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Environmental Constraints in Building Process a Sustainable Geothermal Power Plant on The Slopes of Slamet Mount, Central Java, Indonesia

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Abstract: Indonesia as one of the countries that has a very large geothermal potential. Its utilization should be developed because this energy is classified as renewable and sustainable energy. Indonesia has geothermal potential of 28,910 MW, as the second largest country in the world. So far only 1,699 MW of installed capacity or 5.9% of its geothermal potential. The purpose of this study is to describe how the process of building a sustainable geothermal power plant on the slopes of Slamet Mount has not been successful. The study method used is qualitative with interview, observation and documentation techniques in data collection. The data analysis method uses interactive analysis. The results of the study show that the construction process of geothermal power plants on Slamet Mount has actually started since 2005. The initial plan was that in 2021 it could be exploited with 220 megawatts of electricity. In fact, it's not finished yet. One of these constraints is caused by environmental factors which include abiotic, biotic and social components. Abiotic components in the form of geological aspects and extreme land conditions that cause water pollution. The biotic component is the fishery and agriculture sectors of the population affected by the turbidity of the water. The social component is public unrest, resulting in demonstrations against the development process of sustainable geothermal power plant.

Keywords: Geothermal; Sustainable energy; Environmental constraints; Slamet mount.

1. Introduction

Indonesia is blessed with geothermal resources as an abundance of sustainable energy due to the large number of volcanoes in its territory. Indonesia is also one of the few systems in the world that has great potential for the construction of geothermal power plants (GPP)[1)]. The large islands, only Kalimantan does not have geothermal potential because there are no volcanoes[2)]. The island of Java, which is classified as small with the largest population, has quite a lot of the most active and active mountains. Data from the International Geothermal Congress 2014 in the 2015–2019 MEMR Strategic Plan, Indonesia has geothermal potential of 28,910 MW which is the second largest in the world[3)].

So far as of August 2017 only 1,699 MW of installed capacity or 5.9% of the geothermal potential owned by Indonesia[4)]. The same thing was conveyed by Daud that the total installed capacity of Geothermal Power Plants (GPP) in Indonesia is currently 1,948 MW[5)]. Likewise, Prambadi which states that the installed capacity of GPP in Indonesia is currently 2.1 GW[6)]. This number makes Indonesia the second largest geothermal energy producer after the United States (3,591 MW). In this case, Indonesia as the first in Asia and second in the world. In the ASEAN region itself, now almost followed by the Philippines with a capacity of 1.9 GW.

Utilization that is still low compared to the potential of geothermal energy that Indonesia has is a homework that is being pursued to be improved. The construction of geothermal power plants is being carried out actively because the conditions are still far from the target. Umah informs that the development of the geothermal power plant (DGPP) project is still far from the initial target set by the government in the National Energy General Plan[7)]. The total installed capacity of the national geothermal power plant has only reached 2,100 megawatts (MW). Meanwhile, based on Presidential regulation, the installed capacity of PLTP in 2020 is targeted to reach 3,109.5 MW[8)]. This means that the government has only

realized 67.5% of the predetermined initial target. According to Khatijah, to accelerate the slow development process of geothermal power, it is necessary to establish a fiscal incentive coordinating team, financial support from financial institutions, exemption from local income tax and spare parts, and exploration by the government[9].

Geothermal exploration and exploitation for electricity generation is actually classified as minimal in terms of the facilities, facilities and infrastructure needed. To generate electricity, geothermal power plants only need an area of between 0.4-3 hectares, while a steam power plant for example requires an area of about 7.7 hectares. Geothermal power is included as a new and renewable energy source because the heat extraction is much smaller than the geothermal load. Geothermal power plants' current carbon dioxide emissions are approximately 122 kg CO2 per megawatt-hour (MWh) of electricity, roughly one-eighth of the emissions of coal-fired power plants[10].

