ANALYSIS OF CALCULATION OF COST ELECTRICITY PRODUCTION AT PT PERTAMINA USING FULL COST METHOD

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ABSTRACT

PT Pertamina EP Field Jatibarang is a subsidiary of PT Pertamina (Persero) which is engaged in carrying out business activities in the upstream oil and gas sector including exploration and exploitation. Operationally, Pertamina's upstream business activities are under the Upstream Sub Holding which is managed by PT Pertamina Hulu Energi (PHE). PT Pertamina EP which is located in MOR 2 is a subsidiary of PT Pertamina Hulu Energi (PHE) managing work areas around the West Java area, with one of its areas being the Jatibarang field. The Jatibarang Field focuses on extracting oil from wells which is then collected into the SP (Gathering Station). The electric power system at PT Pertamina EP Field Jatibarang is supplied by 3 Gas Engine Generators (GEG) and one Engine Diesel Generator (EDG) to medium voltage and low voltage loads, respectively. The amount of electricity generation costs is needed to determine the cost of electrical energy products, the amount of which can be used as a billing reference for PT. PSDI and PT. Pertagas which uses the facilities together with PT. Pertamina EP Field Jatibarang. Calculation of the cost of goods using the full costing method can be a solution to determine the reference for the amount of tariff/KWH paid.

Keyword : *Gas Engine Generator, Cost of Production, Full Costing*

1. INTRODUCTION

Energy is the main need for all humans. In particular, electrical energy is always needed and even becomes a dependency. From simple needs for household needs to large quantities in an industry. Most of the industry uses a generator as its power supply. Generators play a very important role and function in the distribution of electric power in an electric power system.

PT Pertamina EP is one of the subsidiaries owned by PT Pertamina (Persero) which carries out business activities in the upstream sector of oil and gas, including exploration and exploitation. In the upstream sub holding, one of them is PT. Pertamina EP Field Jatibarang which is in the working area of MOR 3. In its operation, PT. Pertamina EP Field Jatibarang using its own generator, namely the Mundu Power Plant (PP) which is used to supply office areas, housing, and collecting stations (SP). PP Mundu also supplies other parts such as PT. Pertamina Drilling Services Indonesia or commonly abbreviated as PT. PDSI which is not part of PT. Pertamina EP Field Jatibarang, so that in practice PT. PDSI must pay fees/KWH to PT. Pertamina EP Field Jatibarang. PT. Pertamina EP can withdraw funds for the benefit of facilities with PT. PDSI is water and electricity.

1.1 Purpose

The objectives of this practical work are to:

1. Adding information and knowledge about the electric power system at PT. Pertamina EP Field Jatibarang
2. Knowing the activities and generation activities to determine the electricity price tariff at PT. Pertamina EP Field Jatibarang
3. As a medium for gaining knowledge, critical and practical thinking experience, training skills and acting in an industrial society environment that is in accordance with the disciplines studied

1.2 Scope of Problem

Problem limitations in this practical work report are:

1. In writing this practical work paper the author limits the analysis of the calculation of the cost of product at PT. Pertamina EP Field Jatibarang with a generator from PP Mundu with the full costing method.
2. The calculation is carried out with assumptions and approaches from the reference costs that have been issued in the previous year

2. BASIC THEORY

Electrical network at PT. Pertamina EP Field Jatibarangwhich has a generator in Mundu or what is commonly known as the Mundu Power Plant uses a radial system that places the power plant at one point, namely the main bus and then is distributed to loads with a voltage level of 6.6 kV and is divided into 5 Load Centers (LC). Distribution network at PT. Pertamina EP itself uses a 400V voltage system.

Electrical system at PT. Pertamina EP Field Jatibarang uses 3 units of Gas Engine Generator (GEG) which function to supply the load with 2 GEG operated and 1 GEG in standby condition. When a disturbance occurs which results in blackouts, the 3 main generators are assisted by 1 diesel engine unit Generator (EDG) which serves to supply the office area and also helps the initial starting process of GEG.

