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Engineering Students' Reference of Low Enthalpy Geothermal Potential in Parangtritis

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Abstract. Parangtritis is one of the seashore areas in Indonesia which has a low enthalpy geothermal potential. The possible utilizations suitable to this area is direct use, such as salt production, fish drying, saltwater desalination, and aquaculture. However, the utilization of this energy source is still not optimum yet. Considering the understanding on the technology as a key factor of renewable energy implementation, this paper examines how the geothermal potential and its utilization are understood by university students of Faculty of Mineral and Technology – one of main disciplines in geothermal field – in the Universitas Pembangunan Nasional "Veteran" Yogyakarta. In total, 100 respondents filled in the questionnaire. This study suggested the importance of understanding geothermal potential by Faculty of Mineral and Technology students in order to successfully utilize low enthalpy geothermal potential in Parangtritis and generally in Indonesia.

1. Introduction

Indonesia has big geothermal energy potential as it is located on the ring of fire. Indonesia's estimated conventional hydrothermal geothermal resource base is generally considered to be among the largest in the world. According to Ministry of Energy and Mineral Resources (MEMR) Geological Agency, Indonesia's geothermal potential are up to 29,215 Megawatt (MW). A decade earlier studies states that Indonesia has 27,000 MW, the 27,000 MW figure is cited in many World Bank reports and appears to be the basis for claims that Indonesia possesses 40% of the world's geothermal resources. [1]

One of the areas which has geothermal potential is Parangtritis. Parangtritis is well-known as beach tourism area in Bantul Region, Special Region of Yogyakarta. It is unique that geothermal potential is located near to shore area, while geothermal potential commonly located on highlands which are associated with volcanic system and post volcanic system.



Parangtritis is one of the villages in Kretek District, Bantul Region, Province of Special Region of Yogyakarta. It is located around 13 kilometers (km) from the district capital. The area boundaries of Parangtritis are:

- Northern : Donotirto Village
- Eastern : Tirtohardo Village
- Western : Seloharjo Village and Girijati village
- Southern : Indian Ocean.

Parangtritis village has area of 967 hectares (Ha). This village consists of 55 areas of neighborhood which divided in 11 hamlets. The total population in this village is 7,939 people with the composition of 3,833 men and 4,106 women. Our research location is lied on Mancingan Village since the Parangtritis geothermal manifestation can be found there. The geographical condition in Parangtritis village is lowland coast with the height 25 m above sea level (asl). [2]

The potential in Parangtritis is known by the appearance of manifestation in form of hot spring. Hot water is chloride type, with the neutral pH. From earlier studies, the reservoir temperature is 115 °C from SiO₂ geothermometer. [3] Based in Hochstein classification, Parangtritis geothermal reservoir is classified into the low enthalpy geothermal. [4]

Even low enthalpy geothermal potential has a various direct use application. [5] The utilizations are shown on the Lindal Diagram [6]. The geothermal energy direct use application can contribute significantly to the government's energy diversion program and fossil fuel substitution, as well as increase the life standard of the local communities. [5]

In Indonesia, geothermal direct use utilization has been applied for various usage. In most of geothermal potentials, the utilization is for bathing or hot pools. In certain location, there are mushroom cultivation, cocoa and copra drying plant, aquaculture, and etc. There are no accurate data on the total country's direct use utilization and capacity because of the widely spread of traditional hot bathing along the country, so that they are very difficult to collect and quantify. [5]

Other than bathing, the current technology can develop more utilization from the potential. As the location of Parangtritis is near to shore area, the suited possible direct use utilizations are salt production, water desalination, aquaculture, and fish drying.

Despite the broad use of potential, it is very important to know about the nearby engineering students' comprehension of the geothermal potential and their reference if there is development. As they will have important role to be pioneers of development by conducting research and development on the potential. In this case, the is focused on engineering students in Universitas Pembangunan Nasional "Veteran" Yogyakarta.

Universitas Pembangunan Nasional "Veteran" Yogyakarta or commonly abbreviated as UPN "Veteran" Yogyakarta, is one of the State Universities (PTN) in Indonesia which is located in Depok District, Sleman Regency, Yogyakarta Special Region. UPN "Veteran" Yogyakarta currently has 5 faculties. The target is engineering student in Faculty of Mineral Technology because their field of study is related to geothermal energy.

