TIPCO ASPHALT PUBLIC COMPANY LIMITED

COMMITMENT TO CLIMATE

IFRS S2 Report 2023

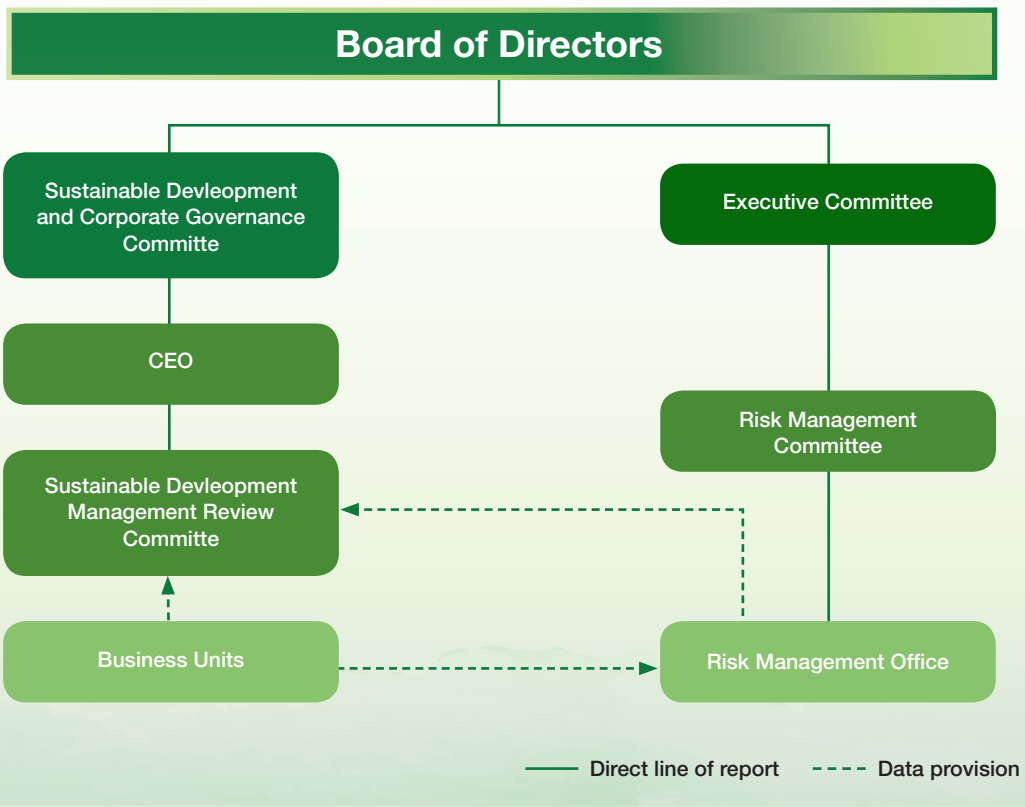
Climate change is a major challenge for all countries with economic and social impacts that has led to nations and businesses to make pledges to reduce greenhouse gas (GHG) emissions through mitigation and adaptation measures. As the effects of climate change will directly impact Tipco Asphalt Public Company Limited's (to be referred to as "Tipco Asphalt" or "the Group") Sustainable Development initiatives, disclosure of its climate-related risk, opportunities, and mitigation efforts will provide transparency and confidence to internal and external stakeholders. The Group has set a target to reduce 36% of GHG emissions (Scope 1 and 2) by 2030 from 2020 base year for asphalt business in Thailand. The following report provides information on the Group's governance structure, strategic initiatives, risk assessments, and metrics and targets with regards to climate-related information, and it covers asphalt business in Thailand only.

This report discloses information for 2023 reporting cycle and has been prepared in line with the International Financial Reporting Standards (IFRS) S2: Climate-Related Disclosures.

1. GOVERNANCE

Tipco Asphalt's Climate Change Governance structure provides Board of Directors (BoD) oversight on Sustainability Development and Climate Change policies, targets, and climate strategies, which are cascaded down towards BoD sub-committees, executive management, business unit directors, and staff as indicated in the figure below. This structure allows the Group to deploy and monitor policy execution and have a timely response towards climate-related program progress, risk and opportunities.

FIGURE 1 TIPCO ASPHALT'S CLIMATE GOVERNANCE STRUCTURE



1.1 BOARD OF DIRECTORS

Body	Roles and Responsibilities
Board of Directors (BoD)	The BoD is responsible for approving policies, strategies, and targets related to climate change that will support sustainable business growth in the short, medium, and long-term. This is with due consideration to the findings and financial implications of the climate risk assessment process, allowing the BoD to allocate funds and resources for the effective and timely implementation of climate mitigation and adaptation measures. The BoD meets at least five times per year and on an annual basis, discusses agendas on Sustainable Development and Climate Change. In 2023, the BoD was informed about Climate Change-related issues at least 4 times by the Sustainable Development and Corporate Governance Committee (SD & CG). The Board of Directors Charter(https://www.tipcoasphalt.com/wp-content/uploads/2023/11/Draft-Board-Charter-Eng-13-Nov-2023.pdf) provides additional details on roles and responsibilities of the BoD.
Sustainable Development and Corporate Governance Committee (SD & CG)	The SD & CG is responsible for overseeing policies, strategies, and direction of Tipco Asphalt's business operation to ensure it is in-line to achieve Sustainable Development and Corporate Governance objectives. These objectives are derived from climate strategies, GHG emissions reduction targets, and outcomes of response measures to Climate Change-related risks and opportunities. For additional details on Tipco Asphalt's climate-related targets and progress, please refer to section 4 of the report. The SD & CG meets on a quarterly basis to discuss climate-related matters, and reports those to the BoD. The Sustainable Development and Corporate Governance Committee Charter (https://www.tipcoasphalt.com/wp-content/uploads/2023/02/SD-and-CG-Charter-Eng.pdf) provides additional details on the roles and responsibilities of the SD & CG.
Executive Committee (EC)	The EC is responsible for establishing policies and operating procedures of the Group's Enterprise Risk Management (ERM) objectives and targets. Through the ERM process the EC is able to review and monitor potential Climate Change-related risks and assessments conducted by each business unit (and respective strategies) and make recommendations for further action to the BoD. The EC meets at least five times per year and reports directly to the BoD.

1.2 EXECUTIVE OVERSIGHT OF CLIMATE CHANGE

Executive Oversight	Roles and Responsibilities
Chief Executive Officer (CEO)	The CEO is responsible for driving Tipco Asphalt's implementation of climate strategic projects and achieving its Climate Change-related commitments and targets. As a member of the SD & CG committee and Chairman of the EC, the CEO oversees monitoring, assessment, and response towards climate-related risks and opportunities.
Sustainable Development Management Review Committee (SDC)	The SDC is responsible for the development and execution of climate-related strategic projects that meet or exceed the established policies and targets of Tipco Asphalt. The committee is represented by senior management from various business units to provide recommendation and resources to the SDC and vice versa. Application of the ERM framework is conducted on all projects and initiatives to assess potential risks and opportunities that may arise to ensure that the SDC, with representation from the Risk Management Office (RMO), makes due consideration to Climate Change-related risks. Once the Group's climate targets have been approved by the BoD, the SDC will implement its climate strategic projects and provide a report to the SD & CG and the CEO on a quarterly basis. Once the Group's climate targets have been approved by the BoD, the SDC will implement its climate strategic projects in each related business unit to ensure that there is alignment between operational-level action plans and corporate-level climate strategies. The SDC consists of senior management with the Chief Operating Officer (COO) as the Chairman of the committee.
Risk Management Committee (RMC)	The RMC is responsible for ensuring that the ERM process is integrated into the climate-based activities and initiatives of the Group, reviewing associated risk assessments, and reporting mitigation plans and procedures to the EC and the BoD. Upon recommendation of the RMC (and RMO) to the EC and the BoD, implementation of additional control measures is to be implemented at the operational-level to ensure risk exposure are within acceptable levels. The RMC consists of business unit heads, c-suite executive management, and executive directors with the Chief Executive Officer (CEO) as Chairman of the committee. The RMC meets on an annual basis and provides a Risk Report to the EC and the BoD.
Risk Management Office (RMO)	The RMO is responsible for ensuring that all related business units utilize, integrate, and receive training on the ERM framework for risk assessment on climate-based initiatives and projects. This allows for the RMO to monitor and provide appropriate response measures and controls on all climate-based activities of the Group. RMO operates as a hybrid model which consists of management "Risk Champions" that are embedded in each business unit to ensure open communication and the exchange of knowledge and information and head by senior management.

Tipco Asphalt has also provided training on climate change to members of the BoD, board sub-committees, and executive management to better prepare them on their roles and responsibilities for Climate Governance. In 2023, BoD-level training session topics consisted of (1) global climate landscape, (2) business implications for Tipco Asphalt, (3) climate risk assessment, and (4) the IFRS S2 standard framework.

2. STRATEGY

2.1 CLIMATE RISK ASSESSMENT

As climate change has been recognized as one of the material sustainability topics for the Group, Tipco Asphalt has identified climate change factors that may impact its operation, health, and safety of its employees and value chain.

2.1.1 PHYSICAL RISKS

In 2023, Tipco Asphalt conducted a physical risk assessment that covered acute and chronic hazards from the effects of long-term changes in climate patterns. The physical risk assessment covered the Group's asphalt operations in Thailand consisting of seven assets: (1) The Head Office in Bangkok, (2) Nakhon Ratchasima plant, (3) Phitsanulok plant, (4) Prapadang plant, (5) Rayong plant, (6) Surat Thani plant, and (7) Laem Chabang Logistic Hub, and related value chain.

2.1.1.1 CLIMATE SCENARIOS

Tipco Asphalt utilized three Shared Socioeconomic Pathways (SSPs) climate scenarios from the Intergovernmental Panel on Climate Change (IPCC) Assessment Report 6, including **SSP 1-2.6, SSP3-7.0 and SSP5-8.5,** in its physical risk assessment. The SSPs are built upon the latest climate science, combining qualitative forecasts of societal features, quantitative measures of economic development and climate data to reflect potential changes in global GHG emissions, energy use, air pollution control, land use, etc.

In terms of the future time horizons applied in the assessment, **the short term (2025) risk** was assessed by using the **historical baseline climate data.** This is because physical climate change takes a much longer time to show its evolution, the Group thus expects climate conditions to remain similar to the historical trend by 2025. **The medium-term** and **long-term time horizons** are defined as **2030** and **2050** respectively, in alignment with the key milestones for managing climate change as internationally recognized. These timeframes have been integrated into the ERM and strategy formulation processes, including the analysis of financial impacts.

