD’s 2021 “Annex: Implementing the Recommendations of the Task Force on Climate-related Financial Disclosures”

https://assets.bbhub.io/company/sites/60/2021/07/2021-TCFD-Implementing_Guidance.pdf

This report also includes our first public disclosure on Internal carbon price, which is an iterative process that is rapidly changing. The main aim of scenario analysis is to evaluate potential impacts from future low carbon economy transition impacts. We anticipate that our approach and quality of data will improve, which will advance our comprehension of climate threats and opportunities. These evaluations will be incorporated into our strategic planning and Enterprise Risk Management framework to assist us improve our resilience and adaptability and climate change that we continue to speed up monitoring the transformation of our value chain.

This report updates the status of Bangchak Corporation’s implementation of each TCFD pillar according to TCFD’s 2021 “Annex”: Governance, Strategy, Risk Management and Metrics and Targets.

Bangchak Corporation Public Company Limited					
Type of company	Entity (Number)				
	Marketing Business Group	Refinery Business Group	Green Power business group	Bio-based product business group	Natural resources and new business group
Subsidiary company	3	4	26	6	8
Associated company		1	2		2
Other company	1	1		5	6

Headquarter: Thailand

Countries of operation: 10 countries including Thailand, Cambodia, Laos, Singapore, Philippines, Japan, Norway, and USA.

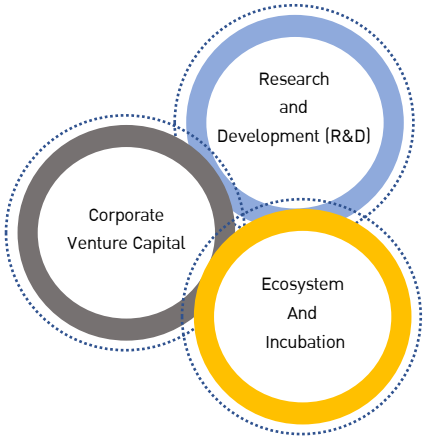
Source: <https://www.bangchak.co.th/en/about/structure#show>

Introduction

❖ Bangchak Initiative and Innovation Center

RESEARCH AND DEVELOPMENT

Bangchak Initiative and Innovation Center (BiiC) aims to create a Green Ecosystem to drive innovation with a focus on green energy and bio-based businesses. Bangchak collaborates and fund research institutes and external parties to explore new technologies in the field of green energy and bio-based products for opportunities to develop new products, intellectual property to develop future products and profit-sharing opportunities.



CORPORATE VENTURE CAPITAL

With a plan to invest more than 300 million baht and new start up companies in its portfolio, Bangchak Corporation is exploring business feasibility and investment and development opportunities in new innovative technology and startups from both domestic and international markets. This is done in order to advance the growth of company's current green energy and bio-based businesses.

ECOSYSTEM AND INCUBATION

Bangchak encourages innovation in cooperation with other organizations, such as the government, academia, the public sector, and startups, to create an innovation ecosystem. We promote the growth of startups by investing in, testing, or buying new technologies from them. Then, through the design-thinking methodology, adapt the new technologies to support the corporate operations, the creation of new goods and services for the market, new customer experiences, as well as new business development.

❖ Bangchak Corporation Climate Initiatives

ENERGY TRANSITION STARTUP

Bangchak is involved with numerous startups that support the low carbon economy transition such as Transitus Energy, a blue/ green hydrogen startup in the UK and supported internal startup for example: Winnonie which is the first electric motorbike rental platform in Thailand with battery swapping stations results in GHG reduction, as its purpose is to help taxi motorcyclists cut GHG emissions while reducing the conventional costs of motorcycle payments, fuel, and maintenance.

CLIMATE ACTIONS

Bangchak has transformed the organization to become Net Zero GHG emission scope 1 and 2 in 2050 by;

- ❖ **Offering:** efficiency and process improvement and canopy solar roof installation at Bangchak service station.
- ❖ **Promoting:** collaboration through carbon markets club (CMC) to promote trading of carbon credit.
- ❖ **Cut:** GHG emissions from road transport by approximately 10,000 tons CO₂ annually though the use of fuel pipeline transportation through our investment in Bangkok Fuel Pipeline and Logistics Company Limited (BFPL).

INVESTMENT

To strive toward the future of low carbon emission business, Bangchak has on the following topics;

- ❖ **Green power:** Bangchak invest through BCPG in renewable energy with solar power, hydropower and wind power businesses.
- ❖ **Low Carbon Product:** Bangchak was the first oil company in Thailand which produced and sold biofuel products including Gasohol and Biodiesel. Moreover, we have BTSG company which offers a one-stop solution from consultancy of fuel economics, energy management and efficiency of using Liquefied Natural Gas (LNG) with GHG reducing 25-50%
- ❖ **Sustainable Aviation Fuel (SAF):** Bangchak is the first company in Thailand in producing sustainable aviation fuel from used cooking oil with the potential to cut down 80% of carbon dioxide. The product is expected to be sold in 2024.
- ❖ **Bio-based product:** Bangchak has invested in producing high-value biobased products which will be distributed across Asia especially Southeast Asia.
- ❖ **Future technologies:** As part of the investment for the future, Bangchak is investing in research and development for Lithium battery business which would accommodate the growth of EV cars.

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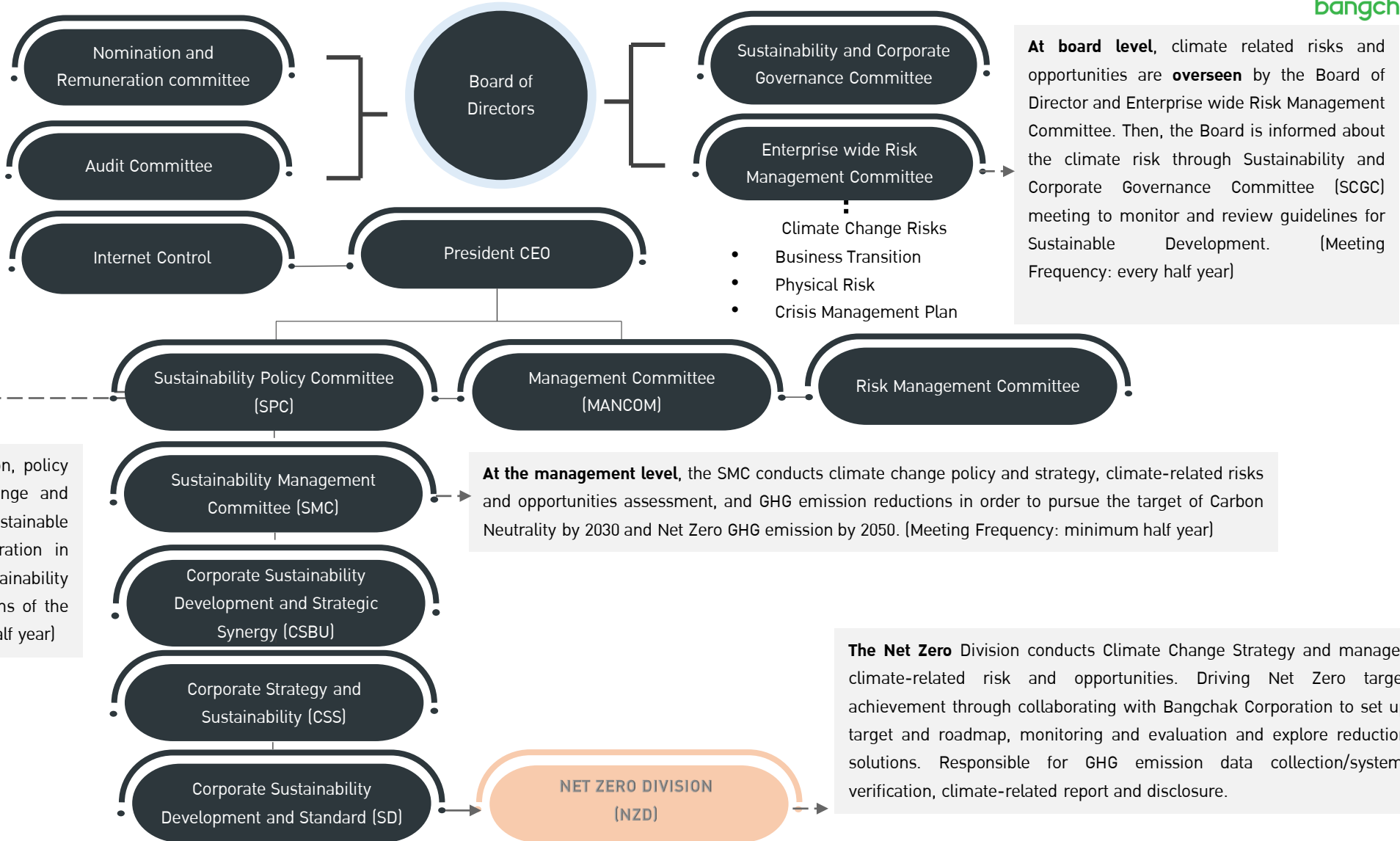
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Governance

Governance





ENTERPRISE WIDE RISK MANAGEMENT COMMITTEE (ERMIC) CLIMATE RELATED ROLES

1. To propose policy, strategy and goals for risk management (including Climate Change related risk)
2. Develop an organization-wide risk management system for continuous efficiency
3. Promote cooperation in risk management at all levels of the organization
4. Supervise the company to have appropriate and effective risk management
5. The Chairman of the Enterprise wide Risk Management Committee reports the results of the next meeting to the Board of Directors.
6. Perform duties as assigned by the Board of Directors

SUSTAINABILITY AND CORPORATE GOVERNANCE COMMITTEE (SCGC) CLIMATE RELATED ROLES

The Sustainability and Corporate Governance Committee (SCGC) is a subcommittee of the board of directors. At Meeting 1/65 of the SCGC, the SCGC proposed “The Path to Net Zero” of Bangchak Corporation.

