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STRATEGY OF BIOMASS SUPPLY FOR COFIRING MINE MOUTH POWER PLANT 3X10 MW

STRATEGI KETERSEDIAAN BIOMASSA UNTUK COFIRING PEMBANGKIT LISTRIK MULUT TAMBANG 3X10 MW

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ABSTRACT

PT Bukit Asam Tbk (PTBA) is in line with the national energy transition vision of Indonesia and its efforts towards becoming Net Zero Emissions (NZE) status by 2060. PTBA has constructed a co-firing plan in a 3×10 MW mine-mouth power plant in Banko Barat, South Sumatra, with an ambition biomass level of 5–10% to reduce coal and carbon emissions. This project highly depends on biomass supply, but there is no clear plan for assured biomass supply. Through comprehensive external and internal analysis such as PESTEL, Porter's Five Forces, McKinsey 7S, VRIO, SWOT, and TOWS, the study identifies opportunities and threats of the external environment in addition to PTBA's internal weaknesses and strengths. The study proposes several actionable plans such as leveraging fiscal incentives such as PMK 130/2020, accessing green financing, developing energy plantations on pre/post-mining land and creating biomass cooperatives. The strategy is developed within an implementation plan that has considered the risk. The strategy ought to react to the challenges that exist and as a real action of PTBA in adopting clean energy transition in the world and Indonesia.

Keywords: *PT Bukit Asam Tbk, Net Zero Emissions, Biomass co-firing, strategy, mine-mouth power plant, internal and external analysis*

ABSTRAK

PT Bukit Asam Tbk (PTBA) sejalan dengan visi transisi energi nasional Indonesia dan upayanya menuju status Net Zero Emissions (NZE) pada tahun 2060. PTBA telah membangun rencana co-firing di pembangkit listrik mulut tambang 3x10 MW di Banko Barat, Sumatera Selatan, dengan tingkat biomassa ambisi 5–10% untuk mengurangi emisi batubara dan karbon. Proyek ini sangat bergantung pada pasokan biomassa, tetapi tidak ada rencana yang jelas untuk menjamin pasokan biomassa. Melalui analisis eksternal dan internal yang komprehensif seperti PESTEL, Porter's Five Forces, McKinsey 7S, VRIO, SWOT, dan TOWS, studi ini mengidentifikasi peluang dan ancaman lingkungan eksternal di samping kelemahan dan kekuatan internal PTBA.34% Studi ini mengusulkan beberapa rencana yang dapat ditindaklanjuti seperti memanfaatkan insentif fiskal seperti PMK 130/2020, mengakses pembiayaan hijau, mengembangkan perkebunan energi di lahan pra/pasca penambangan dan membuat koperasi biomassa. Strategi tersebut dikembangkan dalam rencana implementasi yang telah mempertimbangkan risiko. Strategi ini diharapkan mampu menjawab tantangan yang ada dan sebagai bentuk nyata PTBA dalam mengadopsi transisi energi bersih di dunia dan Indonesia.

Kata Kunci: PT Bukit Asam Tbk, Net Zero Emissions, Biomass co-firing, strategi, PLTU mulut tambang, analisa internal dan eksternal.

INTRODUCTION

The Paris Agreement is a global treaty adopted on 12 December 2015 during the 21st Conference of the Parties (COP21) of the United Nations Framework Convention on Climate Change (UNFCCC) in Paris, France. It entered into force on November 4, 2016, and between January 2021, it had been signed by 195 countries and ratified by 190. The Kyoto Protocol did not account for major emitting developing countries, and therefore there was a need for a more relaxed and inclusive framework which accounts for all countries (Bodansky, 2016). Several of the following factors influenced the creation of the Paris Agreement: (Le Quéré et al., 2018) Fossil fuel emissions, which primarily exist in coal, oil, and natural gas, make up a high percentage of global CO2 emissions,

about 89%". For every 0.5°C rise in global temperature, there is increased risk of disruption to ecosystems, crop loss, and severe weather (IPCC, 2018). With the initiative of its international commitment under the Paris Agreement, Indonesia has completed and updated its Nationally Determined Contribution (NDC) that presents the national plan in responding to climate change.