TABLE 1 CLIMATE SCENARIOS USED IN PHYSICAL RISK ASSESSMENT

Climate Scenarios	Description	Estimated Increase in Temperature by 2100
SSP 1-2.6	A low emissions scenario that shows global efforts in alignment to current commitments under the Paris Agreement.	1.8°C
SSP 3-7.0	A medium-high scenario that represents a realistic worst-case outcome. It implies difficulties in mitigating physical risks due to increasing regional rivalry.	3.6°C
SSP 5-8.5	A high emissions scenario following a 'business as usual' trajectory, assuming no additional climate policy and seeing GHG emissions triple by 2100.	4.4°C

The assessment applied scenario indicators to assess present-day conditions and future projected trends for eight climate hazards. Figure 2 details each of these climate-related hazards alongside their associated indicators and units.

FIGURE 2 CLIMATE HAZARDS AND ASSOCIATED INDICATORS AND UNITS

Hazard	Extreme heat	Coastal flooding	Extreme Rainfall Flooding	River Flooding	Extreme wind & storms	Water stress & drought	Rainfall induced landslides	Wildfires
Indicators	Warm Spell Duration Index (WSDI)	Coastal flooding inundation depth	Pluvial flooding inundation depth	River flooding inundation depth	Maximum tropical cyclone wind speed	Water stress*	Rainfall-Induced Landslides Index	Forest Fire Danger Index (future)/Maximum burned area (historical)
Units	Days	Metres	Metres	Metres	Knots	By category	Days	Days/square kilometers
Methodology	Scenario analysis using Global Climate Models (GCM)							
Scenarios	The Intergovernmental Panel on Climate Change (IPCC) AR6 Scenarios: SSP1-2.6, SSP3-7.0 and SSP5-8.5							

*Definition of water stress based on WRI Aqueduct 2019: Baseline water stress measures the ratio of total water withdrawals to available renewable surface and groundwater supplies. Water withdrawals include domestic, industrial, irrigation, and livestock consumptive and no-consumptive uses. Available renewable water supplies include the impact of upstream consumptive water users and large dams on downstream water availability. Higher values indicate more competition among users.

2.1.1.2 PHYSICAL RISK ASSESSMENT METHODOLOGY

1. **Asset Data Collection:** Data on location and business activities in each asset is collected.
2. **Climate Hazard Data:** Indicators for climate-related hazards at each asset location is obtained and normalized based on the same scale.
3. **Exposure Rating:** Assets hosting different business activities that are exposed to climate-related hazards are determined. An asset with a high exposure rating represents how susceptible that asset is to a particular climate-related hazard.
4. **Risk Scores:** Climate hazard data and exposure ratings are combined to calculate the risk score for each asset and for individual climate-related hazards, or aggregated risk scores. A high-risk score indicates high exposure to a climate-related hazard for a particular type of asset. In addition, the risk scores are also calculated across multiple timeframes to show changes over time.

2.1.1.3 KEY FINDINGS-PHYSICAL RISK ASSESSMENT

Key findings of the physical risk assessment are demonstrated as the baseline risk scores for each asset which are expected to remain the same in the short-term timeframe (2025) and the corresponding projected risk scores based on the SSP1-2.6, SSP3-7.0 and SSP5-8.5 climate scenarios in the medium-term (2030) and long-term (2050) timeframes. Risk scores for each asset are calculated as the average risk scores for hazards applicable to that particular asset. The key findings are shown and summarized below. Additional details on the risk scores for each hazard can be found in Appendix 1.

Risk Scores Legend:

Minimal	Low	Moderate	High	Very High

FIGURE 3 SUMMARY HEATMAP OF PROJECTED RISK SCORES UNDER DIFFERENT SCENARIOS

Assets	Baseline Risk Scores	Projected Risk Scores Averaged for All Hazards					
	Short-term (2025)	Medium-term (2030)			Long-term (2050)		
		SSP1-2.6	SSP3-7.0	SSP5-8.5	SSP1-2.6	SSP3-7.0	SSP5-8.5
Nakhon Ratchasima Plant							
Phitsanulok Plant							
Prapadang Plant							
Rayong Plant							
Surat Thani Plant							
Laem Chabang Logistic Hub							

Note 1: Coastal flooding and rainfall-induced landslides are excluded from the average risk scores in the above heatmap as they are found to be not applicable to all the above assets.

Note 2: Water stress and drought is excluded from the average risk scores in the above heatmap due to it being assessed with a different scoring system used by Word Resources Institute (WRI).

FIGURE 4 HEATMAP OF MAXIMUM RISK SCORES FROM ALL CLIMATE SCENARIOS AND TIME FRAMES

Assets	Maximum Risk Scores Among All Timeframes and Scenarios							
	Coastal flooding	Extreme heat	Extreme rainfall flooding	Extreme winds and storms	Rainfall-induced landslides	River flooding	Wildfires	Water stress and drought
Head Office							N/A	
Nakhon Ratchasima Plant								
Phitsanulok Plant								
Prapadang Plant								
Rayong Plant								
Surat Thani Plant								
Laem Chabang Logistic Hub								

Note: Water stress and drought is excluded from the average risk scores in the above heatmap due to it being assessed with a different scoring system used by Word Resources Institute (WRI).

Summary of Key Findings

- The risks from extreme heat are projected to have the most significant increase for all seven assets in the medium to long-term timeframes, reaching high to very high levels by 2050.
- The risks from wildfires are projected to increase considerably for all assets; there is a significant increase projected for Nakhon Ratchasima and Phitsanulok plants. The risk from wildfire is non-applicable for the Head Office in Bangkok due to its urban location.
- The risks from water stress and drought are already high in the baseline/short-term for most assets and are projected to maintain at a high level by 2030 and 2050. More details in Table 2.
- The risks from extreme rainfall flooding are already high at the baseline in Nakhon Ratchasima plant and is projected to maintain at a high level by all timeframes.
- The risk from river flooding is already high at the baseline in Phitsanulok plant and is projected to maintain at a high level for all timeframes.

TABLE 2 KEY FINDINGS OF THE MOST SIGNIFICANT PHYSICAL RISKS BY TIMEFRAMES AND SCENARIOS

Baseline/Short-term (2025)	Scenario	Medium-term (2030)	Long-term (2050)
Water stress and drought exhibits the highest baseline risk, whereas extreme heat is identified to be the most common climate hazard across the seven assets.	SSP1-2.6	Extreme heat and wildfires show the most substantial risk increase. Water stress and drought remain having high to extremely high risk to most sites.	Extreme heat significantly increases across most assets, followed by wildfires posing elevated risks in several assets. Water stress and drought remain having high to extremely high risk for most sites.
	SSP3-7.0	Extreme heat presents a higher risk in SSP3-7.0 compared to SSP1-2.6. Other hazards remain at similar risk levels.	By 2050, most of the risks identified are projected to intensify under SSP3-7.0, compared to SSP1-2.6
	SSP 5-8.5	Most hazards remain at similar risk levels compared to SSP3-7.0.	Extreme heat is projected to continue intensifying by 2050 under SSP5-8.5, while other hazards remain at similar risk levels compared to SSP3-7.0.

Key Findings for the Nakhon Ratchasima Plant

- The risk from extreme heat is moderate in the baseline and is projected to become very high by 2050 in all climate scenarios.
- The risk from heavy rainfall flooding is very high in the baseline and is projected to maintain at a very high level by 2030 and 2050 in all climate scenarios.
- The risk from wildfires is moderate in the baseline and is projected to become high by 2030 and very high by 2050 under the SSP5-8.5 scenario.
- The risk from water stress and drought is very high by 2030 and 2050 in all climate scenarios.

Key Findings for the Phitsanulok Plant

- The risk from extreme heat is low in the baseline and is projected to significantly increase to very high in SSP3-7.0 and SSP5-8.5 by 2030 and in all climate scenarios by 2050.
- The risk from river flooding is very high in the baseline and is projected to maintain at a very high level by 2030 and 2050 in all scenarios.
- The risk from wildfires is high in the baseline is projected to become very high in SSP1-2.6 by 2030 and in all scenarios by 2050.
- The risk from water stress and drought is very high by 2030 and 2050 in all climate scenarios.

2.1.1.4 PHYSICAL RISK BUSINESS IMPLICATIONS AND RESPONSE MEASURES

Tipco Asphalt has analyzed the implications of the physical risk on its own operations that includes upstream and downstream activities. The Group has also developed corresponding mitigation measures and adaptation strategies.

Hazards	Business Implications	Response Measures
Coastal flooding	**Own Operations** - Increase in operating costs due to flooding causing delay or temporary forced closure to business operations - Decrease in revenue from operational disruptions due to floods (e.g. key access routes for site personnel and logistics may be blocked) - Increase in capital expenditure to restore any damaged physical infrastructure - Decrease in market value of real estate, and increase in insurance premiums for assets located in area with high risks of flooding - Water treatment facilities may reach full capacity and not able to process wastewater further onsite **Upstream: Sourcing** - Delay in shipments of raw materials due to heavy rains or off-season rains - Land transportation of raw materials will be delayed due to severe flooding on the travel route	- Conduct flood risk assessment to identify areas prone to flooding for all key locations - Design and implement suitable mitigation measures to increase capacity of water drainage or pumping systems, construction of flood barrier where needed, etc. - Implement early warning systems at sites that are exposed to flooding risks and conduct capacity building/training on safety measures during floods for employees - Collaborate with other stakeholders such as government agencies and stakeholders in surrounding areas to plan for flood risk management

Hazards	Business Implications	Response Measures
Extreme heat	**Own Operations** - Decrease in efficiency of cooling systems as well as turbines and compressors due to higher temperatures during extreme heat - Increase in energy costs due to higher energy demand for cooling of indoor areas for both personnels and equipment during extreme heat - Decrease in productivity of personnels when working during extreme heat	- Provide training to employees to identify symptoms of heat stress and provide first aid - Evaluate and improve, if found needed, existing operational temperature ranges of the cooling systems for projected extreme temperature ranges - Install energy-efficient cooling systems
Extreme rainfall & riverine flooding	**Own Operations** - Increase in operating costs due to flooding causing delay or temporary forced closure to business operations - disruptions due to floods (e.g. key access routes for site personnel and logistics may be blocked) - Increase in capital expenditure to restore any damaged physical infrastructure - Decrease in market value of real estate, and increase in insurance premiums for assets located in area with high risks of flooding - Water treatment facilities may reach full capacity and not able to process wastewater further onsite **Upstream: Sourcing** - Delay in shipments of raw materials due to heavy rains or off-season rains - Land transportation of raw materials will be delayed due to severe flooding on the travel route	- Conduct flood risk assessment to identify areas prone to flooding for all key locations - Design and implement suitable mitigation measures to increase capacity of water drainage or pumping systems, construction of flood barrier where needed, and etc. - Implement early warning systems at sites that are exposed to flooding risks and conduct capacity building/training on safety measures during floods for employees - Collaborate with other stakeholders such as government agencies and stakeholders in surrounding areas to plan for flood risk management
Extreme Winds & Storms	**Own Operations** - Increase in operating costs due to extreme winds and storms causing delay or temporary forced closure to business operations - Decrease in revenue from operational disruptions due to extreme winds and storms (e.g. key access routes for site personnel and logistics may be blocked) - Decrease in market value of real estate, and increase in insurance premiums for assets located in area with high risks extreme winds and storms - Increase in capital expenditure to restore any damaged physical infrastructure	- Develop response mechanism to plan operations and take preventive steps (e.g., planned shut down before the event, or shift in operation schedule) to reduce impacts - Evaluate and improve, if found needed, existing operational windspeed ranges of high-rise structures for projected extreme wind ranges - Capacity building/training on safety measures for site personnel - Emergency response plan for business continuity or evacuation

