EREM 79/2
Journal of Environmental Research, Engineering and Management
Vol. 79 / No. 2 / 2023
pp. 88–98
DOI 10.5755/j01.erem.79.2.33331

The Urgency of Social Aspects in Environmental Assessment: A Case Study of a Sustainable Geothermal Power Plant Development in Banyumas, Indonesia

Received 2023/02 | Accepted after revision 2023/05

https://doi.org/10.5755/j01.erem.79.2.33331

The Urgency of Social Aspects in Environmental Assessment: A Case Study of a Sustainable Geothermal Power Plant Development in Banyumas, Indonesia

Muslihudin Muslihudin[1,2,*], Imam Santosa[2], Elly Tugiyanti[3], Suyono[4], Prita Sari Dewi[4], Joko Santoso[5]

[1] Faculty of Social and Political Sciences, Jenderal Soedirman University, Purwokerto, Indonesia

[2] Pascasarjana college, Jenderal Soedirman University, Purwokerto, Indonesia

[3] Faculty of Animal Sciences, Jenderal Soedirman University, Purwokerto, Indonesia

[4] Faculty of Agriculture, Jenderal Soedirman University, Purwokerto, Indonesia

[5] Department of Sociology, Faculty of Social and Political Sciences, Jenderal Soedirman University, Purwokerto, Indonesia

***Corresponding author:** muslihudin1963@yahoo.com

For every large-scale development with the potential to have a significant and essential impact, there must be an environmental assessment first. Geothermal Power Plant Development (GPPD) in Banyumas is classified as a large-scale project. Therefore, an environmental assessment was also carried out before the project started. The initiator has owned the Environmental Management Effort (EM) and Environmental Monitoring Effort (EME) since 2011. Due to a change in planning, the EM and EME were updated again in 2016. Even though the GPPD has the environmental management and monitoring plans, it faces an ongoing resistance from the community during the implementation of the exploration stage. This action may disrupt the exploration process. The purpose of this paper is to find out why there is social upheaval or rejection and demonstrations from society. This study was designed as qualitative research that is descriptive and analytic. Descriptive analysis was based on data, documents resulting from interviews and discussions with various stakeholders who know about cases of community demonstrations against GPPD exploration. The results of the study show that social environmental aspects

receive less attention to the affected communities so that when environmental pollution occurs, the community overreacts to the GPPD construction implementers and the government. Supposedly, if the social environment aspect is carried out proportionally, then there will be no resistance from the community. In this case, the executors of the development have been bothered and even disrupted the development process itself. The social aspects that are less proportional are limited socialization, inaccurate ecological delineation, late recruitment of local workers, and insufficient involvement of NGOs.

Keywords: urgency, social aspect, environmental assessment, sustainable development.

Introduction

Indonesia is one of the countries in the world that has great potential for the geothermal power plant development (GPPD). Fathi (2017) informed that the 2014 International Geothermal Congress data in the 2015–2019 MEMR Strategic Plan, Indonesia, has a geothermal potential of 28 910 MW, which is the second largest in the world. So far as of August 2017, only 1699 MW of installed capacity or 5.9% of geothermal potential are owned by the state (Muslihudin et al., 2022).

Investments (2020), Ahmadhidayat (2021) describes that geothermal energy is an environmentally friendly energy source because it comes from the heat within the earth and supports the decarbonization program. Water pumped into the earth by humans or natural causes (rain) is collected to the earth's surface in the form of steam, which can be used to drive turbines to produce electricity. Exploration costs as well as the capital costs of geothermal power plants are higher than for other power plants that use fossil fuels. However, once it starts operating, its production costs are low compared to fossil fuel power plants (Budiman et al., 2017).

Geothermal energy is a source of energy that is local, reliable, tough, environmentally friendly and sustainable. This natural energy has many different applications, such as heating and cooling buildings, power generation, providing warm/cool water for agricultural products in greenhouses, and balneological uses. Geothermal energy is independent of weather or climate and can supply heat and electricity almost continuously throughout the year. It is even possible to use geothermal projects as "thermal batteries", where waste or accumulated heat is stored for future use, even periodic use, making geothermal energy "renewable" on a time scale of years (Soltani et al., 2019).

Indonesia is one of these developing countries which is facing a 10% increase in demand for electricity annually (especially in the islands outside Java), and therefore this country needs additional capacity to generate electricity of around 6 Giga Watt per year. Indonesia's electricity ratio – namely the percentage of Indonesian households connected to the electricity network – was around 98% at the end of 2020 implying that there are still around 5 million Indonesians who do not have access to electricity.