Indonesia in its 2021 Updated NDC report to the UNFCCC has aimed at a reduction of emissions by 31.89% conditionally (by itself domestically) and up to 43.20% conditionally, subject to international support in terms of finance, technology, and capacity building (Government of Indonesia, 2021). This is derived from a business-as-usual (BAU) estimate of 2,869 $MtCO_2e$ in 2030. The approach to meeting this target depends on emissions reductions across five important sectors, viz.: energy, forestry and land use (FOLU), agriculture, industry and waste. Out of the five sectors, the forestry sector forms the pillar of Indonesian emissions cuts. FOLU Net Sink 2030 is a national priority to have the emissions from the forest and land sector sequestered or offset through forest restoration and conservation (MoEF, 2022). PT Bukit Asam Tbk (PTBA) is one of the leading Indonesian state-owned enterprises engaged in coal mining and energy production.

The company plays an important role in maintaining Indonesia's energy security by supplying coal to power plants, industries, and the Asian and global export market. The firm has been at the vanguard of adopting green and sustainable mining technologies, focusing on the conversion of coal as a primary source of energy into cleaner and more effective form of energy. PTBA is also actively diversifying its business through the development of renewable energy sources, including biomass co-firing for coal-fired power plants, and expansion into solar energy. PTBA is also actively involved in power generation through its various power plant projects, utilizing its vast coal reserves to secure Indonesia's energy. Banko Mine-Mouth Power Plant, 3 x 10 MW, is one of the power plants owned by PTBA and will be utilized mainly to supply electricity for operational needs in mines and if there is excess capacity, the same would be supplied to the PLN grid. To assist the government program as stated in the NDC, PTBA targets to be able to use 5-10% biomass as co-firing at the power plants by 2030. Biomass refers to organic matter from living organisms, specifically plants, that can be used as a renewable energy source. It covers such items as wood, agricultural crops, waste residues, and animal manure. However, in this case PTBA will use plants as biomass. However, to achieve the goal of 5-10% biomass for co-firing into PLTU, PTBA has no strategy yet in searching biomass for co-firing PLTU Banko Barat 3x10 MW. Therefore, this thesis will provide some strategies so that the biomass for co-firing is able to be done sustainably. The strategies which will be presented are the strategies that can be implemented immediately so that PTBA is ready to achieve the goals which have already been established

LITERATURE REVIEW

Strategic Management

Strategic management is the process through which firms scan and learn from their internal and external environment, establish strategic direction, formulate strategies that facilitate the firm to achieve established

goals, and execute those strategies (Barney & Hesterly, 2016). Strategic management is the art and science of formulating, implementing, and evaluating cross-functional decisions that enable an organization to achieve its objectives (David & David, 2017).

External Analysis

External analysis is a systematic process of identifying, evaluating, and understanding external factors to the organization that can affect the performance, strategy, and sustainability of the organization.

The main focus of this analysis is to identify opportunities and threats from the external environment such as political, economic, social, technological, legal, environmental factors, and industry competition. External analysis refers to a method of determining the major threats and opportunities in a company's competitive environment that will affect how a company will pursue its mission (Barney & Hesterly, 2016). External audit or environmental scanning is a process that aims to identify and analyze trends and events beyond the control of any single firm. These outside forces could be categorized under five broad sectors: economic, social, cultural, demographic, and environmental; political, governmental, and legal; technological; and competitive forces (David, Fred R. 2017). PESTEL analysis takes into account the political, economic, social, technological, environmental, and legal forces that might impact an organization.