Hazards	Business Implications	Response Measures
Wildfires	**Own Operations** - Increase in operating costs due to wildfires causing delay or temporary forced closure to business operations (e.g. forced stop-work procedures induced by direct fire or dispersed smoke) - Decrease in revenue from operational disruptions due to wildfires (e.g. key access routes for site personnel and logistics may be blocked) - Increase in operating costs, insurance claims, and redundancies due to wildfires disrupting repairs and maintenance activities	- Awareness and preparation are key factors in minimizing risk during wildfire - Emergency response plan for the buildings to evacuate the workers and employees in any emergency - Capacity building/training on safety measures for site personnel - Check local emergency broadcast radio for updated information regarding the path of the wildfire
Water stress & drought	**Own Operations** - Increase in operating costs due to water stress & drought affecting the use of ground and underground water for asphalt emulsion production - Increase in operating costs (e.g., inadequate water supply or increase in water tariffs due to higher competition between water users)	- Explore opportunities for rainwater harvesting at site and within wider watershed area - Adopt water efficient/saving technologies to reduce water usage - Alternate water source/supply should be identified for the site, either externally or internally through the water storage infrastructure - Explore opportunities for recycling and reuse of wastewater

2.1.2 TRANSITION RISKS AND OPPORTUNITIES

The transition risk assessment includes drivers associated with the transition towards a low-carbon economy that are relevant and may impact the Group at the corporate-level and its value chain.

2.1.2.1 CLIMATE SCENARIOS

For the transition risks and opportunities assessment in 2023, Tipco Asphalt used the climate scenarios from the International Energy Agency's (IEA) World Energy Outlook 2023 including the **stated policies scenario (STEPS), the announced pledges scenario (APS), and the net zero emissions by 2050 scenario (NZE).** These scenarios provide a detailed stock take of different levels of efforts that nations have implemented in the transition toward a low-carbon economy. The Group has considered related transition risks and opportunities under the selected scenarios throughout the business value chain including its own operations and upstream and downstream activities.

In alignment with the physical risk assessment, **the short-term, medium-term, and long-term time horizons** for the transition risk assessment are respectively defined as **2025, 2030 and 2050.** In addition, a **medium-long term horizon by 2040** was added to the assessment to consider the fast-changing transition risks and opportunities between 2030 and 2050.

TABLE 3 CLIMATE SCENARIOS USED IN TRANSITION RISK ASSESSMENT

Climate Scenarios	Description	Estimated Increase in Temperature by 2100
NZE	• A pathway to achieve net zero CO_2 emissions by 2050 • GHG emissions fall to 21 Gt CO_2eq in 2030, marking a decisive achievement in global climate action	1.5°C
APS	• All climate commitments, including Nationally Determined Contributions (NDCs), made by governments to be met in full and on time • GHG emissions peak in the mid-2020s and return to just under 34 Gt CO_2eq in 2030, close to current levels	1.7°C
STEPS	• A more conservative benchmark to explore existing and announced policies without assuming full achievement • Global energy-related and industrial process GHG emissions rise to 36 Gt CO_2eq in 2030	2.4-2.8°C

2.1.2.2 TRANSITION RISK ASSESSMENT METHODOLOGY

Tipco Asphalt conducted the transition risk assessment based on the following steps.

1. **Transition Driver Identification:** The drivers that put pressure on (or create opportunities for) the Group to transition into a low carbon economy are determined.
   - 1.1 **Policy and Legal:** Current or emerging policy changes that attempt to reduce GHG emissions can have operational or financial implications for the Group. Non-compliance to laws and regulations, or the deliberate lack of climate action(s) can also lead to litigation by stakeholders and cause legal risks.
   - 1.2 **Market:** Shifts in supply and demand for certain products/services resulting from climate change, including consumer preference for products manufactured from renewable sources.
   - 1.3 **Technology:** Technological improvements or innovations that support the low-carbon transition may accelerate the disruption of older and more carbon-intensive business and systems.
   - 1.4 **Reputation:** Stakeholders are aware and concerned of emissions from fossil fuels and its impacts. Community perception of the Group's contribution to or detraction from a low carbon economy.
2. **Assessment of Internal Factors:** The likelihood and impact level of each driver is determined based on internal comprehensive judgement. Likelihood and impact levels are then calculated into internal risk/opportunity weightings.
3. **Assessment of External Factors:** Transition drivers and associated risk/opportunity weightings are analyzed based on external data under climate scenarios across different timeframes.
4. **Heatmap:** Both internal and external inputs are considered to obtain consolidated risk/opportunity weightings for greater accuracy. Key 'hotspots' in the heatmap will require further in-depth assessment and response measures.

2.1.2.3 KEY FINDINGS-TRANSITION RISK ASSESSMENT

APS Scenario

In the APS scenario where Thailand will pursue and timely realize its NDC goals (i.e., carbon neutrality by 2050 and net zero emissions by 2065), the most important transition risk to Tipco Asphalt is carbon pricing, although it is not expected to have impact by 2030. However, Thailand will have to impose an increasing carbon price to emissions, leading to a high risk to Tipco Asphalt's financial performance by 2040.

In the meantime, to mitigate emissions and associated risks from carbon pricing, Tipco Asphalt will have to invest in decarbonization technologies and low-carbon energy, which imply an important share of capital expenditure in the future. Therefore, the risk from this driver is second to carbon pricing.

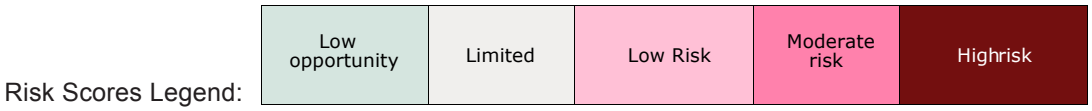


FIGURE 5 HEATMAP OF TRANSITION RISKS AND OPPORTUNITIES FOR APS SCENARIO

Transition Drivers	Timeframes				IEA indicators
	2025 (Short-term)	2030 (Medium-term)	2040 (Medium-long-term)	2050 (Long-term)	
Policy & Legal[1]					
Climate related policies/ regulations (Current regulation)[2]					No proxy
Carbon pricing (Emerging regulation)					Carbon pricing
Market					
Low-carbon product					Oil for non-energy use
Reduced supply of fossil raw materials and fuels					Extra-heavy oil and asphalt production
Technology					
Decarbonization technologies and low-carbon energy					Share of electricity and low-carbon fuel consumption in industry
Low-carbon shipping and distribution[3]					Total CO_2 emissions in shipping
Energy efficiency in business operations (Opportunity)					Total final energy consumption in various industrial sectors

Risk Scores Legend:	Low opportunity	Limited	Low Risk	Moderate risk	Highrisk

Transition Drivers	Timeframes				IEA indicators
	2025 (Short-term)	2030 (Medium-term)	2040 (Medium-long-term)	2050 (Long-term)	
Reputation					
Higher access to capital and finance due to climate responsible practices (Opportunity)					Global investment in energy efficiency, electrification and renewables for industry

Note:

1 Climate policies/regulations and legal included current regulations, emerging regulation, and legal risk. However, legal risk from litigation is not significant to the Group's business context.

2 Increasing risk from climate related policies/regulations are not included in the heatmap due to the lack of suitable proxy indicators. According to the risk heatmap, these drivers could present a limited to moderate risk to Tipco Asphalt's if the Group fails to comply with climate regulations.

3 This transition driver covers shipping activities under the Group's marine business, and land transportation and distribution activities under the Group's asphalt business. However, total CO_2 emissions in shipping is used as the representative indicator for this driver as emissions from shipping is harder to reduce than land transportation, and is governed by IMO's GHG emissions reduction target, which present more significant overall risks to the Group.

- In the APS scenario, all the risks remain limited/controllable by 2030. However, they are likely to increase to a moderate or high level by 2050, requiring close monitoring in 2040 or immediate action by 2050.
- Opportunities appear rather limited to Tipco Asphalt. However, as Thailand introduced Taxonomy to mobilize green finance, Tipco Asphalt would enjoy a higher access to capital and finance at a lower cost. This could become a low opportunity by 2050.

NZE Scenario

In the NZE scenario where Thailand will pursue net zero emissions by 2050 in alignment to the rest of the world, carbon pricing will become even intensified, and will already become a high risk to Tipco Asphalt by 2030. This is because Thailand will have to impose even higher carbon prices at a faster speed to effectively disincentivize further GHG emissions.

In response to this pressure, Tipco Asphalt will have to invest in decarbonization technologies and low-carbon energy much earlier, and thus the required capital expenditure may already start to become a risk to the Group's financial position by 2030.

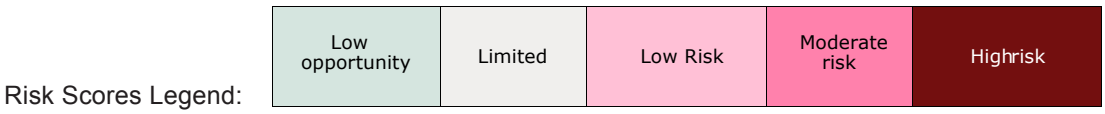


FIGURE 6 HEATMAP OF TRANSITION RISKS AND OPPORTUNITIES FOR NZE SCENARIO

Transition Drivers	Timeframes				IEA indicators
	2025 (Short-term)	2030 (Medium-term)	2040 (Medium-long-term)	2050 (Long-term)	
Policy & Legal[1]					
Climate related policies/ regulations (Current regulation)[2]					No proxy
Carbon pricing (Emerging regulation)					Carbon pricing
Market					
Low-carbon product					Oil for non-energy use
Reduced supply of fossil raw materials and fuels					Extra-heavy oil and asphalt production
Technology					
Decarbonization technologies and low-carbon energy					Share of electricity and low-carbon fuel consumption in industry
Low-carbon shipping and distribution[3]					Total CO_2 emissions in shipping
Energy efficiency in business operations (Opportunity)					Total final energy consumption in various industrial sectors
Reputation					
Higher access to capital and finance due to climate responsible practices (Opportunity)					Global investment in energy efficiency, electrification and renewables for industry

Note:

1 Climate policies/regulations and legal included current regulations, emerging regulation, and legal risk. However, legal risk from litigation is not significant to the Group's business context.

