Determination Program Priority by Applying Variance Analysis Method in Controlling Electricity Main Supply Cost

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***Abstract*— PT. ABC is a State-Owned company managing the electricity sector to meet the needs of the community in providing electricity in Indonesia. Electricity is a commodity that effects the lives of many people, so the basic electricity tariff (TDL) to the community is determined by the government. On the other hand, PT ABC's electricity main supply cost (BPP), are the responsibility of PT ABC itself. The achievement of PT ABC's profits is largely determined by how the BPP is managed and controlled. As of March, the BPP target of the PT ABC power plant managed by PT XYZ was not achieved with an increase in deviation of 27.47 Rp/kWh. The causes of and solutions to the increase in BPP could not be known immediately because PT XYZ did not yet have an analytical method that could explain the causes and their proportions to the increasing deviation comprehensively. Therefore, this study is conducted using the Variance Analysis method in the selection process. The result of this study is the development of BPP controlling method by identifying the BPP component deviations from the predetermined standard costs and suggesting better decision making in prioritizing the work program.**

***Keywords*—Standard Cost, Cost Control, Variance Analysis, BPP.**

I. INTRODUCTION

PERFORMANCE of a company can be seen from the financial performance where profit becomes one of its components. In the highly developed business world today, to get the desired profit requires an effort to be able to control production costs. That effort needs to be done so that the production costs used can be as efficient as possible, therefore the production costs must be planned and controlled so that there is no waste and irregularities. According to Bustami [2], he said that the costs included in production costs are the cost of raw materials, labor costs, and overhead costs. These three elements affect a production process. These three elements if one is removed, then the production process will not run properly because all of them are interconnected with one another. The production process can run well if the company's management is able to apply appropriate and correct methods in accordance with their respective functions.

This production cost control must have benchmarks used as material to measure and evaluate the level of efficiency of production costs. Differentiating costs that can be controlled from other costs is important for evaluation. One that can be applied in controlling production costs is to set standard costs. Standard costs are costs that have been predetermined to produce one unit or a certain number of products during a certain period. The application of these standard costs can be used as a guide in the actual expenditure of costs.

The purpose of these standard costs is to control costs by comparing the standard costs with the realized costs. This can encourage management to arrange standard production costs, so they can find out the amount of expenditure each period.

PT. ABC is a State-Owned Company whose duty is to manage the electricity sector to meet the needs of the community in providing electricity to drive development in Indonesia. The company produces its own electricity or buys electricity from Independent Power Producer (IPP) and then distributes it to the community through transmission and distribution channels. Electricity is a commodity that controls the lives of many people, so the basic electricity tariff (TDL) to the community is determined by the government. On the other hand, the cost of production or commonly referred to as the Cost of Electricity Supply (BPP) of PT ABC's electricity which is the purchase of electricity from Independent Power Producer (IPP) as well as the cost of producing electricity produced by PT ABC's own power plants is the responsibility of PT ABC. The achievement of PT ABC's profits is largely determined by how the BPP is managed and controlled.

In carrying out its business processes PT ABC assigns PT XYZ which is a subsidiary of PT. ABC which is engaged in the field of Power Plants to manage as well as maintain a number of (Coal Fired Power Plant) CFPP and (Combined Cycle Power Plant) CCPP to meet the electricity needs in the Grid system. PT XYZ acts as an Asset Manager and Asset Operator at the power plant as follows Table 1.

As of March, the BPP target of the PT ABC plant managed by PT XYZ was not achieved with an increase in deviation of 27.47 Rp/kWh (See Figure 1). Based on the budget plan, a deviation of an increase of 1 Rp/kWh erodes PT ABC's profit of 26.2 billion rupiah so that the potential for inefficiency is 719.7 billion rupiah.

II. METHOD

The main idea of this research is to perceive the current result and the level of deviation, in relation to which certain actions can be taken for the purpose of correction and improvement of the company's performances. The stages in the research are as follows, study the existing literature, compare between various types of analysis variance and choose the type of variance analysis that is appropriate to the cost structure of the power plant. In order to analyze the variance, the plan and realization of electricity main supply

Table 1.
List of PT ABC power plants managed by PT XYZ

Power Plant	Capacity
CFPP A	2 x 315 MW
CFPP B	1 x 660 MW
CFPP C	2 x 315 MW
CFPP D	3 x 330 MW
CFPP E	2 x 350 MW
CCPP A	242 MW
CCPP B	710 MW
TOTAL	**4.546 MW**

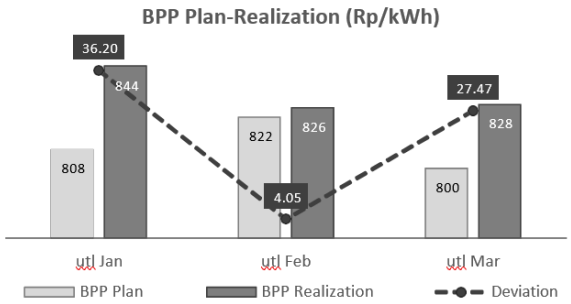

Figure 1. BPP Plan and Realization.

cost must be broken down monthly to be an appropriate cost structure.