The main roles of SCGC are:

1. To propose corporate governance practices and sustainability development including climate change to the Board of Directors.
2. Supervise the operations of the Board of Directors and the management in order to comply with good corporate governance and sustainability principles
3. Review good corporate governance practices. By comparing with international standards and making recommendations to the Board of Directors for continuous improvement and meet the need of stakeholders.
4. Deliver good corporate governance and sustainability development policy (including climate change) to the company's corporate governance working group.
5. Perform duties as assigned by the Board of Directors

SUSTAINABILITY POLICY COMMITTEE (SPC) CLIMATE RELATED ROLES

1. To provide policy and strategy direction for the company's business in accordance with the mission corporate culture, with responsibility to stakeholders, including economic, social, and environmental aspects (including climate change) in accordance with the international sustainability direction, in order to ensure the organization's sustainability.
2. To progress the report to the Sustainability and Corporate Governance Committee (SCGC)

BANGCHAK CORPORATION PERFORMANCE INDICATORS

Bangchak Corporation's sustainability performance has been tracked by Environmental, Social, and Governance (ESG) indicators. It drives implementation of Bangchak Corporation strategy, including the path to 2050 Net Zero roadmap and response to the UN Sustainable Development Goal (UN SDGs).

SUSTAINABILITY MANGEMENT COMMITTEE (SMC) CLIMATE RELATED ROLES

1. To conduct the work plans and manage work according to the responsibilities towards various groups of stakeholders according to the direction and framework specified by the Corporate Sustainability Policy Committee to bring innovation and GHG management tools to use within the Bangchak Corporation in order to achieve Carbon Neutrality in 2030 and Net Zero in 2050
2. To prepare climate strategy and manage opportunities and risks arising from climate change.
3. To encourage work processes and development plans or events to increase awareness, knowledge, and understanding of sustainability (including climate change). Participating in operations with Bangchak Corporation stakeholders by submitting a report to the working committee or reviewing in order to promote collaboration among affiliated companies in Strategic Corporate Governance Planning (CPG Task Force)
4. To progress the report to the Sustainability and Corporate Governance Committee (SCGC)

EXECUTIVE CLIMATE RELATED KPI

To ensure focused implementation of Bangchak Corporation climate change strategy, GHGs reduction target-related Key Performance Indicator (**KPI**) are set as **corporate KPI** in 2022 for **the all executive levels and relevant business unit** including Group Chief Executive Officer, Presidents etc.

Strategy

Preparation to Green Transition

Through our climate-related risk analysis, we have found that Refinery, Retail business and Natural Resource business would be the most impacted by a low carbon economy transition, however, we believe that fossil fuels will still be important for many years in the future while the region will transition to renewable energy, and therefore our refinery business will remain the core source of revenue for Bangchak Corporation.

As we approach the critical year of 2050, there is a possibility that our revenue from fossil fuels will decrease due to the low-carbon economy transition. Bangchak has adopted the **4S business strategy**, i.e., security, synergy, sustainability, and scalability, as well as the **4G sustainability strategy**, i.e., green business, green production, greenovative experience, and green society, as a road to change. This year's business performance reflected the company's strong fundamentals for sustainable growth. As part of its response to the potential risks of the low-carbon economy transition, Bangchak established new businesses, primarily BCPG in 2015 (renewable electricity) and BBGI in 2017 (biofuels), to ensure long-term sustainability. These businesses are currently small in terms of revenue, but they have a high potential for growth and profitability as the low-carbon economy transition progresses. Additionally, together with 10 other companies across multiple sectors in Thailand, we were the co-founders of the Carbon Markets Club, which aims to support the country's transition to Net Zero.

Commitment

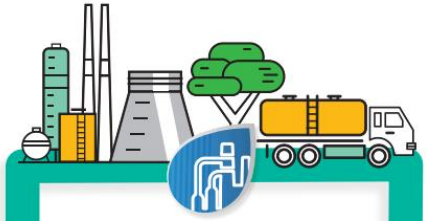
Bangchak has committed to achieve **Carbon Neutral in 2030** and **Net Zero by 2050** through BCP 316NET including Breakthrough performance (B), Conserving nature and society (C), Proactive business growth and transition (P), and Net zero ecosystem (NET).

4G Sustainability Strategy

- **Green business:** Focus on expanding existing businesses and investing in new innovative businesses in term of energy and environmentally friendly innovation
- **Green production:** Focus on environmentally friendly upgrade for the production and operation process
- **Greenovative Experience:** Focus on creating experience and new green innovation
- **Green Society:** Taking care of the environmental, contributing to improving a livelihoods, and enhancing the wellbeing society

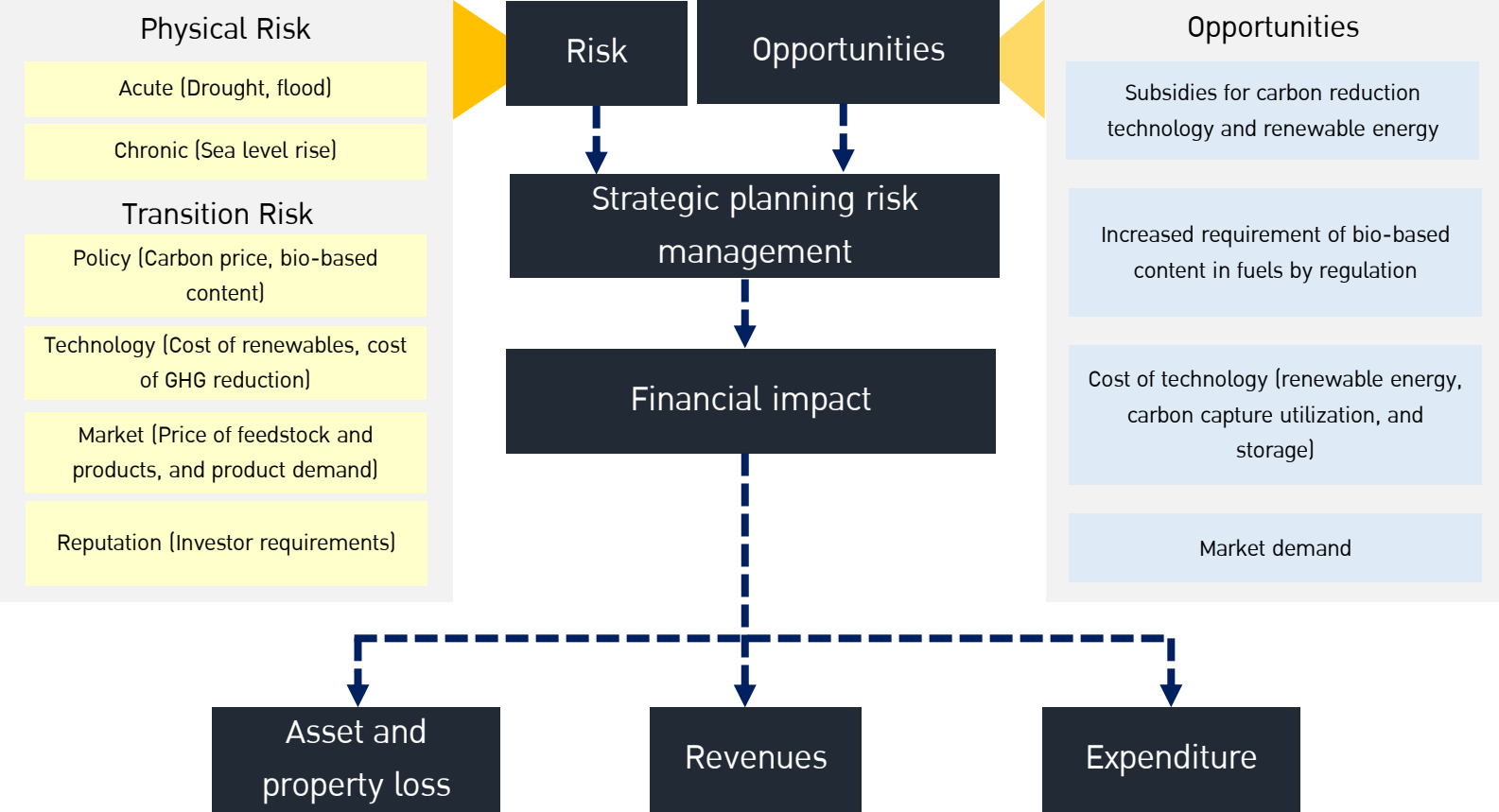
4S Business Strategy

- **Security:** Secure national energy supply
- **Synergy:** Transform and co-creation with synergy on products and services
- **Sustainability:** Accelerate green portfolio inclusion eco-friendly business with Net Zero/ Carbon neutrality targets
- **Scalability:** Reform revenue stream with new S-curves for growth



Climate related risks and opportunities

Physical, regulatory, and transition risks, as well as potential stakeholder impacts, are all taken into account by the company and integrated into our Enterprise Risk Management system and our business strategy. In terms of climate change, we consider the following risks and opportunities as the main drivers to financial impacts to the company.

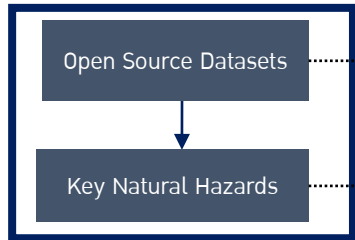


Physical Risk Assessment Process

Bangchak Corporation has identified the physical risk hazard using qualitative assessment methodology.