The main factor hindering investment in geothermal development in Indonesia is the law in Indonesia itself. In the past, geothermal activity was defined as mining activity (Law of the Republic of Indonesia Number 27 of 2003 concerning Geothermal) which indicated that this was prohibited from being carried out in protected forest areas and conservation areas regulated in Law of the Republic of Indonesia Number 41 of 1999 concerning Forestry, despite the fact that geothermal mining activities only have a small impact on the environment (compared to other mining activities). However, around 80% of Indonesia's geothermal reserves are located in protected forests and conservation areas, making it impossible to exploit this potential. In August 2014, when the second term of President Susilo Bambang Yudhoyono's administration was nearing completion, the Indonesian People's Representative Council (DPR) passed the Geothermal Law No. 21/2014. Thus, the Law of the Republic of Indonesia Number 21 of 2014 concerning Geothermal, 2014, separates geothermal from other mining activities and, therefore, opens the way for geothermal exploration in protected forest areas and conservation areas.

Nursyahid (2016) and Daud (2019) have reported that Indonesia's position in the area of collision of tectonic plates and the equator makes this country have large energy reserves. Indonesia has fossil energy reserves such as oil, gas and coal and non-fossil energy reserves such as geothermal, water, wind and solar energy. The

use of fossil energy is detrimental to the environment and its reserves are continuously depleting. So, dependence on fossil energy must be reduced by replacing it with renewable energy with abundant reserves, one of which is geothermal. Because of that, according to Muslihudin et al. (2022), the construction of a geothermal power plant on the slopes of Mount Slamet, Central Java, is a manifestation of these considerations.

Planning for the construction of a GPPD on the slopes of Mount Slamet, including in the Banyumas Regency area, began in 2005. The Ministry of Energy and Mineral Resources is the institution authorized to think about energy as a means of life for the people. The construction implementer is entrusted to a private company, namely PT SAE (Sejahtera Alam Energi). The targeted power is to produce 220 MW of electricity. There is a plan of developing the geothermal electricity that was supposed be finished in 2021. In fact, until 2023, there has not been any geothermal energy that can produce electricity.

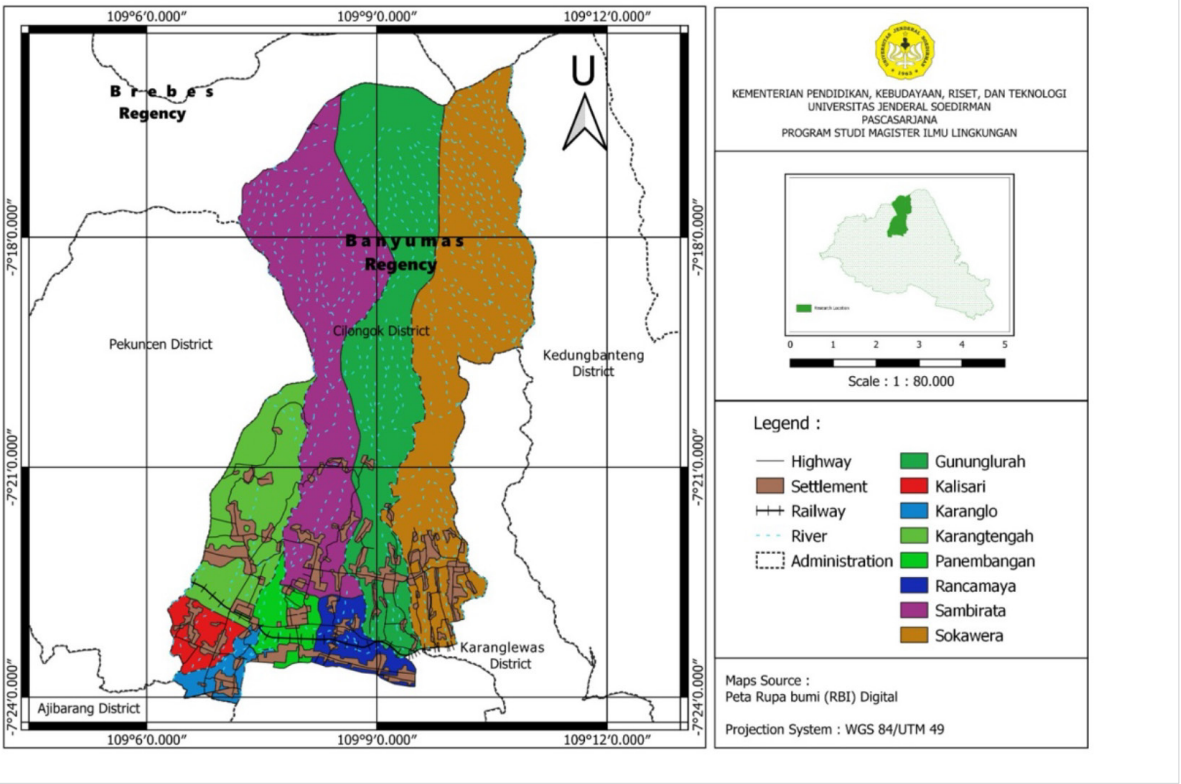
The delay in the construction of the GPPD was caused by a social problem, namely the rejection from the community that occurred in 2017–2019. The community's rejection as a form of social constraint has also troubled the implementing agencies, the village, district and provincial governments. Because this demonstration/rejection not only makes the development process that takes attention, effort and time, it also costs a lot of money that must be allocated to address these social problems. This shows that the social aspect is an important thing to pay attention to (Hardjono, 2004).

