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Scenario Planning for Strategic Decision-Making in Captive Power Plant: A Case Study of EBC Company Facing Global Net Zero Emission Challenges Beyond 2031

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ABSTRACT: Greenhouse gas emissions from human activities, especially the combustion of fossil fuels, increased world surface temperatures by 1.1 °C between 2011 and 2020 compared to the 1850–1900 period. In order to limit global temperature rise, and achieve net-zero emissions by mid-century, as outlined in the Paris Agreement—which Indonesia signed in 2016—a substantial decrease in coal usage is imperative. This poses uncertainties for coal-dependent companies like Eastern Borneo Coal (EBC) in Indonesia. This study investigates the business environment uncertainties faced by EBC, particularly regarding its captive coal power plants, and assesses the potential risks associated with various future scenarios using scenario planning method. Findings suggest EBC must prioritize equipment upgrades and compliance measures in stricter regulatory environments, enhance operational efficiency and diversify investments in favourable conditions, implement cost reduction strategies and focus on high-quality coal production in challenging markets, and maintain flexibility and explore export opportunities under looser regulations. Emphasizing the importance of monitoring key indicators, engaging with stakeholders, and investing in sustainable technologies, the study provides strategic insights to help EBC navigate future uncertainties and maintain competitiveness, positioning it as a leader in sustainable energy practices beyond 2031.

KEYWORDS: Climate Change, Captive Power Plant, Coal, Net Zero Emission, Scenario Planning, Uncertainties.

1. INTRODUCTION

Between the years 2011 and 2020, there was a noticeable increase of 1.1°C in the global surface temperature compared to the period between 1850 and 1900. This rise is primarily attributed to human activities, specifically the emission of greenhouse gases [1]. The main driver of climate change is the burning of fossil fuels, specifically oil, gas, and coal, which leads to significant release of carbon dioxide (CO2) into the atmosphere [2]. The single most significant contributor to climate change is coal, which is responsible for approximately forty percent of the world's CO2 emissions that are caused by energy consumption [3].

The Paris Agreement was carried out, to enhance the worldwide effort against the peril posed by climate change. The agreement promotes the development and execution of emission reduction plans by nations, along with the requirement for consistent progress reporting [4]. The main goal of the Paris Agreement is to limit the rise in global temperatures to a level significantly lower than 2°C above the pre-industrial era, with further efforts to restrict it to 1.5°C [5]. The agreement urges countries to achieve net-zero emissions by mid-21st century and to reduce emissions by approximately 50% by 2030 to keep global warming below 1.5°C, taking into account each nation's documented commitments [4].

The Minister of the Environment and Forestry, representing Indonesian President Joko Widodo, signed the Paris Agreement on Climate Change during a High-Level Signing Ceremony for the Paris Agreement at the United Nations Headquarters in New York on April 22, 2016 [6]. Indonesia ratified the Paris Agreement through Law Number 16 of 2016 on the Ratification of the Paris Agreement to the United Nations Framework Convention on Climate Change, enacted on October 25, 2016, as part of the government's efforts to ensure every citizen's right to a quality environment [7]. To accomplish its goal of achieving net zero emissions, Indonesia intends to expedite the process of transitioning to renewable energy sources while simultaneously decreasing its reliance on coal [8].

Indonesia's First Nationally Determined Contribution (NDC) established an unconditional target to reduce emissions by 29% below the business-as-usual scenario by 2030, or up to 41% with international assistance, and in September 2022, Indonesia submitted an Enhanced NDC, raising its emissions reduction targets to 31.89% unconditionally and 43.20% conditionally by 2030

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[9]. In addition, through a Just Energy Transition partnership signed in 2022, Indonesia plans to retire coal fired power plants early, increase renewable energy capacity to one-third of total electricity capacity by 2030 [10].

Although Indonesian government, with its Presidential Regulation No. 112 of 2022, bans new coal-fired power plants in Indonesia, but still has exceptions for those in PLN's (the state-owned monopoly of Indonesia's power sector) 2021-2030 Business Plan and National Strategic Projects [11]. In 2021, Indonesia ranked 9th globally in CO2 emissions from the electrical sector at 193 million tons, making it a significant contributor to global carbon emissions, and with its expanding economy and energy demand leading to increased reliance on coal-fired power plants, it saw a 33% rise in coal consumption and a 20% increase in fossil fuel emissions in 2022 compared to the previous year [12]. According to a recent analysis by the Global Energy Monitor (GEM) and the Centre for Research on Energy and Clean Air (CREA), Indonesia has seen a surge in the use of captive coal power, with almost eight times as much capacity operating in 2023 as there was in 2013 [13]. Captive power plants are independent power plants owned by companies, primarily in industrial estates, to meet their own electricity needs [14]. The issues faced by captive coal plants in Indonesia are mostly related to the country's national economic strategies, insufficient electricity networks, and the absence of affordable and dependable low-carbon alternatives for captive coal power plants [15]. These contradictions between commitments and facts have created uncertainties for the future of captive coal power plant in Indonesia.

Eastern Borneo Coal (EBC) is one of the companies confronting these uncertainties. Based on its official website, EBC produces on average of more than 50 million tons of coal per year and is sold domestically and abroad. To support such massive production, EBC operates a lot of coal processing, transportation, and shipping machines. All those machines are powered by EBC's captive power plant, which use coal as its fuel source. EBC operates its own coal fired power plant to ensure continuous production without any interruptions caused by electricity supply. Nevertheless, the Indonesian Government's commitment to attaining Net Zero Emission, as articulated in international forums, raises concerns about the future sustainability of coal power stations in Indonesia, particularly in EBC.

The study aims to identify factors contributing to business environment uncertainty, analyze critical uncertainties affecting the future operation of EBC's captive power plants, and assess the potential risks associated with various scenarios. Additionally, the study seeks to develop recommended strategies for EBC to manage uncertainty and create a framework for monitoring and interpreting signals that could alert EBC to the emergence of each scenario, thereby enhancing strategic preparedness and decision-making capabilities.

This study comprises several key sections, each addressing crucial aspects of the study. The literature review section explores the concept of uncertainty, its impact on corporate strategies, and the significance of scenario planning in addressing these uncertainties. Research method section details the rationale for using scenario planning, describing the process and steps involved, from identifying focal issues to developing scenario frameworks. Then, section of result and discussion presents the findings of the scenario planning exercise, outlining four potential future scenarios for EBC, their implications, and strategic recommendations for each including early warning signals to help EBC anticipate and adapt to emerging conditions. Finally, the conclusion summarizes the study's key insights, emphasizing the importance of scenario planning, continuous monitoring, and investment in sustainable technologies for EBC to maintain competitiveness and operational sustainability in the evolving energy landscape.