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2.1 Gas Engine Generator

Generator set or Genset is a device that functions to generate electrical power. Referred to as a generator set with the understanding is a set of equipment combined from two different devices, namely the engine and generator or alternator. The engine is a rotating device while the generator or alternator is a power generating device. The engine can be made from fuel or natural gas, while the generator or alternator is a copper coil or coil consisting of a stator and a rotor.

2.2 Maintenance Generator

Maintenance of brushless generators is useful for preventing disturbances when the unit is operating, so it does not cause greater or fatal damage and the equipment has a longer service life, resulting in better performance and a more guaranteed level of safety.

Based on the time of the election, maintenance can be divided into;

- Routine Maintenance (Preventive Maintenance)
- Periodic Maintenance (Periodic Maintenance)

Periodic inspections are inspections carried out based on the duration of operation of the generator, which are classified:

- Simple check, every 8,000 hours
- Moderate checks, every 16,000 hours.
- Serious checks, every 32,000 hours.

Periodic inspection activities carried out include disassembly (disassembly), inspection (inspection) and testing (testing).

2.3 Production Cost

The definition of production costs is the total cost incurred to produce a product until the product reaches the consumer.

Elements of production costs:

a. Raw Material Cost

According to Mulyadi (2014: 275) "Raw materials are materials that make up the overall part of the finished product. In obtaining raw materials, factories can get them from local purchases, imports, or self-processing". In production activities, it is not only the cost of raw materials that is needed but also several other costs that are important to pay attention to, namely the costs of purchasing, warehousing, and other acquisition costs.

b. Labor costs

According to Mulyadi (2014: 319) "Labor costs are the imposition of labor costs related to the company, the physical or mental effort incurred by employees to process the product, which is called labor". Labor costs incurred can be classified into two, namely direct labor costs and indirect labor costs.

c. Factory Overhead Cost

Factory overhead costs are one of the cost components that make up the amount of production costs, where these costs are core costs in addition to raw material costs and direct labor costs, these costs are production costs that cannot be charged directly to a work unit. The more rapid economic development today, the larger the role of the world of production, this results in an increasingly rapid level of competition in seizing the market. .

Factory overhead costs are costs that are not included in the cost of raw materials and direct labor costs. Mulyadi (2014: 194) states that factory overhead costs can be classified in three ways:

1. Classification of factory overhead costs according to their nature
   - Auxiliary material costs
   - Repair and maintenance costs.
   - Indirect labor costs
   - Direct labor costs
   - Costs incurred as a result of the valuation of fixed assets
   - Costs incurred as a result of the passage of time
   - Other direct factory overhead costs
2. Classification of factory overhead costs according to their behavior.
   Overhead costs can be divided into three groups, namely fixed, variable, and semi-variable factory overhead costs.
3. Classification of factory overhead costs according to their relationship.

2.4 Cost of Good Sold

The cost of production is very influential in the calculation of the company's profit and loss, if the company is not careful or wrong in determining the cost of production, it will result in an error in determining the profit and loss that will be obtained by the company. Considering the importance of the cost of production which requires accuracy and precision, in the sharp competition in the industry as it is today, spurring one company to compete with other companies, in producing similar products or substitute products. That's why cost information and cost of goods manufactured information is needed for various decision making.

In taking into account these cost elements,In the cost of product, there are two approaches, namely the full costing method and the variable costing method

a. Full costing method

Hariadi (2002: 445) suggests that: "Full costing is a method that takes into account all product costs, both fixed and variable in determining the value of supplies to be sold by the company. Meanwhile, Mursyidi (2008:29) defines the full costing method (absorption costing) as determining the price. principal that takes into account all elements of production costs, which consist of raw material costs, direct labor and factory overhead costs that are variable (variable costs) or fixed (fixed costs).