Another advantage of generating electricity from geothermal is that geothermal energy does not produce pollution, and at the same time, does not contribute to the greenhouse effect. Since geothermal energy is energy that comes from within and from itself, no sources outside of fuel are needed to keep the generator running. And what is clear is that geothermal or geothermal energy is renewable energy, which means that as long as we don't pump too much water the energy will continue to exist[11]. The problem is that the advantages of such geothermal power plants are not fully known by the public, even educated people do not necessarily know them. When in the exploration process there is a slight environmental impact, it will cause community reactions which sometimes exceed the magnitude of the impact. On the other hand, sometimes the socialization process is incomplete and does not reach all components of society, especially those that are potentially affected.

DGPP development on the slopes of Mount Slamet is based on the Ministry of Energy and Mineral Resources (MEMR) decree which has designated Baturraden as a Geothermal Working Area (GWA) with a total land area of 24,660 hectares. The Baturraden Geothermal Power Plant (DGPP) is projected to be fully operational in 2022, with a capacity of up to 220 MW. In accordance with the Minister of Energy and Mineral Resources Decree No. 4557 K / 30 / MEM / 2015, the holder of the Geothermal Permit (GP) at the Baturraden GWA is PT Sejahtera Alam Energy (SAE) with share ownership consisting of 75% STEAG and 25% PT Trinergy[12].

DGPP development planning has been started since 2005 by the Ministry of Energy and Mineral Resources as an institution that has been given the authority to think about energy as the life of the community. The development, whose implementation is entrusted to a private company, namely PT SAE (Sejahtera Alam Energi), is targeted to be able to generate electricity potential of 220 megawatts. The initial plan for the development of geothermal electricity is that in 2021 it can operate, but until now at the end of 2020 there has not been a geothermal point that can generate electricity. This means that the exploration stage has not yet obtained definite results. Thus, the exploration period is extended until 2025 is expected to be completed.

On the basis of the reality that until now there is no certainty of obtaining the necessary hot spots, while the development process has taken a long time. A lot of money and effort has been spent but the results are still not visible. Therefore, this article aims to describe the environmental constraints in the geothermal power plant development process in Banyumas.

2. Method

The approach used in this study is a qualitative. This approach is used to understand the subject from the point of view of the informant under study in accordance with what is meant by[13]. The form of this research is descriptive analytic research. Descriptive is a description that describes according to what is in the field. Analytics is a review or analysis of existing data using interactive analysis tools[14]. Data collection methods are interviews, observation and documentation.

The subjects of this research are; First, the people affected by the exploration of the southern slopes of Mount Slamet in Banyumas Regency are people who live in the Cilongok District. There are 7 affected villages, namely; the villages of Karangtengah, Panembangan, Kalisari, Karanglo, Cikidang, Rancamaya and Pernasidi. Second, the related institution is the Banyumas Regency Environmental Service. Third, the Forestry Service for the Cilongkok Banyumas area. Fourth, the company implementing the geothermal power plant development, namely PT SAE (Sejahtera Alam Energi) which is headquartered in Jakarta, and has an office in the field in Kretek Village, Paguyangan District, Brebes Regency.

The research location has several areas. Associated with water pollution that occurs is in villages in the Cilongok District. Related to the administrative area is Banyumas Regency. The research location map is as follows.

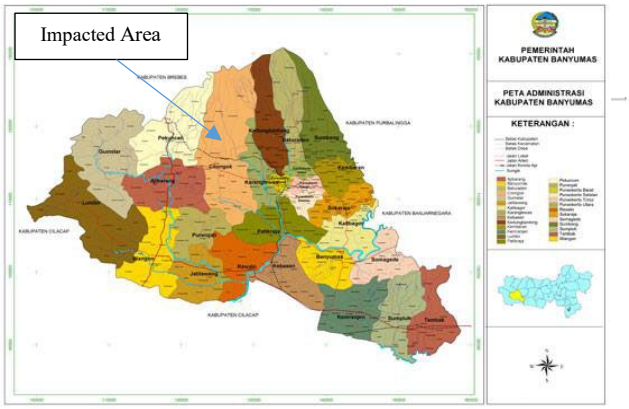

Fig. 1: Banyumas Regency Central Java

3. Result and Discussion

The development process that has been carried out in the geothermal power plant on the slopes of Slamet mount is the planning and exploration process. It is in the exploration stage that environmental constraints occur. Therefore, the discussion in this section includes planning, exploration and environmental constraints.

