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RESERVE CALCULATION OF COAL MINED BASED ON EXAMINATION OF STRIPPING RATIO AT NORTH BLOCK IN PT. PANCARAN SURYA ABADI EAST KALIMANTAN PROVINCE, INDONESIA

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ABSTRACT

Mining is an activity carried out to take deposits of minerals below the earth's surface, one of which is coal. To calculate how much money is spent to buy minerals? Another thing agreed in the calculation of reserves is as a basis for economic evaluation, whether regional research is feasible or not feasible. Research conducted at PT. Pancaran Surya Abadi, Kutai Lama, Anggana District, Kutai Kartanegara Regency, East Kalimantan, where the calculation is done using a computer-based program, Minescape 4118.In this study the block model method is used to determine the optimal potential area for mining activities, from the block model is made a solid block batter (with the contour structure as the lower boundary and topography as the upper limit), so that from the solid block we can make reshgraph based on the stripping ratio value of 4.6: 1, from the results of the reshgraph can be determined the potential area to be mined marked with certain colours. The results of the research that has been carried out, obtained seam A coal seam modelling has a thickness of 2.21 meters and seam B 5.19 meters. The calculation of mining reserves obtained by coal is 13,074,635.12 MT, overburden is 60,532,994.96 BCM, and so a stripping ratio of 4.6: 1 is obtained.

KEYWORDS: Coal, Block model, Solid Batter block, Stripping Ratio, Reshgraph

INTRODUCTION

Background

Coal is a strategic quarry and one of the national energy raw materials that has a major role in national development. Information about coal reserves is the most basic thing in planning a mining business activity. It is common knowledge that the mining sector is one of the business sectors that has a very large investment value with many risks that will be faced when the business runs. To reduce the level of risk of loss that is large enough, it is necessary to do very careful planning and calculation to determine the success of the production carried out. In addition, efforts should also be made to maximize coal reserves owned. Then in order to realize that PT. Pancaran Surya Abadi needs to do long-term planning for the coal mining activities to be carried out. Coal reserves are part of the indicated and measured coal resources that can be mined economically. In its determination, to classify coal resources into coal reserves must consider all related factors such as mining methods, economic, marketing, illegal, environmental, social and government regulations. So then in designing coal mining it is necessary to consider several technical aspects, such as the determination of potential areas, the design of the mining

deadline to the design of the pit design. These parameters are a reference in getting the value of coal mined reserves.

METHODOLOGY

This research was conducted in several stages including pre-field stage, field stage, and post-field stage.

Literature Study Stage. The Literature Study Phase conducted for this research includes:

Literature

This literature study activity is intended to find literature related to research so that it can help in the conduct of this research. Literature can be in the form of books relating to this research and use regional geological maps and regional accomplishments maps as further literature material in order to find out more deeply the geological conditions in the study area.

Formulation of the Problem

Conducted in accordance with the aims and objectives of this study. The purpose of this research is to optimizing the mining pit based on the specified stripping ratio and calculating coal reserves so a design is needed mining to determine the mining boundaries in the study area.

Field Orientation Stage

The field orientation is an introduction to the company where the research was conducted, observations of the planning location to be mined, topographical conditions, the process of activities taking place in the field and the geological conditions of the research area.

Data Collection Stage

At this stage, data collection will be carried out which will later be used for block model construction and mining reserve calculation. The data source used in this study is secondary data, the following explanation: Secondary data sources are data obtained from the results of previous studies, and other supporting data from the company. The secondary data used in this study include:

Resume Data Survey and Resume Lithology Data

Data from exploration drilling is needed to determine the location and condition of coal deposits. From the drill data, it can be seen the coordinates of the point of the drill point, rock composition layer (lithology), coal roof and floor elevation, coal thickness, coal seams, and the quality of the coal itself. Data from exploration drilling is needed to determine the location and condition of coal deposits. From the drill data, it can be seen the coordinates of the point of the drill point, rock composition layer (lithology), coal roof and floor elevation, coal thickness, coal seams, and the quality of the coal itself.

Regional Concession Map

Is a coordinate data boundaries of the area of the study area that aims so that the study area does not exceed the boundaries with other regions.

Topographic Map

Topographic data is required for knowing the shape of the surface morphology. Topographic data are usually presented in the form of maps. This map is used to plot the position of the drill holes to match the actual conditions. In addition, this map is also useful in calculating coal reserves because it is used as the upper boundary at the time of pit design.

Geometry Levels

Level geometry data needed for designing the pit, in designing the pit required data of slope height, slope the safety factor of the geometry level is declared safe.

Data Processing and Data Analysis Stage

The research began with a literature study and later stages of data collection performed simulations (modelling and calculation) using software Minescape 4,118. The stages of data processing and data analysis include the following:

Geological Modelling

To make a pit design, the following stages need to be done:

- **Making Topographic Contours**

Topographic contours are required foreknowing the morphological form of ground level. In topography contour mining activities are used to determine the outcrop points (outcrops).