Therefore, this study is very important to examine the engineering student views toward geothermal energy as renewable energy. Therefore, the optimization of the direct use can be a stepping stone in developing the local citizen's economic condition in Parangtritis.

2. Methodology

The applied method in this research are filling the online questionnaire. The respondent is 100 people which is an active student in Faculty of Mineral Technology, UPN "Veteran" Yogyakarta. The students from Faculty of Mineral Technology are coming from Geological Engineering, Mining Engineering, Petroleum Engineering, Environmental Engineering, and Geophysical Engineering. From the questionnaire data result, statistically analytic data and conclusion making are done.

In order to collect data on people's understanding of geothermal from Engineering Student's in UPN "Veteran" Yogyakarta, we designed 13 questions. The questions are listed in Table 1.

Table 1. Preference and perception questions included in survey.

No.	Questions	Preference
1	Have you picked a topic for your thesis?	A) Yes B) Not yet
2	Geothermal is a renewable and sustainable energy.	A) Know for sure B) Ever heard C) Not sure
3	Geothermal is only located in mountains area.	A) Know for sure B) Ever heard C) Not sure D) Do not know at all
4	Geothermal cannot be found along seashore.	A) Know for sure B) Ever heard C) Not sure D) Do not know at all
5	Indonesia is a country with the highest geothermal potential in the world.	A) Know for sure B) Ever heard C) Not sure D) Do not know at all
6	Around this world, geothermal is only used as power plants.	A) Know for sure B) Ever heard C) Not sure D) Do not know at all
7	Geothermal can be used as other function besides power plants.	A) Know for sure B) Ever heard C) Not sure D) Do not know at all
8	In Indonesia, geothermal is only used as power plants.	A) Know for sure B) Ever heard C) Not sure D) Do not know at all
9	In Indonesia, geothermal is used as other function besides power plants.	A) Know for sure B) Ever heard C) Not sure D) Do not know at all
10	In Special Region of Yogyakarta, there is geothermal potential.	A) Know for sure B) Ever heard C) Not sure D) Do not know at all
11	If there is geothermal potential in DIY, respondents are willing to take it as Final Assessment topic, or participate in development project.	A) Yes B) May be yes C) Have not decided yet D) May be no E) No
12	How is your thought about low enthalpy geothermal utilization as direct use?	

- 13 In your opinion, what kind of geothermal direct use which is suitable to be applied in coastal areas, like in Parangtritis?

3. Result

The survey result is shown in Table 2.

Table 2. Various descriptive result

Respondents Background (persons; %)	Petroleum Engineering (59; 59%)	Geological Engineering (31; 31%)	Geo-environmental Engineering (5; 5%)	Geophysical Engineering (5; 5%)
Semester (persons; %)	1st (2; 2%)	3rd (9; 9%)	5th (57; 57%)	7th (20; 20%) >8th (12; 12%)
Knowledge of geothermal				
Geothermal is renewable and sustainable energy (persons; %)	Know for sure (81; 81%)	Ever Heard (16; 16%)	Not sure (3; 3%)	Do not know at all (0; 0%)
Geothermal potential only exists in highlands (persons; %)	Know for sure (if it only exists in highland) (28; 28%)	Ever Heard (19; 19%)	Not sure (could be anywhere else) (50; 50%)	Do not know at all (3; 3%)
Geothermal is impossible to be existing in shore area. (persons; %)	Know for sure (13; 13%)	Ever Heard (19; 19%)	Not sure (58; 58%)	Do not know at all (10; 10%)
Indonesia has the most geothermal potential in the world. (persons; %)	Know for sure (73; 73%)	Ever Heard (15; 15%)	Not sure (may be have, may be have not, may be not the most) (12; 12%)	Do not know at all (never heard) (0; 0%)
Geothermal is only for power generation. (persons; %)	Know for sure (if it is only for power generation) (9; 9%)	Ever Heard (if it is for power generation) (14; 14%)	Not sure (may be not only for power generation) (45; 45%)	Know for sure (if it is not only for electric use) (32; 32%)
Geothermal in Indonesia is used for other purpose. (persons; %)	Know for sure (58; 58%)	Ever Heard (27; 27%)	Not sure (may be used for other purpose) (13; 13%)	Do not know at all (2; 2%)
There is geothermal potential in DIY. (persons; %)	Know for sure (23; 23%)	Ever Heard (36; 36%)	Not sure (may be there, may be not) (29; 29%)	Do not know at all (never heard) (12; 12%)
Reference of Respondents Final Assessments				
Respondents Final Assessments topic status (persons; %)	Already decided (38; 38%)	Have not decided yet (62; 62%)		
If there is geothermal potential in DIY, respondents are willing to take it as Final assessment topic, or participate in development project. (persons; %)	Yes (29; 29%)	May be yes (28; 28%)	Have not decided yet (31; 31%)	May be no. (8; 8%) No (4; 4%)