2 Increasing risk from climate related policies/regulations are not included in the heatmap due to the lack of suitable proxy indicators. According to the risk heatmap, these drivers could present a limited to moderate risk to Tipco Asphalt's if the Group fails to comply with climate regulations.

3 This transition driver covers shipping activities under the Group's marine business, and land transportation and distribution activities under the Group's asphalt business. However, total CO_2 emissions in shipping is used as the representative indicator for this driver as emissions from shipping is harder to reduce than land transportation, and is governed by IMO's GHG emissions reduction target, which present more significant overall risks to the Group.

- In the NZE scenario, all the risks will likely to remain limited in the short term but some (i.e., carbon pricing and decarbonization technologies) will intensify rapidly already before 2030 while the others will start to show their impact beyond 2030. This will require close monitoring and timely action for effective risk management.
- On the opportunity side, as the financial sector will have to provide more preferential terms to support climate responsible activities in order to support the global net zero goals, Tipco Asphalt may enjoy a higher opportunity from it by 2040 onwards. More ambitious improvement in energy efficiency will be required in a net zero by 2050, also implying a higher cost saving compared to the outcome in the APS scenario.

2.1.2.4 TRANSITION RISK BUSINESS IMPLICATIONS AND RESPONSE MEASURES

Tipco Asphalt has analyzed the implications of the transition risks and opportunities on its own operations, upstream, and downstream activities. The Group has also developed corresponding mitigation measures and adaptation strategies.

Drivers	Implications	Response Measures
Climate related policies and regulations	**Own Operations** - Tipco Asphalt might face increasing litigation and negative impact on the Group's valuation if it fails to comply with climate regulations	- Incorporate transition impacts into financial planning to inform strategic decisions in a low carbon world, and ensure up-to-date compliance with emerging laws and regulations - Apply economic analysis tools such as internal carbon pricing to enable low-carbon investments.
Carbon pricing	**Own Operations, Upstream and Downstream** - Carbon pricing could directly increase operational expenditures or indirectly increase cost of fuel/energy used in Tipco Asphalt's supply chain	- Create and incentivise demand for low carbon products and services - Explore new/niche markets for low-embodied carbon (LEC) construction materials and service offerings
Low carbon product	**Own Operations, Upstream and Downstream** - Tipco Asphalt would need to deploy more capital expense for low-carbon product development and execution of new or converted product lines for low-carbon products	- Assess GHG emissions reduction opportunities at a facility or equipment level in detail

Drivers	Implications	Response Measures
Reduced supply of fossil feedstocks and fuels	**Own Operations, Upstream and Downstream** - Tipco Asphalt may be forced to reduce production (thus affecting operational costs and revenue) due to a shortage of fossil feedstocks or seek alternative suppliers at a higher cost	- Sourcing of alternative fuels and feedstocks - Optimize downstream distribution routes and invest in low-carbon fuels/ fleets (or procure low-carbon logistic services)
Decarbonization technologies and low carbon energy	**Own Operations** - Conducting research and deploying new technologies that will increased operational costs	- Assess the GHG emissions reduction opportunities at a facility, equipment and product level in detail - Prioritize emissions reduction in the short run, while preparing for deep GHG emissions reduction which may not be commercially viable until a later stage
Low-carbon shipping and distribution	**Own Operations Upstream and Downstream** - This includes the need for efficiency improvement of engine systems and fuel switch resulting in increased investment for low-carbon transport fleet and fuel technologies - Investment to upgrade fleets of third-party service providers may result in higher fees and cause higher operational expense for the Group.	- Source alternative raw materials (such as bio feedstocks in Thailand or neighbouring countries) - Optimize supply chain routes and or procure low carbon logistic services - Apply economic analysis tools such as internal carbon pricing to enable low-carbon investments
Energy efficiency in business operations (Opportunity)	**Own Operations, Upstream and Downstream** - Heavy industries can benefit from such an improvement although there may be some upfront CapEx to be made, for example, replacing outdated and inefficient heaters with more modern and efficient one. This helps to maintain the quality of asphalt while saving energy bills (and therefore reducing OpEx).	- Assess the GHG emissions reduction opportunities at a facility, equipment and product level in detail - Use the energy efficient equipment and machinery at customers' construction sites (e.g., energy efficient burners/ heaters)
Higher access to capital and finance due to climate responsible practices (linked to Thailand Taxonomy) (Opportunity)	**Own Operations, Upstream and Downstream** - Meeting and exceeding stakeholder expectations on ethical standards, product quality and environmental responsibility may also increase valuation of the Group, as stakeholders have positive perceptions on Tipco Asphalt's climate responsible practices. - Cheaper cost of capital for new and more efficient machinery and equipment that reduce GHG emissions and increase potential returns on investments	- Conduct cost and benefit analysis for investment in energy efficient and low carbon business and manufacturing practices

2.2 CLIMATE STRATEGIC PROJECTS

Tipco Asphalt has established a target to reduce 36% of GHG emissions (Scope 1 and 2) by 2030 from 2020 base year for asphalt business in Thailand, in alignment with Thailand's Nationally Determined Contribution (NDC) to the Paris Agreement. This target only encompasses GHG emissions reduction on Thailand's asphalt business only.

To achieve its GHG emission reduction target, the Group has developed climate strategies to effectively reduce GHG emissions from its asphalt business in Thailand, while also aiming to expand its coverage in the future. There are six main climate strategic projects under the climate strategies, as follows:

Solar Roof

The Group plans to make substantial investments in renewable energy through installing solar rooftops at its manufacturing plants in Thailand. This project not only bolsters the Group's climate strategies but it also serves as a step towards achieving energy independence and reducing energy costs. The solar rooftops will harness sunlight to generate electricity, reducing reliance on conventional power sources and contributing to a more sustainable energy mix.

Electrical Hot Oil Boiler with Solar Power

The Group plans to reduce GHG emissions through replacing its diesel hot oil boiler unit with an electrical hot oil boiler unit. By using electricity for the heating system in the production process, the Group can eliminate GHG emissions associated with traditional heating methods that use diesel as a fuel source. To further reduce reliance on electrical grid, the Group will also invest in solar power to generate solar energy for the electrical hot oil boiler.

Fuel-switching to LNG

To further enhance the sustainability of its business operations, the Group will invest in a fuel-switching project from diesel to liquified natural gas (LNG) for its hot oil boiler heating system. This project also aligns with the global push towards cleaner and more sustainable fuels.

Electric Vehicles and Electric Trucks

The Group aims to transition its fossil fuel-based vehicles to electric vehicles (EVs) including its own-operated trucks. This commitment sets a good practice for sustainable mobility among peers.

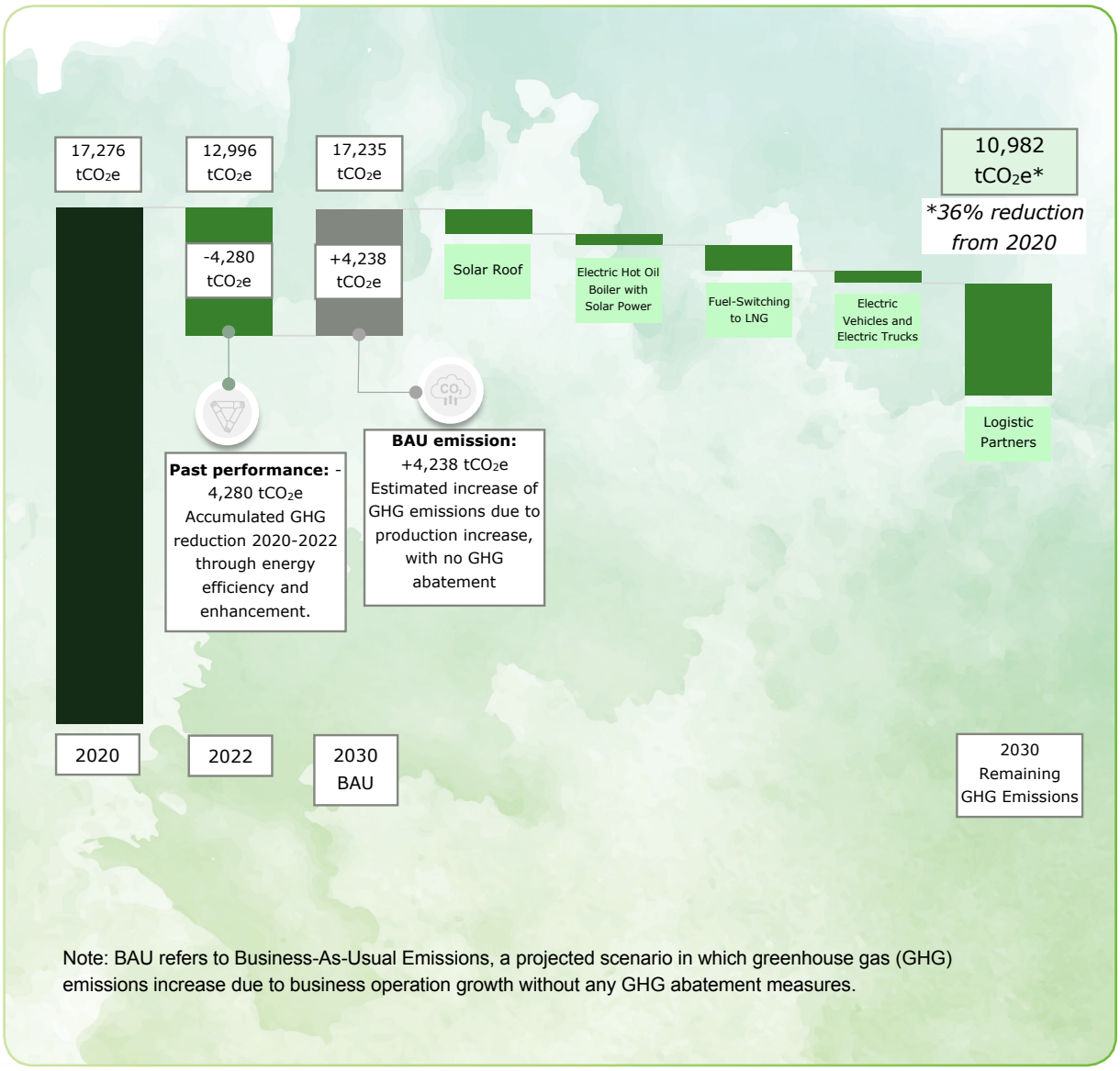
Specialized Logistic Partners

As part of the supply chain optimization initiative, the Group will be able to reduce part of its Scope 1 and 2 GHG emissions by leveraging like-minded specialized logistic partners to effectively and efficiently manage product deliveries and associated emissions. The Group recognizes that logistic-associated emissions of the partners will fall under indirect Scope 3 GHG emissions of the Group, and confirms that the Group will do everything possible to reduce such emissions by means under its control, e.g. by selecting logistic partners that can service with electric or fuel-efficient trucks.