The full costing method is a method that has been widely used in calculating the cost of goods sold, most companies use a full costing approach in determining the cost of the products they sell because of the consideration that all costs incurred should be the burden of consumers and this reason is logical in order to maintain the survival of the company.

The main weakness of the Jull costing method is the inappropriate use of this method for planning and decision making purposes. If there is a difference between production and sales (production > sales), it is very possible that

sales of the break-even point using the full costing method the company earns a profit.
*full cost*is a method of determining the cost of production that takes into account all elements of production costs into the cost of production, which consists of raw material costs, direct labor costs, and factory overhead costs, both variable and fixed.

b.Variable costing method

According to Samryn (2007: 64) Variable costing is an income statement format that groups costs based on cost behavior where costs are separated according to variable and fixed cost categories and are not separated according to production, or administration, and sales functions.

Mulyadi (2006) defines the variable costing method as a method of determining the cost of production that only charges variable production costs into the cost of production. If the company uses the variable costing method, then as stated above, the fixed costs need to be separated into direct fixed costs and common fixed costs.

Direct fixed costs are fixed costs that can be traced directly to a segment or can be avoided if the segment is eliminated because the cost is caused by the segment concerned. An example of a direct fixed cost is the salary of a particular product supervisor or machine depreciation.

While the common fixed costs are costs caused by the existence of two or more segments together in the company. This cost is still incurred by the company even if one segment is closed. Examples of common fixed costs are manager salaries or depreciation of factory buildings.

Benefits of the information generated by the variable costing method is very useful for financial reports where the compilation using the variable costing method is useful for management for planning

3. DISCUSSION AND ANALYSIS

3.1 Gas Engine Generator Power

The recording of existing power is carried out every month which is usually at the end of the month for each period. KWH measurement is done by using a KWH meter that is attached to each outgoing load to the installed load. The KWH used varies in each period depending on the activities of PT. Pertamina EP Field Jatibarang uses electrical energy to supply offices and official residences and is used to supply power at the collecting station (SP). When pumping is done at the collecting station, the KWH automatically used becomes more. The KWH data produced by the three generators in 2020 and 2021 can be seen in table 3.1 and 3.2 the following.

Table 3. 1KWH data generated in 2020.

Month	G-01	G-02 (KWH)	G-03(KWH)
January	173.476	-	189,588
February	155.522	-	173.117
March	56,091	-	199,312
April	14,402	162,682	143.289
May	-	178,635	118.813
June	-	148,849	121.709
July	-	86.523	160,376
August	-	71.885	169,845
September	-	106,386	157.033
October	-	67,973	159,640
November	-	117,242	95,274

December	126,732	18,445	166,931
Amount	526,223	958,620	1,854,927
Total1 year			3,339,770

KWH data generated in 2021 from the period January to June is recorded and the average value is sought, assuming activities from January to December use the same average power usage every month because apart from the routine schedule, there are no other activities that require large amounts of power.

Table 3. 2KWH data generated in 2021

Month	G-01	G-02(KWH	G-03(KWH)
January	-	75,275	268,704
February	-	79.131	201.531
March	-	91.016	241.778
April	-	105,900	243.545
May	3,520	97,517	240,767
June	-	106.052	228,465
Amount		554,891	1,424,790
Total number			1,979,681
AssumptionKWH/year			3,959,362

3.2 Lubricant

In the operation of the engine generator, lubricating oil is needed that is able to prevent damage that occurs due to friction between engine components. In addition, lubricating oil is used to prevent the formation of rust on the engine and is able to cool the engine during the combustion process. Oil usage data lubricating pad PT. Pertamina EP Field Jatibarang can be seen in table 3.3 below.

Table 3. 3 Lubricant usage data.