It is used for outside force analysis that could be utilized to influence strategic choices (Johnson, Scholes, & Whittington, 2017). Porter's Five Forces Analysis for strategic management. It is used in the analysis of external forces within an industry and how existing rivals compete for value or new technologies. Based on this model, it is more practical to understand the complexity of a company's environment without altering the internal processes of a firm or its strategical decisions because it reveals the competitive forces of an industry (Porter, 2008) Internal Analysis

Internal Analysis

Internal analysis is the process of examining an organization's internal environment in terms of its capabilities, assets, core competencies, and value chain activities to determine its weaknesses and strengths. Internal analysis is the process of recognizing and assessing unique resources and capabilities found in an organization that are the foundation of achieving and maintaining a competitive advantage. (Barney & Hesterly, 2016).

McKinsey 7S Framework is presented as an alignment and diagnostic model utilized to analyze and improve the performance of an organization through the evaluation of seven interdependent elements that are crucial in the achievement of organizational goals (Paschal and Austin, 2013).

The VRIO Framework is a strategic management tool in order to be able to evaluate the internal capabilities and resources of a firm and if they are able or not to be a source of sustainable competitive advantage. VRIO is comprised of Value, Rarity, Imitability, and Organization.The model is utilized with the understanding that not every resource has the same value-but merely certain resources, when compared to some standard, can help firms to continuously outperform their peers SWOT Analysis.

SWOT Analysis

SWOT analysis is a straightforward tool of strategic management, which helps organizations evaluate their current internal and external environment. SWOT analysis places the strategic scenario in four groups: Strengths, Weaknesses, Opportunities, and Threats. Strengths and weaknesses are organizational internal characteristics-such as resources, processes, and capabilities-that may support or hinder goal achievement. Opportunities and threats, however, originate from the outside environment, including market trends, regulations, technological progress, and social phenomena.

TOWS Analysis

The TOWS Matrix is a structured planning instrument as stated by Kotler and Keller (2012), that helps organizations identify strategic options by matching them with internal strengths and weaknesses and external opportunities and threats. Kotler and Keller emphasize that whereas SWOT analysis is a diagnostic tool, the TOWS Matrix is a step ahead in enabling strategy development, helping companies solidify what to do with the issues identified through SWOT

Risk Analysis

Risk analysis is a systematic approach to the identification, measurement, and understanding of risks that have the potential to affect the attainment of organizational or project goals. When viewed in terms of project management and strategic management, risk analysis will greatly assist organisations to recognise uncertainty, quantify the probability of risk occurrence, and predict its impact so that the decision to mitigate can be taken more effectively and accurately risk analysis is the backbone of risk management which not only assists us in predicting crises but also in grasping opportunities

RESEARCH METHOD

Data Collection

Data collection is a fundamental and essential step in the research process. There are two primary types of data, which are primary data and secondary data. Primary data is information obtained firsthand by the student through first-hand method is interviews. It is used especially for unique, recent, or situation-specific information is needed. In this there are divisions as subject specialists.

The main methods of data collection in this thesis are:

Interviews - Interview work is conducted among existing stakeholders. Interviews may be structured, semi-structured, or unstructured used to collect in-depth qualitative information. Kvale & Brinkmann (2009) point out that interviews will provide depth and allow for exploration that is greatly required in this thesis. Hence, how the interviewing process is carried out can in turn affect the result.

Document/Desk Study - This is surely done by considering existing reports, studies, and data sets and retrieving good information. This is very useful in policy and environmental analysis. But care must be taken regarding whether the data is obtained from valid sources or not because if the data is not collected from valid sources, then the resulting information will not be good.