Geospatial Information

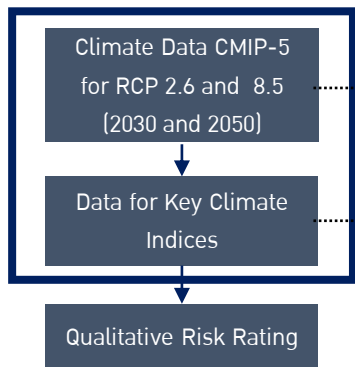
1 Define Baseline Natural Hazards



Apply *ThinkHazard!* developed by World Bank Group to provide a general view of the hazards for a given location that should be considered in climate resilience. The hazard levels provided are based on published hazard data, provided by a range of private, academic and public organizations.

An initial baseline hazard evaluation was conducted for Bangchak using data for **Phra Khanong District only as the location of our Refinery**

2 Climate Change Projections



The *Climate Change Knowledge Portal* (CCKP) provides global data on historical and future climate, vulnerabilities, and impacts.

Extract the hazard risk data from *Climate Change Knowledge Portal*

- Time period: Historical period (1986-2005), 2030,2040 and 2050
- Scenario: RCP 2.6 and RCP 8.5 in 2030 and 2050

Data extracted from *Climate Change Knowledge Portal*. Example of data extraction include:

- Time period: Historical period (1986-2005), 2030,2040 and 2050
- Maximum rainfall (mm): Historical period = 221.51 mm
- Maximum rainfall (mm): RCP 2.6 in Y2030 = -236.74 mm

For more information of Climate Change Projection methodology, please access: [Download Data | Climate Change Knowledge Portal \(worldbank.org\)](#)

ThinkHazard!

Identify natural hazards in your project area and understand how to reduce their impact

Risk	Hazard level	Classification definition
Water Scarcity	Medium	This means that there is up to a 20% chance droughts will occur in the coming 10 years.
Floods	Low	This means that there is a chance of more than 1% that potentially damaging and life-threatening river floods occur in the coming 10 years

For more information on ThinkHazard, please access [Think Hazard](#)

The IPCC's Fifth Assessment Report (AR5) relies heavily on the [Coupled Model Intercomparison Project, Phase 5 \(CMIP5\)](#), a collaborative climate modelling process coordinated by the [World Climate Research Programme \(WCRP\)](#).

- **Coupled Model Intercomparison Project Phase 5 (CMIP5)** provide projections of future climate change on near term and long term.
- **Representative Concentration Pathways, otherwise known as RCPs** – are models that illustrate the future of potential carbon dioxide emissions or the possible reduction of atmospheric concentration throughout the current century.
 - **RCP 2.6** scenario could be considered the best demonstration to limit climate change caused by human activity and the intensive climate policies would be required over the next few year
 - **RCP 8.5** scenario serves as the worst case scenario for the future of emissions. In this RCP, emissions continue to drastically increase throughout the century – predominantly during early and middle parts of the current century

❖ Physical Risk Assessment Process

Result of projection data under RCP 2.6 and RCP 8.5 scenarios at 2030, 2040, and 2050 timeframes (The difference between projection data and historical data)

Hazard	Indicator	RCP 2.6			RCP 8.5		
		2030	2040	2050	2030	2040	2050
Drought	Change in water stress (Drought Index)	-0.08	-0.005	0.07	-0.01	0.095	0.2
Floods	Change in day max Maximum Rainfall (%)	7%	10%	13%	8%	14%	21%

1. Drought was identified as medium risk at baseline level. Despite climate projection data indicates a slightly increase in the RCP 2.6 and RCP 8.5 at 2030 and 2040 timeframes, water availability is crucial to BCP's operations as it directly influences production. Therefore, water scarcity has been selected as one of the most significant risks.

2. Flooding was identified as low risk at baseline level. However, climate projection data indicating a significant increase in the RCP 2.6 and RCP 8.5 scenarios at 2030 and 2050 timeframes. Floods can cause damages to the refinery its operation result in all refining units cannot be operated. This demonstrates the highest difference between baseline and project data (low baseline but large increases in projected data risk score) and suggests floods as the top hazard risk of BCP.

Legend and Hazard Score for RCP 2.6 and RCP 8.5 scenarios:

Category	Drought (Change in annual drought probability)	Floods (Change in 5 day maximum rainfall)
Significant increase	<-1	>10%
Moderate increase	<-0.5	>5%
Slight increase	<0	>0%
No change	0	0%
Slight Decrease	>0	<0%
Moderate Decrease	>0.5	<-5%
Significant Decrease	>1	<-10%

Categorization criteria considers all climate indicator values across scenarios and time horizons. The climate indicator went through a normalization process which involves comparing the minimum and maximum value across all time horizons and scenarios. Process depends on the indicator, some may be normalized by climate zone whereas some are done globally

Strategy

Climate related physical risks and opportunities in each time horizon

Physical risks						
Type of Physical Risk	Climate related risks	Time horizon			Impacts on Bangchak Business	Strategies
		S	M	L		
Acute	Drought	Medium	Medium	Low	Additional cost THB 72,540 at 2021 from groundwater using in drought effect such as salt water intrusion causes	<ol style="list-style-type: none"> Assessed the risk of water stress area using ThinkHazard. Promote 3Rs (Reduce, Reuse and Recycle) 20% reduction of water consumption in all production processes. Use of water technologies such as MF and RO system to reduce water consumption 0.1 million m³/year Alternative water resources such as groundwater which can reduce 64% of water consumption.
	Flood	High	High	High	Daily loss of over THB 12 million due to physical damage and discontinuity of business	<ol style="list-style-type: none"> Monitor flood situation and the sea water level Empty the rainwater drainage regularly Regularly inspecting the readiness of flood prevention equipment Immediate response: Permanent and temporary dyke construction around the refinery using sheet pile
Chronic	Sea level rise	Medium	Medium	High		

Legend: hazard levels in different time horizons

■ High
 ■ Medium
 ■ Low

Definition of time horizons :

(S)hort term: 0-2 years (Based on baseline from ThinkHazard).

(M)edium term 2-10 years.

(L)ong term >10 years (Based on projection data from assessment)

As we are following DJSI questionnaire, Bangchak use 0-2 years as short-term, which is similar to baseline conditions.

Calculation

% Change in Water Stress in RCP 8.5 2030
 = -50% based on physical risk assessment
 (Comparison between Projection data and historical data)

Baseline in 2030

Impact from Water Shortage

Impact = Number of months of impact
 x impact per month
 = 2 x 36,270
 = THB 72,540

RCP 8.5 in 2030

Adjusted Impact = Baseline Impact x (100% + %
 Change in Water Stress in RCP 8.5)
 = 72,540 x (100% - 50%)
 = THB 36,270

Assumption

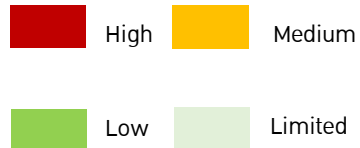
- Refinery production in 2030 is same as in 2021
- Additional cost of THB 36,270 per month is groundwater using in drought effect such as salt water intrusion causes
- Drought occurs once every 5 years with 2 months duration with no adaptation
- Reduction under RCP 8.5 scenarios for Y2030 timeframes based on %change in water stress from physical risk assessment
- RCP 2.6 impact is same as Baseline impact

❖ Climate related transition risks in each time horizon:

Definition of Risk

Uncertain events that may occur in the future and have a **negative effect** on Bangchak Corporation's business objective and goals

Legend: Risk levels in different time horizons



Definition of time horizons :

- (S)hort term: 0-2 years
- (M)edium term: 2-10 years
- (L)ong term: >10 years

Transition risks					
Climate related risks	Time horizon			Impacts on Bangchak Business	Strategies
	S	M	L		
Policy					
Carbon price	Low	Medium	High	- Increased OPEX from mandatory carbon prices	<ol style="list-style-type: none"> 1. Develop low carbon businesses 2. Improve the efficiency of processes 3. Strive for mitigation and Net Zero targets 4. Established the Carbon Markets Club to promote carbon trading
Increased requirement of bio-based content in fuels by regulation	Low	Medium	Medium	- Decreased revenue from fossil fuel portion	<ol style="list-style-type: none"> 1. Continue to follow the regulatory requirements 2. Established a new business line focusing on biofuels.
Market					
Price of crude oil (THB/barrel)	Low	Medium	High	- Impact to Gross Refining Margin from decreased fuel prices due to reduced demand for fossil fuels in a low carbon economy transition	<ol style="list-style-type: none"> 1. Continue to monitor fuel prices, downside protection via financial instruments and diversify our sourcing strategy. 2. Continue to expand high value products and non fossil fuel-based businesses.
Price of fuel (THB/liter)	Low	Medium	High		
Reputation					
Investor demands and data request	Limited	Low	Low	- Increased compliance and reporting cost	<ol style="list-style-type: none"> 1. Assign internal teams to be responsible for data management and reporting obligations. 2. Apply digital solutions to facilitate the process of data management and reporting

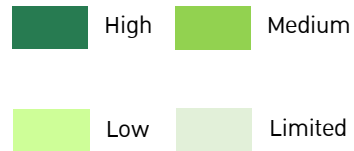
Strategy

Climate related transition opportunities in each time horizon

Definition of Opportunities

Uncertain events that may occur in future and have a **positive effect** on Bangchak Corporation's business objective and goals

Legend: Impact of opportunities in different time horizons



Definition of time horizons:

- (S)hort term: 0-2 years
- (M)edium term: 2-10 years
- (L)ong term: >10 years

Transition Opportunities						
Climate related risks	Time horizon			Impacts on Bangchak Business	Strategies	
	S	M	L			
Policy						
Subsidies for GHG reduction technology and renewable energy	Medium	Medium	Medium	<ul style="list-style-type: none"> - Improved return on investment for GHG reduction technologies and renewable energy - Reduced carbon cost 	<ol style="list-style-type: none"> 1. Monitor and review subsidy opportunities for mitigation technologies suitable for Bangchak Corporation. 2. Encourage private sector and governmental support to deploy key technologies for deep decarbonization 	
Technology						
Renewable Energy Commercialization	High	High	High	<ul style="list-style-type: none"> - Improved return on investment for renewable energy 	<ol style="list-style-type: none"> 1. Strengthen research and development of cost-effective and advanced renewable energy applications 	
Maturation of Carbon Capture, Utilization and Storage (CCUS)	Low	Low	High	<ul style="list-style-type: none"> - Reduced CAPEX for CCUS - Reduced carbon cost. 	<ol style="list-style-type: none"> 1. Seek collaboration with strategic partners to pilot and assess CCUS applications 	
Market						
Increased demand for bio-based fuels (BHD, SAF)	Medium	Medium	Medium	<ul style="list-style-type: none"> - Increased revenue from biofuel sales 	<ol style="list-style-type: none"> 1. Continue to expand biofuel business 2. Strengthen research and development of advanced biofuel products 	
Increased demand for renewable electricity	High	High	High	<ul style="list-style-type: none"> - Increased revenue from renewable energy business 	<ol style="list-style-type: none"> 1. Accelerate renewable energy business expansion 2. Continue to enhance the competitiveness of our renewable energy business against other peers 	

❖ Scenario Analysis

As part of climate strategy, we are exploring the potential climate-related impacts to our business, both through low carbon economy transition and through impacts from physical climate change. Scenario analysis has been used by leading oil and gas companies since the 1970s such as initially as a tool to analyze impacts from uncertainty in oil supply at that time and has since been extended since the late 1980s again to look at financial impacts specifically from climate change. Following the release of TCFD guidelines in 2017, companies globally across all sectors have also started to use TCFD's guidance on climate-related scenario analysis. Bangchak uses the IEA World Energy Outlook 2022 and IEA South East Asia Energy Outlook 2022, with two main scenarios IEA Stated Policies (STEPS) where energy consumption remains mainly fossil fuel based and IEA Net Zero Emissions by 2050 (NZE) where the world transitions to low carbon sources of energy.

To determine the potential risk evolving from the impact of climate change in the medium to long term. The analysis helps the investors and organizations to understand the potential effects on their businesses.

As scenarios look at potential future outcomes, unlike risk analysis, we do not look at the probability of each event occurring, but rather look at a range of plausible scenarios to understand the risks and opportunities to our company.

This section includes the physical risks, transition risks, and transition opportunities according to their time horizon and the financial impacts.

❖ Scenario Analysis

Physical Risks

Bangchak has also considered the impacts of physical risk to the business. According to TCFD, physical risk is separated between chronic (gradual ongoing effects such as rise in temperature or rise in sea level) and acute (sudden high impact events) impacts.

Even with decarbonization through achievement of Net Zero by 2050 there would still be consequences due to increased average global temperatures, even if temperatures are kept within a rise of 1.5 degrees Celsius by 2100 as per Paris Agreement goals. Therefore, even in a low carbon scenario such as RCP 2.6 there would still consequences of physical risk to Bangchak Corporation. Bangchak Corporation has considered a range of scenarios from RCP 2.6 (lowest carbon scenario leading to a 1.5 degrees Celsius rise in temperature) to RCP 8.5 (worst case scenario leading to rise in temperature of 4.3 degrees Celsius).

Physical Financial Scenario Impacts

For RCP 2.6 and RCP 8.5 scenarios Bangchak Corporation has quantified the main impacts to its refinery business around the acute impacts of drought. In a drought situation, Bangchak Refinery would be required to source additional water from groundwater sources in order to continue operating. In the case of water stress, water stress in RCP 8.5 scenario is actually less as more rainwater is available under higher temperatures, therefore there is still risk of financial loss, but it is less in the baseline. We will expand our analysis to other physical risks such as flooding, where we expect flooding to increase in line with increased rainwater. We believe we are resistant to such changes as we have an adaptation plan in place.

	Impact from Water Shortage (Increased operational cost)	
	Scenario 1	Scenario 2
	Baseline in 2030 Equivalent to RCP 2.6	RCP 8.5 in 2030
Financial loss (THB)	72,540	36,270

❖ Scenario Analysis

Transition Risks and Opportunities

Through the Paris Agreement, countries have announced their targets to reduce GHG emissions supported by policy and regulations, however their efforts fall short of the goal to achieve Net Zero globally by 2050. Global decarbonization would also drive pressures in the market to consume more renewable energy and less energy from fossil fuels. This would drive changes in crude oil cost and fuel prices. There is also increasing pressure from investors and financial institutions to push companies to decarbonize, especially those in the energy sector. These global drivers are also relevant in Thailand, however as Thailand Net Zero target is 2065 then the low carbon economy transition is expected to be slower than changes in developed countries. Currently, the Thailand Government is designing a carbon pricing scheme (carbon tax or cap and trade), any scheme will increase Bangchak Corporation's operational cost either directly through taxes or through the increased cost of fuels and other goods.

Bangchak has reviewed the overall impacts to its business through looking at main drivers for revenue and cost, which would ultimately. Under the climate change transition to 2050, according to IEA Stated Policies (STEPS) and Net Zero Emissions by 2050 (NZE) scenarios BCP's refinery, marketing and retail business will be affected by volatility in crude oil and fuel prices due to change in consumer demand (both climate related and non-climate related). Bangchak Corporation's Natural Resource business will be affected by similar circumstance of the world's transition toward cleaner energy. All these businesses will be pressured by rising of carbon price in the form of carbon tax or cap and trade.

For BCPG's power business, according to IEA STEPS and NZE scenarios, by 2050 there are more opportunities in the climate change transition due to increasing demand for renewable energy and decreasing capital and operational costs.

Transition Scenario Financial Impacts

Bangchak Corporation has considered the main impacts from carbon price under both IEA STEPS and NZE scenarios. The overall negative impact of a global low carbon economy transition to Bangchak Corporation would be increased carbon price, mainly for Refinery business that produces the majority of operational emissions. The overall positive impact of low carbon economy transition would be on renewable energy business increasing capacity and generation to meet with increased demand. The impacts for carbon pricing are quantified below with a scenario where we implement our target and another where our target is not implemented. For the target, we assumed achievement of 40% reduction and reforestation by 2030 and 100% reduction and absorption by 2050 in line with our Net Zero target. For reference, Bangchak Corporation accounting EBITDA in 2021 was THB 25,818 million. In both scenarios STEPS and NZE, as well as carbon tax and cap and trade Bangchak is resilient to changes in carbon price.

	THB million per Year			
	Scenario 1: No Target Set		Scenario 2: Target Achieved	
	2030	2050	2030	2050
Carbon Tax to be Paid				
STEPS	395	908	237	0
NZE	783	5,639	470	0
Cap and Trade				
(negative means additional revenue from trading allowances)				
STEPS	39	454	-118	-454
NZE	78	2,819	-235	-2,819

Assumptions:

- Non-climate related costs and revenues will remain unaffected
- Carbon tax in Thailand will be implemented before 2030
- For Cap and Trade the cap reduction will be 2% per year in line with EU-ETS
- Bangchak's business will grow according to current plans
- IEA numbers are in 2021 USD, converted to THB using end of year 2021 currency exchange rate
- Conservative assumption of carbon tax on both Scope 1 and 2, typically governments only put carbon price on Scope 1, however in some jurisdictions such as Japan a carbon price is placed both on Scope 1 and 2

❖ Scenario Analysis

Long Term Strategic Response

Bangchak Corporation is aware of potential future low carbon economy transition and has accordingly expanded its business to renewable energy through BCPG and BBGI (in 2015 and 2017 respectively) in response. A diversified portfolio reduces our overall risk and allows us to capture future renewable energy related opportunities. Through Net Zero and Carbon Neutral targets we have also signaled our commitment to low carbon economy transition both in our existing portfolio as well as in future operations and expansion of our portfolio.

For physical risks we have a long-term adaptation plan that is implemented for all of our operations. This plan includes Business Continuity Plans and plans to implement adaptation measures such as flood walls at our Refinery that prevents floods, reusing good quality condensate water, and improving quality of treated water from wastewater treatment through micro-filtration system.