It is based on that reality that this study was conducted. Why did people reject and demonstrate on a large scale against the GPPD construction in the Banyumas district, even though it is known that the construction of GPPD is a project to develop a source of electrical energy that is environmentally friendly, renewable and sustainable energy?

Methods

This study was designed as qualitative research that is descriptive and analytic. The interactive analysis consists of data processing, data reduction, data presentation, and conclusion. This research is also a type of a

Fig. 1. *Affected area*



case study based on empirical phenomena or an empirical based model (Hajar et al., 2019). The research target was the closest community to the exploration site on the southern slopes of Mount Slamet in the Banyumas Regency area. The closest and affected area is the Cilongok District area. The other research subjects are the officials of the related offices, namely, the Banyumas Regency Environmental Service, the Forestry Service, especially forestry extension workers for the Cilongkok Banyumas area, and the company implementing the development, namely PT SAE.

People who were used as research informants were from 8 villages directly affected by the GPPD: 1. Gununglurah, 2. Kalisari, 3. Karanglo, 4. Karangtengah, 5. Panembangan, 6. Rancamaya, 7. Sambirata, 8. Sokawera. The location of the eight villages is shown in *Fig. 1*.

Research informants were determined by purposive sampling, with the criteria only being subjects who had experienced and knew in real terms that the impact of the GPPD development had occurred on them. The data collection method was interview. The main informants in this study consisted of 16 people, namely the village head or village officials, 8 people from each affected village, and 8 community members affected by water pollution. The selected informants were residents who knew the most, had sufficient knowledge and were able to explain the actual situation of the object under study. In addition, the informants were also trusted by the public to express their opinion and views. Supporting informants were taken from outside the affected population, namely: 1) the head of the Laboratory for the Environmental Office of Banyumas Regency, 2) a forestry supervisor for the Banyumas Regency area, 3) a monitoring specialist of water pollution in the Prukut River, and 4) several experts from the executor of development (PT Sejahtera Alam Energi).

Results and Discussion

Every large-scale development has an impact on the environment including social aspects, both positive and negative (Hardjono, 1998; Muslihudin et al., 2018; Muslihudin et al., 2019). The construction of GPPD in Banyumas district which has been running is also inseparable from its social environmental impacts. The development is not related to land acquisition that belongs to the community because all development land is land owned by the government, especially part of the production forest. Therefore, at the initial stage there were no social problems, especially related to compensation for land acquisition, which has occurred so far that social problems have often occurred with the local community.

In the course of the construction of the GPPD, especially after going through the construction phase (building road infrastructure, land clearing and drilling), social problems arose which made social difficulties for the construction implementers and even local governments from the village level to the provincial level. In detail, there are a number of conditions that do not seem to value the importance of social aspects, causing social problems in the form of demonstrations against GPPD.

Planning

In the planning stage of the GPPD construction, the social environment aspect is already considered. However, the portion is still not sufficient. One of the indications is seen from the identity of the EM and EME drafting team (SAE, 2016). The number of team members consisted of 14 experts, and only 1 person was a social science expert. The other 13 came from a group of exact science experts. There were doubles of certain scientific experts. This means that the social aspect is relatively ignored by development initiators.

In addition, the GDPP construction plan is not communicated to the public. The plan is only communicated to to the government officials from the district level, to village level officials. The local community did not feel involved in this outreach. It can be seen by the statements of the residents affected by the construction as follow.

> *I was never informed about the plan to build a GPPD, I discovered it after the water pollution occurred. After the turbidity of the water disturbed the residents, the residents gathered at the village hall. At that time, it was explained about the incident that caused the community members to suffer losses. Personally I don't agree with this development, but if it's for the prosperity of the wider people that's fine, but I shouldn't be harmed as a small person.*

Other informants who agree with the response above are farmers who claim to have received a compensation from the economic and environmental impact.

They stated that:

> *The GPPD development project is actually important, because if it is useful for the wider community, it might be important. But the important thing is that there must also be outreach to all residents who may be affected. In addition, they also have to be responsible if something happens that harms the residents, don't wait for the residents to demonstrate.*

The two aspects that were not strong enough in the planning stage to deal with the social aspect have so far been considered to be the factors that have supported the violent protests from the community. In fact, there are already good practices (best practices) that have been set as examples by the Ministry of Energy and Natural Resources. EBTKE (2020) describes that intensive coordination with local regional government officials continues to be improved around the project area to express appreciation and ask for community support for the smooth implementation of the project. When the GPPD operates, of course the community through the Regional Government will also experience additional direct benefits in the form of production bonuses. In addition, the implementation of community development will also continue as long as the GPPD is in operation.