3.1. Analysis

According to the above statistic data survey, it can be seen how big the understanding of the Mineral Technology Student in UPN “Veteran” Yogyakarta about geothermal potential is, especially in the potential location, utilization, and local potential in Parangtritis.

The respondents already have enough knowledge and comprehension about geothermal energy in the scope of concept, utilization, and the availability. It is because their science discipline is related to geothermal exploration and exploitation. However, there are some respondents, the 1st and 3rd semester students, who do not know this case since they have not got a further explanation about geothermal energy.

Related to the utilization, 58% respondents know that geothermal energy is not only used for power plants but also for other things. Especially in Parangtritis which located in coast line, this location is more suitable for the application of the geothermal direct use as the enthalpy in this area is low. Some of the respondents also know about the direct use which can be applied in Parangtritis, such as hot spring, fish-drying, fish cultivation, and agriculture. Yet, the reality is the utilization of the direct use in Indonesia has not really widely developed.

It is well known by most of the respondents as they get some insight from their education background and live in Yogyakarta which quite close to Parangtritis. The distance between Yogyakarta and Parangtritis is about 30 kilometers or 1-hour trip by motorcycle. This is the reason which makes the students have a bigger opportunity to observe or doing a field research about geothermal energy in Parangtritis, Special Region of Yogyakarta.

We can see if more than half of the respondents (62%) have not decided their topic to final assignment yet. It is not surprising if we look back into respondent’s composition which is 68% of total respondents are still in 1st, 3rd, and 5th semester, and the rests (32%) are in 7th and above 8th semester – the time when they have to prepare their final assignment. However, there are few respondents in 7th and >8th semester who have not decided their topic for final assignment yet and there are some students in 5th and less which have been decided their topic for final assignment yet, even they still have long way to go.

Based on questionnaire data, respondents have low interest in conducting study/research to develop the geothermal potential in Parangtritis. Only 29% of the respondents were answering “yes” and 28% were answering “may be yes”, 12% were not interested, and the rests (31%) have not decided yet whether they are willing to conducting research or not.

The analysis result shows that students of Faculty Mineral Technology, UPN “Veteran” Yogyakarta, have good-enough understanding in geothermal energy. However, their interests in development of geothermal energy, as renewable and sustainable energy, are still low. So that, we are pointing on the important role of University. Universities must also update course accordingly and develop new courses specifically related to renewable energy leading to recognized degrees. [7][8][9] In this case, it is we are focusing in geothermal energy.

Development of geothermal energy needs high costs. Therefore, engineering students are expected to contribute in study/research in the effort to develop the utilization of geothermal energy which is leading to decrease the cost of utilization of renewable and sustainable energy in the making of renewables more affordable and acceptable in society.

4. Result

Based on the data analysis, we can conclude that:

- Engineering Students, Faculty of Mineral Technology, UPN “Veteran” Yogyakarta has good-enough understanding about geothermal energy. But, they need some to courage them of being involved in development of renewable and sustainable energy, such as geothermal.
- Universities hold important role to improve the improve the students interest in the development of geothermal energy. This could be established by updating courses and department which related to renewable and sustainable energy.

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