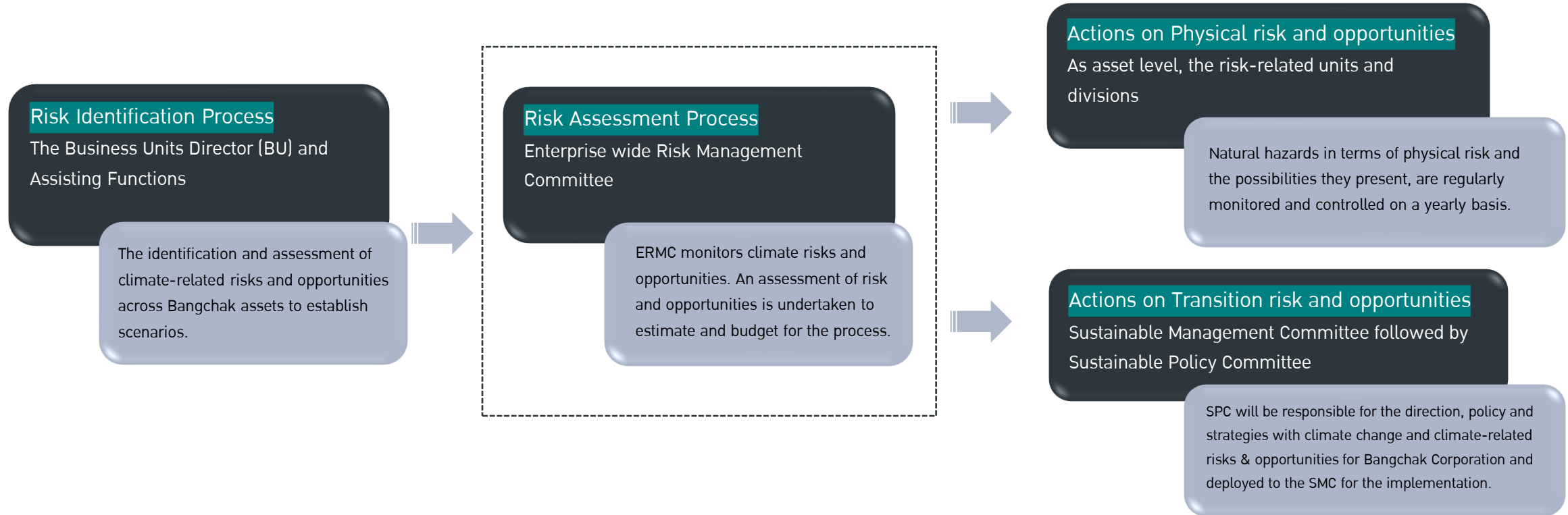
For more details on our strategic response, please see the summary tables on our transition and physical strategy in this section.



Risk Management

Risk Management

❖ Bangchak Corporation's Processes for Identifying and Assessing Climate-related Risks

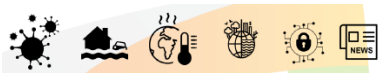


Policies and targets from the SPC are executed through business functions and committees associated with sustainability. The Sustainability Management Committee acts as the main coordinator to monitor, collect, evaluate, and report on progress and performance to the Sustainability Policy Committee. The Sustainability Policy Committee then reports on sustainability performance to the Risk Management Subcommittee, Corporate Risk Management Committee, and the Corporate Governance Committee, respectively.

Risk Management

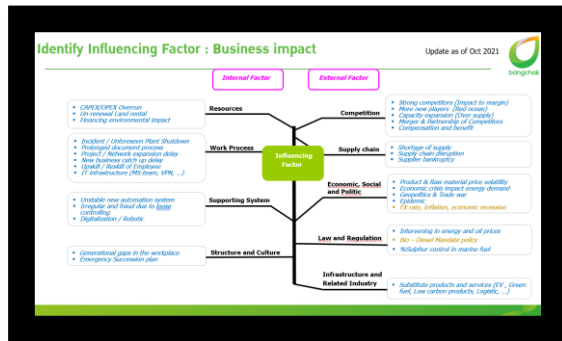
❖ Bangchak Corporation's Processes for Managing Climate-related Risk

ERM



Risk Management Process

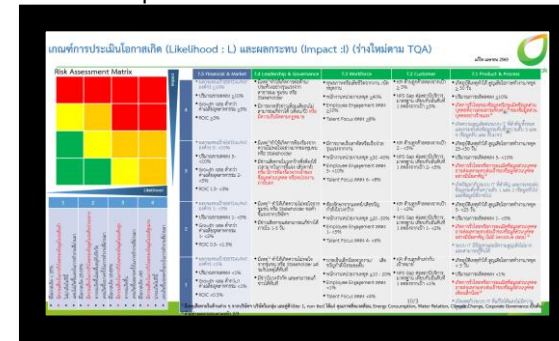
1. Evaluate factors which can affect the goals



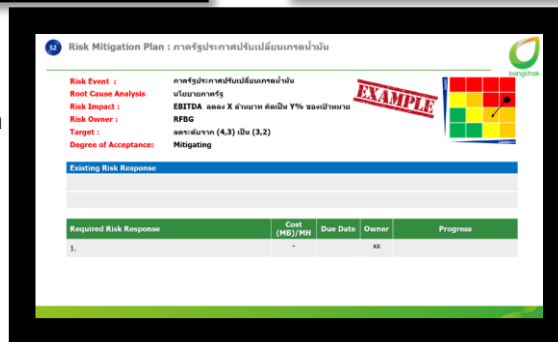
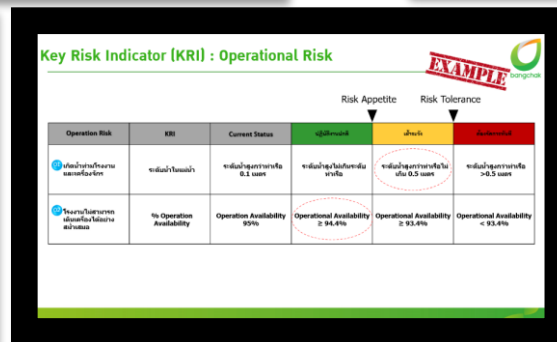
2. Assess how various factors affect each other



3. Risk impacts and likelihood



4. Risk management plan

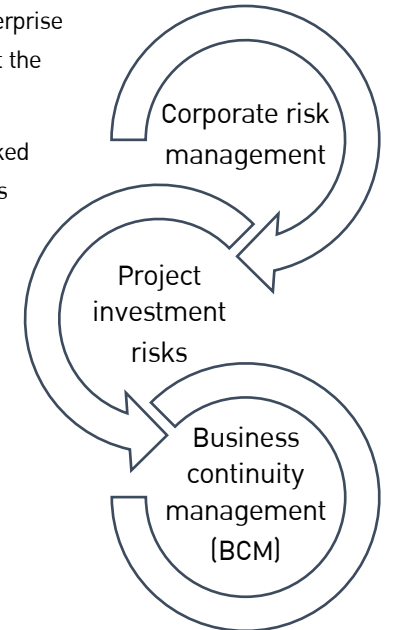




5. Key Risk Indicators (KRIs)

- Used to track the direction of the risk whether the trend has increase or decrease
- Be a warning sign that leads to improvements maintain track of situation
- To follow up on risk management results, whether they are on target or not to have further efficiency improvement

Bangchak Corporation's Enterprise Risk Management system based on Committee of Sponsoring Organizations of the Treadway Commission Enterprise Risk Management (COSO ERM) is intended to help the company identify, evaluate, and manage risks in order to lessen potential impact and assist the accomplishment of our long-term goals and business plan.

The Framework and the principles for risk management that Bangchak Corporation has been utilized to systematize the management of risks linked with climate change throughout the company. The purpose of this is to incorporate climate-related risk management into Bangchak Corporation's internal management to ensure that the company can preserve and generate long-term value.



Administrative System Risk Bangchak Corporation

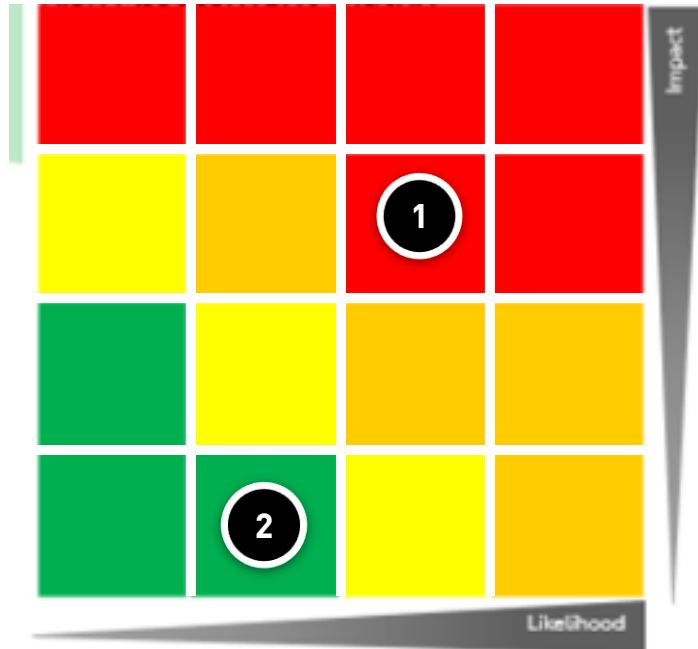
Impact assessment is divided into five areas according to KPIs goals: Financial & Market, Leadership & Governance, Workforce, Customer and Product & Process. Evaluation criteria can be selected as appropriate to the topic of risk

Risk Management

❖ Physical Risk Prioritization Matrix

Our risks are prioritized using our Enterprise Risk Management definitions for impact and likelihood.

This prioritization has helped us understand what parts of our strategy we should pursue first. These risks are described below.