Public relation officers (EBTKE, 2020) consider that in the context of geothermal energy development, the enterprises implementing development need to coordinate with the State Electricity Company (SEC) regarding the completion of transmission construction work, land acquisition, and social issues. Development implementers must immediately start empowering the community, through counseling, technical guidance, and livelihood restoration so that people's welfare can increase with the presence of the GPPD. In parallel, the Geothermal Directorate Team has also coordinated with two village heads and two sub-district heads from project-affected areas to convey that the GPPD project is one of the national strategic projects that must be supported and protected by the entire community because it benefits the interests of the wider community.

Limited socialization/information

Socialization of a development project means providing information and introducing to the public about the development plan in detail, as well as the impacts that may occur, both positive and negative. If socialization is carried out well, good communication will be established between development implementers and the surrounding community. Sunarto (2000) defines socialization as something that must be learned by every member of society through a process of socialization. As for what is learned in socialization is the roles that can be contributed by community members.

Related to environmental issues, Hadi (1995) provides an explanation that the important task of a social study of environmental impact analysis is to mobilize community participation in the development process, preferably even from the time the decision is made on the development plan. Likewise, Bell (1998) stated that in order to raise public awareness of environmental issues there must be a dialogue between social aspects and ecological aspects. Ecological aspects are in the form of real conditions of environmental problems. The social aspect is in the form of moral values regarding the environment, democratic values and democratic institutions.

The case in the construction of the GPPD in Banyumas district was relatively a lack of communication to the community. Actually, the target of socialization is not society in general. The main target is the community that has the potential to be directly affected. From several informants' opinions from the results of interviews with affected communities it becomes clear that they did not know about the GPPD construction in the area where they lived. So, the socialization was carried out only to heads of district level agencies, sub-district heads and village heads. This means only the formal institutional pathway, while the informal pathway is lacking or not even carried out. The following are statements from residents who did not know about the GPPD.

The principle of efficiency should not be prioritized in the development process which is likely to have a large and important impact. If efficiency is prioritized, it usually tends to limit costs in the development process itself. So that socialization is not to all the people who will be affected. How can we hope for community participation if socialization alone does not reach them. Participation requires involvement from the start before development is carried out (Kertaningrum et al., 2021).

Limited socialization and discrimination between community groups makes segmentation occur in society. This also happened in the GPPD development process.

Table 1. *Answers regarding socialization between the village head and ordinary people*

Questions	Answers from the village head	Answers from the community
Do you know about GPPD?	*Yes, I know*	*I don't know, I know since the pollution occurred.*
Was your village affected when pollution occurred?	*No, here, thank God no, because the Prukut river is not crossed. This is where the Sengaji river passes. But I was also worried before.*	*Yes, exposed to fish ponds and rice fields. The pond has received compensation but the rice fields have no compensation.*
Does that mean you used to get socialization about GPPD?	*Yes. Previously from PT SAE, Ministry of Energy and Mineral Recources, and the local government, I even got to the drilling site.*	*Never*
Do you agree with the GPPD construction?	*Agree, because it is in the public interest, even the state.*	*Disagree, because it sacrifices part of society.*

Source: Primary data, 2022

The result is a horizontal conflict between the residents themselves. The following is a statement from the affected residents:

> *The development of this GPPD needs to be communicated again, villagers need to be involved more so that when problems occur village officials are not only the target of mass tantrums. Because of the previous case, residents protested to village officials. The village head even happened to buy a car at that time, the residents thought it was because he got money from the GPPD. So, government officials are quite at risk because they are hostile to residents who are negatively affected by polluted water.*

According to the development implementer (PT SAE), it is hoped that the socialization that has been carried out to government officials will be conveyed to all its citizens. However, it seems that this cannot be conveyed to all members of society.

The data in *Table 2* show that there are very contrasting perceptions between village officials and the affected communities/farmers. All village officials were involved in the socialization and all had a positive perception of the GPPD; on the other hand, the community/farmers/non-officials were not involved in the socialization and all had a negative perception of the GPPD. This implies that socialization has a clear effect on people's perceptions. Thus, socialization plays an important role in the development so that the community will have a positive perception of the development process and will participate in it in the future. This is reinforced by Dieningrum (2020) and Budiman (2013)

Table 2. *Occupation, socialization and perceptions of GPPD*

No	Village	Ocupation	Socialization		Perceptions of GPPD	
1	Karangtengah	Village Official	Yes		Positive	
		Farmer		No		Negative
2	Panembangan	Village Official	Yes		Positive	
		Farmer		No		Negative
3	Kalisari	Village Official	Yes		Positive	
		Farmer		No		Negative
4	Rancamaya	Village Official	Yes		Positive	
		Farmer		No		Negative
5	Karanglo	Village Official	Yes		Positive	
		Farmer		No		Negative
6	Sokawera	Village Official	Yes		Positive	
		Farmer		No		Negative
7	Gununglurah	Village Official	Yes		Positive	
		Farmer		No		Negative
8	Sambirata	Village Official	Yes		Positive	
		Farmer		No		Negative

Source: Primary data 2022

who concluded that the socialization variable is related to perceptions and influences community participation.