2. LITERATURE REVIEW

Uncertainty is the state of not having sufficient knowledge about the probabilities associated with future events [16]. Uncertainty can also be defined as unknowability, novelty, non-optimizable, and doubt [17]. As an illustration of the first definition of uncertainty, consider the situation of energy businesses that are confronted with the unpredictability of future oil prices. During the period when the price of oil was falling in 2014 and 2015, energy companies had a difficult time assigning specific probabilities to the various scenarios, which influenced investment decisions and the distribution of resources [18].

Uncertainty in the business environment can have a range of causes, which can have an effect on decision-making and strategic planning. External factor heavily affects industrial enterprise sustainability, especially in financial-economic. These factors are noticed from policy uncertainty, global crises, and stock market volatility [19]. During the recession period, the effect of these factors can be intensified, which will rather cause a slowing pace of growth in productivity. It will be especially serious in sectors where dependence on outside financing is high [20]. The level of unpredictability in economic policies, which includes the

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environment and trade policies, tends to affect managerial decisions regarding several activities such as equipment investment, overseas operation, among others [21].

The impact of climate change on corporate strategies, financialization, and investment decisions generates substantial uncertainty in the business environment [22]. The existing uncertainty worsens by climate control regulation, which consequently necessitates the implementation of comprehensive planning methodologies [23]. Companies' reactions to climate change are impacted by the relationship between business uncertainty and organizational capacities. When companies feel unsure, they are less likely to implement carbon management practices [24].

In developing countries such as Indonesia, the issue of net zero emissions has generated considerable uncertainty for coal mining companies. The country's commitment to achieve net-zero coal emissions by 2060 [25] and the difficulties associated with a fair transition away from coal [26] have prompted questions regarding the prospective utilization of coal. Further worsening this uncertainty are the potential transition pathways and the significance of coal in Indonesia's energy sector [27]. The situation is further compounded by the political unpredictability surrounding global greenhouse gas mitigation policy and the consequences of expected regulatory repeals and reinstatements [28]. Including captive power plants managed by coal mining companies are similarly impacted by the strive to achieve net-zero emissions. The necessity for a shift towards environmentally friendly energy sources, including nuclear power and renewable energy, stems from the imperative to attain net-zero emissions [25]. Nevertheless, this transition is made difficult by political and economic obstacles in these countries, such as the coal industry's influence and the enormous expenses associated with renewable energy [29].

3. RESEARCH METHOD

In addressing the significant uncertainties faced by Eastern Borneo Coal (EBC) in the context of global net-zero emission targets, it is crucial to adopt a methodological approach that can accommodate a wide range of potential future conditions. Traditional forecasting methods often fall short in environments characterized by high levels of uncertainty and complexity. Therefore, this study employs the scenario planning method, a robust strategic tool well-suited for exploring multiple plausible futures and developing resilient strategies. Scenario planning allows for a comprehensive analysis of diverse external factors and their potential impacts, making it an ideal choice for EBC to navigate the multifaceted challenges posed by regulatory changes, market dynamics, and technological advancements in the energy sector. By integrating various information and perspectives, scenario planning enhances strategic preparedness and decision-making, providing EBC with the insights needed to ensure operational sustainability and alignment with Indonesia's net-zero emission goals beyond 2031.

Scenario planning has an important role in improving strategic thinking and decision-making within businesses. Scenario planning provides a strong alternative to traditional forecasting techniques since it generates a variety of plausible futures, whereas traditional forecasting approaches frequently fail to uncertainty and complexity [30]. Given its capacity to explicitly integrate uncertainties, scenario planning is a valuable approach for addressing future uncertainty [31]. By integrating various information and viewpoints, scenario planning can result in more resilient decision-making [32].

Royal Dutch Shell has been one of companies in effectively implementing scenario planning into strengthening its strategic management from as early as the early 1970s. In this case, the method incorporates the development of several credible future scenarios to project for and prepare for any fluctuations in the business environment. Initially, it was the scenario preparing from Shell only partially integrated to the routine planning processes, which caused its use to turn out more episodic and less effective. By the early 1980s, however, Shell had re-energized its interest, giving scenario planning more verve and formality among its managers [33].

In 2003, scenario planning was utilized by Peter Schwartz and Doug Randall in national scale to evaluate the possible effects of climate change on energy, food, water, and national security in the United States. Schwartz and Randall proposed an extreme climate change scenario with a sharp drop in average temperatures and persistent drought in key agricultural regions. This scenario was based on abrupt climate events like 8,200 years ago [34].

As shown in the figure below, scenario planning would be appropriate and applicable in systems characterized by high uncertainty and uncontrollable. In other cases, optimal control, hedging, or adaptive management may be appropriate responses. [32].

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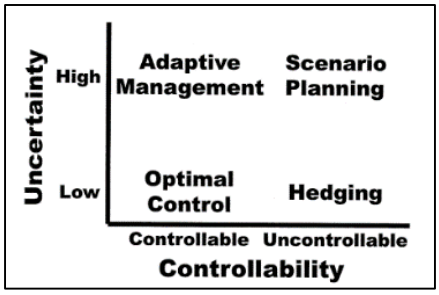

Figure 2.1. Method selection based on uncertainty and controllability [32].

Scenario planning has several steps in its process. Based on the book of Peter Schartz the Art of the Long View, he describes these in eight steps which are identify focal issue or decision, key forces in the local environment, driving forces, rank by importance and uncertainty, selecting scenario logics, fleshing out the scenarios, implications, and selection of leading indicators and signposts [35].

Scenario planning has eight components and five stages [36]. The eight key components, each contributing to a comprehensive analysis of potential futures to guide strategic decision-making. The first component is Key Focal Issue. This is the central question or decision that the scenario planning exercise aims to address. It should have significant long-term implications for the organization. For instance, a retail company might define its focal issue as "Should we expand our operations into emerging markets over the next five years?". The second component is Driving Forces which are the major external factors that could influence the focal issue. They include social, economic, political, and technological trends. For a retail company, driving forces might include changes in consumer behaviour, economic conditions in target markets, political stability, and advancements in e-commerce technology. Among the driving forces, some are more uncertain and impactful than others. These are identified as critical uncertainties, the third component. For the retail expansion scenario, critical uncertainties could include the stability of political environments in emerging markets and the rate of economic growth in those regions. Next component is Scenario Framework, this involves creating a framework by combining the most significant critical uncertainties into a matrix, often a 2x2 grid, to explore different future scenarios. For example, one axis might represent political stability (ranging from stable to unstable), and the other might represent economic growth (ranging from low to high).

