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**BUSINESS OPPORTUNITY FOR GEOTHERMAL POWER PLANTS IN INDONESIA :
A CASE STUDY AT SOUTHERN BANDUNG INDUSTRIAL CENTER, WEST JAVA**

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ABSTRACT

This study would solve some problems, such as the electricity demand, especially in the Southern Bandung area, how big should the geothermal power plants to operate economically and what is the financial advantage to operate geothermal power plants. Three geothermal areas in Southern Bandung, which have reserve potential of 1467 MW are ready to be developed for private sector. In the 6th Five-Year Development Plan the total geothermal power will be installed is 135 MW. Other opportunities, from survey shows that additional power of more than 100 MW is needed to support industries during peak load time in Southern Bandung. The consumption forecasting was less than the actual growth on the market demand, because shortage of supply were covered by other sources for internal consumption.

INTRODUCTION

The existing power plants in Indonesia may be grouped by the type of energy or system used, namely : Hydro Power Plants (PLTA), Geothermal Power Plants (PLTP), Diesel Power Plants (PLTD), and Gas Power Plants (PLTG). Also there are power plants operated on hydro power in a small scale, called micro hydro power plants (PLTM), and Coal Fired Power Plants (PLTU).

Indonesia has a large potential for developing geothermal power plants, estimated at more than 19,000 MW, mostly in Java and Sumatera. However, till now only around 1.2 % of the installed capacity has been utilized.

At the moment, there are five geothermal power plants in operation, namely the Kamojang PLTP (140.25 MW), Dieng PLTP (2 MW), Lahendong PLTP (2,5 MW), Salak (110 MW) dan Darajat (55 MW).

The installed capacity of all types of power plants existing in Indonesia has been increasing since the third five-year

development plan (PELITA III). The steam power plants have the largest share. As an illustration, out of the total installed capacity of the existing power plants at 9,083 Mw in 1989/90, steam power plants accounted for 3,941 MW (43.4 %), followed by hydro power plants at 1,973 MW (21 %).

Most of the geothermal prospect areas are formed by the medium to high elevation terrain of a volcanic complex which are mainly covered by forest and some partly agricultural development. Relative to the field location, some agriculture or forestry industries are also at the same area. Those industries will be one of the target market for electricity sales produced by PLTP, but it depends on the existing transmission line or other infra structure facilities which will influence cost of investment.

The plan of PLTP development on REPELITA VI will be generated from 12 prospect areas located at 7 provinces in Indonesia, spreading along Sumatera, Java, Bali and Sulawesi.

LOCATION, POPULATION AND GROSS DOMESTIC PRODUCT

The Southern Bandung area is included in West Java Province and it is located exactly at Bandung Regency, which are bordered by : Garut, Sumedang, Subang, and Cianjur Regency.

Bandung itself, the capital city of West Java is situated 180 km southeastern of Jakarta. Bandung Region had an area of 3,253.63 km² and the population at about 3,500,000 people (in 1990) or 10 percent of West Java population. The area is divided into 434 villiges within 52 sub-districts.

In 1990, Gross Domestic Product (GDP) in West Java Province reached USD.10,147 millions; about 21.12 percent or USD.2,143 millions came from Bandung Region, so GDP per capita was USD.600.41 per year. The economic sector in this region (Table 4) mainly comes from

agriculture (28.5 %), mining (13.9 %), commercial 29.3 %), industry (20.82 %) and public (7.55%).

GEOHERMAL RESOURCES

In West Java, there are many geothermal field which have been explored, some of them have been approved as reserved area and two of them have produced electricity, as seen on Table 1. There are three geothermal field near to Southern Bandung, such as PTH field, WWD field and KRR field and the cumulative reserved energy is 1202 MW. Those areas have been planned to be developed in PELITA VI as follows : 40 MW, 40 MW and 55 MW. As shown on Table 1, geothermal reserve energy in Southern Bandung is much larger than the exist plan and these are still opened for the private sector to invest in the geothermal business.