Social impact delineation

Making social ecological boundaries is an important thing in the analysis of environmental impacts in a development process (Wagner et al., 2019), especially when it comes to the possible impact on humans. A kind of zoning of potentially affected areas needs to be known so that efforts to localize impacts are easily carried out (Chen et al., 2022; Moukhtar et al., 2020).

There is a data discrepancy between the name list and the affected community in the Banyumas GPPD construction point. This is in accordance with the decision of the Minister of Energy and Mineral Resources Number 1557/K/30/MEM/20010 concerning the Baturraden Geothermal Mining Working Area. The name of the project point is in the Baturraden sub-district area while the impact that occurs affects the community in the Cilongok sub-district area.

At first, it was not thought that water pollution occurred in the Cilongok area as a result of the GPPD construction process at the Baturraden WKP. It was even rumored that the turbidity of the water along the Prukut River was caused by gold mining. It is because the Baturraden area is relatively far away and its river, the Logawa River, is not connected to Prukut River. The confusion over this issue has made the affected residents curious, so they have come to explore along the Prukut River up to the source of water pollution. This was stated by residents who traced along the river.

> *To be precise, at the end of 2017, when there was turbidity, we and various NGO groups tried to trace the Prukut river, departing from here to the location in 7 hours. They found the Taman Dlingo reservoir on the border between Banyumas and Brebes. There are two ponds built by PT SAE, the left pond covers Brebes Regency and the right pond covers Banyumas Regency. The reservoir accommodates the drilling process;, therefore the drilling point is close to the reservoir. There is a river flow underneath so that the mud is also carried into the river during the rainy season.*

Apart from these arguments that it is unthinkable that the impact of water pollution is affecting the people in the Cilongok area, delineation is still important to do. Maybe in the case of the GPPD there is less detail on where the project site locations are carried out so that the boundaries of the ecological areas that will be affected are not known. It should be noted that ecological boundaries are not the same as administrative boundaries. Ecological boundaries are also not the same as social boundaries. Ecological boundaries mean boundaries of areas or zones that are usually affected by an activity. Zoning is a way to find out the boundaries of the area that will be affected by an activity (Muslihudin et al., 2019).

The impacts that occurred were quite felt by the affected population because they affected several sectors as listed in the following *Table 3*.

Table 3. *Sectors affected by pollution*

No	Sectors affected	Environmental Damage
1	Fisheries	Fish die due to damage to respiratory organs due to water turbidity that exceeds the threshold.
2	Agriculture	The soil in the paddy field becomes hard because it is filled with mud containing rock components.
3	Animal husbandry	Disturbed growth and productivity of dairy milk due to polluted water quality.
4	Clean water channel	For about a year, the clean water channel cannot function properly because the water is very turbid.

Source: Primary data, 2022

By knowing the zones or areas that will be affected, environmental management and monitoring efforts will also be more focused and hit the right targets. Building a good relationship with the community can be done with the people who are in the zone. Hadi (1995) describes that good relations with the community are carried out in two directions which can ultimately increase the positive impact of the development process of a program.

In this case, only part of the Cilongok sub-district was directly affected. The wider community was also affected, so that relatively large demonstrations could not be avoided. *Fig. 2* is one of many signs of community resistance.

Fig. 2 shows that the demonstration of the GPPD construction process in the Banyumas district had quite a large number of participants. The construction not

only affected the local community but also various components of society, including NGOs, social organizations and student organizations from several universities in the city of Purwokerto. This indicates that the social aspect in planning the GPPD development in the Banyumas Regency area does not receive sufficient attention.

Fig. 2. *Demonstration against GPPD*

Delayed recruitment of local community

In the case of the GPPD Banyumas development process, there was a lack of community involvement in the project. Local communities that may be affected should be involved in the development process. This is a form of compensation related to a sense of justice. With the presence of the project, the condition of the local residents should be better, for example, they will have job opportunities with adequate wage levels (Armour, 1988).

The involvement of local residents, especially residents of Cilongok District as an affected area, in the GPPD construction process in Banyumas was not from the beginning. Recruitment of only two people was done after the impact of water pollution that disturbed the community. This was stated by an informant from Karang Tengah Village, Cilongok sub-district.