Afforestation

For the past several decades the Group has implemented various afforestation projects with the aim to increase and restore forest areas. In continuation with this aim, a key afforestation strategic project was developed as a major step forward, starting in 2024 and completed by 2033 with the planting of 120,000 trees. The annual GHG emissions reduction from the project is estimated to be 1,140 tCO_2e per year. While afforestation plays a vital role in neutralizing the Group's residual GHG emissions in supporting Thailand's NDC target, it will not be accounted for in the GHG emission reduction targets for 2030.

FIGURE 7 CLIMATE STRATEGIC PROJECTS VS GHG EMISSIONS REDUCTION 2020-2030



Note: BAU refers to Business-As-Usual Emissions, a projected scenario in which greenhouse gas (GHG) emissions increase due to business operation growth without any GHG abatement measures.

[1] The Group recognizes that logistic-associated emissions of the partners will fall under indirect Scope 3 GHG emissions of the Group, and confirms that the Group will do everything possible to reduce such emissions by means under its control, e.g. by selecting logistic partners that can service with electric or fuel-efficient trucks.

3. RISK MANAGEMENT

Tipco Asphalt's ERM process follows the Committee of Sponsoring Organization of Treadway Commission (COSO) ERM framework and the ISO 31000:2018 Risk Management guideline. The ERM process enables the Group to systematically identify, assess, and manage risks across all business operations related to climate-based risk and opportunities. Especially with due consideration to prominent topics, such as Climate Change and the low-carbon transition that can affect the value chain of the Group.

3.1 IDENTIFICATION

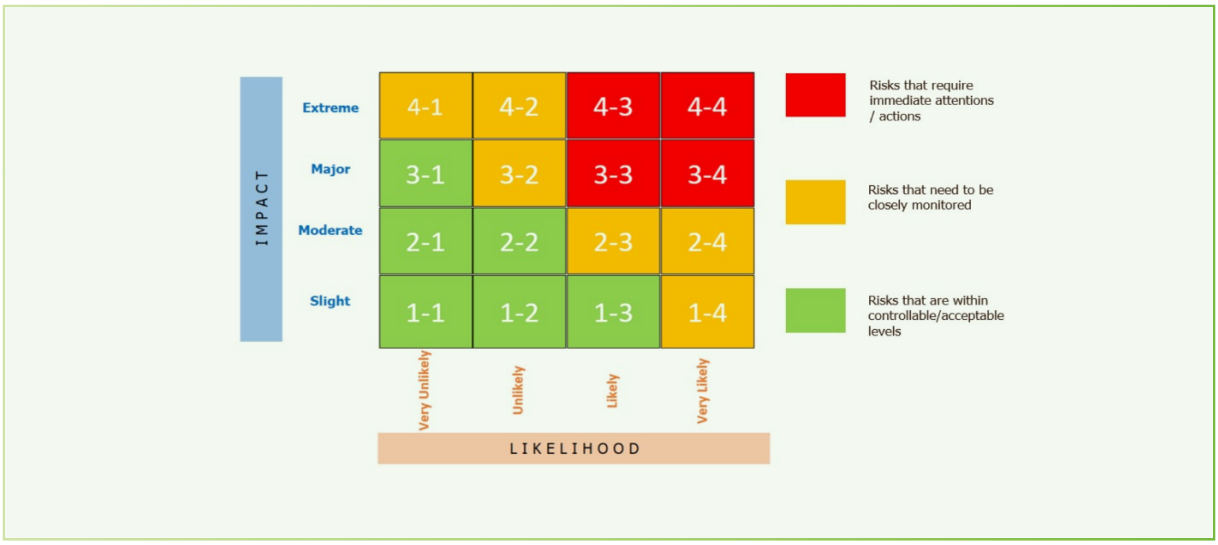
Tipco Asphalt routinely identifies and updates the corporate risk register to account for emerging business trends and changes in regulations. The Group considers five distinct risk types as follows:

- Compliance risk;
- Operational/Financial risk;
- Reporting risk;
- Strategic risk; and
- Sustainability-related risk.

3.2 ASSESSMENT

Tipco Asphalt reviews and refines its risk criteria as a function of impact and likelihood as shown in the risk heatmap. This risk criteria and heatmap provides the framework that is adjusted and defined for various financial and non-financial sustainability-related risks. Each risk is then assessed based on the risk criteria and heatmap to be prioritized into three levels. All top corporate risks are reported to the EC and then the BoD on a quarterly basis.

FIGURE 8 TIPCO ASPHALT GROUP RISK HEATMAP



Climate Change-related risks (a sub-set of sustainability-related risk) are cross-cutting issues that encompass all risk types and can be integrated into the overall ERM process. Physical risks like natural hazards/disasters are continuously assessed by scenario analysis as shown in the above section. Damage to infrastructure or business disruptions from physical risks are closely associated with operational/financial risks. In contrast, transition risks such as policy risk from carbon pricing are closely associated with compliance risk, while market risk from low carbon products is closely associated with strategic risk. Among transition risks, the Group also identifies any potential opportunities. Finally, significant physical and transition risks (and opportunities) per prioritization process are communicated to relevant sub-board-level committees and business units to serve as inputs for conducting the overall ERM process.

3.3 MONITORING AND REVIEW

Significant risks will be monitored based on Key Risk Indicators (KRIs) so that they can be mitigated and controlled within their respective risk tolerance as established by the Group. Risk monitoring is the responsibility of all business units to continuously track and update the KRIs, which are compiled by the RMO and reported to the RMC, EC and the BoD on a quarterly basis or immediately, should there be an urgent situation that warrants a quick response. Risk Champions will directly discuss with corresponding business units on risks that show a worsening KRI trend or have become severe beyond the risk appetite threshold to determine whether existing controls are effective or new control measures are required.

Similar to the aforementioned ERM processes, Tipco Asphalt considers climate-related risks and associated metrics, especially metrics on financial implications of climate change as KRIs. The relevant business units must also monitor these climate-related metrics and report to the executive management (e.g., SD&CG, EC, SDC, etc.) for effective oversight of the monitoring and mitigation of Climate Change-related risks.

3.4 REPORTING AND COMMUNICATION

As Climate Change-related risks play an important part in the process, Tipco Asphalt updates its Climate Change-related disclosures to communicate key findings of its assessment of Climate Change-related risks and opportunities on a regular basis. Moreover, the Group conducts third-party verification of its GHG emissions data to ensure accurate measurement of performance against GHG reduction targets, and transparent communication of results to the BoD and external stakeholders on a regular basis.

4. METRICS AND TARGETS

4.1 GHG EMISSION METRICS AND TARGETS

The Group monitors its progress by continuously measuring and reporting its GHG emissions across its business operations on a regular basis. The GHG emissions data are collected and calculated based on the methodologies of the GHG Protocol, ISO 14064:2018, and The Thailand Greenhouse Gas Management Organization (TGO): The National Guideline Carbon Footprint for Organization (CFO). The Group also conducts third-party verification of the GHG emissions data by external party (e.g., Management System Certification Institute: MASCI) on an annual basis. Compared to 2020, the Group has reduced its GHG emissions (Scope 1 and Scope 2) by 32.9% in 2023 from its initiatives on improving efficiency in its logistics system, improvements in heat transfer for production activities, and reducing heat loss in its product storage tank through better insulation.

GHG Emissions	2020	2021	2022	2023
Scope 1 (ton CO_2eq)	15,159	13,352	11,368	10,255
Scope 2 (ton CO_2eq)	2,115	1,798	1,629	1,602
Total (ton CO_2eq)	**17,275**	**15,150**	**12,996**	**11,586**
GHG emissions intensity (ton CO_2eq/ton of production unit)	0.032	0.029	0.024	0.021

Note: GHG emissions data reported in the above table covers asphalt storage and production, distribution and sales and office work performed by six main assets in Thailand and the Head Office in Bangkok, which is aligned with the Climate Strategic Projects (Figure 7).

Tipco Asphalt is committed to achieving a reduction of 36% in absolute GHG emissions (Scope 1 and Scope 2) by 2030 compared to 2020 base year. The scope of these mid-term targets covers asphalt storage and production, distribution and sales and office work performed by six main assets and the Head Office, all located in Thailand.

Tipco Asphalt Climate Target
• Reduce absolute GHG emissions (Scope 1 and Scope 2) by 36% by 2030 from 2020 base year. This target only encompasses GHG emissions of Thailand's asphalt business.

4.2 OTHER CLIMATE-RELATED METRICS AND TARGETS

4.2.1 ENERGY MANAGEMENT

Tipco Asphalt has committed its business operation and management to promote energy conservation and efficiency throughout its value chain. The Group has set a target of reducing energy intensity (GJ/ton of production) by at least 6% by 2025 with 2020 as the base year covering Thailand's asphalt business only. The data has been verified and certified by third-party auditors (e.g. MASCI) covering asphalt production and distribution scope.

Energy Management	Unit	2020	2021	2022	2023
Total energy consumption	Gigajoule	215,138	190,249	162,818	159,324
Total renewable energy generated	Gigajoule	13,602	14,743	12,742	11,550
Share of renewable energy generation compared to total energy consumption	%	6.3	7.6	7.8	7.25

Other Climate-Related Targets
• Reduce energy intensity by at least 6% compared to total production by 2025 using 2020 as the base year

APPENDIX 1

PHYSICAL RISK FINDINGS: ASSET RISK SCORES BY HAZARDS

Change from Baseline Risk Score					
Significant Decrease	Moderate Decrease	Minimal Decrease	Minimal Increase	Moderate Increase	Significant Increase
					

Head Office: Bangkok

Hazards	Baseline	2030			2050		
		SSP1-2.6	SSP3-7.0	SSP5-8.5	SSP1-2.6	SSP3-7.0	SSP5-8.5
Coastal flooding	Minimal						
Extreme heat	Low						
Extreme rainfall flooding	Minimal						
Extreme winds and storms	Minimal						
Rainfall-induced landslides	Minimal						
River flooding	Minimal						
Wildfires	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Water stress and drought	High	High	High	High	High	High	High

Key Trend and Associated Risks

- Extreme Heat risk is “Low” in the baseline and is likely to increase significantly in the future. In 2030, Bangkok is projected to be at “High” risk under both the SSP3-7.0 and SSP5-8.5 scenarios, while by 2050, the risk will become “Very-High”. There is also a higher possibility of heat-related illness on site personnels, particularly outdoor workers leading to health and safety concerns. Reduced working hours or time off may be required if working conditions are unsuitable.The circumstances can increase the volume of energy and associated expenses necessary for cooling machines.
- Wildfire is rated “Non-Applicable”. This is mainly because the Bangkok office is in an urban setting where burnable materials (e.g., woods, forest) are hardly present. There is no record of burned areas either within the buffer zone (30 km^2) from the historical dataset. Therefore, the wildfire risk is considered not applicable to this asset.