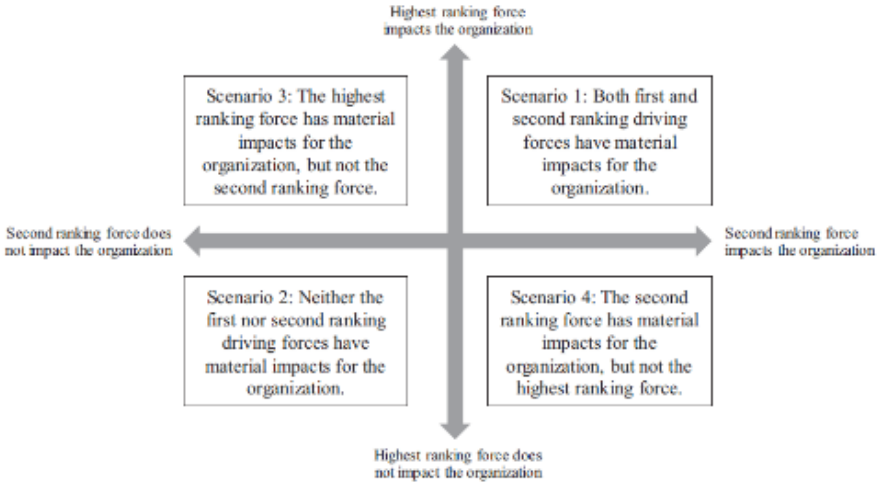

Figure 3.1. Scenario Framework [37].

The fifth component is scenario. Scenario detailed narratives describing possible future environments based on the scenario framework. They help in visualizing how different combinations of uncertainties might unfold. For instance, one scenario might describe a future with high economic growth and political stability, leading to a booming retail market. The next component is

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narrative. Each scenario is fleshed out into a coherent story that explains how the world might move from the present to the future state described in the scenario. This storytelling makes the scenarios vivid and easier to understand. For example, a narrative might describe how stable political policies and economic reforms attract foreign investments, boosting the retail sector. The seventh is implication and option. Once scenarios with its narratives are developed, their implications for the organization are analysed. This step involves identifying potential strategies, actions, and decisions that could be taken in response to each scenario. For example, if one scenario indicates a future where economic growth is high but political instability is a risk, the company might explore options for flexible supply chain management and contingency plans for political disruptions. The last is Early Warning Signals. These are indicators that suggest which scenario might be emerging. They help in monitoring the environment and making adjustments to strategies as needed. For example, an early warning signal for political instability could be changes in government policies or signs of civil unrest.

Scenario planning involves a structured process encompassing five key stages, each essential for effectively navigating future uncertainties. The first stage, orientation, focuses on understanding the key focal issue or decision that the scenario planning exercise will address. This involves conducting background research and interviews to define the scope and timeframe of the issue. For instance, a company might explore whether to expand into emerging markets over the next five years, requiring a deep dive into relevant market conditions, competitive landscapes, and internal capabilities. Then in the second stage, exploration, the study identifies and analyses the driving forces and critical uncertainties that could impact the focal issue. This stage involves extensive research and workshop sessions to uncover social, economic, political, and technological trends that may influence future outcomes. By identifying these driving forces and uncertainties, the study can better understand the factors that could shape the organization's future environment.

The third stage, Scenario Creation, involves constructing a framework for the scenarios by combining the most significant critical uncertainties into a matrix. Typically, this matrix takes the form of a 2x2 grid, where each axis represents a different critical uncertainty. The study then develops detailed narratives for each scenario, describing how different combinations of uncertainties might unfold. These narratives provide a vivid picture of possible future environments, helping the organization visualize potential challenges and opportunities. Next is the Options Consideration stage, the study analyses the implications of each scenario for the organization and identifies strategic options and actions. This involves brainstorming potential responses and evaluating their robustness across different scenarios. For example, the team might consider flexible supply chain strategies or contingency plans for political instability in emerging markets. This stage ensures that the organization is prepared to adapt to a range of possible futures.

The final stage, Integration, involves incorporating the scenarios and strategic options into the organization's current management processes. This includes developing early warning signals to monitor which scenario might be emerging and using the scenarios to guide ongoing strategic decisions. By integrating scenario planning into regular management activities, the organization can stay agile and responsive to changing conditions, ensuring that strategic decisions are informed by a comprehensive understanding of potential future environments.

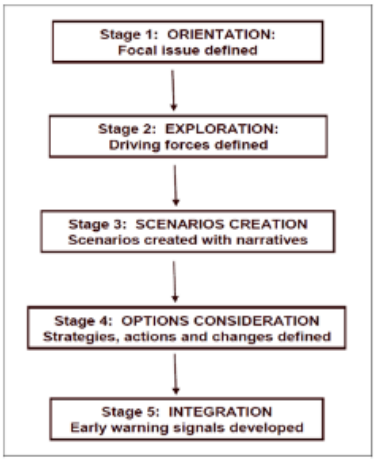

Figure 3.2. Scenario planning method [36].

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4. RESULT AND DISCUSSION

This section presents the result of future strategy development for the captive power plant of PT EBC after 2031 using Scenario Planning method in facing Net Zero Emission challenges. Based on Garvin and Levesque, the Scenario Planning method has five stages [36]. The method began by examining the key focal concerns surrounding Net Zero Emission in the orientation stage, taking into account both current obstacles and future challenges. This was followed by discusses on the driving forces leading to these issues in stage exploration, the creation of multiple scenarios in the stage of scenario creation, and finding the implications and options associated with each scenario in consideration stage, then finally, integration stage which presenting early warning signal.

A. Orientation

The first stage is orientation. During the orientation stage, observation in this study was based on primary and secondary data in order to have a better understanding of the difficulties that may be encountered in the operation of captive power plants in the future. One of the big challenges for EBC is the Indonesia Net Zero Emission (NZE) Roadmap for the energy sector which introduced by the Ministry of Energy and Mineral Resources in September 2022, outlines goals to phase out coal-fired power by 2030 and attain an 87% renewable energy mix by 2060 [38]. Through the use of the Scenario Planning approach, this study made the discovery of a "key focal issue," which is a question that guides the path that research will go. The issue being asked is "How will PT EBC's captive power plant ensure operational sustainability and strategic alignment with Indonesian Net Zero Emission (NZE) targets beyond 2031?".

