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Potential of Geothermal Energy in Indonesia : Accounting Perspective

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Abstract

Geothermal energy is a newest energy that come out from volcano's mount line of Sumatra, Java, Bali, Maluku, Borneo, and Papua. Most 40% of geothermal spot exist in Indonesia or about capacity 29,000 MWH of 285 geo-spot. Those potential can use for habitually need, role of company, households, industry, school, hospital, and others. Now, we find other things about geothermal energy we look from the economics benefit. We will show findings of Sales Electricity Energy, Production Electricity Energy, and Operational Cost of Geothermal Power Plants as big potential Indonesia future energy. As our object, we take data from one big electricity company in Indonesia and Ministry of Energy and Mineral Resources Indonesia and we use Java-Bali as the sample location. By using advanced market analysis, we only calculate all of cost cover which can make sure of how many cost that government should expend to optimized geothermal energy.

Keywords: Potential, Cost Accounting, Geothermal Energy

1. Introduction

Nowadays, electricity is important thing in human life. Almost every part of human life aspect use electricity support, in industrial and technologies need it. Electricity founded in eighteenth centuries, at that time only government and high-status people used. There is many power plants reactor been established, right start from hydro, steam, coal-steam, till geothermal used to be. Yet, geothermal as newest founded reactor could be grouped as special power plant, because only few country that can use this reactor, among of them are tropical countries such as Indonesia which country-under equator remarkable as tropic country.

Indonesia has many geothermal spot, around 285 spot emerged from all islands those separated, it converted about 28.1 GWH. Indonesia being a country that pass-over along circum-pacific line from Europe tailed to Indonesia. If the productivity of electricity converted into Megawatt, the number that stated, up to 29,215 MW, which is a big amount if all the potential are installed. Currently, Indonesia just installed only 0.04% from the total of geothermal potential or around 1196 MW. This number is far from expectation, especially recently Indonesia is experiencing a crisis of electricity production.

In our research, we take a sample of the Java-Bali region which is connected power plant system in Indonesia. In java-bali electricity system, there are 8 national and private companies that handle the electricity in overall, then distributed by national company, PLN (National Electricity Power Plant). All of those companies produce the electricity from various power plant, and mainly is steam power. It is the main power plant in Java-Bali region, because of the high-level of production which is produce bigger electricity power, it can be generated by coal-based and fuel-based. But as we know, it is non-renewable energy, whereas there is 76 geothermal-spot that identifiable and potentially explored in Java-Bali which is about 10,013 MW.

In a research, certainly there is always less and more, we hope our research could be the basis of reference for further research about geothermal energy and could make this research as an useful information for world-wide community. This research would be appropriate to use basic of cost-benefit analysis method, we use cost-analysis method for our research.

We found that the potential of geothermal in Indonesia could help the production and distribution of electricity, as well as the state revenue. Moreover, Indonesia has a lot of geothermal craters compared to the most of other country in the world. This opportunity that we want to analyse, the potential of geothermal calculation based on the calculation of cost and management accounting. We use the basic units, production, and sales revenue from electricity sales in 2011. From this reference, we calculate the potential which not installed yet, and we find that geothermal potential will proven beneficially when optimized. We take a Java-Bali region for sample basis because it is the largest electricity network in Indonesia, and we take the sample data from PT. Indonesia Power for electricity production because it has contributed to 34% of total production from the 8 companies.

2. Literature Review

Geothermal is renewable energy that found in the 20 century. This energy source could be the future energy resource, from the thermal-fluid engineering book, it said that geothermal energy is the one that has longest lifespan compared with propulsion engine or another power plant (Z.Warhaft).

Our research should use cost-benefit analysis. An analyst using CBA should recognize that perfect evaluation of all present and future costs and benefits is difficult, and while CBA can offer a well-educated estimate of the best alternative, perfection in terms of economic, efficiency and social welfare are not guaranteed. The limitation of data become our research risk, due to the data limitation that could we collect, so the data of operational cost of Java-Bali power plant we take from previous research in Indonesia (La Ode Muh. Abdul Wahid). The table below, will show the total cost and the elaboration of each cost. The cost consist of Variable Operational/Maintenance, Fixed Operational/Maintenance, and Fuel cost. The cost accounting calculation is based on total cost and unit production. Cost per unit obtained from the total cost divided by units produced (Hansen & Mowen 2008). Cost per unit will be used for the calculating the geothermal potential that has not installed yet, we also calculate the income from each unit. So net income (operational cost only) obtained by operational sales revenue minus by the cost.

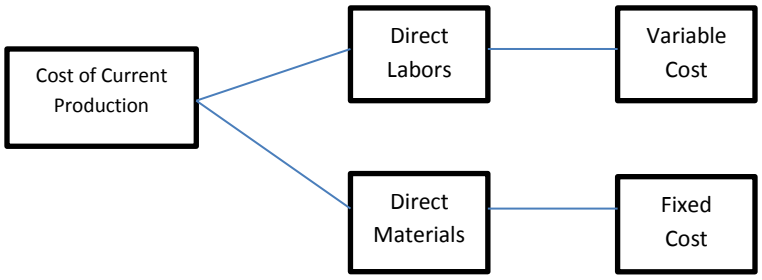
In 2009 – 2011, all the cost have been summarized on the average and the data is limited, so we can not provide such complex information below,

	2009	2010	2011
Power Generating cost in Average (Rp/KWh)	639,87	701,39	792,61
Operational Cost (Million Rp)	2.242.397,55	2.383.344,64	2.764.130,18

3. Discussion

In early calculation, the calculation of the potential and current production from generating company – Indonesia Power in 2011, the company contributed approximately 34.4% from total production of power generating companies in Java-Bali. The total cost will be compare with production unit that produced by Indonesia Power Company. Cost per unit that obtained will show the number which is the small number at the time, but if it correlated with the potential, it will be totally different and the result would be positive and greater than now. Correlation is proper analysis to solve this problem, so we use multiple regression.