Nakhon Ratchasima Plant

Hazards	Baseline	2030			2050		
		SSP1-2.6	SSP3-7.0	SSP5-8.5	SSP1-2.6	SSP3-7.0	SSP5-8.5
Coastal flooding	Minimal						
Extreme heat	Moderate						
Extreme rainfall flooding	Very high						
Extreme winds and storms	Minimal						
Rainfall-induced landslides	Minimal						
River flooding	Minimal						
Wildfires	Moderate						
Water stress and drought	Extremely High	Extremely High	Extremely High	Extremely High	Extremely High	Extremely High	Extremely High

Key Trend and Associated Risks

- Extreme Heat risk is “Moderate” in the baseline. Under the SSP1-2.6 and SSP3-7.0, the plant is anticipated to face a “High” risk in 2030, and a “Very-High” risk is anticipated to fall under SSP5-8.5 in 2030 and all scenarios in 2050. There is also a higher possibility of heat-related illness on site personnels, particularly outdoor workers leading to health and safety concerns. Reduced working hours or time off may be required if working conditions are unsuitable.
- Heavy Rainfall Flooding risk is “Very High” in the baseline and will remain so in both timeframes under all scenarios. It can cause physical damage to the infrastructure and forced shutdown, resulting in downtime and revenue loss.
- The risk associated with Wildfires is “Moderate” in the baseline but is expected to rise moderately to “High” in 2030 and may become a “Very High” risk in 2050 under high-emissions scenarios. Heat and flame can cause direct physical damage to units, operational equipment, and vehicles. Because of the flammable products present, there is a potential explosion risk at sites.
- Water stress & drought exhibits an “Extremely High” risk to the plant under all the scenarios and time frames. Lack of water may affect productivity. The cost of water may go up and there may be competition for water resources between sectors which can lead to reputational issues.

Phitsanulok Plant

Hazards	Baseline	2030			2050		
		SSP1-2.6	SSP3-7.0	SSP5-8.5	SSP1-2.6	SSP3-7.0	SSP5-8.5
Coastal flooding	Minimal	—	—	—	—	—	—
Extreme heat	Moderate	⌃⌃	⌃⌃	⌃⌃	⌃⌃	⌃⌃	⌃⌃
Extreme rainfall flooding	Minimal	—	—	—	—	—	—
Extreme winds and storms	Minimal	—	—	—	—	—	—
Rainfall-induced landslides	Minimal	—	—	—	—	—	—
River flooding	Minimal	—	—	—	—	—	—
Wildfires	Low	⌃	⌃	⌃	⌃	⌃⌃	⌃⌃
Water stress and drought	High	High	High	High	High	High	High

Key Trend and Associated Risks

- Although Extreme Heat is “Low” in the baseline, it is projected significantly increase to “Very High” under SSP3-7.0 and SSP5-8.5 in 2030 and under all scenarios in 2050. There may be a rising cost from energy demand for cooling personnel inside areas. There is also a higher possibility of heat-related illness on site personnels, particularly outdoor workers leading to health and safety concerns. Reduced working hours or time off may be required if working conditions are unsuitable.
- River Flooding risk is “Very High” in the baseline and will remain so in both timeframes under all scenarios. It can cause physical damage to the infrastructure and forced shutdown, resulting in downtime and revenue loss.
- The danger of wildfire is “High” in the baseline and may increase to “Very High” in 2030 under SSP1-2.5. By 2050, the site is expected to face a “Very High” risk under all scenarios. Physical damage from heat and flame can occur to units, operational equipment. Heat, flame, smoke, and dust from wildfires may interrupt operations.
- Water stress & drought exhibits an “Extremely High” risk to the plant under all the scenarios and time frames. Lack of water may affect productivity. The cost of water may go up and there may be competition for water resources between sectors which can lead to reputational issues.

Prapadang Plant

Hazards	Baseline	2030			2050		
		SSP1-2.6	SSP3-7.0	SSP5-8.5	SSP1-2.6	SSP3-7.0	SSP5-8.5
Coastal flooding	Minimal	—	—	—	—	—	—
Extreme heat	Moderate	⌃	⌃	⌃	⌃	⌃	⌃
Extreme rainfall flooding	Minimal	—	—	—	—	—	—
Extreme winds and storms	Minimal	—	—	—	—	—	—
Rainfall-induced landslides	Minimal	—	—	—	—	—	—
River flooding	Minimal	—	—	—	—	—	—
Wildfires	Low	⌃	⌃	⌃	⌃	⌃	⌃
Water stress and drought	High	High	High	High	High	High	High

Key Trend and Associated Risks

- Extreme Heat is “Moderate” in the baseline, it is rapidly increasing to “High” under SSP1-2.6 and “Very High” under SSP3-7.0 and SSP5-8.5 in the 2030s and in all scenarios in the 2050s. Extreme heat can lead to a higher energy demand for air conditioning. There is also a higher possibility of heat-related illness on site personnels, particularly outdoor workers leading to health and safety concerns. Reduced working hours or time off may be required if working conditions are unsuitable.
- Wildfire is rated “Low” in the baseline. In 2030s, Wildfire level is projected to be “Moderate” under all scenarios. In 2050s, the risk is estimated to “High” under SSP3-7.0 and SSP5-8.5. Operations could be disrupted by a wildfire incident. Staff may need to leave their locations of work, which could cause downtime and loss of revenue. Dust and smoke from nearby fires could affect any outdoor activities.
- Water stress & drought is “High” in the baseline and will remain so across all timeframes and scenarios.

Surat Thani Plant

Hazards	Baseline	2030			2050		
		SSP1-2.6	SSP3-7.0	SSP5-8.5	SSP1-2.6	SSP3-7.0	SSP5-8.5
Coastal flooding	Minimal	—	—	—	—	—	—
Extreme heat	Low	⌃⌃	⌃⌃	⌃⌃	⌃⌃	⌃⌃	⌃⌃
Extreme rainfall flooding	Minimal	—	—	—	—	—	—
Extreme winds and storms	Very high	⌃	⌃	⌃	⌃	⌃	⌃⌃
Rainfall-induced landslides	Minimal	—	—	—	—	—	—
River flooding	Minimal	—	—	—	—	—	—
Wildfires	Minimal	—	—	—	—	—	⌃
Water stress and drought	Medium-High	Medium-High	Medium-High	Medium-High	Medium-High	Medium-High	Medium-High

Key Trend and Associated Risks

- The risk associated with Extreme Heat is “Low” in the baseline. However, the plant is anticipated to be at “Very High” risk under all scenarios in both timeframes. There is also a higher possibility of heat-related illness on site personnels, particularly outdoor workers leading to health and safety concerns. Reduced working hours or time off may be required if working conditions are unsuitable.
- Extreme Winds & Storms risk is “Very High” in the baseline, and the level of risk is projected to increase slightly in all scenarios for both 2030s and 2050s timeframes. High wind speeds can cause physical damage to site structures and processing units, resulting in business interruptions and additional capital expenses to restore the damaged assets.

Rayong Plant

Hazards	Baseline	2030			2050		
		SSP1-2.6	SSP3-7.0	SSP5-8.5	SSP1-2.6	SSP3-7.0	SSP5-8.5
Coastal flooding	Minimal	—	—	—	—	—	—
Extreme heat	Moderate	⏫	⏫	⏫	⏫	⏫	⏫
Extreme rainfall flooding	Minimal	—	—	—	—	—	—
Extreme winds and storms	Low	—	—	—	—	—	—
Rainfall-induced landslides	Minimal	—	—	—	—	—	—
River flooding	Minimal	—	—	—	—	—	—
Wildfires	Low	⏫	🔼	⏫	🔼	⏫	🔼
Water stress and drought	High	High	High	High	High	High	High

Key Trend and Associated Risks

- In the baseline, the risk associated with Extreme Heat is “Moderate” and is projected to substantially increase to “Very High” in the foreseeable future. The Rayong plant is projected to be at “Very High” risk in both future timeframes under all scenarios. There is also a higher possibility of heat-related illness on site personnels, particularly outdoor workers leading to health and safety concerns. Reduced working hours or time off may be required if working conditions are unsuitable.
- Wildfires are rated “Low” in the baseline but will rise to “Moderate” risk in both 2030s- and 2050s-timeframes under all scenarios. This occurrence can cause a temporary stop in activities and increased operating costs. Wildfires can be dangerous to the health and safety of people on the spot.

Laem Chabang Logistic Hub

Hazards	Baseline	2030			2050		
		SSP1-2.6	SSP3-7.0	SSP5-8.5	SSP1-2.6	SSP3-7.0	SSP5-8.5
Coastal flooding	Minimal	—	—	—	—	—	—
Extreme heat	Low	⏫	⏫	⏫	⏫	⏫	⏫
Extreme rainfall flooding	Moderate	—	—	—	—	—	—
Extreme winds and storms	Low	—	—	—	—	—	—
Rainfall-induced landslides	Minimal	—	—	—	—	—	—
River flooding	Minimal	—	—	—	—	—	—
Wildfires	Low	🔺	🔺	🔺	🔺	⏫	⏫
Water stress and drought	High	High	High	High	High	High	High