3.1. Planning

Dirjen EBTKE states that the government is trying to develop energy based on green energy principles, especially geothermal energy[15]. Presidential Decree No. 5/2006 on National Energy Policy (NEP) targets that by 2025 electricity originating from geothermal energy must reach 9500 MW or contribute 5% of the total national energy consumption as seen in Figure 1

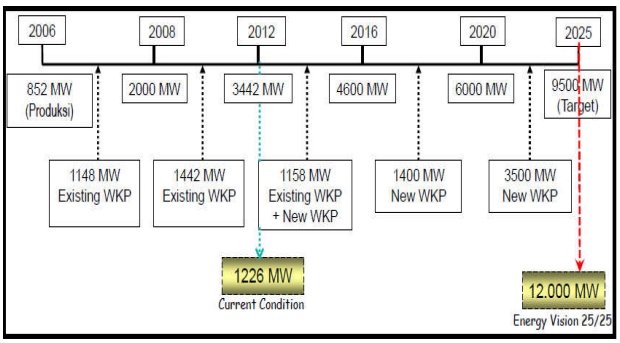

Fig. 1 Road Map of Geothermal Development 2006-2025

A good road map above must be supported by all components of the nation, because it is very good for the fulfillment of people's energy in the future with environmentally friendly technology. Although the targets set by the government above may be too high and relatively short in time.

The experience that has been made by MEMR is that the construction of DGPP takes a long time compared to other power plants, and the electricity yields obtained are also not that large. For example, the construction of the Sarulla DGPP in Tapanuli, North Sumatra alone took 24 years. The electricity yield obtained is 330 megawatts, consisting of 3 units, and each unit produces 110 megawatts of electricity. The DGPP is the largest geothermal generator not only in Indonesia, but the largest in the world. Iskana reports that the three units in the Sarulla geothermal project will produce 330 megawatts (MW). This capacity is equivalent to the consumption of 2.1 million households in Indonesia[16]. With the operation of the third unit, the Sarulla project is currently the largest geothermal project in the world.

Why does DGPP need to be developed in Indonesia, because geothermal energy is very much in line with the principle of sustainable development which produces less emissions than the electric energy of PLTU, for example, which has been built so far. Research conducted by Tanoto showed that in 2014, the emissions resulting from the geothermal power generation scenario are lower than the emissions from the coal-fired power plant scenario[17]. At the end point of the planning horizon, the scenario using coal emitted 487 million tonnes of CO2 equivalent, while the scenario with geothermal succeeded in reducing emissions by 43.3 million tonnes from the scenario caused by coal. For this reason, it is very appropriate for Indonesia to pay attention to the development of DGPP.

One of the locations that has geothermal potential is on the slopes of Mount Slamet. The location for the construction of a geothermal power plant in the Baturraden working area actually covers the entire slopes of Mount Slamet which includes the districts of Banyumas, Brebes, Tegal, Pemalang and Purbalingga. However, in the meantime, the construction site is located on the southern slope of Mount Slamet so that it is in the Brebes and Banyumas Regencies. The entrance to the construction site is through Pandansari Village, Paguyangan District in the Brebes Regency area, while the drilling point that has been carried out is in the Banyumas Regency area.

The geothermal development business permit (GDBP) for the Baturraden area was granted to PT Sejahtera Alam Energy (SAE) with the Central Java Governor's Decree Number: 540.1 / 27/2011 which was stipulated on April 11, 2011. Based on the mining business permit, PT SAE has effectively implemented geothermal development in the Baturraden area starting in 2011 April 12.[18].