A. Electricity Main Supply Cost Components

The generation cost component is stated in units (Rp/kwh) consisting of component A (investment return cost), component B (fixed operating and maintenance costs), component C (fuel cost) and component D (variable operation and maintenance costs). Components A and B are of fixed value even though the electricity production of the power plant changes. These two components determine the amount of installed capacity costs at the electricity tariff. Whereas the components B and D depend on the amount of electricity produced. These two components determine the amount of variable costs at the basic electricity tariff.

B. Variance Analysis

Variance analysis is a method used to measure and control deviations from the realization of operations against plans [8]. Simply put Cost variance analysis is a systematic process by comparing planned costs with actual costs, analyzing differences, and explaining significant deviations [5]. According to Hilton [5], various types of variance analysis are explained. Several types can be chosen to analyze the structure of the power plant BPP because the nature equation is fixed overhead variance, direct material variance, and efficiency variable variance. Efficiency is an assessment of the company's success in achieving the goals set with the amount of output obtained greater than the amount of input issued. The efficiency of the power plant BPP is assessed by comparing the realized costs with the budgeted costs. If the realization costs are higher than budgeted, an unfavorable difference occurs, whereas if the realization costs are lower than the budgeted, a favorable difference occurs.

1) Direct Material Variance

Direct material variance is formed from the multiplication function between price, material volume and quantity of purchases [5].

This variance consisting of arithmetic products of five elements, AQ (actual quantity), AP (actual price), SP (standard price), SQ (standard quantity), PQ (purchased quantity)

Direct material price variance

Used to explain the deviation in material usage costs caused by differences in material volume

$$Direct\ material\ price\ varian = (AQ \times AP) - (AQ \times SP) = AQ(AP - SP) \quad (1)$$

Direct material quantity variance

$$Direct\ materi\ antity\ variance = (AQ \times SP) - (SQ \times SP) = SP(AQ - SQ) \quad (2)$$

Direct material purchase price variance

$$Direct\ material\ purchase\ price\ varian = (PQ \times AP) - (PQ \times SP) = PQ(AP - SP) \quad (3)$$

2) Direct Labor Variance

Direct Labor Variance is used to analyze the deviation of direct labor costs that enter into the variable cost [5]. This variance consisting of arithmetic products of four elements, AH (actual hours), AR (actual rate per hour), SR (standard rate per hour), SH (standard hour allowed).

Direct Labor Rate Variance

$$Dire\ bor\ rate\ variance = (AH \times AR) - (AH \times SR) = AH(AR - SR) \quad (4)$$

Direct Labor Efficiency Variance

$$Direct\ labor\ efficiency\ varian = (AH \times SR) - (SH \times SR) = SR(AH - SH) \quad (5)$$

3) Variable Overhead Variance

Variable overhead variance is a variance analysis used to analyze the deviation of the planned and realized overhead costs [5]. This variance consisting of arithmetic products of three elements, AQ (actual quantity), SVR (standard variable overhead rate), AVR (actual variable overhead rate)

Variable-Overhead Spending Variance

$$Variable\ overhe\ ending\ variance = (AQ \times AVR) - (AQ \times SVR) = AQ(AVR - SVR) \quad (6)$$

Variable-Overhead Efficiency Variance

$$Variable - overhe\ ficiency\ variance = (AQ \times SVR) - (SQ \times SVR) = SVR(AQ - SQ) \quad (7)$$

4) Fixed Overhead Variance

Fixed overhead variance is a variance analysis used to analyze the deviation of the fixed overhead plan and realization [5].

Fixed overhead budget variance

$$F\ budget\ variance = Actual\ Fix\ OH - Budgeted\ Fix\ OH \quad (8)$$

Fixed overhead volume variance

$$F\ volume\ variance = Budgeted\ Fix\ OH - Applied\ Fix\ OH \quad (9)$$

$$Applied\ Fix = Predetermined\ Fix\ OH\ x\ Standard\ allowed\ activity\ level \quad (10)$$

5) Efficiency Variable Variance

Efficiency Variable Variance is the variance of variable factory overhead costs by comparing variable factory overhead using actual activities with factory overhead with standard activities [2].

