

Role of Earth Scientists in the Geothermal Energy and Volcanic Hazard Education

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ABSTRACT

The geothermal energy development in Indonesia still facing various challenges, despite the government plan to increase its utilization. One of the issues is the negative response from the local people or people resistance. In some geothermal projects, this problem is even the biggest obstacle that can stop a project activity. One of the factors that gave rise to the local people resistances perhaps due to a lack of understanding regarding with the positive impacts of the geothermal energy. Based on our study, some local people think that geothermal activities have an impact to their agricultural outcome and the environment around them. This problem may not be able to solve only by FPIC (Free, Prior, Informed, Consent). Earth scientist as one of the lead experts in the geothermal development activity must play an active role to educate the local people about the pros and cons of the activity. Universitas Brawijaya (UB) works together with Geoenergis to try in initiation the Geothermal Education Program to Students and Local People in East Java. The objective of this program is to give continuous geothermal education to the local people, so that they are well informed and support geothermal development activities in their surroundings. In addition, we also give awareness to the potential hazard that may possible to happen in the geothermal environment. This paper describes the initial planning & activities of our program, along with the future work plans.

1. INTRODUCTION

Nowadays, geothermal development in Indonesia still facing various problems. Umam, et al. (2018) identified one of the constraints that hinder geothermal development activity is social acceptance issue. This problem emerges due to lack of understanding of the local community about the importance of geothermal development and its positive impact. Utami, et al (2011) explain that the development of geothermal field brings high technology into the area which can raise various kinds of questions for the local people. Lack of continuous education, socialization, and public counselling which is usually only done at the beginning of the project makes the community understanding about geothermal energy is partial. According to Purba, et al. (2019) an extra effort is required from all of the geothermal stakeholders, such as government, geothermal developer, academician to resolve the challenge.

To realize one of the missions as an agent of renewal, a pioneer and disseminator of science, technology, arts and humanities, Universitas Brawijaya try to initiate geothermal education to provide continuous education about geothermal resources to local communities, especially those in East Java. This program is also supported by Geoenergis as a geothermal consultant who also has a mission to raise community awareness of geothermal energy as clean, renewable, and sustainable resources. The objective of our proposal program is to give continuous geothermal education to the local people, so that they are well informed and support geothermal development activities in their surroundings. In addition, we also give awareness to the potential hazard that may possibly happen in the geothermal environment. It is hoped that they not only get the better understanding of the geothermal resources, but also the potential disaster.

Cangar is located in the vicinity of the Arjuno-Welirang geothermal prospect, East Java. We choose Cangar as the site to implement our program because its location in the Batu City which is surrounded by mountains (Kelud, Arjuno-Welirang, Kawi-Butak, Panggungan, etc) which make this place has a beautiful landscape that can be enjoyed by many people. Its location that also adjacent to volcanic-hosted Arjuno-Welirang geothermal field, where there is no just geothermal resource within the area, but also an active Arjuno-Welirang volcano. Therefore, the people who live there must be well educated and aware, regarding the potential hazard that can be happened any time.

2. ISSUES ON GEOTHERMAL DEVELOPMENT

The majority of Indonesia's geothermal potential is located in or near forest areas has sparked societal worries about the effects on the environment and society, particularly in forests that are crucial for the supply of fresh water, protect endangered wildlife, or have significant cultural or religious significance. Geothermal development has considerable and complicated environmental and social hazards, and it is unclear how much these risks and impacts differ between different geothermal development projects (Meijaard et al., 2019). Based on our experiences, there are several issues in geothermal development activity such as environmental impact, local culture, participation of the geothermal stakeholders, etc.

2.1 Environmental damage

Environmental damage is one of the most serious issues that has resulted in widespread resistance from the community surrounding the geothermal area. People are concerned that geothermal activities will harm their environment, such as contaminated river or water sources, earthquakes, toxic gas, land subsidence, and especially worriedness regarding with hot mud eruption as it happened in Sidoarjo. The environmental impact of this geothermal exploration activity can be linked to the problem of hazy rivers caused by soil sediment carried

into springs and rivers (Dharmawan, 2017). An example from the author's experience is where people in Nage were worried if drilling exploration activity can cause hot mud eruption like in the Sidoarjo. This worry stems from the general lack of knowledge in society, hence it is crucial and required for earth scientist to be on the front lines of knowledge dissemination in this domain.

The exploration process is carried out by a business entity that acts as the geothermal field's executor; if these activities do not pay attention to aspects of environmental sustainability, it will have a negative impact on the environment, which can affect people's lives. Working on geothermal projects requires seriousness and responsibility from a variety of entities such as government, stakeholders, corporate entities, and surveyors (World Bank, 2015).

2.2 Local culture

The development of a geothermal project was thought to potentially increase negative social impacts in areas inhabited by indigenous peoples, as well as the reputational risk faced by operators developing projects in these areas. The presence of customary land, in addition to the presence of indigenous people, was included as a social factor (Meijaard et al., 2019).