Legend



1. Flood and Sea level rise

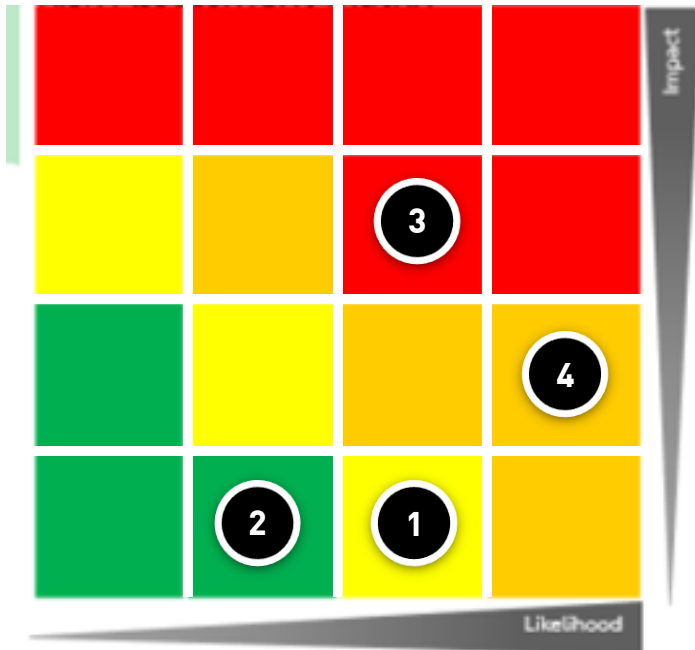
Rising sea level might cause flooding in operation are which effect to total production. From the assessment and risk management plan, Bangkok metropolitan flood protection could support equivalent to 2.23 m. above the sea level.

2. Drought

- In 2021 Bangchak conducted water stress assessment through the AQUEDUCT program to find that the location of Bangchak Refinery was a medium-high (20-40%) risk area, which by definition is not a significant area for water stress.
- Promote the reduction of water consumption in all production processes with all affiliates and business units, led by the water recycling program by the Bio-based Product Business Group. Moreover, a project of drilling for ground water was initiated for water storage and supply for the facilities.

Risk Management

❖ Transition Risk Prioritization Matrix



Legend



Market

1. Crude oil price

Lower demand could result in a drop in price. However, there are three main coping mechanisms; [1] Enhance flexibility of Crude sourcing via establishment of BCPT, [2] To increase reliability and reduce the risk of operational downtime, refineries can be optimized using a variety of optimization programs, [3] Diversification of products to increase product value. To place a stronger emphasis on product diversity, we modified the refinery to enable Bangchak to introduce new, more diverse products to the market. These products include paraffin wax and unconverted oil, which are produced from a variety of fuels. We also produce solvents, important industrial components that are used in the production of paint, thinner, and resin. In the future, Bangchak still intends to sell a wider variety of goods.

2. Price of fuel

Sales volume might decrease according to the lower demand due to sustainability trend, or lower margin due to lower fuel price. Bangchak has been developing model to enhance return, not only to maintain high quality fuel but also new value proposition to our value customer as a “Greenovation Destination”, a lifestyle destination for intergeneration, to fulfill customers’ needs and meet their changing behavior. The model has included on-site offering of variety food and beverage services from well-known brands, Grab & Go delivery services, unique design service station, and installation of EV chargers at 70 Bangchak service stations in 37 provinces nationwide.

3. Demand of renewable energy

Shifting consumer demand to more sustainable product could be an opportunity to adopt Green business by investment through subsidiary company. Bangchak subsidiary company BCPG and BBGI in 2021 BCPG and BBGI account 36% and 8% respectively on BCP consolidating EBITDA (16,725 MTHB)

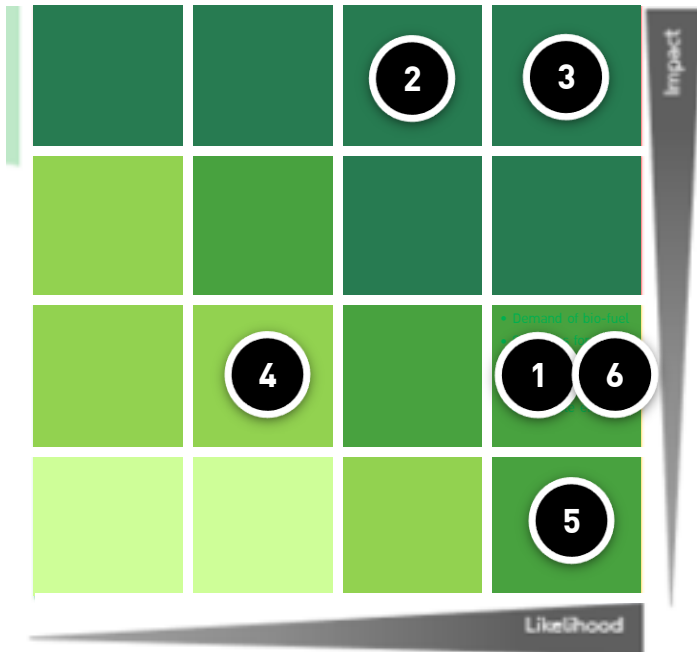
Policy

4. Carbon price

Bangchak has been increasing the proportion of revenue from low carbon footprint businesses while improving the efficiency of processes and using low-emission products to achieve company target on reduction carbon emission 30% by 2030 and a zero GHG emission target by 2050. In addition to our ambition goal, the company was one of 14 organizations receiving the Low Carbon and Sustainable Business Awards from Thailand Greenhouse Gas Management Organization (TGO). The evaluation was based on good governance, sustainability reports and business size based on economic, environmental and social indicators in line with the country’s sustainable development goals. The company also founded the Carbon Markets Club to promote carbon credit trading to accelerate the transition into low carbon society.

Risk Management

❖ Transition Opportunity Prioritization Matrix



Legend



Market

1. Demand of bio-fuel

Bangchak Corporation has expanded their business to transition to a low carbon economy. One of the businesses offers high-quality bio-based products. Therefore, the increase in demand for bio-fuel would promote the business, resulting in higher revenue for Bangchak Corporation.

2. Demand for renewable electricity

A shift in consumer demand toward more sustainable products offers BCP an opportunity to adopt clean technologies and provide low-carbon products and services that also create business opportunities (e.g., generation of geothermal energy, solar energy, or other clean energies).

Technology

3. CAPEX cost of renewable energy

A better technology that enhances production efficiency at an affordable cost. The change will reduce the capital cost of renewable energy due to the advancement of future technologies, and there will be higher usage of low carbon technologies such as green hydrogen, solar PV, wind, hydro, and geo-thermal.

4. Cost of carbon capture, utilization and storage

Cut down on operational costs as the cost (USD/tCO₂) of CCUS technologies drops below the price of carbon (USD/tCO₂e). This technology helps reduce the amount of money paid to the government regarding emissions by cutting down on emissions. (Note: without a carbon price, CCUS will not be feasible from a cost perspective).

Policy

5. Increased requirement of bio-based content in fuels by regulation

The increase in demand would result in higher revenue for BBGI, which has already expanded its business to adapt to the low carbon economy.

6. Subsidies for carbon reduction technology and renewable energy

The requirement from the policy would reduce the investment costs for carbon reduction technology and renewable energy.

Risk Management



❖ Processes for Mitigating Climate-related Risks

Multiple internal and external risk factors that may affect Bangchak Corporation's business operation have been analyzed both in short term, medium term and long-term period. The system incorporates risks in strategy and finance. It is managed with specific key risk indicators (KRIs) to monitor and track the likelihoods and severity of all identified risks and provides treatment plans to mitigate and minimize the risks and drive operations to succeed as planned. The company promotes a culture of risk management in the organization and extends it to companies in the group by allowing all departments in the Bangchak Corporation of Companies **to create a risk plan every year**. With an action plan for climate change, Bangchak Corporation has invested in green energy business to use renewable energy and have been enhanced green procurement for products and services through supply chain management in 5 years target (2018-2022). In addition, we have conducted scenario analysis of our own internal carbon price. To identify the impact on EBITDA and plan the strategy in different scenarios, a carbon tax aligned with well below 2 degrees Celsius and 1.5 degrees Celsius scenarios, as well as Thailand's cap-and-trade scheme, was considered. Examples of actions to mitigate transition risks include reducing GHG emissions through energy efficiency improvement projects and implementing internal carbon shadow prices for new investment decision-making and energy efficiency projects.

For physical risk, water stress and floods pose a significant risk to Bangchak Corporation's businesses and its business partners value chains. We have prepared measures to mitigate and manage these effects. The refinery plant located in Phra Khanong district was assessed the likelihood of hazards for physical risk as our refinery major receptor of our risks throughout our business.

Metrics and Targets

Metrics and Targets

Bangchak Corporation continually monitors our climate impacts through measurement of our GHG emissions and other indicators.

We use the following methodologies to quantify and track our GHG emissions:

- **Baseline year for target:** 2019
- **Boundary of GHG reported:** Refinery business, M-Tower and regional office, and marketing business
- **Scopes included:** Scope 1 and 2
- **Emission factor and methodology source:** Intergovernmental Panel on Climate Change (IPCC) National Greenhouse Gas Inventory Guidance 2006, American Petroleum Institute (API) GHG Compendium 2009, Thailand Greenhouse Gas Management Organization (TGO)