Month	G-02 (liters)	G-03 (liters)
January	300	300
February	100	100
March	200	200
April	287	181
May	200	0
June	10	0
Amount	1097	781
Total number		1878
Average per month		313

Based on table 3.3 regarding data on lubricant consumption in 2021, the assumption of average lubricating oil usage is 313 liters per month. Lubricating oil is purchased in the form of drums containing 209 liters at a price of Rp. 5,000,510 per drum. Then by calculating the use of oil as much as 1878 liters is less than 9 drums with an estimated total cost of Rp.89,865,625. The increase in lubricating oil prices is 3% per year based on the 2021

inflation target released by Bank Indonesia so that the calculation results are obtained in accordance with the following table 3.4.

Table 3. 4 Use of lubricating oil.

Year	Price/Drum (Rupiah)	Lubricating Oil Needs	AmountCost (Rupiah)
2020	5,000,510	1878	89,865.625
2021	5,150,525	1878	92.561.593

3.3 Natural Gas Material

The fuel used to supply the 3 gas engine generators is by using natural gas which is channeled directly from the collection station (SP) to the generator by passing through the gas scrubber. The average use of natural gas is 300 MSCFD per day with an increase in raw material prices of 3% per year based on the inflation target targeted by Bank Indonesia in 2021. From company data it is known that 1 MSCFD is equivalent to 1.082 MBTU at a price of 0.44 USD. Calculation of costs for the use of natural gas in 2020 and 2021 results in accordance with the following table 3.5.

Table 3. 5 Material usageraw.

Year	Fuel (MBTU)	Unit price (USD)	Total price (Rupiah)
2020	118479	0.44	756,967,307
2021	118479	0.44	779,676,326

3.4 Direct Labor Costs

The operation of the generator is carried out continuously or it can be interpreted that the operation of the generator is carried out 24 hours per day, therefore adequate manpower is needed to carry out the operation of the generator continuously. The alternative is to use a shift system, shifts are carried out every 12 hours and each shift consists of 2 operators. The workforce needed for PP Mundu operations is for 6 operators divided into 3 shifts so that shift changes can be made for day and night. The salary for each operator is IDR 6,634,379 per month, and then we can calculate it for one year's salary, namely by multiplying the total salary of 6 operators multiplied by 12 to get the total salary paid in 2020.

Table 3. 6 Direct labor costs in rupiah.

Monthly Operator Salary (Rupiah)	Number of Workers (Persons)	AmountSalary 2020 (Rupiah)	Total Salary 2021 (Rupiah)
6,634,379	6	477,675,288	492.005.547

3.5 Cost of Production With Full Costing Method

The calculation is done by adding all production costs which include raw material costs, direct labor costs, and overhead costs and then divided by the KWH produced each year to determine the cost of the product.

Table 3. 10 Calculation of the cost of production using the Full method costing.

Full Method *costing*	2020 (Rupiah)	2021 (Rupiah)
Natural Gas Cost	756,967,307	779,676,326
Lubricant and Fuel Cost Other	89,865.625	92.561.593
Energy Cost Live Work	477,675,288	492.005.547
Cost of depreciation Generator	900,000,000	900,000,000
CostTransformer and Network Depreciation Distribution	200,000,000	200,000,000
Cost*Preventive Maintenance*	2,352,304,094	2,352,304,094
Breakdown Cost *Maintenance*	956,324,000	1,032,829,920
The amount of costs Production	5,498,484,930	5,607,686,555
Total KWH generated (Watts)	3,339,770	3,959,362
Tariff/KWH	IDR 1,717	Rp 1,477

4. CONCLUSIONS

Based on the results of calculations of electrical energy production at PT Pertamina using Full Costing Method, it can be concluded as follows:

1. The cost of production using the full costing method in 2020 obtained a price of Rp. 1,717/KWH while in 2021 the price is Rp. 1.477/KWH.
2. The amount of the cost of production can affect the company's profit and loss where the HPP must be smaller than the market price to avoid losses, for PT. Pertamina EP HPP is used for billing the use of electricity and water by other Pertamina business units such as PDSI and Pertagas.
3. The amount of HPP/KWH is proportional to the amount of production costs and inversely proportional to the product produced.

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