- **Making Geological Database**

The database of geology isa combination of exploration drill data in the form of survey data and lithology data from correlated drill points. This data provides conclusive information about the unit equivalents of the drill points.

- **Making Contour Structure**

Contour structure is data describe the position or location of coal that is below the surface with known elevation of each contour. The purpose of making the contour of the structure is to determine the pattern of spread of the coal roof (top layer) and floor (bottom layer) and provide an overview of the direction and slope of the coal

- **Making Cropline Seam Lines**

Cropline is an imaginary line that connects the outcrops of topographic contour intersections with the contours of a coal structure. Cropline is made with the aim to determine the pit limit to be made.

Pit Design

After Geological Modelling

the next step is to design a pit by making block model construction and calculating coal reserves and overburden to get the SR value determined by the company so that it can the outermost pit limit is to be made in accordance with the predetermined stripping ratio, the pit design stages are as follows:

Making Block Model Construction

Making block model construction conducted in the area of reserve distribution that has been modelled, namely the structure contour.

Calculation of Coal Reserves and Overburden

The calculation is performed using the block model method with the formula of the beam or prism plane.

The calculation uses the help of Microsoft Excel in the form of tabulating data containing overburden volume and tonnage of coal which aims to determine the appropriate stripping ratio.

Reshgraphic Modelling (Reserve Graphic)

Function to Describe

The values in each block resulting from the calculation of a solid brick into a colour gradation. From this reshgraphic modelling, it can be determined the optimum area to be mined based on the SR determined by the company.

Final pit design

Making pit design that has been in accordance with the SR and the amount of reserves determined by the company.

Results

In this section contains conclusions obtained after completing the data processing stage. The conclusion was obtained after the pit design and the final result of all the problems discussed.

RESULTS AND ANALYSIS

PT. Pancaran Surya Abadi

PT. Pancaran Surya Abadi is a national private company engaged in the coal mining industry located in Salok Palai Village, Muara Badak District and Kutai Lama Village Anggana District, Kutai Kartanegara Regency, East Kalimantan Province, covering an area of ± 991 hectares with a Mining Business Operation License

(IUP-OP) Number 540/025 / IUP-OP / MB-PBAT / IX / 2009 dated September 10, 2009.

Processing and Analysis of Data

The processing and data analysis is done at PT. Pancaran Surya Abadi, Desa Kutai Lama (site) and Villa Tamara Housing, Samarinda (office) for approximately four months. In the early days of the study, the majority of activities were carried out in a field orientation to find out the topography of the study area. In addition, the research data was collected to support data processing and data analysis.

Geological State

Regionally the research area of PT. Pancaran Surya Abadi has the main geological structure found in the Balikpapan Formation.In the study area based on the grouping of coal deposit types and geological conditions that refer to (SNI 5015: 2011), the study area is included in the simple geological group.

Based on drill data in the Mining Business Permit area of PT. Pancaran Surya Abadi, there are 6 coal seams. Here is a table of drill data that illustrates the distribution of coal in the mining permit area of PT. Pancaran Surya Abadi:
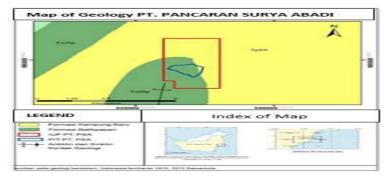

Figure 1: Regional Geological Map of PT.PSA.

Reserve Calculation of Coal Mined Based on Examination of Stripping Ratio at North Block in Pt. Pancaran Surya
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Table 1: Coal Lithology Data Resume

Hole Id	From	To	Thickness	Lithology	Seam
PSA 01	8.4	12.3	3.9	CO	A
PSA 01	38.8	43.4	4.68	CO	B
PSA 02	6.3	14.5	8.2	CO	B
PSA 02	26.5	26.9	0.45	CO	C
PSA 03	5.58	7.3	1.72	CO	C
PSA 03	36.5	37	0.5	CO	D
PSA 04	7.6	11.39	3.79	CO	A
PSA 05	26.6	27.5	0.9	CO	C

Table 2: Coal Resume Survey

Hole Id	X	Y	Z	Hole Deep
PSA 01	536496	99540834	58.671	50
PSA 02	536431	9953998	39.824	50
PSA 03	536384	9953935	35.532	50
PSA 04	536442	9954179	49.565	50
PSA 05	536391	9954112	32.632	50
PSA 06	536340	9954044.	36.11	50
PSA 07	536394	9954287	40.818	50
PSA 08	536347	9954219	31.356	50
PSA 10	536336	9954371	37.928	50
PSA 12	536234	9954235	48.298	50