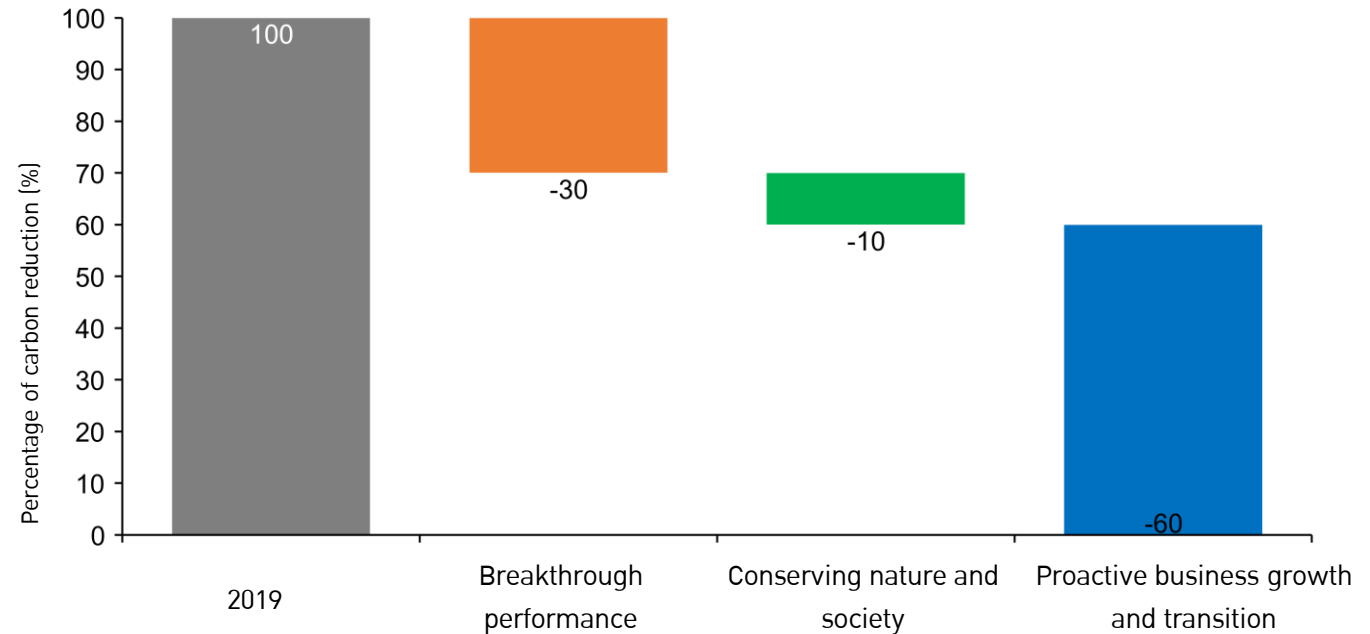
Our targets are to achieve **Carbon Neutral in 2030** and **Net Zero by 2050**. For more information on our Net Zero target please visit our website <https://investor.bangchak.co.th/en/net-zero>



Net Zero by 2050

We aim to reduce 100% of Scope 1 and 2 emissions by 2050 through:

- **(B)reakthrough performance:** Efficiency and process improvement
- **(C)onserving Nature and Society:** Green and blue carbon through reforestation and marine ecosystems
- **(P)roactive Business Growth and Transition:** Green Portfolio, Future Technology and Carbon Offsets

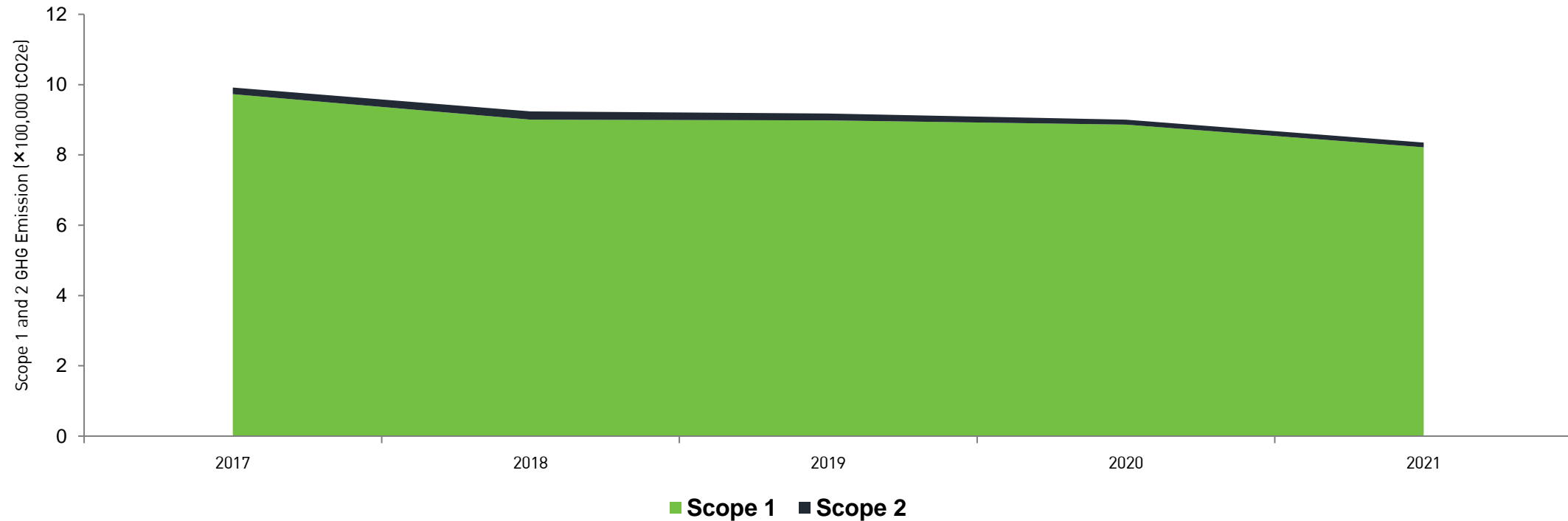


Metrics and Targets



Greenhouse Gas Emissions

We have improved GHG performance through continuous energy efficiency improvements, especially in our refinery and decreased emissions by 9.06% by 2021 according to 2019 baseline.



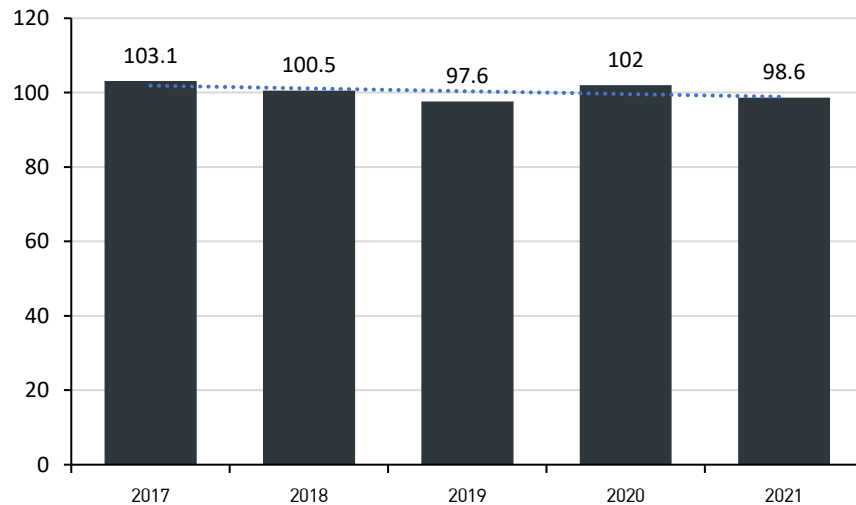
- Notes:**
- Scope 1 covers refinery, M-tower and regional office (2021), and marketing business (2020-2021)
 - Scope 2 covers refinery, M-tower and regional office and marketing business (2021).
 - Scope 1 and 2 data have been verified by a third party, see p.189 [Sustainability Report 2021 \(bangchak.co.th\)](#)

Metrics and Targets

❖ Energy Efficiency

Energy efficiency comprises of 30% of our total GHG reduction under our Net Zero target. Bangchak defined Energy Intensity Index (EII) as standard KPI for benchmarking which is at level 1 (98.6). The EII has improved when compared to 2020 (102) as the COVID situation become more lenient resulting in increase in oil demand domestically. The increase in demand has increased the production capacity, resulting in an improvement of EII in 2021. Bangchak has set short term and medium term plan. The short term plan is to set an energy consumption target and improve the existing system. The medium plan is to enhance the efficiency and effectiveness of production.

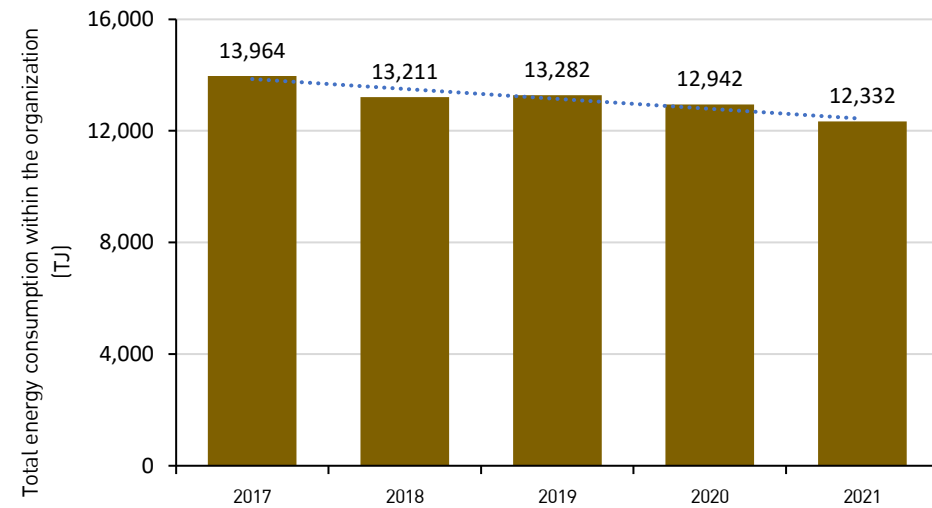
Energy Intensity Index



Notes:

- Energy Intensity Index (EII) covers refinery.
- Energy consumption is the total consumption of non-renewable and renewable energy. The renewable energy is generated within the plant using wind and solar energy.
- The energy consumption covers refinery business (2021).

Total Energy consumption (TJ)



Key metrics for energy:

- Energy Intensity Index (EII).
- Energy consumption within the organization.

