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## INCREASING COMMUNITY KNOWLEDGE OF GEOTHERMAL POTENTIAL AND DEVELOPMENT

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### A. Introduction

Geothermal is a source of heat originating from within the earth. Geothermal energy is a flexible energy resource that can be used for purposes in many conditions (Glassley, 2010). Geothermal energy can be utilized, directly or indirectly. Direct use such as for heating, tourism, health, fisheries and agriculture. Utilization indirectly is for the power plant (Manyoe, 2019).

Indonesia's geothermal potential is one of the largest in the world. Indonesia's large geothermal potential is indicated by the concentration of high temperature geothermal resources. Indonesia's geothermal energy potential is estimated at 28,617 MW. Indonesia's geothermal energy potential is around 40% of the world's geothermal potential (Bina et al, 2018). Indonesia is committed to reducing greenhouse gas emissions by 29% by 2030. One of the efforts is to accelerate the development of renewable energy (Direktorat Panas Bumi, 2017).

Geothermal utilization in Indonesia is carried out directly or indirectly. Geothermal utilization or geothermal development in Indonesia is supported by exploration studies and further research. Exploratory research is carried out by means of a geological survey (Manyoe and Bahutalaa, 2017; Tolodo et al., 2019), geophysics survey (Manyoe, 2016; Manyoe et al., 2018, 2015a, 2015b; Manyoe and Hutagalung, 2020), and geochemistry survey (Suleman and Angsari, 2005).

Geothermal, besides having the potential that can be developed for direct and indirect use, has other potentials contained in it, namely disasters. This shows that there is a need for efforts to increase community knowledge regarding potential geothermal resources and potential disasters in geothermal areas.

### B. Discussion

Increasing community knowledge of geothermal potential can be done through socialization and training. Socialization can be done through lectures, discussions, and mentoring methods. Training can be carried out by making information boards and disaster maps of geothermal tourism areas.

#### 1. Increasing Community Knowledge through Socialization

Increasing community knowledge through socialization can be done in the form of lectures, discussions, and assistance in areas that have geothermal potential. Increasing community knowledge is carried out with the aim of making community understand the potential of geothermal energy that can be developed for various purposes in the region. Geothermal socialization in areas far from geothermal potential is equally important as an enlightenment, effort in order to increase understanding of geothermal potential and things that need to be avoided when visiting geothermal locations.

Geothermal potential in several areas has been utilized directly, such as for tourist purposes. However, in some areas, the utilization of geothermal potential for direct use such as for tourism has not been carried out. Some hot springs that can be developed for tourist purposes in some areas are simply abandoned without any exploitation efforts. Some of the hot springs that have been developed for tourist purposes due to lack of management, some are no longer operational.

Regions that utilize the geothermal potential for tourism purposes have increased incomes because the tourism sector is a growing sector. In order for geothermal potential to continue to be developed, it is necessary to maintain the recharge area. Maintenance of recharge areas keeps water discharge intact. The addition of artistic attractions is equally important in geothermal tourist destinations. The addition of art attractions is carried out to make the existence of tourism can continue. Community knowledge about the importance of recharge areas to maintain water discharge and the importance of artistic attractions in geothermal tourism areas can be provided in the form of socialization (Fig. 1).



Figure 1 Geothermal socialization to communities in the geothermal tourism area of the Pentadio Barat Village.

Increasing community knowledge about geothermal potential needs to be applied early on in children (Fig. 2). Socialization of geothermal potential can be given to elementary school children and can be given in the form of programs to increase knowledge of geothermal potential. Socialization of children is intended to introduce geothermal potential to them and to increase children's awareness about the geothermal environment.



Figure 2 Geothermal socialization at the Suwawa Tengah elementary school and assistance for the Sekolah Geotermal (Geothermal School) program in Pentadio Barat Village.

Increasing community knowledge through socialization is not only carried out in areas that have not been developed yet, but is carried out in communities in areas where geothermal development is for electricity. The socialization is given to provide enlightenment to the community because the construction of geothermal power plant can cause community concerns.

Community concerns in the geothermal power plant development area may occur due to a lack of knowledge and concerns related to agriculture. Lack of community knowledge includes lack of knowledge of the hydrogeological system, lack of knowledge of geothermal manifestations, and lack of knowledge of power plant development and management systems. Community concerns include worries about the decreasing quantity of water in natural springs which are the main source of irrigation for village horticultural agriculture, fears of losing their main livelihoods as horticultural farmers due to lack of water discharge for irrigation, and worries about reducing agricultural land due to land expansion of geothermal power plant development (Riogilang, 2019).

The socialization begins with conducting a scientific study of the existing problems. The community service stages carried out include discussions with the community to accommodate all concerns related to the development of a geothermal power plant, involve the community in scientific studies carried out, and provide an understanding of the development of a geothermal power plant (Riogilang, 2019).

Community service carried out in the geothermal power plant development area shows that community involvement in geothermal development efforts is urgently needed. This community involvement is to eliminate all community concerns regarding geothermal development and the lack of community knowledge about geothermal development.

