
| RESEARCH ARTICLE

Gender, Geothermal Energy, and Environment: The Impact of Baturraden Geothermal Power Plant Exploration on Women and Environment in Banyumas, Indonesia

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| ABSTRACT

Geothermal energy is considered as renewable energy and environmentally friendly. However, during the exploration process, a Geothermal Power Plant (PLTP) commonly leaves various environmental problems, such as destroyed conservation areas, floods, landslides, and reduced clean water sources. The impact of the Baturraden Geothermal Power Plant exploration also has resulted in water pollution of the Mengaji and Prukut rivers, which eventually could no longer be used as clean water sources for people's daily lives, especially women. This PLTP Baturraden case study aimed to observe the relationship between environment, gender, and geothermal energy, especially the impact of geothermal power plant exploration. This research used a qualitative method by collecting primary data through interviews and secondary data through literature studies. This study showed that PLTP Baturraden exploration had negative impacts in 2017-2018 water pollution of Prukut River as a clean water source and directly affected women in Panembangan, Cilongok. Using a gender analysis, environmental destruction is analyzed through three things, namely formal and informal constraints, division of labor, and access to resources which have a worsening impact on women.

| KEYWORDS

Geothermal energy, geothermal power plant, gender analysis, environmental destruction, clean water source

| ARTICLE INFORMATION

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1. Introduction

Indonesia is one of the world's largest fossil energy producers, oil producers, coal exporter and seventh largest natural gas exporter. However, the Indonesian people's energy source consumption is also large. Indonesia has been recently facing an electricity crisis in which the system in various regions of Indonesia is vulnerable to sporadic power outages. It is projected that the national electricity consumption will continuously increase by approximately 8.5% per year until 2025 (Fan & Nam, 2018: 105). The increasing energy consumption in Indonesia can also be seen from the data on Indonesia's total energy consumption from 2010 to 2020, which showed an increase of approximately 16% (Ministry of Energy and Mineral Resources, 2020). The increasing energy consumption is mostly due to the use of fossil fuels, approximately reaching 86% in 2020. On the other hand, the renewable energy fuels available in Indonesia have only been utilized by approximately 14% (EIA, 2021).

The use of renewable energy in Indonesia is still in a small portion. Thus, the government has continuously promoted the development of geothermal energy as a renewable energy source. Through the President Regulation No. 79 Year 2014 on National Energy Policy (NEP), Indonesia has encouraged people to reduce the use of petroleum up to 25% of primary energy supply and, at the same time, increase the Renewable Energy Distribution (RED) of approximately 23% by 2025 (PwC, 2019). The geothermal potential in Indonesia is adequately large. The data showed that until December 2019, the geothermal potential reached 23.9 Gigawatts, according to the Geological Agency. Meanwhile, according to data from the Directorate of Geothermal, this potential

has only been utilized around 8.9% or 2130.6 Mega Watts (MW). Thus, the government set a target to utilize geothermal energy up to 16.8% or approximately 7,241.5 MW by 2025 (ETBKE, 2020).

Today, Indonesia has 16 Geothermal Power Plants that generate about 2,130.7 MW of electricity (Richter, 2020). One of the geothermal development and utilization programs for electrical energy is the exploration project on the Geothermal Power Plant (PLTP) in Baturraden, Banyumas Regency. However, the stages in utilizing geothermal renewable energy are not always environmentally friendly. The stages in PLTP exploration have negative social and environmental impacts. Awaluddin & Rusito (2020) explained that the PLTP Baturraden construction project had threatened the forest ecosystems, biodiversity, and wildlife conservation allegedly as a form of wildlife and forest crime (WLFC). Yanis & Pane (2019) also explained that PLTP Baturraden had made the Prukut River water mixed with mud in high turbidity and eventually could not be utilized for people's daily lives, and it also impacted public health.

This geothermal energy exploration also affected women and men in different ways. In the context of geothermal energy provided by the PLTP, village women in the Cilongok district were affected in different ways from men in terms of their roles of task division in finding clean water sources. The impact of high turbidity in Prukut river water has made the village women continuously struggle to meet the basic needs of their families.

Thus, the relations between energy and gender are closely related. Based on the abovementioned backgrounds, a research question was formulated as follows: how the impact of PLTP Baturraden exploration is seen through a gender analysis? This research aimed to explore the impact of geothermal exploration of PLTP Baturraden based on environmental and gender perspectives in Panembangan village.