Key Trend and Associated Risks

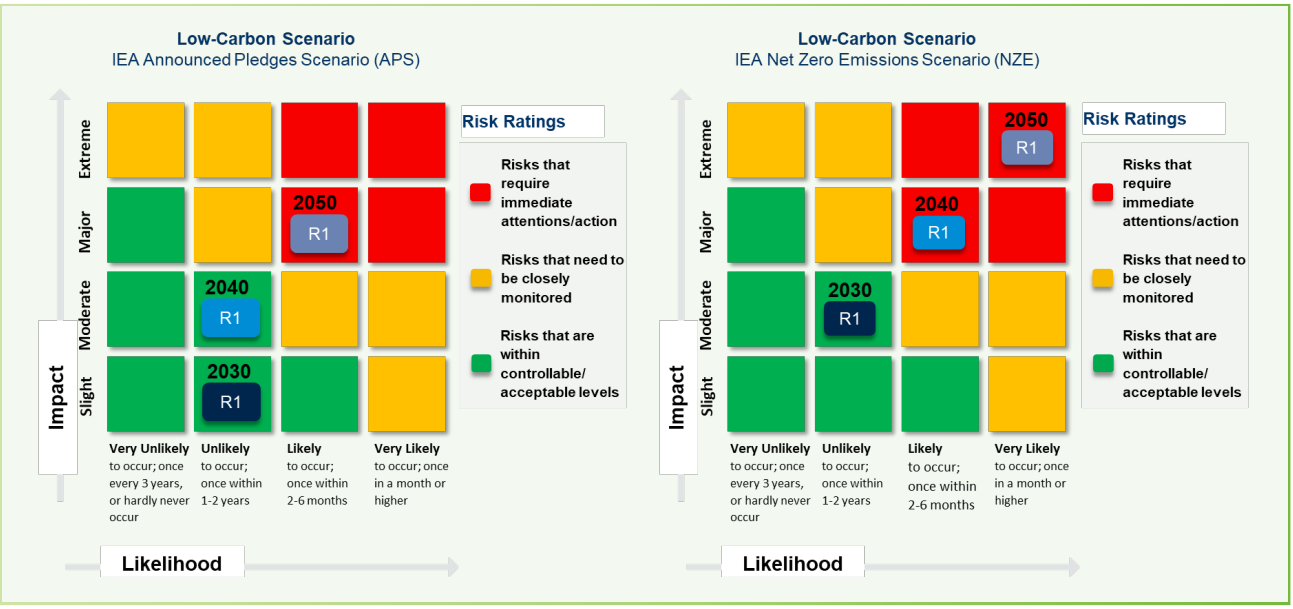
- The risk associated with Extreme Heat is “Low” in the baseline. However, the asset is anticipated to be at “Very High” risk under all scenarios in both timeframes. There is also a higher possibility of heat-related illness on site personnels, particularly outdoor workers leading to health and safety concerns. Reduced working hours or time off may be required if working conditions are unsuitable.
- Wildfire risk is “Low” in the baseline, but the level of risk is projected to increase in all scenarios for both 2030 and 2050 timeframes. Wildfires destroy site infrastructure within its vicinity, including roads and warehouses.. This will result in business interruptions and additional capital expenses to restore the damaged assets.
- Extreme Rainfall Flooding has the highest baseline risk score among all the hazards although with a “Moderate” rating. However, the projected risk remains relatively the same under all scenarios across all timeframes. Similar to wildfires, flooding on the roads may cause road blockage, hence delaying transportation of asphalt and resulting in business interruptions.
- Although water stress shows a high risk, it is unlikely to have a material impact on the asset as the operation is not water dependent.

APPENDIX 2

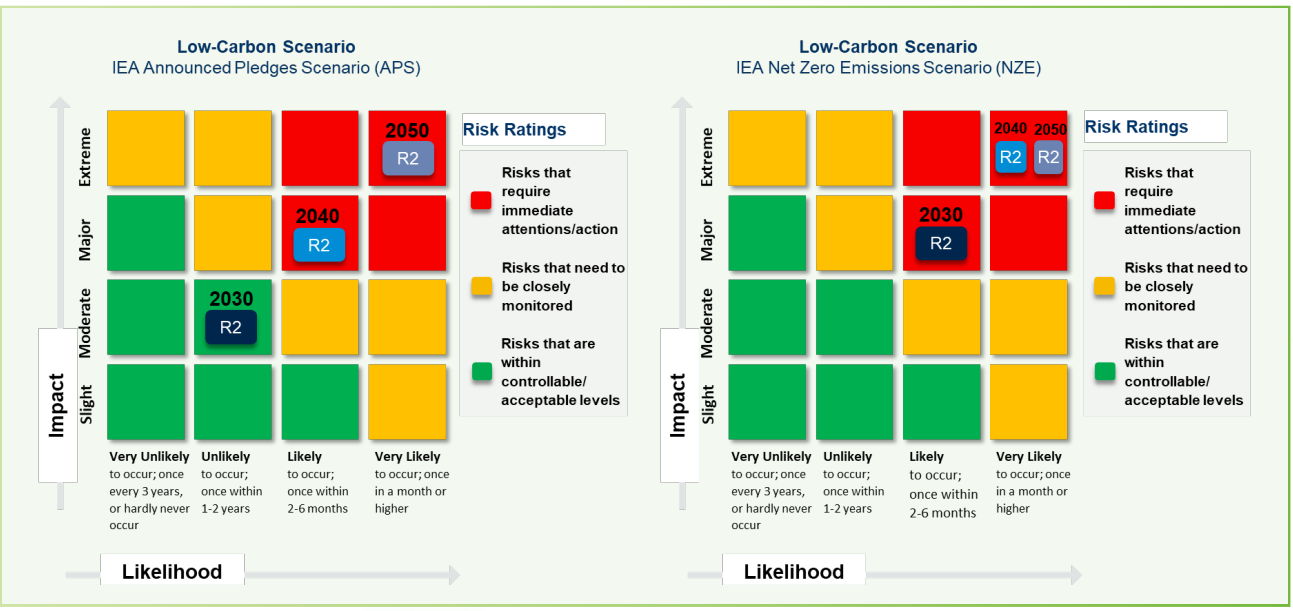
TRANSITION RISK FINDINGS: RISK HEATMAP COMPARING APS AND NZE AGAINST STEPS FOR EACH TRANSITION DRIVER

POLICY & LEGAL

R1: Climate related policies/regulations (Current regulation)



R2: Carbon pricing (Emerging regulation)

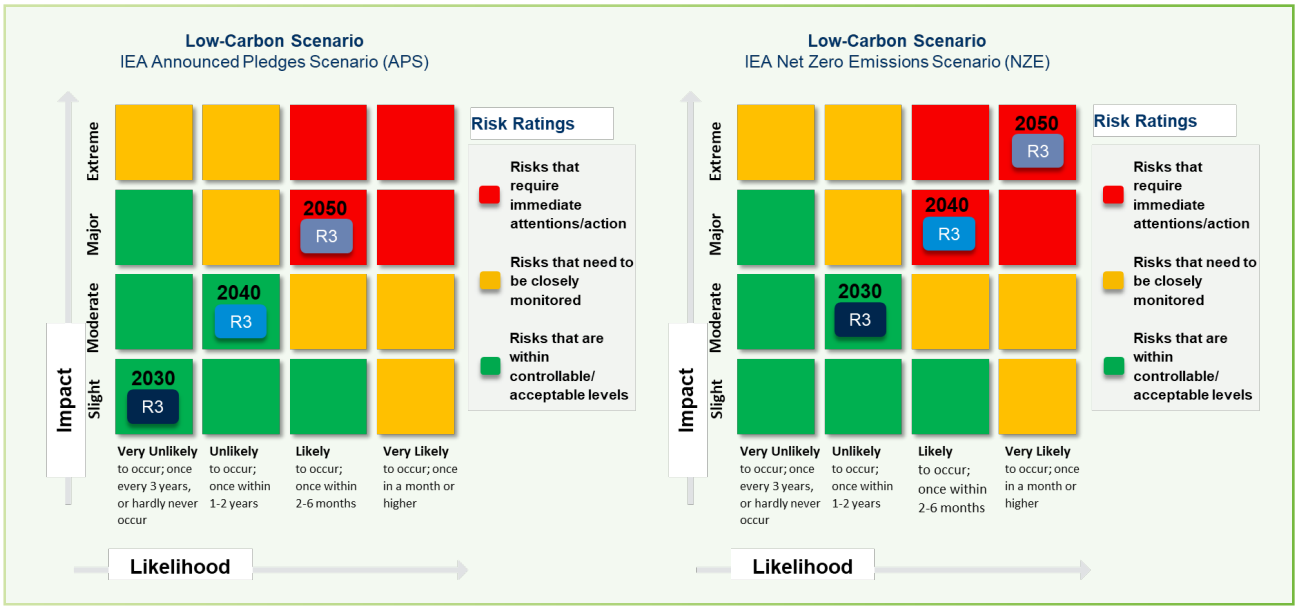


Rationale

- Some key factors may influence the predictability i.e., the clarity and consistency of the government's commitment may be impacted by the stability of the government, policies that establish improper benchmarks or introduce unjustifiable biases, and the uncertainty of supporting related-financial incentives or low-carbon investments.

MARKET

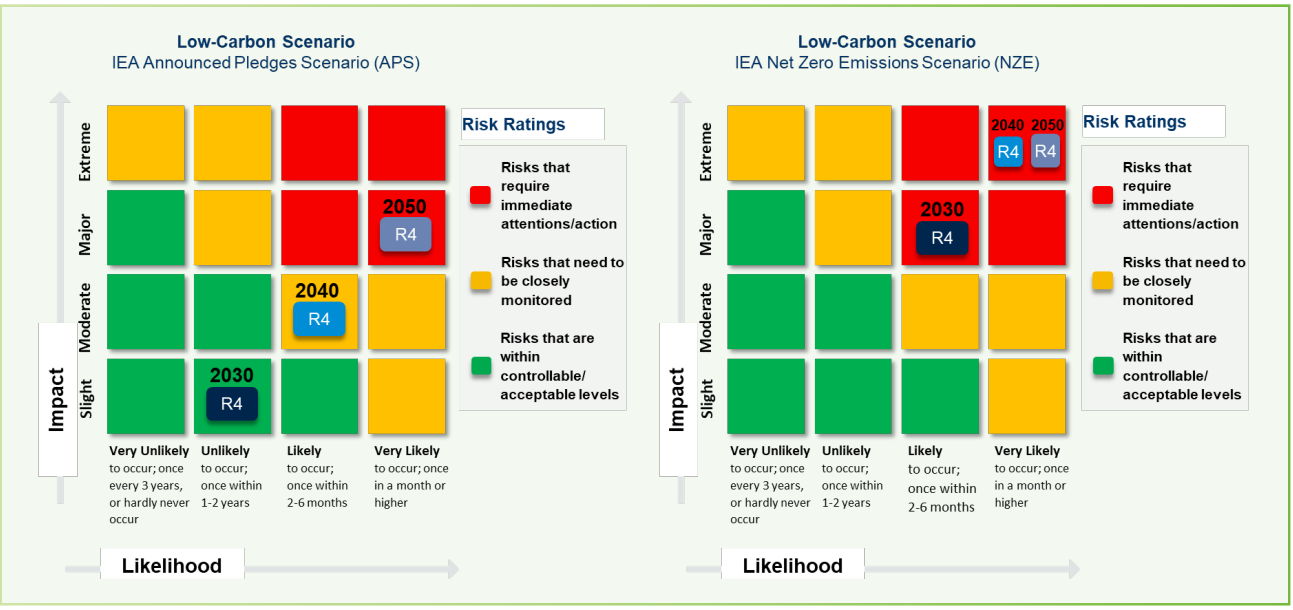
R3: Low-carbon product



Rationale

- Shifts in supply and demand for certain commodities, products and services as climate-related risks and opportunities are considered.
- Customer behavior change preference for energy from renewable sources.