Situation of Topography

Topographic map is a picture of the surface of the earth that can be identified in the form of natural and artificial objects. The topographic map presents objects of the earth's surface with heights calculated from the surface of the sea water and drawn in the form of contour lines, where each contour line represents one height. The highest area in the mining business permit area belongs to PT. Pancaran Surya Abadi has the highest elevation of 100 meters above sea level. Whereas the lowest elevation is at the level of 10 meters above sea level.
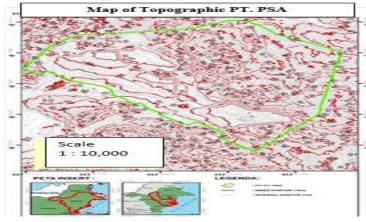

Figure 2: Topographic Map of PT. PSA.

Coal Modelling

In this research, coal modelling is conducted to determine the distribution, strike value, dip and thickness of coal in the study area. Data from exploration drilling results are processed to provide an overview of the condition of coal deposits in PT. Pancaran Surya Abadi. Following are the steps taken in coal modelling:

PlottingDrilling Data

There is a Data Processing Activity

Where researchers place drill points whose data have been obtained from exploration drilling activities and presented in a topographic map of the study site. Drilling by PT. Pancaran Surya Abadi in the study area amounted to 108 drilling points. The highest elevation of drilling is at 82.87 meters, while the lowest elevation is at 23,962 meters Drilling carried out in the study area is drilling depth of ± 100 meters from the surface. The distribution of drill points can be seen in Figure 3.
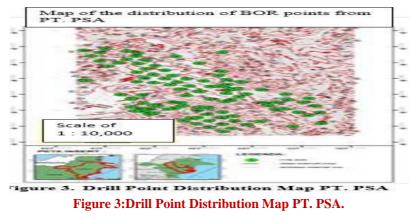
Correlation of Rocks

From the results of drill data generated orthe so-called log drill is obtained data that lists the depth values where a rock layer was found. With the drill log data and correlating it, we can find 6 coal seams at PT. Pancaran Surya Abadi. However, the coal seam used in the northern block contained 2 seams, namely seam A with an average thickness of 2.21 meters and seam B with an average thickness of 5.19.

Structure Contour Modelling

This structure contour is in the form of roof structure contour and floor structure contour. Making the contour of the roof structure and the contour of the floor structure will model the distribution of coal deposits that will be calculated as reserves in the study area. Contour roof structure is the upper limit of coal deposits with rocks above, while the contour of the floor structure is the lower limit of coal deposits with rocks below.

After modelling the contours of this structure, we will get a cropline from the modelled coal deposit. Cropline is an imaginary line that connects the intersection points between the topographic contours and the contours of the coal structure. Map of the contour structure of the study area can be seen in Figure 4and Figure5.
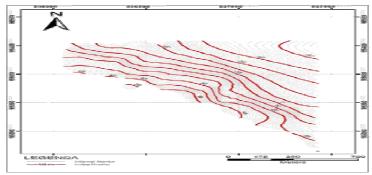
Figure 3:Drill Point Distribution Map PT. PSA.

Figure 4: Contour Structure of Seam A

Reserve Calculation of Coal Mined Based on Examination of Stripping Ratio at North Block in Pt. Pancaran Surya
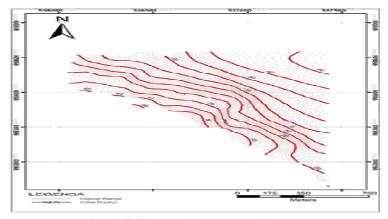*Abadi East Kalimantan Province, Indonesia*

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Figure 5: Contour Structure of Seam B.

Solid Batter Block Method Study

Before making a solid batter block, the first thing to do is to make an intersection that functions to make blocks and strips that will later be changed to solid after which a calculation of each seam will be displayed in the form of tables on each batter block (solid). The more solid batter blocks made, the more solid batter block results are obtained. The amount of solid or not does not affect the calculation results and if there is only a very thin difference. This is due to the calculation of a solid batter block meeting unlike the cross section that still has a distance. The size of the solid batter block is only used for the continuation of mining scheduling. Calculations using the solid batter block method are very easy this is due to an automated system only if not careful will slow down the calculation process itself as when making a solid batter block, making a solid batter block must be understood because otherwise the software will not be functioning properly and will result in incorrect calculation. This method also automatically calculates the relative density of coal which will automatically simplify and can immediately determine the tonnage of coal to be extracted or mined without having to multiply again with the coal density. Calculations using the batter block solid method in this study were carried out in the area distribution of structural contours in the area

Research, then blocks are made which later each block has a stripping ratio value, the stripping ratio value of each block will be marked with colour variations. From the blocks that are known the value of stripping ratio can be made mining limits based on the recommended SR (stripping ratio) company that is a maximum of 15: 1
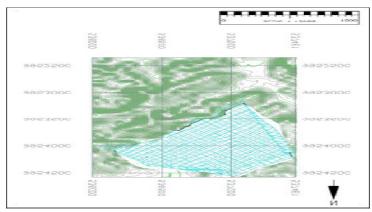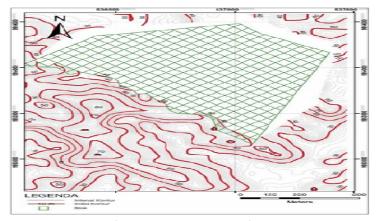

Figure 6: Solid Block.