B. Exploration

In the exploration stage, this study identified and analysed the driving forces and critical uncertainties that could impact the focal issue which has been identified in the previous stage. Identification of driving forces began with collecting data from interview record of EBC's management and literature such as official report from the previous study related with scenario planning in energy sector. The collected data is codified and the categorized using PESTEL Analysis. PESTEL analysis is a method used to examine external factors that can impact the effectiveness of an organization or project [39]. From the analysis 21 driving forces were identified as shown in the table.

Table 4.1. Driving forces from PESTEL Analysis.

PESTEL Category	Driving Forces
Political	Geopolitical Dynamics
	Political Dynamics in Indonesia
Economic	Coal Price Trends
	Global/International Coal Demand
	Indonesia's Coal Reserves
	Indonesia's GDP Growth
	Green Financing Challenges
	Local/Indonesian Coal Demand
Social	Qualified Workforce
	Electricity Demand Trend
	Community and Customer Aspirations
	Distribution and Access to Energy for Communities
Technological	Advancement in Energy Storage Technology
	Carbon Capture, Utilization, and Storage Technology
	Coal Down streaming Technology

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Environmental	Climate Change Trends
	Pollution Trends in Indonesia
	Renewable Energy Usage Trends in Indonesia
Legal	Carbon Tax & Carbon Credit Regulations
	Coal Sales Royalty Regulations
	Regulations on the Ban of Coal-Fired Power Plants

In politic, geopolitical shifts can disrupt the energy transition, as they can transform socio-economic models, trade patterns, and global power dynamics. The transition to net zero emissions could destabilize countries that heavily rely on income from fossil fuels. International cooperation is needed to manage risks arising from the energy transition [40]. In the economy, 2021 and 2022 price hikes allowed Indonesian coal companies to invest in cleaner technologies, increase profitability for environmental compliance, and boost efficiency [41]. The process of reaching net-zero emissions has started, and it is already abundantly clear that the path to get there will be challenging. The development of a net-zero workforce that is tailored to the vision and scope of the net-zero portfolio must begin immediately if the goal of minimising the increase in global temperature to 1.5 degrees Celsius by the year 2050 is to be achieved [42]. In order to work towards achieving net-zero goals, in technology sector, it is also likely that CCUS will be required to play a part. Nevertheless, it is of the utmost importance to make certain that CCUS does not continue to rely on fossil fuels and does not contribute to the local harms that are associated with the continued operation of factory or power plants [43]. In the environmental perspective, Indonesia has potential to develop renewable energy, located at the equator, has the highest solar potential of all renewable sources with an average generation potential of 4.8-5.1 kWh/m²/day (112,000 GWp/day), making solar energy the lowest cost and most flexible option for the country [15]. In legal aspect, the regulations on the ban of coal-fired power plants can significantly impact the operations of captive power plants, influencing their strategies towards achieving net zero emissions [44].

From the listed of driving forces, internal stakeholders of EBC management were asked to rate each force based the impact and the uncertainty level to the company. Score one to five is utilized to rate the driving forces in order to find the most critical uncertainties. The most critical uncertainties are taken from combination of the most impactful and the most uncertain driving forces. If the impact level 5 means the driving forces is very impactful to the company while level 1 is the least. For the uncertainty level, 5 means the driving force is the most unpredicted or uncertain, while 1 means it can be easily be predicted.

Table 4.2. Finding critical uncertainties from driving forces.

Rank	Driving Forces	Impact	Uncertainty	Total (Impact x Uncertainty)
1	Carbon Regulations.	75	60	4500
2	Coal Price Trends.	69	65	4485
3	Global/International Coal Demand.	70	63	4410
4	Regulations on the Ban of Coal-Fired Power Plants for Captive Power Plants.	73	60	4380
5	Coal Sales Royalty Regulations.	72	60	4320
6	Geopolitical Dynamics.	64	66	4224
7	Coal Down-Streaming Technology.	67	63	4221
8	Political Dynamics in Indonesia.	65	63	4095
9	Local/Indonesian Coal Demand.	71	56	3976
10	Carbon Capture, Utilization, and Storage Technology.	66	55	3630
11	Climate Change Trends.	65	51	3315
12	Green Financing Challenge	65	51	3315

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13	Advancement in Energy Storage Technology.	61	52	3172
14	Indonesia's Coal Reserves.	70	44	3080
15	Indonesia's GDP Growth.	66	46	3036
16	Renewable Energy Usage Trends in Indonesia.	64	47	3008
17	Pollution Trends in Indonesia.	62	44	2728
18	Community and Customer Aspirations.	57	47	2679
19	Electricity Demand Trend	61	43	2623
20	Distribution and Access to Energy for Communities or Customers.	55	47	2585
21	Qualified Workforce.	78	33	2574

C. Creation

After finding the top two driving forces which are considered as the most critical uncertainties. Both forces are described into matrix 2 x 2. This matrix will show each extreme condition for both driving forces. By having this matrix, this study finds four scenarios. In this research, each scenario will be given a name. The names have themes that evoke clear images and emotional responses, it becomes easier for stakeholders to grasp the underlying dynamics and prepare for each possibility.

Scenario 1 encapsulates the dual nature of circumstances, often referred to metaphorically as "The Double-Edged Sword." After 2031 and the mining permit extension, EBC enjoys high coal prices, boosting revenue and enabling significant investments in cleaner technologies. However, strict Net Zero Emission regulations create challenges, requiring EBC to balance profit with sustainability efforts. Indonesian coal companies capitalized on price hikes, achieving substantial profits in 2021 and Q1 2022, amassing a US$6.8 billion cash balance to invest in cleaner technologies, enhance profitability for environmental compliance, and drive efficiency improvements [41]. The metaphor underscores the complexity where advantageous developments are countered by challenging obligations. This dual impact necessitates strategic manoeuvring by EBC, balancing economic benefits with the imperative of sustainability mandates.

In Scenario 2, "Silver Lining," despite extended mining permit and continued low coal prices after 2031, EBC finds opportunities amidst challenges due to relaxed regulatory conditions. This "Silver Lining" scenario enables EBC to explore new ventures and maintain operational stability despite reduced revenue from coal sales. The flexible regulatory environment helps EBC adapt and leverage new growth opportunities in the coal mining sector.

In Scenario 3, termed "Perfect Storm," EBC confronts a challenging situation characterized by low coal prices diminishing revenue alongside stringent regulations escalating operational costs and complexities. This scenario exemplifies a convergence of adverse factors that severely impact EBC's operations and profitability, illustrating the compounded difficulties faced during this period of significant challenge in the coal mining industry. This idiom describes an event where a rare combination of circumstances aggravates a situation drastically. It indicates a convergence of multiple negative factors leading to a dire outcome.