> *I have been measuring the turbidity of water in the Prukut river since 2017 until now. I used to be a small-scale activist in this village from the affected community. In the past, when turbidity occurred, I traced the river up to the top, then met at the top with the regent's entourage and PT SAE, concluding that the source of the turbidity was from GPPD activities. Then the regent decided to make a post in Karangtengah as the most affected village. To be precise, since January 2017 the post has been made.*

After the negative impact on the community members, the new development implementer recruited local residents to work on the project. This had become a problem because it also sparked horizontal conflicts with local residents. There is a jealousy among the residents. Thus, residents working in the PT SAE project act as company representatives in the village. At certain times when there are residents who protest, it is always directed at the residents who work at the company. Other workers involved in the GPPD project also stated this.

> *Ancient times, the Prukut river has never experienced turbidity. After the pollution happened, we were put to work on the project. In fact, the workers recruited from this village have a double function. On the one hand, it helps work related to the project, such as observing and monitoring water pollution that has occurred. On the other hand, workers from this village also have the function of helping to maintain or dampen problems if there are problems in the community, especially those related to the GPPD project.*

In many successful activities, one of the keys is the involvement of local communities as a strategy. Zakaria, (2011) and Syafa'at et al. (2016) concluded that the involvement of local residents in regional development programs and economic enterprises is the most effective way to get participation from the community and not cause other social problems. The local residents who are involved do not have to be from the local elite, even the brute force will also function in the same way. Research by Muslihudin et al. (2021) also showed that the involvement of the village elite in a productive business development program for a village community greatly helps the success of the program. Village elites in a broad sense are not only village officials as political elites, but also social, economic, cultural, security elites, etc. depending on the real conditions in each village.

NGOs are less involved

Non-governmental organizations, especially those engaged in the environmental sector, should be involved in activities that may affect society and possibly damage the environment (Waniatri et al., 2022). Non-governmental organizations in many cases can function as a disturbing variable; conversely, they can also function as a damper if social conflict occurs. In the case of the construction of the Baturraden GPPD, it has a stronger

function as a defender for people who have been negatively affected. This can be seen from the statement of an NGO activist in Banyumas Regency:

> *There are differences among NGOs, also among experts, in local governments too. Biologists themselves are also divided between those who support and oppose the GPPD project. Those NGOs that don't know what to do are usually the ones looking for money. If the good ones are the most silent, Walhi (Environment NGO) is also silent. So those who refuse are certain groups seeking profit.*

In line with the statement above is a statement from the expert staff of the Banyumas Regency Environmental Service:

> *Even if it is true that NGOs that are against the construction of GPPD are NGOs that are less credible and only seek profit, good NGOs just keep quiet. Silence has no clear meaning, support or counter. This means that none of the NGOs support the project of GPPD in the Banyumas Regency area.*

The existence of NGOs is also important to be seen in cases of environmental conflicts and development initiators. NGOs have a role as a reflection of community groups who care and are concerned about environmental problems (Hannigan, 1995). In addition, NGOs are also very significant as a representation of opposition forces that often control government policies. In other cases, there are also many NGOs that really help the community, such as dealing with problems where the government is unable to do so (Muslihudin et al., 2023). The form of NGO contributions to helping the government is mostly done for people who are marginal, neglected, powerless in the fields of economy, education, social, justice, security, etc., which means that NGOs function to help government programs or tasks.

Conclusions

During the construction process of the GPPD in Baturraden Banyumas, there was a massive demonstration against the development initiator. This happened because of the negative environmental impacts in the form of river water pollution. Such a demonstration occurred because the social environment aspect did not receive correct and sufficient information so that when an environmental impact occurs, the community overreacts to the GPPD development initiator. If the social environment aspect received a proportional portion, there should be no resistance which is enough to make the initiator troublesome and even disrupt the development process itself.

The social aspects that are lacking in the GPPD development process are the following: community participation is still not optimal since, in the planning stage, socialization is limited to formal leaders and less to people who are potentially affected. Recruitment of workers from the local community was behind; as they were appointed after the negative impact by the construction. The last is the lack of involvement of NGOs in the GPPD construction process.

Acknowledgments

We express our gratitude to the Institute for Research and Community Service, Jenderal Soedirman University for funding so that this research could be carried out as well as to the informants in the field who have provided very meaningful information for this study, and to the management and staff of PT. Sejahtera Alam Energy (SAE), who agreed to discuss with the research team.

References

Ahmadhidayat. (2021). Potensi Panas Bumi Indonesia Terbesar Kedua Dunia, PLN Gencar Kembangkan PLTP [The World's Second Largest Geothermal Potential in Indonesia, PLN Incessantly Develops GPPD] (in Indonesian). Available at: https://web.pln.co.id/cms/media/siaran-pers/2021/07/potensi-panas-bumi-indonesia-terbesar-kedua-dunia-pln-gencar-kembangkan-pltp/ (accessed 4 May 2021)

Armour, A. (1988). New Direction in Impact Management: A Discussion Paper. Conflict Management Seminar. York University, Toronto, Canada. 79 p.

Bell, M.M. (1998). An Invitation to Environmental Sociology, Sociology for A New Country, Department of Sociology Iowa State University, United State of America. 342 p.