This variance reflects an efficient and inefficient to be used as a basis by companies in charging overhead costs.

Table 2.
Mapping the appropriate type of variance analysis

Type	Component	Cost Structure	Variance Analysis
Fix Cost	A	Component A	Fixed Overhead Budget Variance
	B and D	ABOP	Fixed Overhead Budget Variance
Variable Cost	C	Fuel Oil	Fixed Overhead Budget Variance Fixed Overhead Volume Variance
		Coal Price	Direct Material Price Variance
		Gas Price	Direct Material Price Variance
		NPHR CFPP	Direct Material Quantity Variance
		NPHR CCPP	Direct Material Quantity Variance
		Energy Mix	Efficiency Variable Variance
Production	A,B,C & D	Electricity sales	Fixed Overhead Volume Variance

Table 3.
Clarification of calculations

Description / Variance		Rp/kWh
1.1 Component A		(23.66)
1.2 ABOP	1.57	
1.3 Fuel Oil		(0.82)
1.4 Electricity sales		11.29
1.5 Coal Price		(2.12)
1.6 Gas Price		42.72
1.7 NPHR CFPP	1.61	
1.8 NPHR CCPP		(5.18)
1.9 Energy Mix	4.19	
1. Total Variance		**29.59**
2.1 BPP income statement until April		825.65
2.2 BPP plan until April		796.06
2. BPP Deviation (2.1 – 2.2)		**29.59**
3. Data Clarification (1-2)		**(0.00)**

Table 4.
Variance of electricity sales

Power Plant	Plan (kWh)	Realization (kWh)	Difference (kWh)	Variance (Rp/kWh)
CFPP D	1,785,775,358	1,852,014,870	66,239,512	(2.06)
CFPP C	1,182,198,756	1,431,552,017	249,353,261	(7.74)
CCPP 5	292,539,883	241,083,693	(51,456,190)	1.60
CFPP B	896,066,569	527,482,200	(368,584,369)	11.44
CFPP A	744,513,659	111,651,731	(632,861,928)	19.64
CFPP E	1,292,970,325	1,641,387,148	348,416,823	(10.81)
CCPP A	1,380,593,241	1,405,813,888	25,220,647	(0.78)
Total	**7,574,657,791**	**7,210,985,547**	**(363,672,244)**	**11.29**

$$Efficien\ riable\ Variance = (actual\ activity - standard\ activity) x\ variable\ tarrif \quad (11)$$

C. Analysis

The electricity main supply cost (BPP) is then arranged according to the power plant cost structure as shown in the table and detailed in a monthly period, so that it can be compared between the plan value and the realized value. The process of controlling Electricity Main Supply Cost (BPP) based on the Variance Analysis method is preceded by determining the cost structure of the power plant and the alternative type of Variance Analysis used in each cost structure. The determination is based on the characteristics, business scheme and available data base (see in Table 2).

III. RESULT AND DISCUSSION

After each deviation's cost structure is calculated, the next step is data clarification. In the clarification stage, the results of data processing are carried out backward by adding all the variances that have been obtained, then compared with the difference between the BPP plan until April and the realization of the BPP in the Income Statements until April. The purpose of this clarification is to ensure that the variance that has been obtained is in accordance with the Income Statement data (see in Table 3).

From Table 3 above we can see that the results of the clarification of the calculation produce a value of 0.00 so that it can be concluded that the results of the variance analysis are in accordance with the BPP plan data and the Income Statement data and can be used as analytical materials at a later stage namely the action plan discussion. The power plant which has the largest variance in electricity sales is the first priority as the object of the program related to power plant reliability. This is because BPP CFPP are classified as low so that when the CFPP is ready for operation, it will definitely be ordered to operate at optimum load. The first step in the