## 2. Increasing Community Knowledge through Training

Increasing community knowledge through training is carried out in areas that have exploited geothermal potential. Geothermal areas that have been used as tourist areas and visited by tourists need additional infrastructure. The infrastructure required is in the form of tourist information boards, disaster risk information boards in geothermal tourism areas and disaster risk zoning maps in geothermal tourism areas.

The tourist information board is made as a form of information for tourists visiting geothermal tourist areas. The risk information board and risk map for geothermal tourism areas are made in an effort to reduce the risk of accidents for tourists in geothermal tourism areas. Information boards are made based on science and local wisdom in the community. Information boards and maps were created with the involvement of the community and government.

The training provided was in the form of training on making information boards and training in map making (Fig. 3). Community involvement in the creation of information boards and risk maps of geothermal tourism areas makes the community better understand tourism potential and disaster risk areas. Community involvement can add information about geothermal potentials and locations of unknown hazards.



Figure 3 The process of making a geothermal tourism information board in the Pentadio Barat Village.

The availability of tourist information boards provides satisfaction for tourists visiting geothermal tourism areas. The availability of risk maps provides security for tourists visiting geothermal tourism areas. Community involvement through training makes community have knowledge. Therefore, the community can update the information board and disaster risk map of the geothermal tourism area.

### 3. Increasing Community Knowledge of Geothermal Potential and Development During Covid-19 Pandemic Era

The Covid-19 pandemic period caused changes in the process of education, research, and community service. Educators, researchers and extension workers or instructor are required to be able to adjust to the conditions during the Covid-19 pandemic. Community service that was carried out face-to-face at the pandemic era can't be done.



Figure 4 The video conferencing is used for community service during the Covid-19 pandemic in Lupoyo Village.



Figure 5 Community service during the Covid-19 pandemic used a radio broadcasting platform.

Community service methods that can be done during the Covid-19 pandemic are community service methods that use digital platforms like video conferencing (Fig. 4) and radio broadcasting platform (Fig. 5). Socialization and training aimed at increasing community knowledge regarding geothermal potential and development can be done using digital platforms.

The disadvantage of video conferencing is that it can only be implemented in areas that have internet networks. Areas that do not have internet access cannot use the video conference platform. The solution for areas that do not have internet access is to use a radio broadcasting platform. People in remote areas can listen to socialization through radio broadcasting platforms. Extension officers or people providing socialization and radio broadcasters who are in the broadcasting room apply health protocols.



Figure 6 Implementation of strict controls of health protocols on community service program during the Covid-19 pandemic.

Another community service method that can be done during a pandemic is a community service method that implements strict health protocols (Fig. 6). Community service is still carried out face-to-face but adheres to health protocols such as maintaining distance, washing hands, and wearing masks. The implementation of community service during the pandemic can still be done by using digital platforms and implementing strict controls of health protocols.

### C. Conclusion

Increasing community knowledge of geothermal potential and development can be done through socialization and training. Socialization is given to communities in areas that have utilized geothermal for direct and indirect use to increase knowledge of geothermal potential and geothermal power plant development. Geothermal socialization for elementary school children is important to increase geothermal knowledge and raise awareness of the geothermal environment. The training is provided in the form of community involvement in making information boards and disaster risk maps for geothermal tourism areas. Community service during the Covid-19 pandemic was carried out using a digital platform and implementing strict health protocols.

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## Glosarium

**Geothermal Power Plant** is a power generation technology, capable of processing geothermal energy into a source of electrical energy.

**Hydrogeology** is a branch of science that studies the movement, distribution and quality of water, especially groundwater in the earth's crust.

**Geothermal Manifestation** is a sign on the surface that indicates the potential presence of geothermal energy. Examples of geothermal manifestations are hot springs, fumaroles, solfataras, geysers, hot pools and alteration rocks.

**Recharge area** is a water catchment area which can naturally add groundwater to a groundwater basin.

## Biography

### Intan Noviantari Manyoe



Born in Limboto, Gorontalo. Intan holds a bachelor's degree in Geophysics and a master's degree in Geological Engineering from Hasanuddin University. Intan is a lecturer in the Geological Engineering major, Universitas Negeri Gorontalo and Head of the Geological Engineering Laboratory. The main focus of her research is renewable energy, geothermal, geotourism, geophysics and geological hazard.

Intan participated in a young lecturer apprenticeship program carried out by the Directorate General of Higher Education at Universitas Gadjah Mada in 2009. She participated in geothermal trainings conducted by the Ministry of Energy and Mineral Resources, UGM, ITB, Utrecht University, The Netherlands Organization for Applied Scientific Research and Geothermal Capacity Building Indonesia-Netherland in 2017. She joined in international collaborative research in the field of eco-geotourism with the Research Institute for Humanity and Nature, Kyoto, Japan and joined in geothermal scientific writing with lecturers at the Institute Technology of Petronas (ITP), Malaysia.

Intan received several awards, including a certificate of commendations from three Japanese professors; Dean of FMIPA, Rector of UNG; Directorate General of Higher Education; and the President of the Republic of Indonesia. Communication with Intan can be via email [intan.manyoe@ung.ac.id](mailto:intan.manyoe@ung.ac.id) or website [www.intanmanyoe.com](http://www.intanmanyoe.com).