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Six Big Losses Method for Management Maintenance on the Coal Feeder Machine PT Indonesia Power

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A B S T R A C T

PT. Indonesia Power Suralaya is a steam power generating company. The coal feeder machine is an auxiliary tool in the steam power plant (PLTU) cycle. The object of this research is the coal feeder machine located in the boiler plant. The coal feeder machine functions to regulate the amount of coal needed to be used as heating fuel in the boiler system. One of the problems with the coal feeder machine is that it is ripped or the belt is torn causing the machine to not operate. This failure or damage causes downtime or the machine stops operating. One of the methods used in this research is the six big losses which find out what types of losses can affect the effectiveness of a machine or component and this method aims to find out what losses affect the effective reduction of a machine's effectiveness. One of the purposes of using six big losses is to find out what losses affect the function and performance of the machine/equipment used and to avoid the six big losses found in coal feeder machines so that the machine avoids stopping suddenly. The purpose of this research is to determine the losses that occur when the machine experiences problems using the six big losses method. The results of calculations using the six big losses method show that the largest loss in equipment failure losses is 1.

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INTRODUCTION

Practical Work Lectures (KKP) are a form of integrated application of attitudes, abilities and skills that students acquire in lectures. By participating in the KKP, students can increase their knowledge, skills and experience in applying the knowledge gained and also be useful for companies in terms of mediating community relations and awareness of the world of education.

State Electricity Company (PLN) Persero Suralaya Steam Power Plant Unit (PLTU) is trying to provide reliable, efficient and quality electric power by building 7 central steam power units with coal as the main fuel. Units 1-4 have a capacity of 400 MegaWatts and units 5-7 have a capacity of 600 MegaWatts so that the community's need for electrical energy can be met. PT PLN (Persero) PLTU Suralaya Generating Unit meets the needs spread across the islands of Java and Bali, namely 8,921 MegaWatt.

Steam power plants require a process of evaporating water and then heating it through a boiler system so that it can produce dry steam to drive a turbine and then drive a generator as a means of producing electricity. The process of producing dry steam is fulfilled by the boiler plant as a heating device, whether for fuel heating, space heating, water heating or for other purposes so that company operations can run smoothly. Boilers area closed system that can produce steam with a pressure greater than one atmosphere by heating water by heating the results of burning fuel until it becomes steam. A Boiler needs to be equipped with auxiliary equipment to increase its efficiency so that Boiler operations run safely.

One of the auxiliary tools used in this boiler system is a coal feeder, which is a auxiliary tool that functions as a regulator of the amount of coal flow, which is then crushed in a pulverizer before entering the combustion chamber. The Coal feeder machine could be damaged at any time, so it is necessary to carry out maintenance or checks to avoid the machine being damaged during operation. From that I took the title KKP which is the six big loses method for maintenance management on coal feeder machines. With my placement in this part of the plant, it is hoped that I will be able to find out the next corrective action for the Coal feeder machine.

Formulation Of The Problem

Based on the background above, the main problems taken by the author are as follows:

1. What are the types of six big losses in Coal feeder machines?
2. How are corrective actions taken to reduce the risk of damage to the Coal feeder?

Research Purposes

The research objectives are as follows:

1. To find out the types of losses in Coal Feeders
2. To find out corrective actions and reduce the risk of damage to the Coal Feeder.

LITERATURE REVIEW

Six Big Losses method is an approach used in machine maintenance management. This method aims to identify and overcome six main types of losses that often occur in machine operations. This approach helps in improving efficiency and productivity with a focus on reducing these six major losses.

The benefits of applying the Six Big Losses Method in machine maintenance management are as follows:

1. Identify Key Problems: This method helps to clearly identify the types of major losses that can occur in the operation of the machine. Thus, management can focus on addressing the root cause.
2. Prioritization of Corrective Actions: By knowing the main types of losses, companies can give priority to the most crucial corrective actions that have a significant impact on operational efficiency.
3. Cost Savings: By reducing major losses that can affect machine performance, companies can save costs that would otherwise be used to overcome those losses and make additional repairs.
4. Improved Operational Efficiency: By reducing major losses such as machine downtime, companies can improve overall operational efficiency, which in turn can improve production and overall performance.
5. Productivity Improvement: By overcoming the huge losses that hinder machine productivity, companies can increase production rates and optimize the use of uptime, resulting in increased productivity.
6. Optimize Resource Usage: Identification of key losses allows companies to use resources, including labor, materials, and time more effectively and efficiently.