Land in some areas in Indonesia is not owned by one person but by one village on a communal or customary land. This means that all decisions related to the land must be discussed together and can take a long time, especially if one member of the community does not agree (Laturette, 2017). The various causes mentioned above usually occur if the geothermal development company concerned does not invest sufficient effort, time and money to socialize the project to local indigenous peoples and fails to build genuine and open relationships with the community.

Socio-cultural factors are the order in many relationships with specific social positions based on a community group's system of values and norms. One of these social factors is ethnicity, where the surrounding community, there are still many who think that customary land is sacred and should not be disturbed (Brahmantyo, 2016). Based on this, geoscientists and stakeholders must be serious, creative, and mature in making plans for approaches to communities around geothermal areas because each region has a different culture.

3. PROGRAM INISIATION

On the beginning of the program, people awareness of the geothermal resource should be developed. UB which is supported by various geothermal stakeholders such as local government and geothermal developer, including Geoenergis has conducted some socialization and seminar to several communities in East Java (**Figure 1**). Despite the pandemic conditions, some events have still been carried out using online platform.

- a. Webinar Series by John O'Sullivan & Rosalind Archer in collaboration with UB (February 2021) discussed about collaboration between academics and practitioner in succeeding Indonesia's Geothermal Exploration Program. John O'Sullivan & Rosalind Archer are well known geothermal practitioners/researchers who are heavily involved in geothermal technology development and researches. This event was made possible due to the close relationship of Geoenergis and The University of Auckland where they come from. It is hoped that by bringing them to discuss the topic can open up more knowledge about the importance and positive impacts of the geothermal development.
- b. Speaker on the Seminar that was held at the one of the Islamic Institute in East Java (March, 2021) to discuss energy crisis and sustainable development in Indonesia regarding with the current situation of the global energy crisis. On this event also invited the Minister of Finance, Minister of Tourism & Creative Economy, and Governor of East Java.
- c. Geothermal socialization and consolidation for the farmer groups (Kelompok Tani) and local people communities (April 2021) to educate and socialize about renewable energy, in particular the utilization of geothermal energy. This event also has an objective to maintain, also establish good relations and communication with the farmer groups and local people communities around Arjuno-Welirang area.



Figure 1. A & B: Geothermal webinar series in collaboration between UB, Geoenergis, and University of Auckland with invited guests Rosalind Archer & John O'Sullivan, C: Prof. Adi Susilo (wearing batik) from UB was talking in geothermal seminar held by IKHAC, D: Prof. Sukir Maryanto from UB was socializing about geothermal development to the local community in East Java.

4. FUTURE PLAN

The hydrothermal alteration in Dieng Geothermal Field were deduced from Shalihin (2020). The identity and the distribution of Several programs have been planned, however, supports from all of the geothermal stakeholders are still needed so that the programs can be carried out. The programs include the development of Agro Techno Park and Town & School Watching for the local people around Arjuno-Welirang Area.

4.1. Integration of the Development of Agro Techno Park

Agro Techo Park has been developed by UB in Cangar, Batu, East Java. Agro Techno Park Cangar was established by Faculty of Agriculture UB (1981-2014) to support their learning activities, as well for the community empowerment. Afterwards in 2015 this area has been developed for a wider use including for the geothermal education (**Figure 2**). Arjuno-Welirang Volcanic Complex is spatially associated with geothermal resource as indicate by the presence of surface thermal manifestation. Thermal manifestation in the form of solfatara emerge at the crater of Mt. Welirang, then hot springs also can be found in Padusan, Coban, and Cangar. In Cangar, the hot spring is directly utilized for bathing. Besides of its geothermal potential, Arjuno-Welirang also has the potential hazard in the form volcanic eruption. The last eruption of Mt. Arjuno-Welirang was recorded in 1950 and 1952. Based on Kusumadinata (1979), Mt. Arjuno Welirang can be classified as a A-type volcano which indicates very young magmatic activity of the mountain. Accordingly, the potential of volcanic eruption is still high. Therefore, the location of Techno Park area which is adjacent to volcanic-hosted Arjuno-Welirang geothermal field making it very suitable to be used as a natural laboratory of volcano and geothermal education. At this time, Brawijaya Volcano & Geothermal Research Center Laboratory (BRAVO GRC) has been developed around the Agro Techno Park area as one of the attempts to achieve our objective for geothermal education. Some activities of the BRAVO GRC has been described by Maryanto (2018) in his journal.