Planning in the exploration phase which began on April 12, 2011, has been a change in planning, so PT SAE has to re-conduct an environmental study in the form of an environmental management plan (EMP) and an environmental monitoring plan (EMP). The first EMP document was issued on 15 December 2011 and the second EMP document was issued 27 April 2016. The changes to the existing exploration plan are listed in Table 1 as follows:

Table 1. Changes to exploration plans

No.	Activity Plan	Activity 2011 (Total Area)	Activity 2016 (Total Area)
1.	Development *well pad*	140.000 m^2	280.000 m^2
2.	Access road	215.625 m^2	2.807.165 – 5.534.015 m^2
3.	Pipeline	92.500 m^2	63.475 m^2
4.	Temporary building	50.000 m^2	40.000 m^2
5.	Disposal	There is no	749.055 m^2
6.	Embung	There is no	42.800 m^2
7.	New bridge	There is no	1.154 m2
8.	Water usage	2 surface water sources	tilization of surface water - Utilizing ground water

Source: EMP data for Banyumas Regency

The planning change contained in the EMP-EMP document from 2011 to 2016 lies in the addition of the land area needed to support the exploration process. This means adding to the costs as well as the timeframe required for the construction process. In addition, the risk of potential environmental impacts is getting bigger as the cultivated land becomes larger. It can be imagined that drilling activities as part of mining require infrastructure development as the infrastructure. The infrastructure built includes access roads, bridges, reservoirs, disposal areas. Meanwhile, construction is also needed, such as the base camp, field office, warehouse, equipment yard, etc. The development of infrastructure and infrastructure which requires quite a lot of land, does not rule out the possibility of obstacles and their impacts.

Development that takes up the most land is road access. Access roads that have been built have reached more than 5 million square meters, so that is where potential environmental problems occur. Why is that, because the development is located on a plateau or mountain slope with a fairly high slope of land, while the area below is a stretch of residential housing with all its activities. This condition becomes very logical if there are a number of obstacles in geothermal development, namely the high investment costs due to exploration costs and high Engineering, Procurement, and Construction (EPC) costs.

Andiesta et al stated that in connection with the many risks that arise, in developing geothermal energy, an appropriate and well-planned program and a clear source of funding are needed. Sustainable geothermal energy development cannot run if it is not supported by various parties. All stakeholders from government, private sector, academia, research institutions, non-governmental organizations and from other parties must work together to make efforts so that the National Energy Policy can be achieved. In addition, it also needs to be understood that the DGPP construction time takes a long time, which can be up to 11 years to 15 years[19].

3.2. Exploration

The DGPP development in the exploration stage means that it is the initial stage of the entire development process. Activities related to geothermal are classified as mining activities, so the development process must also refer to mining regulations. The concept of exploration is one of the mining concepts. Exploration is different from mining. Exploration is only defined as excavation, whereas mining is everything related to mining, including exploration[20),21),22)]. According to Indonesia law concerning Mineral and Coal Mining, the definition of mining is the stages of mining business activities to obtain detailed and accurate information about the location, shape, dimensions, distribution, quality and measured resources of minerals, as well as information on the social and environment[23)].

Indonesia as a mining developing country[24)] has the mining law that regulates mining business permits (MBP) for Exploration which are defined as business permits that are granted to carry out the stages of activities for general investigations, exploration and feasibility studies. After the exploration is complete, the exploitation activity is left, also known as the production process. The regulation states that a production operation MBP is a business license that is granted after the completion of an exploration IUP to carry out a production operation activity stage.

The exploration process for GPP slopes of Mount Slamet was officially started in 2010 which was marked by the Decree of the Minister of Energy and Mineral Resources Number 1557K / 30 / MEM / 2010. However, in real terms the exploration process carried out by PT Sejahtera Alam Energy has only started since 2011, after fulfilling various other requirements. Until now (2020) it means that the exploration process has been running for 10 years. It can be said that the results of the exploration process have not shown any results. The drilling of the 3 well pads that has been carried out has not yet obtained geothermal energy which is determined to be suitable as a power plant, even though the long process has been carried out.