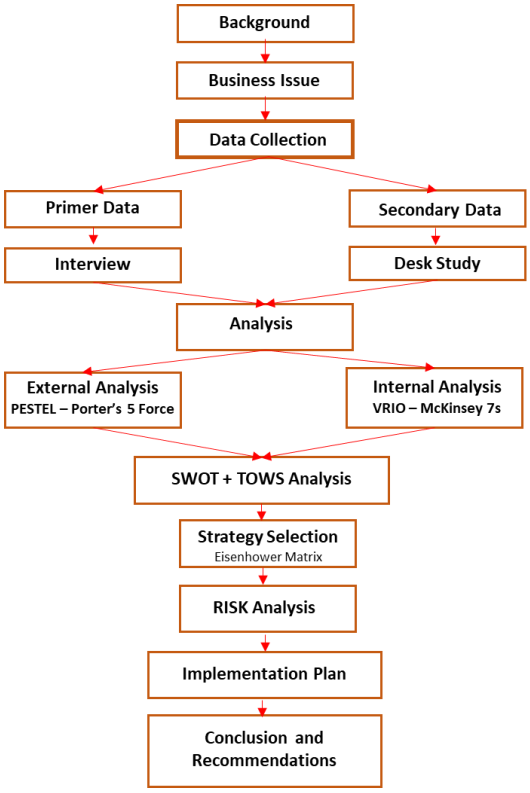

Figure 1. Flowchart of research

RESULT AND DISCUSSION

External Analysis – PESTEL Analysis.

Political, strong commitment from the Indonesian government to renewable energy and NZE 2060; policies that support co-firing of power plants as a decarbonization strategy; regional political stability will support investment in the biomass sector. (Opportunities). **Economic,** very rapid Fossil Energy Price Fluctuations or Uncertainties and Biomass Stability Potential. (Threats). The Existence of Fiscal and Non-Fiscal Incentives for Biomass Investment, quite tight market competition but there are still opportunities for biomass exports (Opportunities). **Social**, potential for empowering local communities through biomass supply chain, environmental, awareness and social pressure on the mining industry ((Opportunities)). **Technological,** there are already technologies that support co-firing activities on a commercial and operational scale, biomass processing technology, the use of IoT and blockchain for transparency and efficiency. (Opportunities). **Environmental,** biomass needs will also affect deforestation activities. These activities must be balanced with reclamation. (Threats). **Legal**, there are some regulations on new renewable energy, Corporate ESG Compliance. This must be met to maintain the company's name. (Threats)

Porter's Five Force

Threat of new entrants, the biomass market is still open and dominated by informal players (60% according to IESR, 2023) and barriers to entry are low. (Opportunities). **Bargaining power of Suppliers**, supply is fragmented, seasonal and disrupted by export markets (mills & pellets) and export prices are much higher. (Threats). **Bargaining power of Buyers**, PTBA is the final buyer, not dependent on other buyers. (Opportunities). Threat of substitute products, PTBA as a supplier of solar, wind, RDF, and green hydrogen is growing fast. (Threats). But co-firing is the most feasible at the moment. end buyer, independent of other buyers. (Opportunities). Rivalry among existing competitors, PLN and IPPs dominate downstream, exporters compete upstream and competition for raw materials increases.((Threats)

Internal Analysis – McKinsey 7S Frameworks Analysis.

Strategy, biomass co-firing strategy aligned with NZE 2060, RUPTL, and national renewable policy (Streangth). **Structure,** The organizational structure supports cross-functional projects, but there is no dedicated biomass supply chain unit

(Weakness). **System,** CISEA, ISO 50001, and SMBA exist as the basis for ESG digitization and reporting, but biomass supply chain integration is not optimal (Weakness). **Shared Value**, culture of sustainability and social responsibility embedded at the management level and CSR strategy (Strength). **Style,** transformational leadership that is adaptive to the energy transition, driving innovation (Strength). **Staff,** Strong human capital in the mining sector, but little experience in renewable energy and agribusiness supply chains transformational leadership adaptive to energy transition, driving innovation (Weakness). **Skills,** power plants 's technical capabilities are strong; new skills in biomass and carbon are still under development (Weakness).

VRIO Analysis

Sustainable Competitive Advantage (SCA) from PTBA is Interconnected infrastructure from Mine to Mine Mouth Power Plant (owned). The main advantage of PTBA is that it has complete infrastructure from upstream to downstream. This is very necessary in the cofiring process, of course this makes PTBA difficult to compete with or imitate by its competitors.