In Scenario 4, named "Golden Era," EBC enjoys unparalleled prosperity due to high coal prices and lenient regulatory conditions, leading to maximized profits without the burden of strict compliance measures. The value of coal mining firms is greatly influenced by financial performance, which is measured by profitability and solvency [45]. This ideal scenario reflects a period of thriving business operations, symbolizing peak success and minimal constraints for EBC in the coal mining industry.

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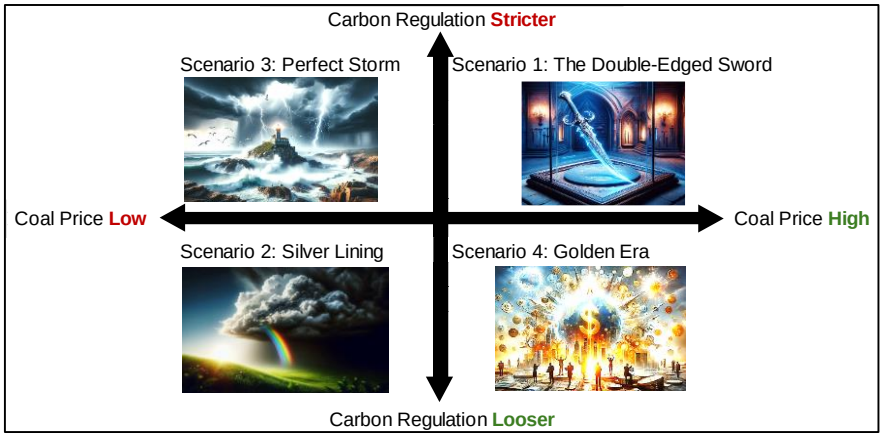

Figure 4.1. Four most critical scenarios.

D. Consideration

During this stage, after identifying 4 scenarios which are the most critical scenario for EBC, this study observed the primary and secondary data to see the implications that might happen to the company in each scenario. The "Double-Edged Sword" scenario implies EBC in several ways. First implication is regulatory pressure. Stricter regulations will increase operational costs to comply with carbon emission limits. For instance, the report "Pathways to 2050: Alternative Scenarios for Decarbonizing the U.S. Economy" mentions that companies are required to reduce greenhouse gas emissions by 80% from 2005 levels by 2050 [46]. Next implication is technological advancements. Investment in emission control technology will be necessary to meet regulatory standards. To achieve net-zero CO2 emissions by 2070, as outlined in the Sustainable Development Scenario, the energy sector must advance significantly in technology, focusing on energy efficiency and renewable, along with other necessary technologies [47]. The third is financial implications. Short-term costs will rise due to compliance and technology investments, but there could be long-term benefits in sustainability. The report "Managing financed emissions: How banks can support the net-zero transition" mentions that banks need to commit to transitioning the emissions from their investment and loan portfolios to align with the net-zero pathway [48]. The next implication is operational changes. EBC needs to monitor and manage flue gas emissions more rigorously. For instance, the recovery and utilization of waste heat from exhaust gases can provide technical, socio-economic, and environmental benefits [49]. Another implication is investment shifts, as attracting investors will be challenging without a clear transition plan where net zero emission requires transformational changes and significant investments [50].

The "Silver Lining" scenario presents a unique set of challenges and opportunities for EBC in the face of low coal prices and relaxed regulations, amidst the global transition towards Net Zero Emissions. The first implication of this scenario is operational changes. The relaxation of regulations could provide EBC with greater operational flexibility. This could allow for strategic adjustments in response to market conditions and regulatory changes. This flexibility could be crucial in maintaining operational efficiency and competitiveness. Next is financial implications which include the potential negative impact of low coal prices on revenue, which could be partially offset by reduced regulatory costs, thereby providing some financial relief amidst the challenges posed by low coal prices. Investment shift challenge also becomes an implication of this scenario. Demonstrating adaptability and resilience in the face of these challenges could potentially attract investments. Investors are increasingly looking for companies that can navigate the transition towards Net Zero Emissions effectively. The fourth implication is technological advancements. The relaxed regulatory environment could provide an opportunity for EBC to gradually invest in cleaner technologies. This could be done without the immediate pressure of regulatory compliance. The last implication of this scenario is reputation and social license. Adapting and innovating in response to market conditions could lead to a positive public perception. This could enhance EBC's reputation and social license to operate. For example, the idea that a mining company must engage with local communities to obtain a social license to operate (SLO) has become a key concept in the discourse on responsible resource extraction in recent years [51].

The "Perfect Storm" scenario refers to a challenging situation where low coal prices reduce revenue, and stricter regulations further strain the financial and operational capabilities of EBC post-2031, amidst the global transition towards Net Zero Emissions. The first implication is significant high regulatory pressure. Increased regulatory pressure could lead to higher costs and operational

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challenges for EBC. In extreme cases, it could even result in the closure of operations at EBC's captive power plant. This could disrupt the supply chain and affect the overall productivity of EBC. Moreover, the need to comply with these regulations could divert resources from other critical areas of the business. Market dynamics goes to lower demand. The low demand for coal could exacerbate the decline in revenue for EBC. This could affect the company's ability to invest in new technologies or infrastructure. Furthermore, the low demand could also impact the company's market share and competitive positioning. Requirement of technological advancements also become the next implication. There is an urgent need for EBC to invest in cleaner technologies to comply with regulations, despite the financial strain. This could require a significant upfront investment, which could strain the company's finances. However, these investments could also lead to long-term cost savings and operational efficiencies. The fourth implication is related to financial implications. EBC could face severe financial stress due to low revenue and high compliance costs, risking operational sustainability. This could affect the company's ability to invest in new projects or technologies. Moreover, it could also impact the company's credit rating, making it more difficult to secure financing for future projects. The fifth implication which is identified in this study is reputation and social license. EBC could potentially face reputational damage if it fails to meet environmental standards. This could affect the company's relationships with stakeholders, including customers, investors, and regulators. Moreover, it could also impact the company's social license to operate, which is increasingly important in today's business environment.