METHODOLOGY

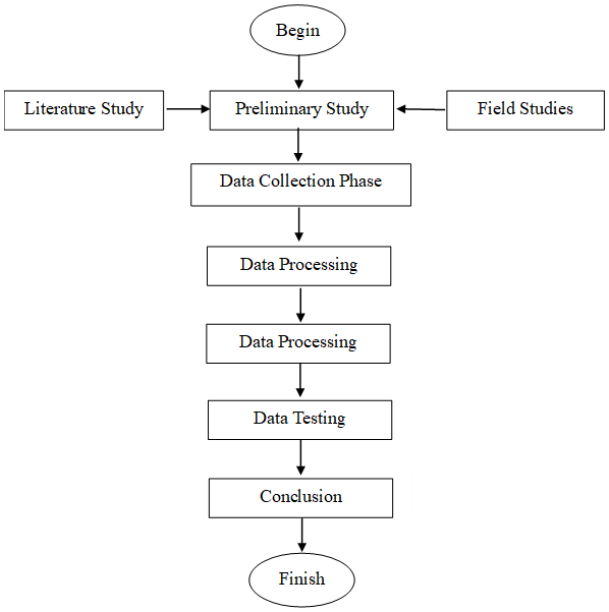

Figure 1. Flow Chart

Data collection techniques in this research used methods, including:

1. Documentation Method
   With this method the author obtained data from previous damage reports from the Boiler 5-7 division team.
2. Interview Method
   Interviews are the author's communication technique with the Boiler 5-7 division team to obtain the data the author needs regarding problems with the Coal feeder.
3. Internet Browsing Methods
   Browsing is a method of collecting data via the internet related to the needs of this research.
4. Formulation of the problem
   The next step is to describe the problem to make it simpler and easier to understand.

The stages of this research consist of:

1. Literature studies are carried out to determine the problem solving method that will be used and also look for supporting theories aimed at strengthening the method that will be used.
2. Preliminary study by direct observation in the field.
3. Formulate the problems that occur in the background of the problem and create research objectives based on the problem formulation.
4. Problem limitations are carried out to limit the problems that will be discussed.

DISCUSSION

Data collection

The machine that is the object of research for data collection is the Coal feeder machine. This machine functions as a tool to control the amount of coal needed in the grinding machine.

A. Coal feeder machine damage data

Table 1. Coal feeder machine malfunction data

Coal feeder machine	Month	Damage
	March	Ripped
7c	June	Ripped
	October	Ripped

(Source: Company Data 2022)

It can be seen in the table above that the damage occurred due to Ripping, namely the condition of the Coal feeder belt being torn which caused the machine to not operate and had to be repaired immediately.

B. Machine maintenance data

Coal feeder machine time data consists of data on loading time, operation time, breakdown time, setup, planned maintenance

Table 2. Machine Maintenance Data

2022	*Coal Feeder machine*	Month	*loading time* (hour)	*breakdown time* (hour)	*set up* (hour)	*downtime* (hour)	*opreation time* (hour)	*planned maintenance* (hour)
		March	743	9.45	1.15	11	732	1
	7c	June	719	9.45	1.15	11	708	1
		October	743	9.45	1.15	11	732	1

(Source: Company Data 2022)

Data processing

Calculation of Six big losses

The six big losses calculation consists of 6 calculation factors, namely, equipment failure losses, setup and adjustment losses, idling and minor stoppages, reduced speed, defect losses, and reduced yield are as follows:

1. *Equipment Failure Losses*

   *Equipment failure losses*is namely damage to machines or equipment that suddenly causes losses, because damage to the machine causes the machine to not operate to produce output. To be able to determine equipment failure losses requires breakdown time and loading time data.

