

IJEMS-Sustainable Mining

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**Research Article****Sustainable Mining Environment: Technical Review of Post-mining Plans**Restu Juniah^{1,*}¹Mining Engineering Department, Sriwijaya University**ABSTRACT**

The mining industry exists because humans need mining commodities to meet their daily needs such as motor vehicles, mobile phones, electronic equipment and others. Mining commodities as mentioned in Government Regulation No. 23 of 2010 on Implementation of Mineral and Coal Mining Business Activities are radioactive minerals, metal minerals, nonmetallic minerals, rocks and coal. Mineral and coal mining is conducted to obtain the mining commodities through production operations. Mining and coal mining companies have an obligation to ensure that the mining environment in particular after the post production operation or post mining continues. The survey research aims to examine technically the post-mining plan in coal mining of PT Samantaka Batubara in Indragiri Hulu Regency of Riau Province towards the sustainability of the mining environment. The results indicate that the post-mining plan of PT Samantaka Batubara has met the technical aspects required in post mining planning for a sustainable mining environment. Post ponement of post-mining land of PT Samantaka Batubara for garden and forest zone. The results of this study are expected to be useful and can be used by stakeholders, academics, researchers, practitioners and associations of mining, and the environment.

Keywords: Post-mining Plan, Sustainable Coal Mining Environment, Technical Aspects.

1. INTRODUCTION

Natural resources of forest and coal provide economic benefits for forest areas. Mining benefits arising from mining business activities for the state are a source of state revenue and foreign exchange earners. The other benefits are as a producer of raw materials for industry, construction of facilities and infrastructure, employment providers, absorption of labor. Utilization of natural resources of coal by mine open in forest area to get the benefit, on the other side causing environmental losses [1].

Nations and countries wanting the conservation of natural resources must implement environmentally sound development. Maintaining and sustaining the preservation of natural resources is necessary for the survival of human beings today, as well as for future generations. The relationship between the community, forest-forming plants, with the fauna and nature of the environment is very close and cannot stand alone so that the forest is seen as an ecosystem. This is because the destruction of the forest will damage the existing ecosystems in the forests and surrounding areas, as well as damage all living systems [2].

Coal has calories that can be utilized for various purposes, including for industry, household and electric power generation. Policies made by the central and local governments in Riau Province are the driving factors for the establishment of several business entities engaged in Mining, including PT. Samantaka Batubara located in Peranap and Rakit Kulim District, Indragiri Hulu Regency Riau Province.

The post-mining plan is an obligation that must be implemented by mineral and coal mining companies. The obligation to make the Post-Miner Plan is regulated in Government Regulation no. 78 Year 2010 on Reclamation and Post-Mining, Ministerial Regulation No. 7 year 2014 on Implementation of Reclamation and Post-Mining Plan on Mineral and Coal Mining Business Activities. Post-mining activities are defined as planned, systematic and continuous activities after the end of part or all

of the mining business activities to restore the function of the natural environment and social functions throughout the mining area. Therefore post-mining activities are carried out in order to improve or manage the use of disturbed land due to coal mining, in order to be functional and efficient in accordance with its allocation to keep the coal mining environment sustainable.

Post-mining activities of PT Samantaka Batubara through the post-mining land allotment are expected to restore the function of the forest as an ecosystem so that the forest as a natural resource remains sustainable and the coal mining environment remains sustainable. Based on this it becomes an important point and becomes a force in this research to study the technical aspects of post-mining plan of PT Samantaka Batubara.