Table 5.
BPP realization based on Variance Analysis

Description / Variance	BPP Realization (Rp/kWh)								
	utl Apr	utl May	utl Jun	utl Jul	utl Aug	utl Sep	utl Oct	utl Nov	utl Des
BPP Plan	796.06	787.80	781.15	777.64	774.40	769.71	767.37	767.33	764.47
BPP Realization (income statement)	825.65	810.54	782.71	771.89	777.61	774.65	764.85	759.63	767.71
BPP Deviation	**29.59**	**22.74**	**1.56**	**(5.75)**	**3.21**	**4.93**	**(2.52)**	**(7.70)**	**3.24**
Coal Price	(2.12)	(3.05)	(36.09)	(31.19)	(22.44)	(23.41)	(24.66)	(23.53)	(23.47)
Gas Price	42.72	40.33	43.99	46.20	51.53	52.04	50.07	47.15	50.65
Fuel Oil	(0.82)	(1.43)	(1.05)	(1.33)	(1.44)	(1.50)	(1.71)	(1.66)	(1.26)
Electricity Sales	11.29	8.07	14.87	10.03	9.04	7.15	3.93	3.37	2.84
Energy Mix	4.19	6.44	4.76	(0.91)	(1.34)	(1.54)	(1.74)	(1.67)	2.26
ABOP	1.57	(1.59)	(3.57)	(6.10)	(8.25)	(5.07)	(5.11)	(7.28)	(4.11)
Component A	(23.66)	(21.28)	(17.18)	(18.18)	(18.98)	(17.42)	(17.08)	(17.33)	(16.36)
NPHR CFPP	1.61	0.89	1.30	0.83	0.06	(0.56)	(1.43)	(1.97)	(2.15)
NPHR CCPP	(5.18)	(5.65)	(5.46)	(5.11)	(4.95)	(4.76)	(4.79)	(4.78)	(5.16)
Total Variance	**29.59**	**22.74**	**1.56**	**(5.75)**	**3.21**	**4.93**	**(2.52)**	**(7.70)**	**3.24**
Data Clarification	**(0.00)**	**(0.00)**	**(0.00)**	**(0.00)**	**(0.00)**	**(0.00)**	**(0.00)**	**(0.00)**	**(0.00)**

discussion of electricity sales is to determine the proportion of each unit to the variance of electricity sales worth 11.29 Rp / kWh as shown in Table 4.

From Table 4 we can see that the largest variance in electricity sales is the CFPP B and the CFPP A. This sequence is the order of priority in the implementation of the program related to the reliability of power plant. The discussion was supported by secondary data related to, among other things, the concession report and the operation report. Data from the concession report revealed that CFPP B in the period January-March did not operate due to turbine rotor disruption. With status as the first priority for implementing the reliability program, we agreed to propose the program. Short-term: turbine rotor repair. Long-term: Procurement of new turbine rotors.

The CFPP A reliability program gets the second priority. By looking at the business report data, it is known that the CFPP A suffered damage to some equipment, so that in the discussion, we agreed to propose a strategic spare program, with the aim that if there was damage to the same equipment it could be immediately overcome by the availability of spare equipment that was stand by. As a form of monitoring and evaluating the implementation of the action plan, it is necessary to carry out routine BPP monitoring so that the company can know firsthand the effect of implementing the action plan program on the realization of BPP achievement as shown in Table 5.

From Table 5 we can see that the BPP achievement deviation has decreased from 29.59 Rp/kWh in April to 3.24 Rp/kWh in December, so that the decrease in BPP is obtained by 26.35 Rp/kWh. While the deviation of achieving Electricity Sales has decreased from 11.29 Rp/kWh in April to 2.84 Rp/kWh in December, so that the reduction in BPP was obtained by 8.45 Rp/kWh. Based on the budget plan, a deviation of an increase of 1 Rp/kWh erodes PT ABC,s profit of Rp 26,185,050,931.00, so that a production cost savings of Rp 221,263,680,363.00 is obtained. This shows that the short-term program execution of the CFPP B turbine rotor repair contributed to the reduction in BPP realization.

IV. CONCLUSION

The variance analysis is a very significant tool for a company's management in order to be able to perceive the current result and the level of deviation, in relation to which certain actions can be taken for the purpose of correction and improvement of the company's performances. The variance analysis indicates the company's departments which need to be taken care of, as well as where to focus their actions. The existence of good communication between the parties involved in the production process is crucial, whether these parties are directly or indirectly included. This research successfully recommend to repair turbine rotor of the CFPP B as a program with priority to be executed.

In the times of high technological development, when the competition for gaining buyers has become the supreme goal of each company, companies have to find a way to keep up with the global tendencies and win over the competition by offering a product of the highest quality, with the lowest production costs. Finding the way to decrease production costs is the supreme goal of people employed in the production departments of companies. In order to follow the results, the variance analysis is a very strong tool. If everyone contributes to the more effective usage of material, workforce, energy and resources, depending on their responsibilities, the company can offer better product and ensure benefits both for the buyer and the owner of the company. To analyze BPP structures outside of power plant, such as in transmission, distribution and other types of industries, variance analysis is used with adjustments to the respective cost stuctures.

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