Figure 7: Block Intersection.

Figure 8: Resgraph SR.

Mining Design

To design the mining activity plan of PT. Pancaran Surya Abadi provides recommendations for pit design geometry in the study area with a single slope angle of 50 °, high wall and side wall and for the low wall following the coal bedding and for overall slope is 41.17 ° the width of each level is set at 3 meters and the level height is 10 meters. Mining activities carried out to a depth of - 43,626 meters.

Based on the recommendation, a pit with RL (request level) of mining is generated at -40 elevation on the contour of the coal floor to elevation in the topographic area. A map of the pit design can be seen in Figure .9.

Pit Design

After modelling the blocks and calculating the volume in each block, the next step is to optimize the pit design by determining the optimal boundary of the pit. Determination of boundary pit, first make a tabulation containing overburden volume and tonnage of coal which aims to provide stripping ratio values for each block. Optimization is only done by using the Microsoft Excel application that is generated from the calculation of the block model volume that was previously created. The data needed to determine the boundary pit are the names of each block, the total volume of each block, coal tonnage, and the total volume of overburden. Optimizing pit design with Microsoft Excel can make it easy to limit blocks that have planned stripping ratio constraints. Other than that also makes it easier for researchers to get the estimated stripping ratio in the design of the pit to be made. The planned stripping ratio value is less than 4.6.

Areas that have an estimated stripping ratio value determined by the company are indicated by area blocks in blue-green colour i.e. blocks that have stripping ratio values of less than 15: 1. And then the researcher can determine the optimal pit limit by integrating the blocks into the pit design planning with the help of a computer system.
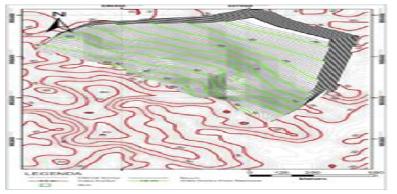

Figure 9: Map of North Pit Block Design PT. PSA.

Coal Reserves Calculation Results

In this study reserve calculations are performed using the triangle method. The triangle method is used to calculate coal reserves. The calculation is done by determining the boundary that becomes the calculation parameter, the limit for calculating the volume of coal and the total waste, namely the topography (surface) as the upper limit and pit design is used as the lower limit.

Reserve calculations using the butter block solid method, as previously explained, the calculation data can be seen in table 3. following:

Table 3: Reserve Calculation Results with the Triangle Method

1	Overburden	60.532.994,96	BCM
2	Tonnase Coal	13.074.635,12	MT
3	Stripping Ratio	4.6	

Stripping Ratio

Based on the results of processing and calculation of pits in the northern block of PT. Pancaran Surya Abadi by using solid block butter obtained coal reserves of 13,074,635.12 MT with total waste

60,532,994.96 BCM, then the stripping ratio calculation is as follows:

- SR (stripping ratio) = Total volume of waste:

- Coal tonnage= 60,532,994.96:13,074,635.12

- = 4.6298037692≈ 4.6

So that the pit design results obtained total coal reserves mined with overburden 60,532,994.96 BCM tonnage 13,074,635.12 MT and to obtain an overall SR of 6.04: 1 in accordance with SR recommendations from the company which is a maximum of 4.6: 1.

CONCLUSIONS AND SUGGESTIONS

Conclusions

Based on the results of research conducted at PT. Pancaran Surya Abadi obtained the following results:

- The pit limit in the study area is designed with a depth of ± 100 m, ranging from topographic elevation to ± 60 m, down to -43 m.

- Estimated results of mined reserves and

- Mining overburden calculated using the triangle method with Minescape 4.118 software is as follows: Tonnage coal 13,074,635.12 metric tons and Total waste 60,532,994.96 bcm.

- Stripping ratio obtained 4.6: 1.

Suggestions

Based on observations and results of research conducted at PT. Pancaran Surya Abadi made the following suggestions:

- It is better to design an optimization pit by accompanying costs to produce an optimization pit with an estimated profit for the company.

- Perform the comparison of the results of the reserve calculation with the block model method, cross section or with the polygon method in the Minescape application.

- Done sequence design mining.

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