2. EXPERIMENTAL SECTION

The research method used is survey by observing directly to the location of coal mining business license PT Samantaka Batubara. The analysis used descriptively to describe or describe how the initial hue conditions at the research location, so that can be mapped technically aspects of post-mining land titling PT Samantaka coal. This awakening is for the sustainable return of the mining environment. Data collection is done through collecting data in primary to get primary data, and secondary to get secondary data. Primary data is obtained by direct observation, and secondary data is done by tracking literature study and instasional. Research location of Coal Mining Business License PT. Samantaka Batubara is located in the southeast of Pekanbaru City in Peranap Subdistrict (Pauh Ranap & Gumanti Village), Batang Per-

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Figure 1. Map Location of PT. Samantaka Batubara [3]

anap Sub-district (Punti Kayu Village), Rakit Kulim Sub-District (Talang Durian Cacar Village) INHU Regency of Riau Province. Delivery of the territory can be reached by road from Pekanbaru City towards Peranap through the East Cross Road Sumatra with a distance of approximately 200 Km or travel for approximately 4 hours using the Four Wheel vehicle with paved road conditions. The location of research is shown in Figure 1.

3. RESULTS AND DISCUSSION

The technical aspect is an important aspect besides the economic aspect in determining the post-mining land allocation. This is because the economic planning has in addition to having a very close relationship with the technical aspects also becomes the basis in determining the economic planning of the post-mining costs. The technical aspects discussed are as follows:

3.1. Pleminery Hue

Pleminery hue becomes fundamental in technical planning especially related to the return to post-mining land use function. Allotment of former mining land is expected to restore the minimum as the initial hue before the activity. Used land is a land that has been taken or carried out activities of mining commodities (minerals,

coal and rocks) in the place or location. The initial tone is largely divided into geophysical groups of chemical biology, socio-economic, cultural, and public health.

The pleminery hue in this study focused on the geophysical conditions associated with the soil and biology associated with the existing plant site location. This emphasis is based on the results of previous research conducted by kusmana on coal mining PT Arutmin Indonesia Site Batulicin South Kalimantan Province. Kusmana research finds if soil character effect on plant growth [4]. The influence of soil character in the kusmana et.al study area indicates if soil characteristics have caused stunted sengon and acacia plants used as test mediums. The test results found that sengon plants suffer from small dwarfs in most plots, whereas acacia plants are found only on a few plots. Technical aspects such as soil analysis should / should be undertaken prior to reclamation and revegetation activities to determine treatment for soil properties improvement [5].

The largest soil type of coal mining area of PT Samantaka Batubara is yellow red podsolc spread of eastern hills and red latosol in the west. This land has low fertility. This is related to the level of soil acidity, low nutrient, high clay content [6]. The tendency of the soils on the post-mining land of coal to be sour caused by pyrite minerals which is one of the compounds of coal minerals. The soil quality at the study site is influenced by land cover vegetation. Based on a survey conducted showing some plants or vegetation cover in the location of coal mining PT Samantaka is the dominant rubber garden and oil palm plantation. The visible forestry crops are jabon, rengas, meranti, pule, waru. Other plants have bananas, areca nut and shrubs. Vegetation of ground cover in coal mining PT Samantaka Batubara is shown Figure 2.

3.2. Mine Design And Mine Age

Coal mining planning is aims to technically design coal mining activities such as mining methods, mining systems, mining design and mine life. Based on these matters, it can be planned for post-mining land plots. The method used in PT Samantaka Batubara open pit (surface mine) with open cast mining system [7]. This selection is based on characteristics of available coal depos-



Figure 2. Uninterrupted Area, Disturbed Land, Reforestation and Other Utilization of Mined Land

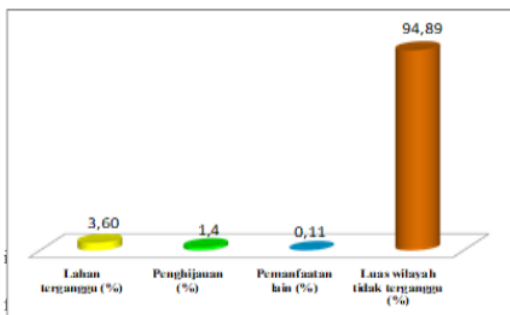


Figure 3. Postpartum Phase Diagram

1. The mine design plan is 26° with single slope 45° and FK> 1.3. This is based on the overall slope recommendation
2. A temporary mining design, following the limits of Production Forest and location topography.
3. Mining blocks with geometry of 150 x 150 meters with a height of 5 meters level became the basis for making the mining schedule.
4. Mining is done by cutting the hill up to an elevation of ± 150 meters above sea level, and for long-term mining it is possible to lower it at lower elevations by forming bench levels.
5. Mining is done from the west to the eastern part.
6. The first work begins by establishing access roads to reach the top of the hill, further lowering the elevation to the height of the mining plan.
7. Coal production capacity ± 1,000.000 tons / year for a total of 11,800,000 tons for seven years of mine life.