R4: Reduced supply of fossil feedstocks and fuels

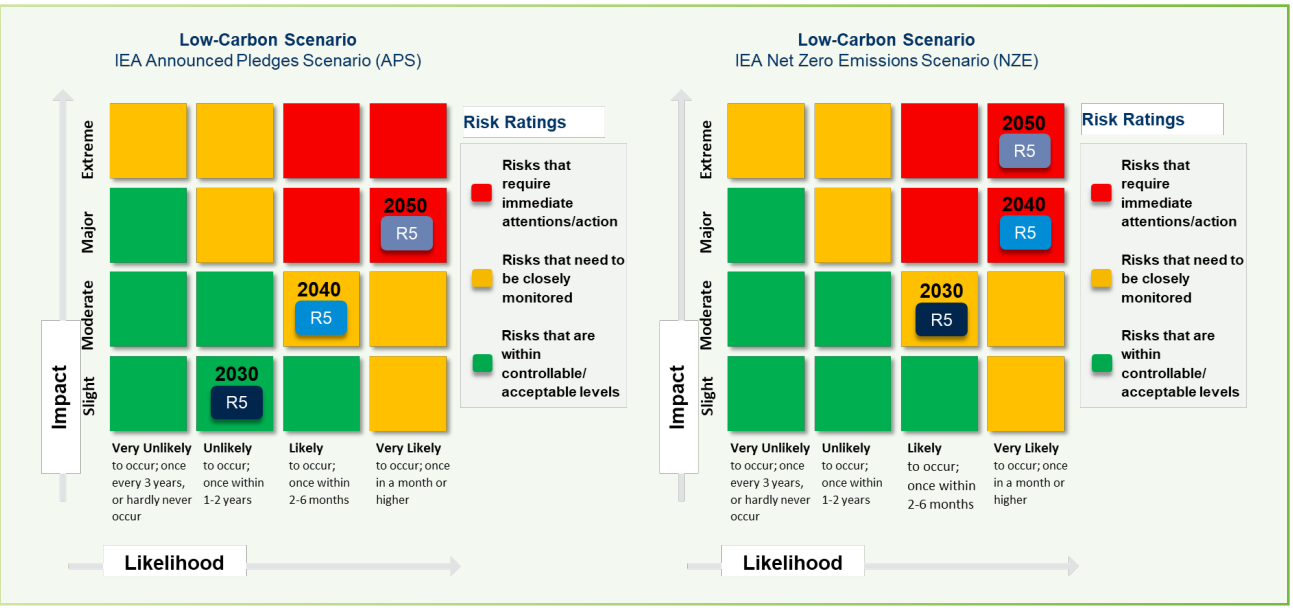


Rationale

- In the transition towards a low-carbon economy, the production and trade of fossil fuels would have to peak and decrease very soon. This may lead to a market shortage and price volatility during the transition period.
- Businesses that strongly rely on fossil fuels may be directly affected by volatile input costs. This can make it challenging for businesses to plan and allocate resources effectively.
- Volatile fossil fuel prices could serve as a reminder of the importance of diversifying energy sources and moving towards sustainable alternatives for raw-materials, such as recycled or biobased materials.

TECHNOLOGY

R5: Decarbonization technologies and low-carbon energy



Rationale

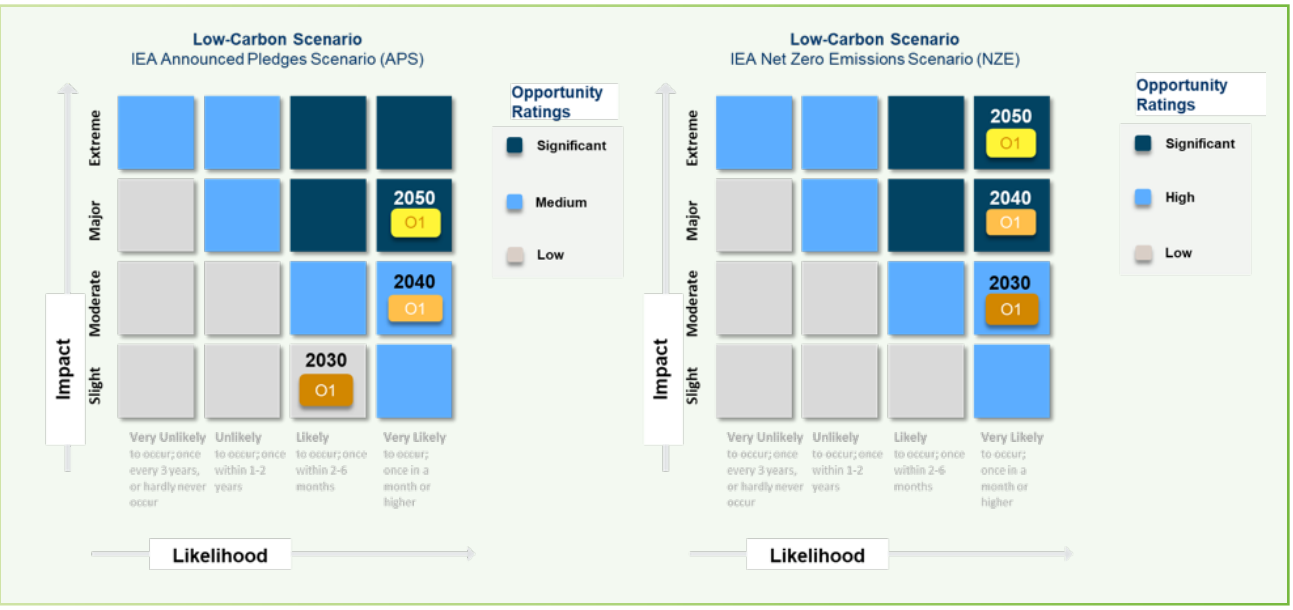
- Renewable electricity, alternative fuels and raw materials, and carbon removal technologies, if applicable, play crucial roles in supporting Tipco Asphalt's climate journey.
- More research and funding are required to fully realize the promise of these technologies and to guar antee the proper deployment and operation of new technologies.
- Some of the technologies require a high capital investment, posing a large pressure on Tipco Asphalt's financial management.
- OpEx may increase to build the technical capacity for the operation and maintenance of new technologies.

R6: Low-carbon shipping and distribution

Rationale

- Shipping is among the most hard-to-abate sectors. The International Maritime Organization (IMO) commits to net-zero GHG emissions from international shipping close to 2050 and an uptake of alternative zero and near-zero GHG fuels by 2030.
- Efficiency improvement of engine systems and fuel switch imply important capital investments to upgrade fleets of third-party service providers. This may result in higher OpEx due to the pass-through effect and higher fees by third-party service providers.
- Low-carbon land transport is relatively more mature than low-carbon shipping in terms of technical applicability and commerciality. However, decarbonizing heavy road freight remains to be highly capital intensive as battery and full cell trucks have not yet reached price parity with ICE vehicles.

O1: Energy efficiency in business operations (Opportunity)

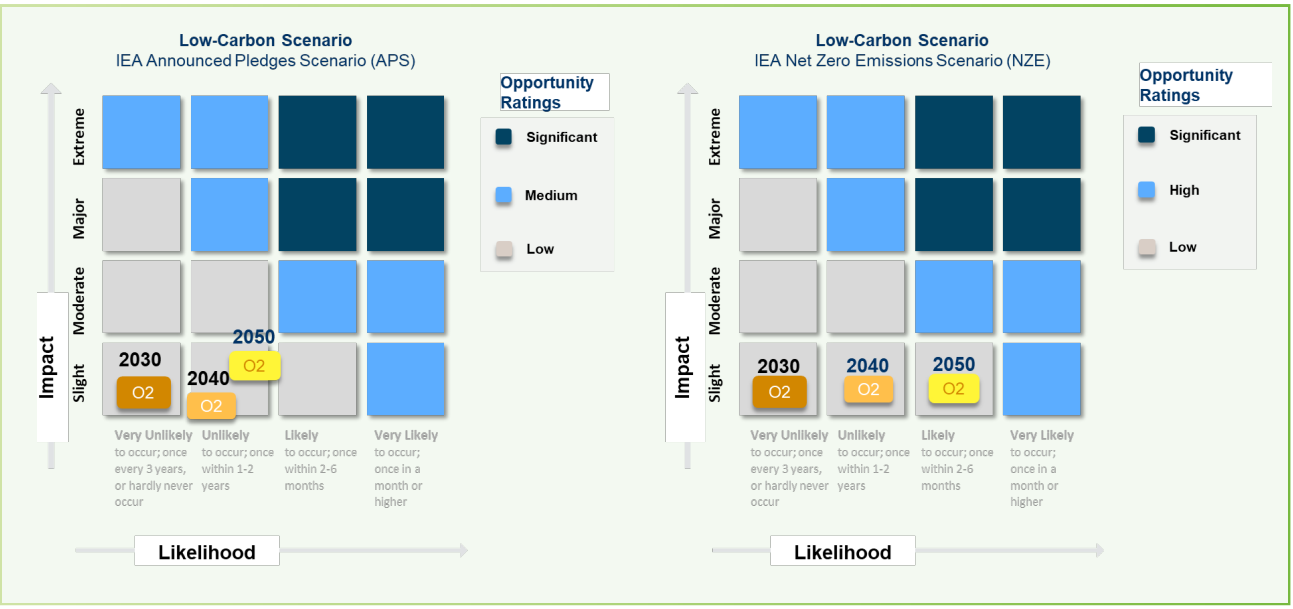


Rationale

- Heavy industries account for over 30% of global total primary energy demand. Improving energy efficiency increases industries' competitiveness, reduces energy bills and helps to mitigate greenhouse gas emissions, according to IEA.
- For example, fossil-fueled burners only operate at 80-85 percent efficiency when new. Meanwhile, an electric hot oil boiler can operates at 100 percent efficiency from day one. Over the lifetime of the equipment, electric heat can become a more cost-effective option even if it requires a higher upfront investment. (source: How to Improve Your Asphalt Plant's Energy Consumption)
- This also aligns with Thailand's upcoming National Energy Plan which places a strong emphasis on enhancing energy efficiency across various sectors.

REPUTATION

O2: Higher access to capital and finance due to climate responsible practices (Opportunity)



Rationale

- Society enthusiastically embraces higher ethical standards, product quality, and environmental responsibility from businesses and the industry sector. Meeting and exceeding these expectations not only enhance the brand and reputation but also leads to improved financial performance and stability.
- Particularly, Thailand Taxonomy was released as a reference tool for economic activities according to environmental objectives, including the 1.5°C goal of the Paris Agreement. The system facilitates investors and other stakeholders' identification of green activities in line with the Paris Agreement goals, while discouraging finance from supporting red activities that are deemed harmful to the goal of reducing GHG emissions.
- Prioritizing climate responsible practices can effectively manage costs, attract socially conscious investors, and access capital markets with ease. This strengthens an ability to generate long-term value, withstand economic challenges, and seize new opportunities for growth and innovation.