The "Golden Era" scenario refers to a situation where both high coal prices and looser regulations create an optimal environment for revenue growth and operational ease for EBC post-2031, amidst the global transition towards Net Zero Emissions. This scenario has some positive implications. The first is favourable market conditions which could lead to increased profitability for EBC. High coal prices could boost revenue, while the demand for coal remains strong, particularly in emerging markets. This could result in a significant increase in EBC's profitability. The increased profitability could be used to invest in new projects, technologies, or infrastructure, further enhancing EBC's market position. Additionally, the strong demand for coal could also provide an opportunity for EBC to expand its market share and reach. Reduced regulatory pressure will imply to smoother operations and less compliance-related expenditure for EBC. This could enhance operational efficiency and reduce costs, thereby improving the company's bottom line. The improved operational efficiency could lead to higher productivity and better utilization of resources. Moreover, the reduced compliance-related expenditure could free up resources that could be invested in other areas of the business, such as research and development or employee training. The next positive implication is financial stability. High revenue with minimal regulatory costs could enhance EBC's financial health. This could strengthen the company's financial position and provide a buffer against potential future challenges. The strong financial position could also enhance EBC's creditworthiness, making it easier for the company to secure financing for future projects. Furthermore, the financial buffer could also provide EBC with the flexibility to navigate any potential market downturns or regulatory changes. The fifth implication is having bigger investment opportunities. The favourable market conditions could make it easier for EBC to attract investments. Investors are likely to be attracted to the strong financial performance and the potential for high returns. The ability to attract investments could provide EBC with the necessary capital to invest in new projects or technologies.

After implications are identified, this study collected the information from internal stakeholder of the company through interview, questionnaire, and secondary data to find the suitable recommendation for each scenario and its implication.

In "Double-Edged Sword" scenario, EBC faces increased regulatory pressure, necessitating significant investments in technology and operations to achieve net-zero emissions, alongside financial strain from these investments. First recommendation is upgrade installation of emission control systems. Based on the discussion with internal EBC management, they believe that investment in upgrading emission control systems and carbon capture storage technologies will be able to ensure compliance with stricter regulations. Investing in emission control systems like flue gas desulfurization (FGD), which reduce sulphur dioxide emissions and include CO2 removal strategies such as pre-combustion, oxyfuel, and post-combustion approaches, has proven beneficial for improving air quality, as demonstrated by successful installations in China and the USA [52]. Second is develop renewable energy projects. It can be started by integrating renewable energy sources such as wind, hydro, and solar power to diversify energy supply and reduce carbon emissions. The integration of renewable energy sources like wind, hydro, and solar has proven successful in decreasing emissions, with examples such as Rio Tinto in Australia and Gold Fields in South Africa effectively using solar energy to reduce their carbon emissions [52]. Next recommendation is operational efficiency program. This program implements an operational efficiency activity that includes waste heat recovery, energy efficiency improvements, and better waste

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management to minimize environmental impact and enhance sustainability. Implementing waste heat recovery and energy efficiency improvements have shown to enhance sustainability and reduce costs in industrial sectors[53]. The fourth recommendation is evaluation program for regular maintenance and equipment upgradation. Based on the answer from the questionnaire, respondents believe that evaluating the regular maintenance and having timely upgradation of equipment can prevent inefficiencies and maintain compliance with environmental standards. Regular maintenance and timely equipment upgrades can prevent inefficiencies and ensure compliance with environmental standards, leading to improved operational efficiency [52]. The other recommendation is adoption of renewable energy in mining operations. Incorporate renewable energy technologies within mining operations to reduce overall carbon footprint. Using renewable energy technologies within mining operations has been successfully implemented to reduce the overall carbon footprint [54]. The sixth recommendation is exploring green financing options and evaluate the implementation of the existing cost management strategies. In 2021, Indonesia issued a sustainability bond to support the Sidrap Wind Farm project in South Sulawesi, which will install 30 wind turbines by 2028, generating enough renewable energy to power over 70,000 homes [55].

"Silver Lining" scenario involves low coal prices and relaxed regulations, providing operational flexibility but posing financial challenges due to reduced revenue. With all the implications that might impact EBC, this study found some recommendation option to cope with the situation. First is developing flexible operational strategy. Develop a flexible operational strategy that allows EBC to adjust production levels and resource allocation in response to market fluctuations. This strategy should include scenario planning and risk management frameworks. A notable example of a mining company implementing a flexible operational strategy is Freeport-McMoRan which achieved a sustainable annual profit increase of $10 to $20 million by leveraging advanced analytics and neural-network models to integrate data from various sources, enhancing yield and operational efficiency in its Americas copper operations without substantial capital outlays [56]. Second is cost optimization program. Implementing a cost optimization program aimed at reducing operational costs through process improvements, energy efficiency measures, and the adoption of lean management principles. A success story of this recommendation comes from the global mining company Centamin, which maintained its production guidance through a comprehensive cost optimization program, achieving significant cost savings from lower fuel costs and the optimization of the open-pit fleet maintenance strategy [57]. Third, gradual investment for clean technology. Establish a gradual investment program in clean technologies, taking advantage of the relaxed regulatory environment to phase in new technologies without immediate financial pressure. A notable example of a company implementing a gradual investment program in clean technologies is the OCP Group, which launched a $13 billion Green Investment Strategy for the 2023-2027 period, allowing them to integrate new technologies progressively without immediate financial pressure [58]. Next, establishing public-private partnerships. Pursue public-private partnerships to leverage government incentives for clean energy projects and infrastructure development. These partnerships can help share the financial burden and accelerate technology adoption. An example of collaboration is between the U.S. Department of Energy's (DOE) National Renewable Energy Laboratory (NREL), National Energy Technology Laboratory (NETL), and ExxonMobil, where ExxonMobil will invest up to $100 million over ten years to advance lower-emission energy technologies like biofuels and carbon capture and storage to commercial scale [59]. The other recommendation option is community engagement and social license initiative by focusing on transparent communication, community development projects, and addressing local environmental concerns. Canadian company, Agnico Eagle has mitigated environmental impact by investing in community development projects, including the construction of a 5G wireless network to improve safety and extend connectivity to the surrounding area [60].

Recommendation options for "Perfect Storm" Scenario have to cope with low coal prices and stricter regulations, creating significant financial and operational challenges for EBC. Firstly, crisis management and resilience program. This program to develop a comprehensive crisis management and resilience program to navigate the dual pressures of low revenue and high compliance costs. This program should include contingency planning, stakeholder communication strategies, and financial stress testing. Enterprise risk management techniques, which include risk governance frameworks, risk awareness, risk artifacts, and risk culture, significantly impact the development and maintenance of resilience resources and capabilities [61]. Secondly, selected and urgent technological upgradation. Initiate an urgent technological upgradation project to comply with stringent regulations. This project should focus on fast-tracking the implementation of cleaner technologies and improving environmental performance metrics. While most green industry technologies and carbon removal are still in the prototype stage, bioenergy and green building technologies have already surpassed the early adoption stage [62]. Thirdly, financial stability and risk mitigation strategy to manage