Based on the mineable reserves amount of ± 25,000,000 tons, taking into account the target market, in the first year coal mining amounted to ± 1,000,000 tons, and continues to increase every year, to reach the level of production in the year to 6 and 7 to 3,000.000 tons.

3.3. Reclamation and Allocation of Post-Mined Land

3.3.1. Mine Reclamation

The objectives of mine closure and impacts due to mine closure should be considered from an early stage of activities so that mining can contribute positively to sustainable development both economic, and social & environmental. Therefore, mine closure planning should integrate these three aspects.

Characteristics of mineral and coal resources in Indonesia are one of them characterized by the availability of most of the sediment in the layer of the earth near the surface of the soil. This leads to many mining methods that are open pit. Use of this method can cause changes in landscape elements, including topography, vegetation cover, hydrological patterns, soil structure damage, and others. This condition can complicate the reclamation process. Reclamation is needed to restore and restore the former land according to the purposes. Mine reclamation is part of post-mining activities.

Approaching and technologies are needed in reclaiming ex-mining land. The approach and technology used will be different [8]. This depends on the nature of the disturbance that occurred and also the allocation (use after the reclamation process). Reclamation is done by the following steps: top soil conservation; Planting cover crop; Planting of pioneer plants; Countermeasures of heavy metals. Area, Mine Used, Greening, Other Utilization Some Types of Mining Enterprises in Indonesia are presented in Table 1.

Based on the above table it can be seen that until 2009 the disturbed land for mine and infrastructure area was only 78.81 ha from the total area of 2,205,348 ha, with reclaimed land of 31.209 ha. Figure 2 shows the disturbed land used by coal mining activities until 2009 was only 3.6% of the total land. Reforestation activities undertaken on degraded land of 1.4%, and by 0.11% for other uses. The overall of the entire disturbed land are 1.51% or 41.94%. This condition is actually not ideal if referring from the existing regulation of the Minister of Energy and Mineral Resources No. 07 of 2014 and PP RI no. 78 in 2010, reclamation no later than six months after mining commodity mining activities.

The above indicates that if reclamation/vegetation activities and other utilization are done on mining land in accordance with the provisions of the law, then until the end of 2009 the percentage of reclamation / revegetation and other utilization will be equal to the disturbed land or at least 80%. Based on one of the objectives of the mine reclamation activity is to restore the environmental function to the disturbed land, with the greater the percentage of reclamation and other utilization of disturbed land

Table 1. Area, Mine Used Land, Reforestation, Other Utilization Some Types of Mining Enterprises in Indonesia

No	Type of business	Area (ha)	Land area disturbed (ha)	Greening (ha)	Other uses (ha)	Total (ha)
1	Contract of work production stage	516,803.30	15,856.48	9,088.09	877.81	9,965.90
2	Coal mining concession agreement production stage	825,862.60	36,988.63	15,077.32	735.3	15,812.62
3	Mining rights exploitation	862,682.46	25,965.78	7,044.29	944.77	* 7,989.06
Total		2,205,348.35	78,810.89	31,209.70	2,557.88	33,767.58