The exploration stage that has been running, of course, costs a lot of money, time and energy. How the stage of the exploration process that has been carried out can be seen from Figure 2, as the guidelines for the following environmental management business documents and environmental monitoring efforts.

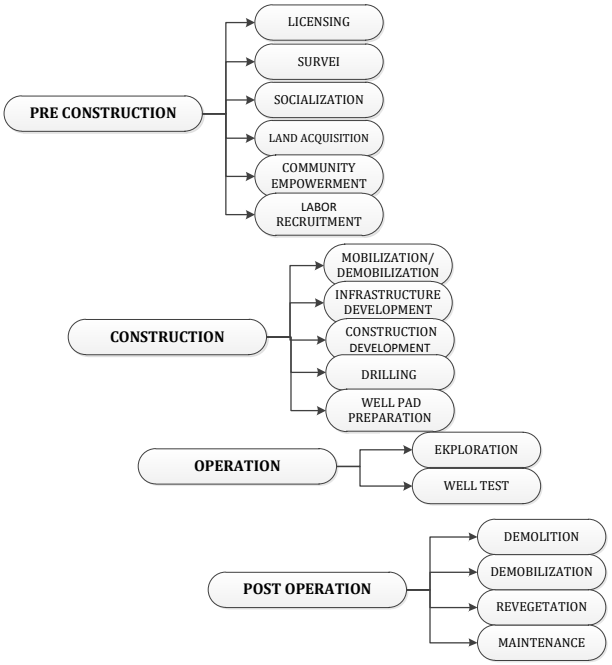

Fig. 2 DGPP exploration stage

The development exploration stage always follows the standard stages, namely the pre-construction, construction, operation and post-operation stages. Likewise with the exploration of DGPP in the Baturraden working area, which in principle the guidelines are used as a reference. For more details, the stages in exploration are as shown in Figure 2, namely the pre-construction, construction, operation and post-operation stages.

a. Pre-Construction

The construction of a geothermal power plant in the Baturraden working area which has been and is currently underway has almost completely been exceeded. The pre-construction stage which includes licensing, surveys, outreach to communities in 5 (five) districts, land acquisition, community empowerment, and formal labor recruitment have been carried out. With the exception of land acquisition, it is not carried out because the land used as the site for infrastructure development is state-owned land, namely in the form of protected forests and production forests.

In terms of the quality or intensity of the implementation of the pre-construction stage, the level of difficulty and risk varies. Licensing, surveying and land acquisition are relatively easy stages because they only involve project implementers and the government. Meanwhile, the socialization, community empowerment and labor recruitment sections are classified as more complicated because they involve the wider community, which can be said by those who do not know about the matters of the project. The socialization, community empowerment and recruitment of personnel in the DGPP development appeared to be less than optimal, resulting in considerable resistance and demonstrations.

b. Construction

The construction phase includes mobilization and demobilization of heavy equipment, materials and human resources, infrastructure development, construction construction, drilling, and preparation of well pads. This stage is almost entirely a technical issue, whether related to technical construction or related to land or terrain. Even though it is classified as difficult land because it is located on a mountain slope, the process that has been carried out can be said to have been successful. It is undeniable that from the construction process, environmental impacts are very potential and can actually occur.

In the same construction stage, DGPP causes environmental impacts, namely in the form of very large erosion, which causes an impact on the area or landscape in the area below. Soil material from road infrastructure development which takes up the largest area of land in the project area causes runoff of rainwater to cause turbidity. The construction phase of construction can be said to be completed, but the effect is that it creates social problems in the community. Perhaps the material impact becomes a social problem when the socialization stage, community empowerment and recruitment of local personnel are not maximized. That is what appears to be happening in the DGPP construction.