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the severe financial stress. This strategy should include exploring alternative financing options, such as green bonds, and renegotiating existing debt structures. For instance, Brazil issued its first green bond in 2023 to finance projects aimed at protecting the Amazon, demonstrating how green bonds can be used to leverage private finance for significant environmental projects [63]. Fourthly, reputation management and stakeholder engagement related to environment issue. Launch a reputation management and stakeholder engagement program to mitigate potential reputational damage. This program should involve proactive communication with stakeholders, transparency in sustainability efforts, and participation in industry-wide sustainability initiatives. Stakeholder management is crucial for effective crisis response, as inadequate stakeholder management and communication plans have damaged the reputations of major mining operators [64]. Fifthly, Operational Restructuring Project to streamline operations, reduce costs, and enhance productivity. This project should involve process reengineering, workforce optimization, and adoption of digital technologies for efficiency gains. Sibanye-Stillwater, a global mining and metals processing conglomerate, declared in September 2023 that it intended to restructure the business because to prolonged losses and operating limitations at one of its business shafts [65]. Sixthly, develop a long-term sustainability roadmap that outlines EBC's strategic direction towards achieving net-zero emissions. This roadmap should include specific targets, timelines, and milestones for reducing emissions, increasing renewable energy use, and improving overall environmental performance. For example, ADBRI, a leading Australian company in construction materials and industrial mineral manufacturing, has developed a comprehensive net-zero emissions plan that includes reducing absolute emissions by 7% by 2024, transitioning to 100% zero emissions electricity by 2030, and achieving net-zero emissions by 2050 by focusing on energy efficiency, alternative fuels, and breakthrough technologies through partnerships and research collaborations [66].

In "Golden Era" scenario, high coal prices and looser regulations create favourable conditions for EBC, enabling revenue growth and operational ease. This study found some options for EBC to do. The first, develop a strategic investment program to capitalize on high coal prices and increased revenue. This program should focus on expanding production capacity, investing in new projects, and upgrading existing infrastructure. For Instance, an Australian mining company, BHP (Broken Hill Proprietary) increased capex guidance to $11 billion per year for the medium term, of which approximately $4 billion in aggregate will be channelled to operational decarbonization before the end of 2030 [67]. Next recommendation option is implementing a program to enhance operational efficiency and productivity, leveraging the favourable regulatory environment. This should include process automation, digitalization, and workforce training initiatives. For instance, Petrosea, an Indonesian mining company, enhanced operational efficiency and productivity through the Minerva digital transformation program, resulting in a 23% increase in daily production, 10% fewer vehicles, an 8% reduction in fuel consumption, and a 15% overall cost decrease [68]. The third, establish a renewable energy transition fund to finance the gradual shift towards cleaner energy sources. This fund should be used to invest in renewable energy projects, such as solar and wind farms, and to support R&D efforts in clean technologies. In 2023, Fortescue Metals Group launched an investment platform to attract funding for its green hydrogen and green ammonia projects, aiming to support its global transition to environmentally friendly energy sources and reduce carbon emissions [69]. The fourth, develop a market expansion strategy to explore new markets and increase EBC's market share. This includes market research, strategic partnerships, and targeted marketing campaigns to tap into emerging markets with high coal demand. One of the examples is Rio Tinto, an Anglo-Australian multinational company, which has expanded its market presence and diversified its holdings through significant acquisitions, including B.P. Minerals, Nerco, Cordero Coal Mining Company, and a stake in the Grasberg copper-gold mine, making it the largest global copper producer and a key player in the iron and titanium industries [70]. Next recommendation, launch an enhanced CSR (Corporate Social Responsibility) program focusing on community development, environmental conservation, and sustainable practices. This program can improve EBC's public image and strengthen its social license to operate. Barrick, a Canadian gold mining company, has led in CSR by providing $24.6 million in scholarships to over 20,000 students in the past five years and spending $234 million on various CSR efforts from 2007 to 2012 [71]. The last recommendation option is developing a long-term financial planning strategy to ensure financial stability and resilience. This strategy should include creating financial reserves, exploring diversification opportunities, and implementing robust risk management practices. According to PwC's "Mine 2024" report, mining companies are adapting to the evolving market for key minerals and the global energy transition by engaging in mergers and acquisitions, adopting low-carbon technologies, and securing sustainability-linked financing to stay competitive and financially stable amid fluctuating commodity prices and stricter regulations [72].

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E. Integration

In this stage, this study identified the early warning signs for each scenario. The signs will guide EBC to discover step by step which scenario is going to happen. Therefore, EBC can implement the recommendations to ensure the sustainability of their captive power plant in the future.

For the "Double-Edged Sword" scenario, the first warning sign is the emergence of new environmental regulations. Stricter regulations could lead to increased operational costs, aligning with the regulatory pressure implication in this scenario. This is because as governments and regulatory bodies impose stricter environmental standards, companies like EBC may need to invest more in compliance measures, which could significantly increase their operational costs. The second warning sign is the development and adoption of clean technologies. This could disrupt the coal industry, necessitating technological advancements as outlined in the scenario. The reason for this is that as clean technologies become more advanced and widely adopted, traditional coal-based operations like those of EBC may become less competitive. Therefore, EBC would need to invest in these technologies to stay relevant in the industry. The third warning sign is the trend in ESG (Environmental, Social, and Governance) investment. Increased pressure from investors for sustainable practices could lead to investment shifts, a key implication in this scenario. This is because as investors become more conscious about the environmental impact of their investments, they may prefer companies that follow sustainable practices. As a result, EBC may need to shift its investment strategies to attract these investors. The fourth warning sign is the availability of green financing options. This could impact the financial implications in this scenario. The availability of green financing options means that there are specific financial products available for projects that have positive environmental benefits. However, to avail of these financing options, EBC would need to invest in environmentally friendly projects, which could increase their short-term costs. The fifth warning sign is global net zero commitments. Global commitments to net zero emissions could influence regulatory and market conditions, leading to the conditions outlined in this scenario. This is because as more countries and organizations commit to achieving net zero emissions, the regulatory environment for coal-based companies like EBC could become more stringent. Moreover, the market conditions could also change as demand shifts towards cleaner energy sources.