Based cost-analysis of this research, as below:



	Class (MW)	EPC ($/KW)	IDC ($/KW)	Total ($/KW)	Fuel Cost (Cents/Kwh)	Fixed O&M ($/KWM)	Var O&M ($/MWh)
Nuklir	900	1500	435	1935	0.5	2	2
PLTU-FGD	600	990	228	1218	1.22	2	1
Combined Cycle	750	500	100	600	2.18	0.67	2
Gas Turbin	150	280	28	308	5.02	1	2.5
Pump Storage	250	580	174	754	*	0.55	-
Geothermal	60	950	133	1083	2.2	2.5	0.03

Input previous paper with markal (Market Analysis)

Indonesia has different unit compared with another country. In Indonesia 1 MW equal to 0.12 GWH, we have testing sample to calculate this in table below. $|1MWe =$

$$0.12\ GWh \begin{cases} \frac{375\ MWe}{3144.94\ GWh}\ (Indonesia\ Power - Installed\ Geothermal\ by\ current\ production) \\ \frac{1124\ MWe}{9259.95\ GWh}\ (All\ Companies - Installed\ Geothermal\ by\ current\ production) \end{cases}$$

4. Production

From the testing above, we use it to standardized calculation for electricity in Indonesia. Now, we calculate current production from 7 hot-spots. We found that in one hot-spot which already installed has different level of productivity, then we calculate overall hot-spot which already installed has the power around 1196 MWe. From the data, Indonesia Power company controlling around 375 MWe that is processed, this power plant contribute around 4.17% from another power plant owned by Indonesia Power. Then, the installed power plant's capacity will multiply with the standardized unit, it will produce the electricity as much as the power plant capacity.

After we calculate the current production, we move to calculate the potential. Based on PLN's data, Java-Bali region have geothermal potential around 10,013 MWe of 76 hot-spots which has been identifiable. We use similar calculation as electricity production with installed capacity, multiply by 0.12 GWh.

5. Sales

After we calculated the installed and potential production, then we analyse the sales activity when using sales price and the current cost. Reviewing from the sales of entire power plant, we collect the data from the government institution.

We estimate, the whole sales of electricity from power plant in Java-Bali region (8 Power plants & 8 companies) are 120,817.43 GWh, about 42,255.27 GWh contributed by Indonesia Power. The sales come from 8 power plants, where 7,09% that produced by Indonesia Power come from geothermal sector, if we multiply that number to geothermal percentage of Indonesia Power, the result will be 2998.77 GWh which is the sales from geothermal of PT. Indonesia Power in 2011.

The revenue of the Indonesia Power company that come from electricity sales are $28,220,476.05. The table below will show the comparation of PT. Indonesia Power cost of production and the sales as well (geothermal electricity sales).

	Installed (Mwe)	Potential Installed (Mwe)	Current Period			Cost of Production Miliar RP/year	price/KWh
			Production (GWh)	Sales (GWH)	Sales (Juta Rp)		
Indonesia Power (geothermal)	375	296	3,125	2,998.77	2,302,601.47	2,399,527	767.84864
PLN (geothermal)	1196	9,717	3,487.39	(*	(*	2,463,340	706.35

Table 1 (input from authors)

As we explained, that the calculation of the potential will compared between the electricity production in 2011 and the potential of geothermal if every hot-spot already installed, we assume the production and the sales using current price. The result will show in the table below.

	Potential Future		
	Production (GWh)	**Estimated Sales (GWH)**	**Sales (Trilion Rp)**
Indonesia Power (geothermal)	28,570.43	28,570.43	21,937,764.14
PLN (geothermal)	83,441.67	83,441.67	58,939,551.75

Table 2 (input from authors)

In table 2, it show if the production of the electricity generated by all of the potential hot-spot in Indonesia which already identified, with assumption in one generator, the estimated sales of all production and the sales price, the result will be increased about 9 times higher than the current production.

6. Results

From our research, we can make hypothesis,
(1) The potential production will 9 times higher than the current production.
(2) The electricity which generated through geothermal, Listrik yang dihasilkan melalui geothermal could supply the electricity needs for Jakarta capital city for a year - based on table of sales per distribution area.
(3) Electricity sales increased approximately 11 times higher at the current price per unit. (Except for PLN's data, we don't have any sufficient data from PLN)

To prove that our research is empiric, we performed multiple regression techniques to prove our hypothesis , we analyse through bivariate to find the correlations current production and potential production.

Descriptive Statistics

	Mean	Std. Deviation	N
Current	9238.4390	47.46918	3
Potential	56006.0500	38799.82590	2

Table 3: Production Statistics(Current/Potential)

7. Conclusion

Based on the tested hypothesis, it show H>0, which mean there is no correlation between them, because of the lack of data, we only use the last three years data. From the potential that we calculated before, we can said if Geothermal Energy is a renewable energy power plant which is important for energy sustainability. Furthermore, Indonesia is a country that has many hot-spot compared with other country.

The needs of investment and cooperation to optimize geothermal energy is important issue to realize the ideals of environmental conservation by optimizing the existing resources. It would have a great prospect for long term investment because geothermal is renewable energy that can last up to long period of time.

Due to the lack of data that we took, we conclude that our research is fairly weak, basically we want to make our research with cost-benefit analysis method. To make this research perfect it required a lot of data, while we are still in undergraduate programme. So, we conclude that this research is just for base of study for the perfect research with cost-benefit analysis in the future research.

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