c. Operation

The operation phase which includes exploration and testing of 3 well pads that have been drilled has been carried out. The results are not in accordance with the predictions, so the overall exploration process has not yet obtained results. When the well test has not obtained the expected results, has it failed completely, statement from the implementer:

No sir, we are the target of 2 x 110 = 220 Mega Watt. The results of the analysis in one well are only 5 - 7 megawatts. Actually, according to the results of a study by geologists around the Baturraden area there are 220 watts. Then from the SAE study it appears in the northern and southern areas. And yesterday we drilled 2 locations 3 points in the south area and the result was failed. However, it does not mean total failure, only the results are less economical. The heat is about 300 degrees Celsius. Re-evaluate its direction to the north.

Thus, the operation stage of the 3 wells that have been drilled cannot continue to produce electrical energy. That means having to carry out more construction including drilling at predetermined points.

d. Post Operation

The post operation stage includes dismantling the equipment from the construction and operation stages. Demobilization of various equipment had also been carried out. Revegetation and maintenance at the time of

this research are said to be underway. With the drilling of 3 well pads that have been carried out, but without the results obtained, it can be said that the exploration activities that have been running for 15 years have not produced the expected geothermal energy.

The post-operation stage was marked by the handover of PT Sejahtera Alam Energy (SAE), the geothermal developer that manages the Mount Slamet GWA, Central Java, donating more than Rp 11 billion worth of road and bridge infrastructure to the Brebes Regency Government. The roads and bridges that have been donated have been built by PT SAE since 2018 for the benefit of geothermal exploration in Kalibuntu Village, Paguyangan District. However, because the exploration results have not shown positive results, PT SAE will divert exploration activities to the Sirampog District[25].

The fact that this result has not yet been confirmed is also confirmed by geologists in the field who state that our target is 2 x 110 = 220 Mega Watt. The results of the analysis in one well are only 5 - 7 megawatts. The potential locations are in the northern and southern areas. And yesterday we drilled 2 locations 3 points in the south area and the results were not optimal. But that does not mean failure, only the results are less economical. The heat is about 300 degrees Celsius. Another evaluation, later the direction will be explored again to the north.

3.3. Environmental Constrains

a. Abiotic Components

Indonesia has an abundant natural resources which highly profitable, development of this sector is growing rapidly based on thirty-year. However, this development is not in balance with the mining policy formulation, especially in the environmental protection[26]. Likewise in the field of geothermal power plant development.

The construction of geothermal power plants is classified as a more difficult type of technology compared to hydropower, steam power, and solar power technologies. In addition, the risk is higher and the time needed to build it takes longer. Not to mention the land that is used as a drilling location, which is usually located in the highlands and at high slopes. This condition was acknowledged by the project implementing party (PT SAE) that the environmental constraints in implementing its development were indeed high. The mining expert's statement is as follows. “Geothermal mining is different from coal or oil mining. Where, if oil and coal are found, they must be traced. Geothermal must be mined at a new point. The difference with oil is that it can immediately make money, if geothermal is only 2 years away from being able to make money. But if oil mining is endless, geothermal has no end”.

Construction on the slopes of a mountain is of course more difficult than on flat land. The slope of the slope of the mountain is certainly higher than the slope of other land. Mount Slamet, which has an altitude of 3,000 mpdl, has many areas of land with extreme contours. Therefore, in order to construct a road from the entrance to the points of the drilling well, first; a lot of cutting is done at the top of the hill and filling the ravine. Second; making roads that should be straight are forced to zigzag or turn. Third; it was very high rainfall on the southern slopes of Mount Slamet. These conditions eventually cause a lot of soil and litter to be carried away by rainwater when it rains. This is consistent with the SAE expert's statement:

The contours of Mount Slamet are too rolling, so the hills are not sloping but are very extreme, like a deep and sharp trough again, that's what makes us bother. This character is also the reason for the entrance to the association because the best access to the slopes of Mount Slamet is Paguyangan, namely Kaligua, Brebes Regency. Actually there is access from Cilongok and Baturraden, but the road is very extreme to get to the DGPP point location.