ELECTRICITY DEMAND SURVEY ON INDUSTRY

From questionnaires distributed to industry's and responses in southern Bandung, some replied properly as shown on the following table 3. As seen on Table 3, almost all of the companies are operating private electricity sources, either for emergency uses when State Electricity Company (PLN) sources broke down or for covering the need during peak load time. Sometimes the power is the only insitu electricity source, because PLN transmission does not reach the company's location, such as tea factories at Pangalengan, Southern Bandung.

Based on the installed capacity of private power, the survey data can be divided into three grades, firstly "high", if the installed capacity is over than 1000 kVA, secondly "medium" between 500 to 1000 kVA and thirdly "low" is less than 500 kVA. Beside PLN supply, for maintaining the continuity of supply for their needs, the companies generated their own power for private uses, especially during peak load time, which is charged at a higher price per kWh if the company uses PLN supply.

The power owned by company is also generated for anticipating the inefficiency of public power supply. Because of the efficiency problem, the industries will give a good response to private power companies which can produce and distribute electricity in a competitive price compared to the company's own operation.

The data sample shows that the total owned power investment reached USD.1.7 millions for high grade industries, USD.0.5 millions for medium and USD.0.047 millions for lower grade. Total expenses for electricity consumption by industries reach USD.12.4 millions per year.

The older power units are no longer operated, because the average operation time for diesel power plants technically is not more than 10 years, if operated with high load efficiency (at least 80 %).

The operation age of power plants from the survey is between 3 to 50 years, and shows the attractive situation for private power companies for those industry's plants. In Java- Bali, including West Java, the existing power supplied by PLN always shows less than the real total demand as seen on Table 5.

Based on the data above, there seems to be an increase of the demand of electricity consumption, especially in the industrial sector. The increased demand of electricity consumption means more power plants are required and the private geothermal power companies are able to get involved in the opportunity by entering the electricity market share in PELITA VI.

From the above data, there is evidence that the average demand is increasing by 16.8 % each year. It is also expected that the demand will still increase till the end of PELITA VI in 1998. Out of 240 MW being installed at the moment, there is a solicited plan for geothermal plants which have been decided by Minister Mines and Energy in PELITA VI. The total capacity for large scale plants will be 767 MW and for small scale plants 25.9 MW at the end of 1998/99. About 685 MW (90%) of large scale capacity has been awarded to private power companies and 82 MW (10%) capacity will be developed by PERTAMINA.

Total funding will be required for supporting the solicited plan is estimated at US\$. 3.5 billions to be offered to private geothermal companies till the end of PELITA VI.

INTERPRETATION

Total supply from PLN sources seem to be based on actual data, but for demand data, PLN does not consider each company's own electricity sources, these reach a minimum of hundreds megawatts in West Java alone. It is confirmed by samples taken from industries in Southern Bandung, that 10 companies need 11.5 MW during peak load time (Table 3). The duration of peak load time takes about 5 hours per day and will number 20,988 MWh per year. The expenses for electricity by private industries reach about USD.2.29 millions per year.

Instead of PLN plan's opportunity 10,615 MW (Table 5), the excess demand which will grow similar to industrial growth is about 14 % and this will be an additional opportunity for private power

companies besides selling electricity to PLN as the previous single buyer, this gives 3880 MW for private until 1999/2000. Throughout Java-Bali, 3880 MW electricity capacity will be offered to private sectors, 235 MW of them will be supplied from geothermal power plants including 135 MW that will be generated at Southern Bandung.

In 1991/92 West Java consumed 6,919.32 GWh electricity. The growth of electricity consumption was 14 %, in 1994/95 West Java which consumes 9,825.43 GWh, while in the same area PLN electricity production is only 8,685.94 GWh.

The shortage of electricity supply is covered by transmitting from other plants at Jakarta - Tangerang area and from industry's own power plants. For examples, two cement factories at Cibinong and fertilizer factory at Cikampek, have their own gas power plant which totally produce more than 200 MW.