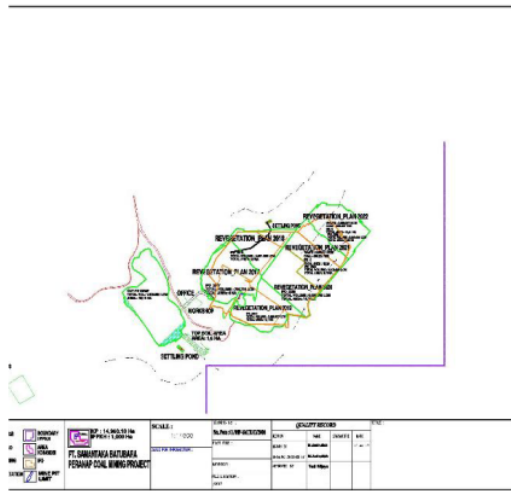


Figure 4. Land Use Plan (Coal End Mine) Coal Mining PT. Samantaka Batubara [3]

will further improve the environmental function returns so that the mining environment is more sustainable. Uninterrupted Areas, Disturbed Land, Reforestation and Other Utilization of Mine Extracted Land are shown in Figure 2.

3.3.2. Allotment of post mining land

The challenge for sustainable natural and environmental sustainability in Indonesia is one approach that can be used in natural resource management policies in sustainable development [9]. Its implications in the mining sector are post-mining planning for a sustainable mining environment. Post-mining stages for mineral, coal, nonmetallic and rock mining are conducted as shown in Figure 3 [10].

Based on the Figure, post-mining land use is included in stage 1 in post-mining planning. Postpartum planning is set forth in the post-mining plan document or known as the post mining plan document. Post mine land clearance either from the various researches conducted by previous researchers as well as those contained in the post mining plan document aims to sustain the environment and the environment of sustainable mining.

Witoro has studied of coal mining of PT Kaltim Prima Coal in East Kutai Regency of East Kalimantan Province, and found various ex-mining land uses with various scenarios for forests, for rubber gardens and oil palm plantations [5]. Utilization of Land Used Coal Mine was implemented in PT. Kaltim Prima Coal (KPC) East Kutai Regency, East Kalimantan for agricultural land using sago plant with balanced fertilization [12]. Dairah et.al [13] found the utilization of former mining land for plantation crops, cultivation of seasonal crops including paddy rice, and brown crops. Utilization of post-mining land of PT Adaro Indonesia in Tabalong District South Kalimantan Province was implemented for lakes, irrigation, clean water, electricity, fishery program, agriculture, livestock and plantation. Yuniawatiningsyas [14] develops post-mining areas as an arboretum that conserves soil, water, and biodiversity especially local crop species. The concept was developed into the concept of space, circulation, activity and facilities and vegetation.

Natural resources that are affected by mining activities, in principle or action should be returned to safe and productive conditions through rehabilitation. The final condition of rehabilitation can be directed to achieve such conditions before being

mined or other conditions agreed upon. Rehabilitation aims to return the mine site to conditions that allow it to be used as a productive land. The determination of post-mining land use depends on various factors such as the ecological potential of the mine site and the wishes of the people and the government. Formerly rehabilitated mining sites should be maintained to remain integrated with the surrounding landscape ecosystem.

PT. Samantaka Batubara is committed to maximizing post-mining land titling and post-mining physical environment management in order to provide sustainable benefits not only for PT. Samantaka Batubara but also to people living around the mine and mining environment. Post-mining land that used plan in PT. Samantaka Batubara based on Forest License Use Permit in the designation into a garden zone with an area of 51.79 ha.

The exploited mining area was originally a plantation and a shrub. For ex-mining land use coal exploitation activities in order to continue to provide economic benefits for local communities and local commodities in a sustainable manner, the restoration of ecosystems of ex-coal mining areas will mostly be allocated for sustainability of plantation products. Therefore, the zoning of former mining land of PT. Samantaka Batubara is for the garden zone. This zone is an area that will be planted with local commodities, both from the vicinity of Mining Business License PT. Samantaka Batubara or bring in the seeds from outside. Land Allotment Plan (Coal End Mine) Coal Mining PT. Samantaka Batubara is shown in Figure 4.

4. CONCLUSION

Postponement of post-mining land of PT Samantaka Batubara at the end of production operations is planned in order to restore environmental function and sustainable coal mining is for the garden zone. This is based on technical studies such as initial hue conditions, mine design and mine life, Forest Area License Use Permit with an area of 51.79 ha.

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