SWOT Analysis

Strength:

(a) PTBA's status as a state-owned enterprise;
(b) Existing power plant infrastructure and pre/post mining land access;
(c) ISO 50001/14001 certification & ESG reporting system;
(d) Biomass wood pellet production pilot plant facility;
(e) Sustainability culture and transformational leadership style

Weaknesses:

(a) Dependence on informal and seasonal suppliers;
(b) Limited human resources and expertise in the biomass sector;
(c) The absence of digitalization of the biomass supply chain;
(d) The scale of biomass production and supply is still very limited;
(e) The organizational structure has not yet formed a special operational unit for biomass.

Opportunities:

(a) Increasing Domestic Biomass Demand;
(b) Global Biomass Export Market Growth;
(c) Fiscal Support and Green Finance from Governments and Global Partners;
(d) The Great Potential of Local Biomass from Agricultural and Forestry Waste;
(e) Market and Investor Demands for ESG Transparency and Carbon Reporting.

Threats:

(a) Competition for Raw Materials from More Profitable Export Markets
(b) Fluctuations in Supply and Quality of Materials
(c) Threat of Substitution by Other Renewable Energy Technologies
(d) Socials and Ecological Risks
(e) Regulatory Inconsistency and Uncertainty of Government Incentives.

TOWS Analysis

Based on SWOT, using TOWS analysis, 18 strategies were obtained. Of the 18 strategies selected using the Eisenhower Matrix. The Eisenhower Matrix, also known as the Urgent-Important Matrix, is a strategic decision-making instrument used to

guide individuals or groups to choose between decisions and actions by the two primary axes of urgency and importance.

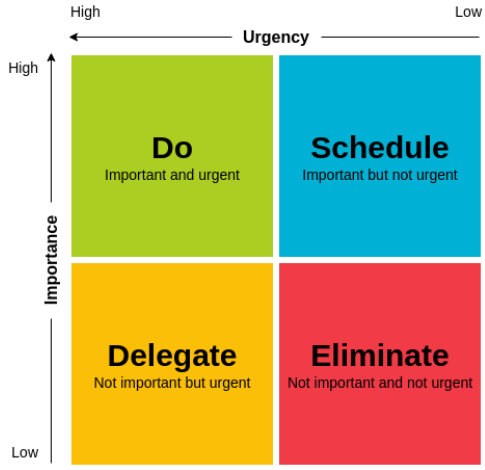

Figure 2. Eisenhower Matrix

Under strategy selection, the Eisenhower Matrix is used to classify and decide on which strategies must be:

- Implemented immediately (Do) – those that are urgent and important
- Planned (Schedule) – the things that are important but not urgent
- Delegated (Delegate) – strategies that are urgent but less important,
- Avoided or postponed (Eliminate) – strategies that are not important and not urgent.

After the analysis was carried out, 5 prioritized strategies were selected, namely:

(a) (SO1) Using state-owned company status and PLN access to obtain fiscal incentives PMK 130/2020 and green financing from BPDLH/Green Fund;

(b) (WO1) Establishing a farmer biomass cooperative and SNI 8021–2014 training with CSR funds or Green Fund grants;

(c) (WT1) Diversification of suppliers and long-term contract systems and quality grading to prevent supply only to exports;

(d) (SO2) Develop pre/post-mining land into energy plantations;

(e) (ST2) Using existing Power Plants infrastructure as a technology buffer against varied and fluctuating raw materials.

Risk Analysis

Risk analysis is carried out on the strategy to be implemented. This analysis is expected to reduce the possibility and/or impact that may occur in each strategy. Following are the risks and mitigation plans for each strategy.

(a) (SO1) **Risk**: Failure to access fiscal incentives (PMK 130/2020), the project did not pass the fiscal incentive verification. **Mitigation**: prepare complete documents and consult from the start with DJP/BPDLH.

(b) (WO1) **Risk**: Biomass quality does not comply with technical standards / SNI. **Mitigation**: Provide SNI 8021-2014 training and distribution of measuring instruments.

(c) (WT1) **Risk**: The supplier refused to do so. **Mitigation**: Implement incentive pricing and grading-based purchase guarantees.