In the "Silver Lining" scenario, EBC has to be aware with some warning signs. The first early warning sign is energy prices. Tracking the prices of coal and renewable energy sources could provide insight into the financial implications of this scenario. This is because the price of coal directly affects EBC's revenue. If coal prices are low, EBC's revenue could decrease, aligning with the financial implications outlined in this scenario. This is crucial for EBC as it directly impacts their profitability and financial stability. The second early warning sign is the adoption rates of clean technologies within the industry. Observing these rates could indicate the pace of technological advancements in this scenario. If the adoption rates of clean technologies are high, EBC may need to invest in these technologies to stay competitive. This aligns with the implication of technological advancements in this scenario. Understanding this trend can help EBC strategize its technology investments and stay ahead in the industry. The third early warning sign is community feedback. Gauging local community sentiment could help EBC understand potential reputation and social license implications. If the community sentiment is negative towards coal-based operations, EBC may need to adapt and innovate in response to market conditions to maintain a positive reputation and social license to operate. This is important as maintaining a good reputation and social license can influence EBC's relationships with stakeholders and its overall business success. The fourth early warning sign is the political climate. The political climate and stability could influence the operational changes and regulatory environment in this scenario. If the political climate is stable and regulations are relaxed, EBC could have greater operational flexibility, which is one of the implications in this scenario. Monitoring the political climate can help EBC anticipate potential regulatory changes and plan its operations accordingly. The fifth early warning sign is economic indicators. Monitoring economic indicators could provide insight into the market conditions outlined in this scenario. If the economy is strong, the demand for coal could remain high despite low prices, which could partially offset the negative impact of low coal prices on EBC's revenue. Keeping an eye on these indicators can help EBC understand the market dynamics and make informed business decisions.

In the "Perfect Storm" scenario, there are five early warning signs that need to be aware of. Firstly, coal demand trends. A significant decline in coal demand could signal the market dynamics outlined in this scenario. This is because the demand for coal directly affects EBC's revenue. If demand for coal decreases significantly, EBC's revenue could decline, exacerbating the financial stress outlined in this scenario. This is crucial for EBC as it directly impacts their profitability and financial stability. Secondly, the maturity and reliability of new technologies. Assessing these factors could indicate the urgency and feasibility of technological

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advancements in this scenario. If new technologies are mature and reliable, EBC may need to invest in these technologies to comply with regulations. This aligns with the implication of the requirement of technological advancements in this scenario. Understanding this trend can help EBC strategize its technology investments and stay ahead in the industry. Thirdly, banking and financing challenges. Challenges in securing financing could lead to the severe financial stress outlined in this scenario. If EBC faces difficulties in securing financing, it could strain the company's finances, risking operational sustainability. This is important as maintaining financial stability is crucial for EBC's long-term success. Fourthly, actions and campaigns by environmental NGOs and activists. These could influence public perception and regulatory actions, leading to the high regulatory pressure in this scenario. If environmental activism increases, it could influence public perception and lead to stricter regulations, aligning with the implication of significant high regulatory pressure in this scenario. Fifthly, the direct impacts of climate change. These could affect plant operations and highlight the urgency of reducing emissions, a key implication in this scenario. If extreme weather events become more frequent due to climate change, it could disrupt EBC's operations and highlight the urgency of reducing emissions.

For the "Golden Era" scenario, the first early warning sign is government incentives for renewable energy projects. These incentives could influence the market conditions and regulatory environment in this scenario. If governments provide incentives for renewable energy projects, it could create favourable market conditions for EBC, leading to increased profitability. This is because these incentives could make renewable energy projects more financially viable, allowing EBC to diversify its energy sources and potentially increase its revenue. The second sign is observing the actions and strategies of industry peers. This could provide insight into the operational efficiency and productivity implications in this scenario. If industry peers are making significant strides in operational efficiency and productivity, EBC may need to follow suit to stay competitive. This aligns with the implication of reduced regulatory pressure in this scenario, as increased operational efficiency could lead to smoother operations and less compliance-related expenditure for EBC. The third is aligning with long-term sustainability goals. This could guide EBC's transition towards cleaner energy sources, a key recommendation in this scenario. If EBC aligns its operations with long-term sustainability goals, it could lead to financial stability due to high revenue with minimal regulatory costs. This is because sustainable practices are often more cost-effective in the long run, and can also attract investment due to increasing demand for sustainable businesses. Then the fourth early warning sign is global net zero commitments. Global commitments to net zero emissions could influence the favourable market conditions outlined in this scenario. If more countries and organizations commit to achieving net zero emissions, it could create bigger investment opportunities for EBC. This is because these commitments could drive demand for cleaner energy sources, providing new investment opportunities for EBC. The fifth sign is reductions in the costs of clean technologies and renewable energy. This could make their implementation more feasible, aligning with the technological advancements in this scenario. If the costs of clean technologies and renewable energy decrease, EBC could invest in these technologies to improve its public image and strengthen its social license to operate.

5. CONCLUSION

The implementation of scenario planning is a strategic imperative for coal-dependent companies like Eastern Borneo Coal (EBC) as they navigate the complexities and uncertainties of achieving net-zero emissions. The study utilizes scenario planning method, which comprises five critical stages: orientation, exploration, scenario creation, consideration, and integration. This structured approach allows EBC to systematically address the multifaceted challenges posed by regulatory changes, market dynamics, and technological advancements.

The exploration phase identified key driving forces and uncertainties affecting EBC, such as geopolitical dynamics, coal price trends, regulatory changes, and advancements in carbon capture and renewable energy technologies. These factors were categorized using PESTEL analysis, highlighting the multifaceted nature of the uncertainties EBC faces.

The study pinpointed the most critical uncertainties by assessing their impact and unpredictability. This analysis revealed that carbon regulations, coal price trends, global coal demand, and local regulatory frameworks are the primary factors influencing EBC's operations. These insights are crucial for understanding the potential challenges in different future scenarios.

By developing four distinct scenarios— "The Double-Edged Sword," "Silver Lining," "Perfect Storm," and "Golden Era"— the research evaluated the implications of each scenario on EBC's operations. For instance, "The Double-Edged Sword" scenario necessitates significant investments in emission control technologies due to high regulatory pressure, whereas the "Golden Era" scenario emphasizes maximizing profits in a favourable market environment with high coal prices and lenient regulations.

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Each scenario was accompanied by tailored strategic recommendations. For example, in the "Double-Edged Sword" scenario, EBC should focus on upgrading emission control systems and integrating renewable energy sources. In contrast, the "Silver Lining" scenario suggests a gradual investment in clean technologies and the formation of public-private partnerships to leverage government incentives.

The integration phase established early warning signals for each scenario, such as tracking regulatory changes, technological advancements, market dynamics, and community feedback. These indicators will help EBC anticipate and adapt to emerging conditions, ensuring proactive and informed decision-making.

In conclusion, scenario planning has provided EBC with a robust framework to manage uncertainties and align its strategic initiatives with the global net-zero emission targets. By identifying critical uncertainties, assessing potential risks, and developing strategic responses, EBC is better positioned to maintain operational sustainability and enhance its competitiveness in the evolving energy landscape. The study underscores the importance of continuous monitoring, stakeholder engagement, and investment in sustainable technologies to navigate the transition towards a net-zero future effectively.

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