ANALYSIS OF DEMAND-SUPPLY AND OPPORTUNITY

In terms of handling cost, geothermal energy cannot be transported long distance, and also cannot be exported. Historically, geothermal energy was the same as petroleum gas in the last two decades, but now petroleum gas is a valuable exported commodity in international market, when people are thinking of clean energy, with concerns for environmental problems. Geothermal energy thus becomes more attractive as energy alternative.

Geothermal energy is used as alternative energy for local market. The main demand comes from PLN which supplies industries, households and other commercial activities.

Based upon the proposal made by the Department Mines and Energy (DME), electricity coming from geothermal in PELITA VI (1994 - 1998) will reach the total of 700 MW including 135 MW supplied from the geothermal field at Southern Bandung area. For developing 135 MW will the budget is USD.297 millions, which will be offered to private sector. Besides PLN planning, there is still a wider electricity market, which can substitute the power produced by industry's own sources.

From the survey of 10 companies, a total consumption 11.5 MW is projected. Based on data taken from the District Government of West Java, in Southern Bandung Area, there are 100 industrial companies consuming about 115 MW. This is the additional demand during peak load time which is supplied by company owned sources.

74 % of total geothermal power will be generated in Java which has a Java- Bali 150 kV transmission line. All power plants have been connected along this transmission line, which transmits through out Java-Bali. This facility will give the opportunity to private power plant to be built anywhere in Java and be connected into the same transmission line.

ANALYSIS OF ECONOMICAL ASPECTS

There are two issues to be given attention in promoting geothermal energy. Firstly, developer should have a reasonable Rate of Return (ROR) and secondly, this energy should have a competitiveness compared to other energy alternatives.

Increased investment will affect to an increase of production (positive), but increased price will decrease demand (negative). The increased investment is affected by the increasing of rate of return. ROR will increase, if price and production also increase, but otherwise ROR will decrease, if cost and taxes increase. So, ROR is function of price, production, cost and taxes. The project will be feasible when ROR is higher than the cost of capital.

If the company is awarded a contract supplying 60 MW (3 X 20 MW) or 44 % of electricity needs at Southern Bandung, it will generate total estimated sales of USD.33 millions per year.

The Return on Investment (ROI) will be almost 4 times and the Net Present Value (NPV) will be greater than 1.00 (positive). If the electricity price is USD 70.00/MWh, calculated Rate of Return (ROR) will be 17 percent with a 6 year Break Even Point (BEP), and ROR will increase or decrease depend on sales price.

As comparison, the following Table 2 shows how price varies the ROR for each unit of power plant with unit of 55 MW, 20 MW and 5 MW; all have been calculated based on capacity factor of 80 percent.

These estimates are mainly calculated from electricity sales only, with the heat energy from waste water has not been considered on the revenue. If the company can sell the residual energy to nearest industries, 360 MW Heat of waste water will produce an estimated income as about USD.3 millions per year.

Total energy sales will be USD.36 millions per year. If direct sales to private industries can be made, the investor's company will obtain more income without adding any further investment for extra production facilities.

In PELITA VI, the electricity demand will be offered to private sectors which a capacity of 700 MW as "solicited geothermal projects" to meet the demand and diversify an interesting business in Indonesia.

DISCUSSIONS

The rapid growth of the industrial sector since 1989, has caused the demand of electrical power to increase at a higher rate than expected. The electricity supply is composed of PLN production and industry's owned production for their own operation.

The demand for electricity produced by PLN has been projected to have an increase of 14 % per year in 1991/92, but actual data shows the real growth was 18 %. So the estimation was less than the actual growth on the market demand, because the shortage of supply was covered by the other sources for their own consumption, especially during peak load time.

PLN has not been able to meet the growing demand for electricity, as indicated by supply shortages throughout the country, especially in Java at present. Actual data shows that supply shortages in Java was not overcome until 1992, which is why private power companies are considered for developing power plant.

The demand for electricity supply (10,615 MW in Java) comes not only from PLN as the single buyer, but also from direct sales to industrial uses (115 MW in West Java) near the power plant.