Such conditions, as a result, cause water turbidity as a result of the exploration process for geothermal power plants. The extreme turbidity of the water has polluted all waterways along the Krukut River. Pollution affects all clean water channels, fishing ponds, causing fish to die, and agricultural waters.

Fig. 3 Condition of river water before and after pollution

The reality of such water shows that the exploration process for the development of geothermal power plants has an impact as an environmental obstacle that has occurred. Figure 3 shows that before the construction project the water was very clear, while after exploration the water became very cloudy.

Turbidity of water due to pollution from the geothermal power plant construction process exceeds the predetermined threshold. This can be seen from the results of laboratory tests at several locations as well as several conditions in the following table.

Table 2: The level of water turbidity in the polluted area

No	Condition	Rate of TSS (mg/L)		
		Waterfall Cipendok	River Prukut	Irrigation to the Community
1.	No Rain	172	94	94
2.	Before Rain	396	198	114
3.	After Rain	2346	2026	1588

Source: Banyumas Regency of Environmental Service

The quality standard for water turbidity (TSS) is 50 mg/L. The results of sampling in 3 conditions namely no rain, rain and after rain exceeded the maximum threshold which was very much higher. This shows that the turbidity of the water that occurs is very cloudy. Likewise at 3 different locations, from the closest village in Karangtengah to irrigation canals to rice fields, fisheries and community clean water, the numbers are very high compared to the quality standards.

b. Biotic Components

The component of the environment that is affected by water turbidity pollution is fisheries. The majority of residents in villages affected by turbid water have ponds which all suffer losses because the fish die. Ibrahim reported that the director of PT SAE said that he was currently recording the impact of what happened after heavy rains early last week. PT SAE is also investigating the main cause of the cloudiness of a number of rivers. Even so, he suspects that the cloudy river flow is caused by residual sedimentation from initial exploration in the form of land clearing to build roads. Soil and other materials are carried to the middle of the forest or waterways. When it rains heavily, the sediment is washed away again by the river flow to residential areas in the downstream area and causes cloudy water [27].

Fig. 4 Dead fish in the resident's pond

A village head stated that the cloudy water was due to the geothermal power plant project in Baturraden, owned by PT SAE. “Like last year, this is also the case. Possible remnants of the project that used to be carried away by water when it rained. He was not the only one who suffered losses due to the death of his fish, as shown in the figure 4. However, other fish farmers in his village also complained about the same thing. “Here there are about 250 fish farmers experiencing the same thing.

Kadus II Karangtengah Village, Triyono said that it was not only fish farmers in his area whose fish died. However, farmers also complain about the volume of mud that is increasingly polluting the fields. "The problem is that more and more mud makes the cost of rice production increase. The use of fertilizers also automatically increases. Thus, the biotic component of the turbidity of the water that occurs is the death of fish and the decline in the quality of rice plants in the fields because the soil becomes hard

c. Social Components

Social aspects in some processes of physical development of natural resources and the environment are usually somewhat subordinate to physical or material aspects. Ideally this is not the case. The social aspect must be considered early because if they are disturbed it will create resistance to the development process itself. If resistance is widespread and radical, it will be more troublesome, which in turn will be troublesome for the development process itself. Likewise, the results of research by Fardausi which examined the potential social impacts of development planning. Social impact analysis is an important but often neglected component of development planning[27]. The social aspect can trigger the failure to achieve development goals, especially in terms of utilization. Therefore, Shahriari et al emphasize the importance of green human resource management to be considered[28].

Wirutomo emphasizes the importance of social development[29]. Social development is not just increasing and accelerating material or economic output, but how to build an economy that is rooted in the basic elements of social life, namely structure (balance of power relations becomes more inclusive, participatory), culture (a value system that promotes human dignity), social processes (free space for expression, aspirations and negotiations). Therefore, the emphasis on the concept of socio-cultural development does not separate economic development from social development, but rather unites them systemically.