Budiman, A. H., and Windaru, A. (2017). Analisa Biaya Pembangkit Listrik Tenaga Panasbumi Skala Kecil [Cost Analysis of Small-Scale Geothermal Power Plant Generation] (in Indone-

sian). Jurnal Energi dan Lingkungan 13(2): 47-52. https://doi.org/10.29122/elk.v13i1.4259

Budiman, R., Saam, Z., and Tamrin. (2013). Community Participation and Perception in Efforts to Maintain Environmental Management and Maintain the Clean City Predicate. Jurnal Ilmu Lingkungan 7(2): 103-113.

Chen, J., John, R., Yuan, J., Mack, E. A., Groisman, P., et al. (2022). Sustainability Challenges for the Social-Environmental Systems Across the Asian Drylands Belt. Environmental Research Letters. 17 (2) 023001. https://doi.org/10.1088/1748-9326/ac472f

Daud, Y. (2019). Energi Geotermal di Indonesia: Potensi, Pemanfaatan, dan Rencana ke Depan [Geothermal Energy in Indonesia: Potential, Utilization and Future Plans] (in Indonesian). The Conversation. Available at: https://theconversation.com/energi-geotermal-di-indonesia-potensi-pemanfaatan-dan-rencana-ke-depan-11292 (accessed 14 April 2022)

Dieningrum, A.N.A., Muslihudin, M. Suyanto, E. (2020). Partisipasi Masyarakat dalam Pemanfaatan Sampah Plastik menjadi Paving Blok di UD Wong Cilik Desa Jetis Kecamatan Kemangkon Kabupaten Purbalingga [Community Participation in Utilizing Plastic Waste to Become Paving Blocks at „UD. WONG CILIK" Jetis Village, Kemangkon District, Purbalingga Regency] (in Indonesian). Jurnal Analisa Sosiologi 9(2): 582-596. https://doi.org/10.20961/jas.v9i2.44430

EBTKE (2020). Ditjen EBTKE Melanjutkan untuk Pengawasan Pembangunan Pembangkit Listrik Tenaga Panas Bumi [Continue to Supervise the Development of Geothermal Power Plants] (in Indonesian). Kementerian Energi dan Sumber Daya Mineral Direktorat Jenderal Energi Baru Terbarukan dan Konservasi Energi, Jakarta

Fathi, A. (2017). Memahami Tujuan, Permasalahan, dan Mencari Titik Temu Pembangunan Pembangkit Listrik Panas Bumi (PLPB) Baturraden [Understanding the Goals, Problems, and Finding Meeting Points for the Development of the Baturraden Geothermal Power Plant] (in Indonesian). Available at: https://medium.com/@fathitecno/mehami-tujuan-permasalahan-dan-mencari-titik-temu-pembangunan-plpb-baturraden-2ae23b67f3a5 (accessed 1 August 2020)

Hadi, S. P. (1995). Social Aspects of Amdal, History, Theory and Methods (1st ed.). Gadjah Mada University Press, Yogyakarta.126 p.

Hajar, S. M. M., Fauziah, K., Sharifah Sakinah, S. A., and Emaliana, K. (2019). Flood damage assessment: A preliminary study. Environmental Research, Engineering and Management, 75(3), 55-70. https://doi.org/10.5755/j01.erem.75.3.22433

Hannigan, J. A. (1995). Environmental Sociology, A Social Constructionist Perspective. Routledge, New York. 236 p.

Hardjono, I. (1998). Urgensi Aspek-aspek Social dalam Kajian Dampak Lingkungan [The Urgency of Social Aspects in Environmental Impact Assessment] (in Indonesian). Forum Geografi 12(1): 16-24. https://doi.org/10.23917/forgeo.v12i1.479

Invesments, I. (2020). Indonesian Geothermal Energy. Available at: https://www.indonesia-investments.com/id/bisnis/komoditas/energi-panas-bumi/item268 (accessed 20 March 2021)

Kertaningrum, P. H., and Widayati, W. (2021). Community Participation in Development of Environmental Impact Analysis Documents (AMDAL) Based on Arnstein Concept. Law Development Journal 3(2): 175-183. https://doi.org/10.30659/ldj.3.2.175-183

Law of the Republic of Indonesia Number 41 of 1999 concerning Forestry, Publication in Jakarta, 30 September 1999.

Law of the Republic of Indonesia Number 27 of 2003 concerning Geothermal, Publication in Jakarta, 22 Oktober 2003.

Law of the Republic of Indonesia Number 21 of 2014 concerning Geothermal, Publication in Jakarta, 17 September 2014.