Geothermal as clean energy will take a role in the future, because more people are concerned about protecting their natural environment from pollution. Geothermal power has a share about 12 % of the energy mix in West Java of which 135 MW (PLN planning) will be developed at Southern Bandung area, and to be sold directly to the industrial center, (which consumes additional 115 MW during peak load time).

A power plant of 20 MW size is the smallest commercial and economical plant to be installed to geothermal power generation. But at the present time the favoured unit for geothermal energy is 55 MW capacity. In order to minimise cash flow and to accelerate the revenue, unit 20 MW becomes a favourite plant for the future.

The example using a 60 MW geothermal power plant gives an interesting number to support feasibility of geothermal power plant project. These results are : ROI 4 times. NPV > 1 and ROR 17 %, BEP 6 years

with electricity price USD.70.00/MWh.

CONCLUSIONS

Until 1999/2000 in West Java the electricity demand will reach 14,668.95 GWh with installed capacity 2093 MW, PLN plans to supply 1346 MW and the rest will be offered by private power company.

Until 1999/2000 the shortage of supply will be 10,615 MW in Java-Bali, and the geothermal power plants supplying 700 MW. In West Java geothermal power will share 135 MW in PLN Planning and a 115 MW opportunity for direct sales to industries in Southern Bandung.

A model study for developing a 60 MW geothermal power plant produce interesting sales of about USD.36 millions per year with ROI 4 times and ROR 17 %. This study supports the conclusion that privatized geothermal power is a feasible business in the present and in the future, which the people will much concern to environmental problems and clean energy. Because in the future, every production has to pay for environmental cost.

The favourite installed geothermal plant currently is 55 MW, but in the future a unit size of 20 MW will minimise the cash flow and accelerate the revenue.

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Table 1
Geothermal Energy Potential in West Java
(Pertamina, 1994)

Prospect Area	Installed (MWe)	Reserves (MW)	Resources (MW)	Total (MW)
KMJ	140.25	300	-	300
SLK	110	490	-	490
DRJ	55	250	-	250
PTH		417	65	482
WWD		385	75	460
KRH		400	125	525
CUMMULATIVE	305.25	2352	265	2617

Table 2
Electricity Price (\$/MWh) Geothermal Power Plant
(Ganda, 1994)

Unit Capacity/ROR	10 %	12 %	14%	16 %	18 %	20 %
55 MW	35.85	43.65	52.80	63.60	75.90	90.15
20 MW	65.21	80.56	98.80	120.23	145.16	173.88
5 MW	74.53	92.55	114.11	139.37	168.78	202.97

Table 3
Sampling Result at Industries in Southern Bandung (May 1994)
(Ganda, 1994)

REMARKS/GRADE	HIGH >1,000 kW	MEDIUM 500-1000kW	LOW <500kW
- Consumption per year (MWh)	52,560	19,710	2,800
- Unit Capacity (kVA)	500	500	50
- Power Investment (USD.millions)	1.785	0.5	0.047
- Cost to Private Power (USD.millions per year)	1.499	0.599	0.039
- Cost to PLN Power (USD.millions per year)	7.195	2.878	0.191

Table 4
Electricity Sales Based on Consumers in 1991/92
(GWh)
(State Electricity Company, 1992)

A R E A	HOUSEHOLD	INDUSTRY	COMMERCIAL	PUBLIC	TOTAL
West Java	1854.25	4584.05	218.84	262.19	6919.32
Java	7593.98	13562.49	2238.26	1683.59	25078.33
Indonesia	10325.75	16026.03	2831.99	2297.50	31481.27

Table 5
Electricity Supply-Demand and Opportunity in Java - Bali
(Ganda, 1994)

YEAR	EXISTING SUPPLY (MW)	OPPORTUNITY (MW)*	PEAK LOAD DEMAND (MW)
1992/93	6357	-	5277
1993/94	6357	-	6210
1994/95	6357	1386	7743
1995/96	5931	3307	9238
1996/97	5931	4917	10848
1997/98	5904	6576	12480
1998/99	5609	8698	14307
1999/2000	5609	10615	16224

* excluding industry's own power plant