Hadi found that there is resistance in the construction of geothermal power plants in Mount Talang, Solok Regency, because the community's knowledge of the geothermal to be built is not yet complete[30]. The community equates this geothermal with oil and gas mines in Indonesia and this knowledge is only an understanding of the impact that will arise as a result of work accidents that may occur if this development is continued. Neither the community nor the village elite have in-depth knowledge of geothermal.

Ningsih who examined the same object, namely the construction of DGPP in Mount Solok, concluded that the plan to build the Gunung Talang Geothermal Power

Plant (PLTP) which will be carried out by PT Hitay Daya Energi raises various views or perceptions from Nagari Batu Bajanjang community so that there are two groups of community perceptions, namely accept (agree) and reject (disagree)[31]. Community perception is influenced by the community's understanding of DGPP and the impact it causes (social, economic and environmental impacts). In addition, to increase public understanding, the government and PT conducted outreach to the community but it did not run optimally.

In the case of DGPP construction on the slopes of Mount Slamet, initially there was a lack of attention to the social aspects, especially the people who may be affected. This is natural because the impact that occurs is beyond the estimation of the development implementer. In accordance with the statement of the implementing party:

Actually, the initial plan was to get electricity in 2021 but was hampered by an incident which caused demonstrations from the community due to turbidity of the water. with the incident so it's like we have 2 projects. First, a pipeline project and second a geothermal project. Approximately 1600 registered pool owners who received compensation.

Such social constraints turn out to be quite a hassle for the company working on the project, as shown in Figure 4. Likewise, the local government has also been troubled by the reaction of the people who refuse to build a geothermal power plant.

Fig. 5 Demonstration against DGPP construction

Rejection from various elements of society was enough to make the project implementers complain. Energy and costs are also absorbed to overcome social problems as a result of the impact of water pollution. Compensation for fish farmers and the construction of water channels to overcome the turbidity are jobs that are not planned by the company. In line with this case forces the local government to take part in handling it like other cases[32].

Another social condition that occurs from the process of developing geothermal power in Banyumas is the occurrence of conflicts that are not only vertical, but also horizontal. Vertical conflict is the community's demands on the project initiator and the government. Horizontal conflicts that occur are between community groups who are pro-development because they are also recruited as workers and community groups who are disadvantaged by the occurrence of environmental pollution. According to Sukardi that horizontal conflicts are often colored by various anarchic events which actually depart from the low public trust in the government[33].

The regulations governing conflict actually already exist, concerning the handling of social conflicts[34]. The purpose of the law is as an effort to overcome conflict both in the context of conflict prevention, conflict cessation and post-conflict recovery efforts. In the case of conflicts, the developing of geothermal power development process is also finally carried out in accordance with the concept of the law. According to Kitjanukit, to increase public trust to the company and increase positive perceptions, including being able to eliminate conflict, is corporate social responsibility[35].

4. Conclusion

The planning process for the geothermal power plant development on Slamet mount, actually started since 2005. The initial plan was that it would be completed in 2021 and could be exploited with 220 megawatts of electricity. In fact, until 2022 this has not been completed. This fact is due to one of the reasons for the existence of environmental constraints that occur both abiotic, biotic and social components. Abiotic components in the form of geological conditions and extreme land conditions, as well as high rainfall. The biotic component is the occurrence of many cases of fish deaths and the destruction of agricultural land and clean water networks belonging to the affected communities. The social component is in the form of community reactions because they are affected by water pollution, so that the resistance and demonstrations are quite large and long. In the process of handling demonstrations from the community, there were also a few social conflicts between residents and residents, as well as residents and village government officials.

The solution taken from this case is to provide compensation from PT SAE to the affected community members. The form of compensation provided is the provision of compensation for the death of fish and polluted agricultural land, as well as the construction of a clean water network. Although the compensation carried out has not satisfied the affected residents, the current condition is that there are no more demonstrations against the geothermal power plant. Public resistance due to the impact of turbid water is a burden on the development initiator.

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