Moukhtar, I., Ibrahim, A. A., El Seoud, T. A., and Mostafa, S. (2020). Assessment of the Environmental Carrying Capacity for Protected Areas: A Study of Petrified Forest and Hassanah Dome, the Great Cairo. Environmental Research, Engineering and Management 76(4): 106-117. https://doi.org/10.5755/j01.erem.76.4.26665

Muhsin Zakaria, M. (2011). Dinamika Sosial Ekonomi Priangan Abad Ke-19 [The Socio-Economic Dynamics of Priangan in the 19th Century] (in Indonesian). Sosiohumaniora 13(1): 96-107 https://doi.org/10.24198/sosiohumaniora.v13i1.5464

Muslihudin, M., Adawiyah, W. R., Hendarto, E., Megasari, R. D., and Ramadhan, M. F. (2022). Environmental Constraints in Building Process a Sustainable Geothermal Power Plant on The Slopes of Slamet Mount, Central Java, Indonesia. Evergreen 9(2): 300-309. https://doi.org/10.5109/4793669

Muslihudin, M., Hendarto, E., Rostikawati, R., Windiasih, R., and Retno Wulan, T. (2018). Relationship between Environmental Damage and Corruption Cases in Indonesia. The 3rd International Conference on Energy, Environmental and Information System (ICENIS 2018) https://doi.org/10.1051/e3sconf/20187302011

Muslihudin, M., Hussin, R., Wulan, T. R., Santoso, J., and Wijayanti, S. (2023). The Role of Non-Government Organizations in the Education of Migrant Worker's Children in Sabah Malaysia. International Conference on Politics, Social, and Humanities Sciences, 2023, 363-373. https://doi.org/10.18502/kss.v8i3.12841

Muslihudin, M., Rosyadi, S., Santoso, J. (2019). Sustainable Traditional Gold-Mining Management in Banyumas Central Java, Indonesia. International Journal of Conservation Sciences 10(1): 147-156. Available at: www.ijcs.uaic.ro

Muslihudin, M., Siswandi, S., Iqbal, A., Bahtiar, R.A. (2019). Zone Engineering of People's Mining Areas as A Limitation on Environmental Destruction in Banyumas Indonesia. International Journal of Mechanical Engineering and Technology (IJMET) 10(6): 278-284. Available at: http://www.iaeme.com/IJMET/index.asp278

Muslihudin, M., Wulan, T. R., Sugiarto, T., Wardhianna, S., and Wijayanti, S. (2021). Village Elite Role on The Productive Migrant Village Program in Banyumas Indonesia. Jurnal Komunitas 13(2): 179-189. https://doi.org/10.15294/komunitas.v13i2.29144

Nursyahid. (2016). Sistem Kerja Pembangkit Listrik Tenaga Panas Bumi [Geothermal Power Plant Work System] (in Indonesian). Available at: https://www.cnzahid.com/2016/12/sistem-kerja-pembangkit-listrik-tenaga.html

(SAE), S. A. E. (2016). Upaya Pengelolaan Lingkungan Hidup dan Upaya Pemantauan Lingkungan Hidup [Environmental Management Efforts, Environmental Monitoring Efforts] (in Indonesian). Changes to Geothermal Exploration Activity Plans in the Baturraden Work Area. April 2016, Jakarta

Soltani, M., M., F., Kashkooli, A. R., Dehghani-Sanij, A. R., Kazemi, N., Bordbar, M. J., Farshchi, M., Elmi, K., Gharali, B., M., and Dusseault. (2019). A comprehensive study of geothermal heating and cooling systems. Sustainable Cities and Society, 44, 793-818. https://doi.org/10.1016/j.scs.2018.09.036

Syafa'at, N., Simatupang, P., Mardianto, S., and Pranadji, T. (2016). Konsep Pengembangan Wilayah Berbasis Agribisnis dalam Rangka Pemberdayaan Petani [The Concept of Agribusiness-Based Regional Development in the Context of Empowering Farmers] (in Indonesian). Forum Penelitian Agro Ekonomi. pp 26-43. https://doi.org/10.21082/fae.v21n1.2003.26-43

Sunarto, K. (2000). Pengantar Sosiologi [Introduction to Sociology] (in Indonesian). Publishing Institute of the Faculty of Economics, Universitas Indonesia. 290 p.

Wagner, I., and Suteki, S. (2019). Independensi Penilaian Amdal sebagai Wujud Perlindungan terhadap Lingkungan Hidup [Independence of AMDAL Assessment as a Form of Environmental Protection] (in Indonesian). Jurnal Pembangunan Hukum Indonesia 1(3): 404-424. https://doi.org/10.14710/jphi.v1i3.404-424

Waniatri, W., Muslihudin, M., and Lestari, S. (2022). Dampak social, Ekonomi dan Lingkungan Pertambangan Pasir di Desa Luragung Landeuh, Kuningan, Jawa Barat [Impact of Social, Economic and Environmental of Sand Mining in Luragung Landeuh Village, Kuningan, West Java] (in Indonesian). Jurnal Ilmu Lingkungan 20(2): 279-290. https://doi.org/10.14710/jil.20.2.279-290