   The formula used to calculate Equipment failure losses is:

$$\textit{Equipment failure losses} = \frac{\text{Total Breakdown Time}}{\textit{loading time}} \times 100\%$$

$$= \times 100\% \frac{9{,}45\ (jam)}{743\ (jam)}$$

$$= 1.27\%$$

Table 3. Equipment failure losses calculation results

Coal Feeder machine	Month	*breakdown time* (hour)	*loading time* (hour)	*Equipment Failur Losses* (%)
	March	9.45	743	1,27
7c	June	9.45	719	1,31
	October	9.45	743	1,27
Avarange				1,28

(*Source: data processing*, 2022)

2. *Setup and Adjustment Losses*

*Setup and adjustment of losses*are losses due to installation and setup, namely all setup time including adjustment time and also the time required for activities to replace one type of product with the next type of product for the next production process. To be able to determine setup and adjustment losses requires data on total setup and adjustment losses and loading time. The formula used to calculate setup and adjustment losses is:

$$\textit{Setup and adjustment losses} = \frac{\text{Total } \textit{setup and udjustment}}{\textit{loading time}} \times 100\%$$

$$= \frac{1.15}{743} \times 100\%$$

$$= 0{,}15\%$$

Table 4. Setup and Adjustment Losses calculation results

Coal Feeder machine	Month	*set up* (hour)	*loading time* (hour)	*Setup And Adjustment Losses* (%)
	March	1.15	743	0,154
7c	June	1.15	719	0,159
	October	1.15	743	0,154
Averange				0,16

(*Source: data processing*, 2022)

3. *Idle and Minor Stoppage*

*Idle and minor stoppages*caused by events such as momentary engine stops, engine stalls, and engine idle time. To be able to determine idle and minor stoppages, data on planned maintenance time and loading time is required. The formula used to calculate idle and minor stoppages is:

$$Idle\ and\ minor\ stoppages = \frac{Planned\ \ maintenance\ \ time}{loading\ \ time} \times 100\%$$

$$= \frac{1}{743} \times 100\%$$

$$= 0{,}13\%$$

Table 5. Idle and Minor Losses calculation result

Coal Feeder machine	Month	*planned maintenance* (hour)	*loading time* (hour)	*Idle and Minor Losses* (%)
	March	1	743	0,134
7c	June	1	719	0,139
	October	1	743	0,134
rata-rata				0,14

(*Source: data processing*, 2022)

4. Recapitulation of Six big calculations *losses*
After carrying out calculations from the existing data, a data recapitulation is made as follows:

RecapitulationCalculation of Six big losses

Table 6. RecapitulationCalculation of Six big losses

Coal Feeder machnine	Month	*Equipment Failur Losses* (%)	*Setup And Adjustment Losses* (%)	*Idle and Minor Losses* (%)
	March	1,27	0,154	0,134
7c	June	1,31	0,159	0,139
	October	1,27	0,154	0,134
amount		3,85	0,467	0,407
averange		1,28	0,156	0,136

(Source: data processing, 2022)

Based on calculations using the six big losses, there are only 3 losses that can be obtained based on data obtained in March, June and October.

Analsis And Improvement Sugestion

Table 7. Analsis And Improvement Sugestion

Coal feeder machine	Month	*planned maintenance*(hour)	*loading time*(hour)	*Idle and Minor Losses*(%)
	March	1	743	0.134
7c	June	1	719	0.139
	October	1	743	0.134
average				0.14

(Source: Data Processing, 2023)

Based on the results of the analysis using the six big losses on the coal feeder machine, there are 3 losses, including equipment failure losses of 1.28%, setup and adjustment of 0.156% and idle and minor losses of 0.136%.

After obtaining the results of the calculation of the six big losses on the coal feeder machine, the largest loss value lies in equipment failure losses amounting to 1.28% of the equipment failure losses causing machine operations to stop due to component damage.

After carrying out the analysis, it is found that the factor causing the biggest loss is component damage, the suggestions that can be given are:

1. Carry out routine checks on the coal feeder, including the belt, which is a component prone to tearing
2. Check the coal supply that will enter the coal feeder to avoid objects that could damage the belt
3. Replacing the belt with a better specification so that the components can last longer with a shorter failure time interval.

CONCLUSION

Based on the results of data processing and discussions that have been carried out, the following conclusions can be made:

1. The types of losses obtained were 3 out of 6 types of losses in the six big losses method, namely equipment failure losses of 1.28%, setup and adjustment of 0.156% and idle and minor losses of 0.136%. Of the three

losses, the highest percentage value was in the equipment failure losses category at 1.28%.

2. Based on the research above, it is known that the greatest value is in equipment failure losses, so the recommended corrective action is to replace the equipment/spare part belt specifications with stronger quality.

SUGGESTION

From the results of the research that has been carried out, the following suggestions can be given:

1. Companies need to pay more attention to maintenance patterns by making schedules to avoid machines suddenly stopping.
2. Keep the belt free from foreign objects other than coal so that the belt doesn't get damaged quickly.

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