Notes:

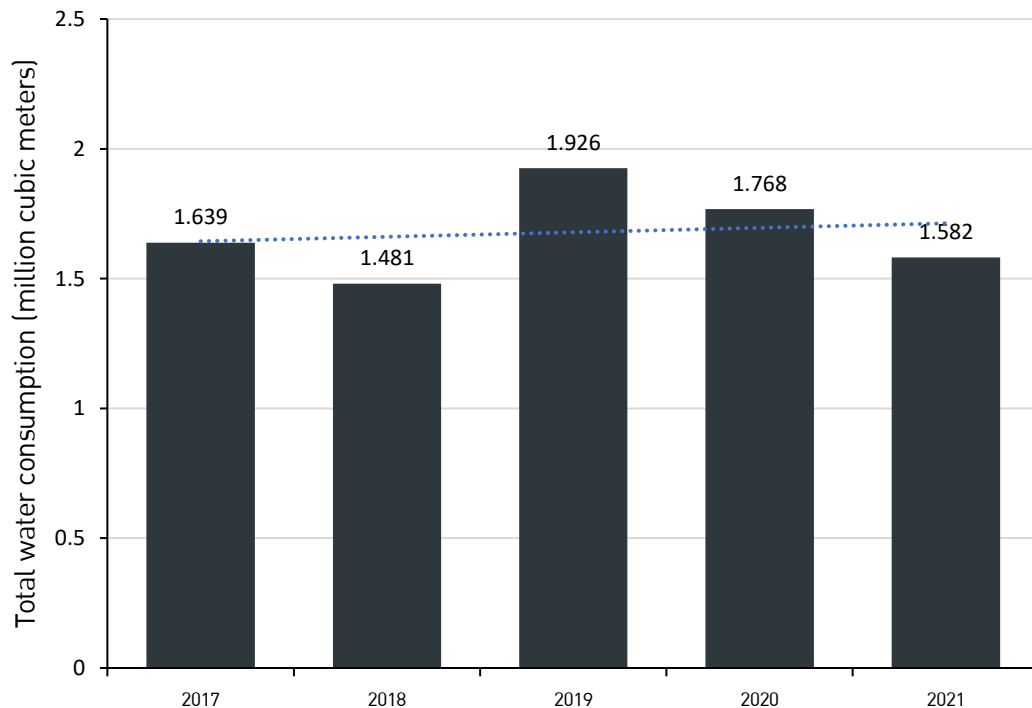
- Energy data has been verified by a third party, see p.189 Sustainability Report 2021 (bangchak.co.th)

Metrics and Targets

❖ Water

Our physical risks are mostly related to water use. We therefore closely monitor the water situation as water is vital to our refinery operations. Water consumption has increased since 2017 and it reached its highest in 2019 before reducing to 1.582 in 2021. Bangchak has reported water according to the standard of Global Reporting initiative (GRI) which includes the assessment of both water quality and quantity, both of these could be affected by the climate change. The operation has been assessed in all areas including the water stressed area. As a result of the assessment,

Total water consumption



Bangchak trend of water consumption has fluctuated over time indicating the need to address the problem of water shortage and poor water quality in the future. Bangchak has conducted AQUEDUCT analysis to evaluate water stress risk area to assess the worst possible effect.

Key metrics for water:

- Water consumption in all areas.
- Water consumption from all areas with water stress.

Source:

- Water consumption covers refinery business.

Notes:

- Water data has been verified by a third party, see p.189 [Sustainability Report 2021 \(bangchak.co.th\)](#)

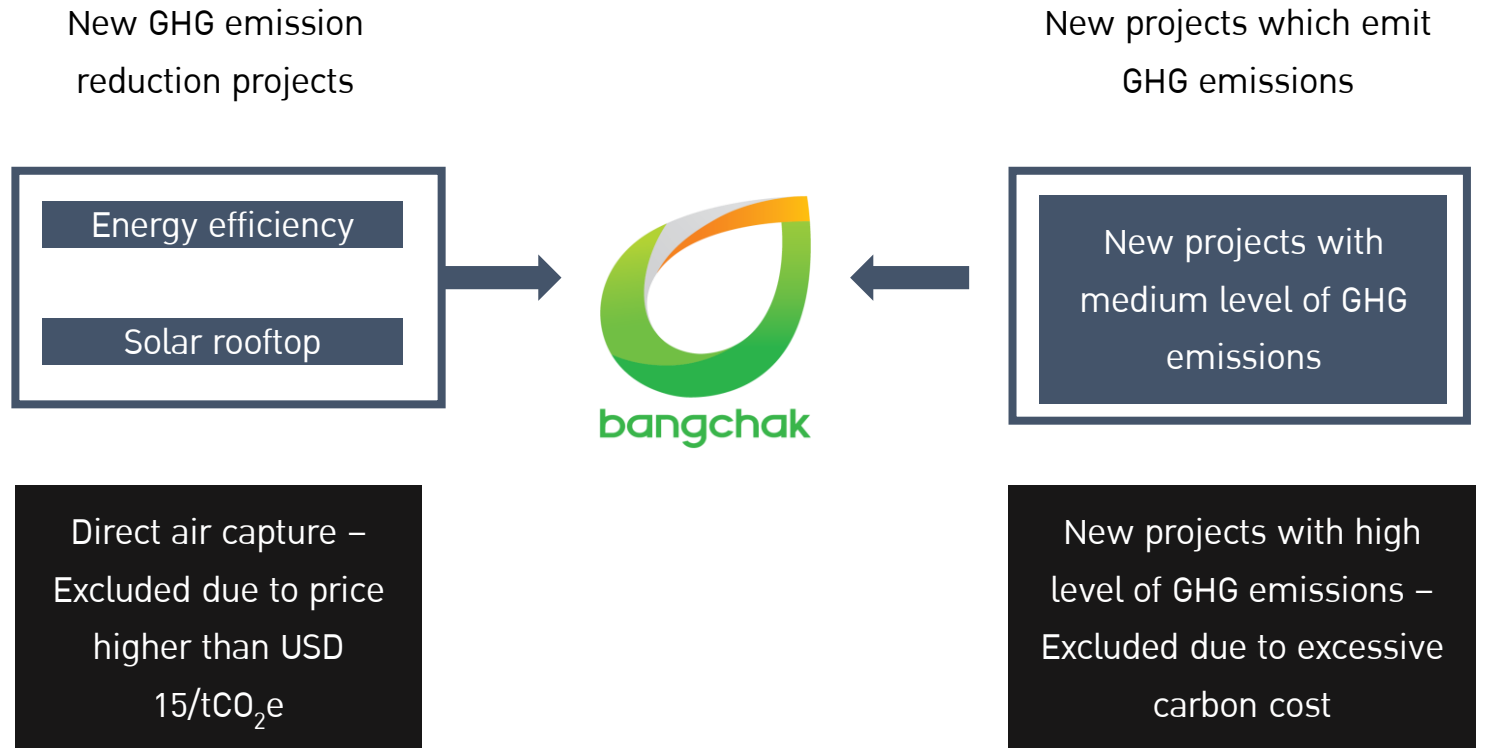
Metrics and Targets

❖ Internal carbon price

Objectives

Currently, Bangchak Corporation is transitioning the organization to a low-carbon economy. Therefore, the shadow price has been enforced at the rate of USD 15/tCO₂e.

Our main objective for internal carbon pricing is to support reduction of GHG emissions in our organization in line with our Net Zero target. We use a shadow price of USD 15/tCO₂e to help us seek and invest in low carbon technologies and energy efficiency. We will also use the shadow price to prepare for future regulatory schemes in the jurisdictions that we operate in. We also use the shadow price to stress test new projects and investments to see how much we would need to pay in carbon taxes for these projects in the future.



TCFD Content Index



Disclosure Area	Disclosure Requirement	External Source Location
GOVERNANCE		
Disclose the company's governance around climate-related risks and opportunities	a) Describe the board's oversight of climate-related risks and opportunities	Sustainability Report Bangchak Corporation (Page 23)
	b) Describe management's role in assessing and managing climate-related risks and opportunities	Sustainability Report Bangchak Corporation (Page 23)
STRATEGY		
Disclose the actual and potential impacts of climate-related risks and opportunities on the company's businesses, strategy, and financial planning where such information is material.	a) Describe the climate related risks and opportunities the company has identified over the short, medium, and long term.	Not Applicable
	b) Describe the impact of climate-related risks and opportunities on the company's businesses, strategy, and financial planning.	Not Applicable
	c) Describe the resilience of the company's strategy, taking into consideration different climate-related scenarios, including a 2°C or lower scenario	Not Applicable
RISK MANAGEMENT		
Disclose how the company identifies, assesses, and manages climate-related risks.	a) Describe the company's processes for identifying and assessing climate related risks.	Sustainability Report Bangchak Corporation (Page 20,23,95)
	b) Describe the company's processes for managing climate related risks	Sustainability Report Bangchak Corporation (Page 67)
	c) Describe how processes for identifying, assessing, and managing climate related risks are integrated into the company's overall risk management.	Sustainability Report Bangchak Corporation (Page 68,74,77,79,93)
METRICS AND TARGETS		
Disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material	a) Disclose the metrics used by the company to assess climate-related risks and opportunities in line with its strategy and risk management process.	Sustainability Report Bangchak Corporation (Page 22,166-174,186)
	b) Disclose Scope 1, Scope 2, and, if appropriate, Scope 3 greenhouse gas (GHG) emissions, and the related risks.	Sustainability Report Bangchak Corporation (Page 168-169)
	c) Describe the targets used by the company to manage climate-related risks and opportunities and performance against targets.	Sustainability Report Bangchak Corporation (Page 16,22,92,158) NET ZERO Bangchak Corporation



bangchak



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🌐 <http://www.bangchak.co.th>

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