(d) (SO2) **Risk:** Community resistance to pre/post-mining land conversion and failure to grow energy crops. **Mitigation**: Test the soil and select plant varieties that are tolerant to field conditions in the company.

(e) (ST2) **Risk**: Incompatibility of supply with power plants capacity and power plants is not compatible with low quality biomass. **Mitigation**: Burner modification and discussion of biomass moisture content < 20%

Implementaion Plan

In order for this strategy to be implemented properly, an implementation plan needs to be made that contains the activity plan, the person in charge of the activity and how

long it will take. This strategy can be done in parallel, of course by considering the existing human resources. The following is the implementation plan for strategi SO1:

Activity:

(a) Create special team for preparing and manage PMK 130/2020;
(b) Identification of biomass projects that meet the criteria of PMK 130/2020 and the BPDLH Green Fund;
(c) Preparation of submission documents (proposal, feasibility study, environmental documents, work plan and budget) and consult from the start with DJP/BPDLH;
(d) Registration and official submission to DJP (for fiscal incentives) and BPDLH (for green financing)
(e) The process of clarification, revision and technical negotiation with related ministries/institutions;
(f) Monitoring, reporting, and (if approved) tracking of disbursement of incentives and grant/soft loan funds;

PIC: Project Management Office and Budgeting Division.

Timeline: 6 Months.

The implementation plan for strategi WO1:

Activity:

(a) Identification of potential villages and cooperatives around the PLTU;
(b) Preparation and signing of partnership MoU;
(c) Biomass quality technical training (based on SNI 8021-2014);
(d) Provision of simple tools (weighing tools, sieves, dryers);
(e) Supply quality monitoring and incentives based on grading.

PIC: Tanjung Enim Site

Timeline: 6 months

The implementation plan for strategi WT1:

Activity:

(a) Identification and selection of potential suppliers based on location and type of biomass raw materials;
(b) Preparation of biomass quality grading system (water content, size, calorific value) according to SNI 8021-2014
(c) Preparation of long-term contract models (1–3 years) with quality-based incentive schemes
(d) Socialization and contract negotiation with cooperative suppliers and local entrepreneurs
(e) Implementation of grading system and recording of volume and quality at the point of delivery

PIC: Maintance Division

Timeline: 6 months

The implementation plan for strategi SO2:

Activity:

(a) Mapping and zoning of pre/post-mining land suitable for energy plantations;
(b) Selection of energy plant types (kaliandra, gamal) and preparation of garden design;
(c) Procurement of seeds, planting tools, and construction of simple irrigation facilities;
(d) Initial planting and maintenance of energy crops (±50 ha);
(e) Growth monitoring, biomass yield evaluation, and farmer group training.

PIC: Tanjung Enim Site

Timeline: 6 months

The implementation plan for strategi ST2:

Activity:

(a) Technical Study of Combustion System Adaptation;
(b) Construction of Quality Buffer Facilities;
(c) Operator Training and Co-Firing SOP;

(d) Multi-Quality Operational Trial;
(e) Evaluation of Results and SOP Integration.

PIC: Maintenance Division
Timeline 6 months

CONCLUSION

Based on the analysis that has been carried out, both internal and external analysis and considering the strengths, weaknesses, opportunities, threats as well as existing priorities and risks, 5 main strategies were selected that can help ensure the availability of biomass for cofiring activities, namely:

(a) (SO1) Using state-owned company status and PLN access to obtain fiscal incentives PMK 130/2020 and green financing from BPDLH/Green Fund;
(b) (WO1) Establishing a farmer biomass cooperative and SNI 8021–2014 training with CSR funds or Green Fund grants;
(c) (WT1) Diversification of suppliers and long-term contract systems and quality grading to prevent supply only to exports;
(d) (SO2) Develop pre/post-mining land into energy plantations;
(e) (ST2) Using existing Power Plants infrastructure as a technology buffer against varied and fluctuating raw materials.

In ideal conditions this strategy can last for 6 months with each person responsible for the work.

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