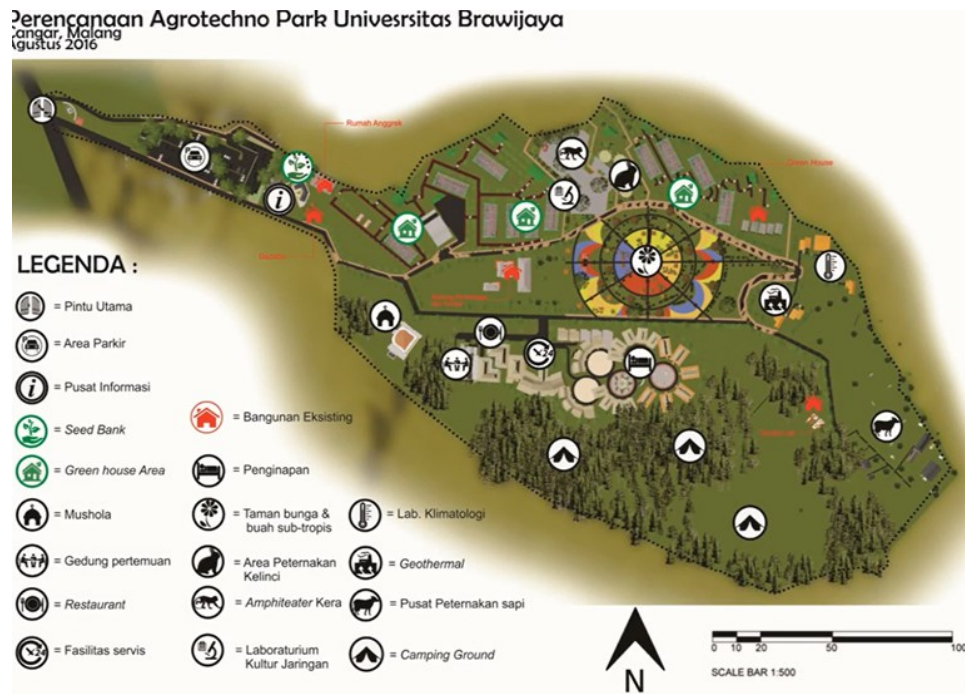


Figure 2: Agrotechno Park Plan design by University of Brawijaya, Malang (Badan Usaha Akademik UB, 2016 in Maryanto, 2018).

4.2. Geothermal Education and Socialization

One of the problems in geothermal development activity is the local people resistance, this problem is also occurring in Arjuno-Welirang area. We conclude that the main issue of this resistance because of misinformation and disinformation about the geothermal development plan, and also the less understanding of the local people about the geothermal resource. By integrating social and scientific approaches, the Town and School Watching method is trying to be implemented to the people around the Arjuno-Welirang. The main activity is to educate the lay people continuously regarding with the volcanic-hosted geothermal system, what is it and then how to live in harmony within the area. The existence of BRAVO GRC laboratory in Cangar and also supported by Geoenergis are also very helpful to work on the program (Figure 3). It is hoped that the program can give a wider and direct impact to every geothermal stakeholder within the area, including the developer and government, most notably to achieve public consultation for the community empowerment for the geothermal development in conservation environment.

The number of students, individually and groups are encouraged to implement their knowledge directly to the local people who live in nearby villages around Arjuno-Welirang. Town and School Watch concept is adapted along with the supporting activities such as webinar series, workshop, research, as well community services to achieve the objectives of the program. Town watching targeting people who live in an area with objectives to increase public awareness of disaster management with identifying environmental and surrounding vulnerabilities. It also identifies the capacity of the people in dealing with disasters and identify the main problems that are developing among the people to find solutions for those problem. Whereas, the School Watching targeting educational facilities (Figure 3) with identifying the risk parameters, analysing hazard impact, and finding the problem solving to communicate and socialize the findings to the educational elements (teachers, students, etc). It is hoped, all levels of the community will have a better understanding and more educated about the geothermal development and its potential hazard.



Figure 3:A: Signboard of Brawijaya Volcano & Geothermal Research Center Laboratory, Cangar shown by Prof. Sukir Maryanto from UB, B: Town & School Watching Program by Prof. Sukir Maryanto from UB which provided education on volcanic disaster mitigation in front of the students (prasetya.ub.ac.id)

5. CONCLUSION

Geothermal development faces many challenges, one of which is environmental issues and resistance from the community, based on research results show that resistance from the community is caused by several things including public knowledge of geothermal innovations is still minimal, because of the assumption that geothermal is the same as oil and gas mining and this understanding is only to the impact that will result from the development. The lack of public knowledge and understanding of geothermal is caused by (1) lack of socialization, (2) lack of community participation and (3) low level of public education. Second, the community also refused because there were no direct benefits from this development plan. The community feels that they have been harmed, because it will damage soil fertility and water management. So, this damage will have an impact on reducing crop yields and even losing their jobs as farmers because the land is no longer suitable for growing vegetables. Third, there are some people who refuse because of land or land problems, be it individual land or communal land.

As an example, the initiation of the development of Agro Techno Park through Brawijaya University and Geoenergys is an important milestone that marks a collective effort in community empowerment through public education. Although the idea is still in its early stages, its existence is expected to accelerate the implementation of larger scale developments.

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Shailihin, et al.

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