2. Literature Review

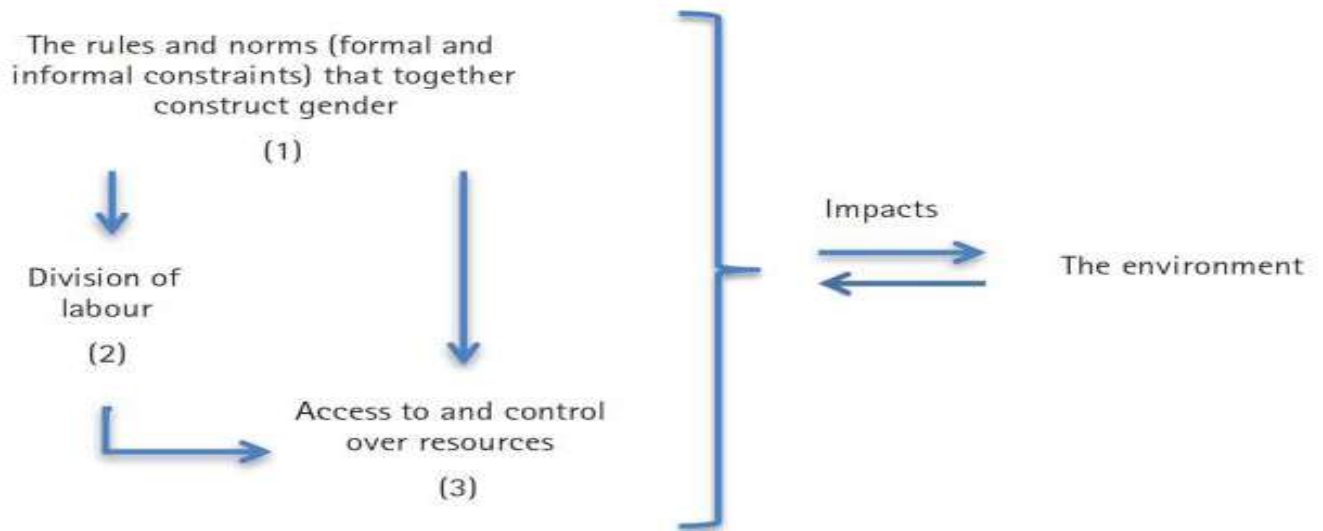
2.1 Gender, Environment, and Energy

The relationships between men and women in society have been the central point in gender discussion. The biological differences have contributed to the inequalities and injustice experienced by millions of women and men in many parts of the world. The definition of gender in social science is non-biological difference, that is, a social construction related to men's and women's nature, attitude, characteristics, identity and social roles. (Oakley, 1972; Gregson. et.al., 1997; Williams et.al,1994). The definition of gender varies with regard to international relations. However, it mainly refers to "a set of culturally shaped and defined characteristics associated with masculinity and femininity. These characteristics can and do vary across time and place...while what it means to be a man or a woman varies across cultures and history, in most cultures, gender differences signify relationships of inequality and the domination of women by men (Tickner, 1992: 7)."

In the environmental context, gender norms affect human behaviors, especially the division of environment-related works, affect the impact of environmental destruction on women and men, and affect the access to and power over natural resources. The interlinks between gender and the environment have been prominent since the 1990s, especially since the Earth Summit or the United Nations Conference on Environment and Development in Rio De Janeiro, Brazil, 3-14 June 1992 (un.org, n.d). The conference resulted in Agenda 21, which has become an essential blueprint for achieving the global sustainable development goals (SDGs) in the 21st century. The SDGs are one of the most important global decisions in this century that addressed the inequality and injustice issues across regions, borders, and genders. The specific roles assigned to women and men globally have resulted in the environmental crisis. There is a significant difference between green politics and environmentalism, although those two concepts are juxtaposed into one basket in many cases. In his assessment of environmentalism and green politics, Paterson elaborates, "Environmentalists accept the framework of the existing political, social-economic and normative structures of world politics, and seek to ameliorate environmental problems within those structures, while Greens regard those structures as the main origin of the environmental crisis and therefore contend that they are structures which need to be challenged and transcended (2005: 236)." Environmentalist tries to work within the existing structure. Therefore, it is more compatible with the Liberal Institutional perspective supported by Keohane (1995), especially in its belief that the cooperation between states is feasible and sustainable. Environmentalism also discusses energy because energy is fundamental in every aspect of human life, from economic activities to security; it revolves around energy.

In the context of gender and environment, the gender analysis method based on the Swedish Society for Nature Conservation (2015) can be taken as a reference to analyze the impact of geothermal exploration on the environment and gender. There are three categories, namely: a). formal and informal constraints, b). division of labor, c). access to and control over resources. *First*, formal and informal constraints cover the rules and norms that shape an actor's behavior in the community, gender relations, and its identity. *Second*, division of labor means the tasks and responsibilities expected to be met by men and women both in public and private scopes. *Third*, access to and control over resources. In a broad sense, this means women and men have access to and control over decision making. Below is the scheme of the relationship between gender analysis and environment:

Figure 2. Gender Analysis on Environment



Source: Swedish Society for Nature Conservation, 2015.

The relation of gender and energy are also closely related. The European Institute for Gender Equality has published a working paper on Gender and Energy (2016), and it examines that :

"Women spend more time than men in unpaid household work. This means that women spend more time at home and are, therefore, more dependent than men on heating and indoor air quality. In addition, women are more dependent on energy to use household devices (e.g. ovens, dishwashers and vacuum cleaners). Poor housing conditions (such as poorly insulated environments) and pollutant electronic devices and fuels may have a negative impact on women's health (2016: 3)."

The task division between women and men in meeting basic household needs, such as cooking and washing, makes women more dependent on energy. Due to the utilization of household appliances, such as stoves, rice cookers, washing machines, dispensers, etc, are mostly used by women. Women's dependence on energy, electronic devices, and pollutant fuels from households has also negatively impacted women's health (European Institute for Gender Equality, 2016). The different aspect of energy consumption, the different needs between men and women, and the different impact of energy development has to be considered when policymakers formulate policies on energy or renewable energy.

There are several sources of renewable energy, and one of them is Geothermal energy. Geothermal energy is "heat within the earth. Geothermal energy is a renewable energy source because heat is continuously produced inside the earth (EIA, 2021)." On its website, The U.S. Energy Information Administration explains three main types of Geothermal energy systems, namely: a) direct use and district heating systems, b) geothermal power plants, and c) geothermal heat pumps (EIA, 2021). Indonesia is "the second-largest geothermal electricity producer after the United States, at nearly 14 billion kWh of electricity, which was equal to about 5% of Indonesia's total electricity generation (EIA, 2021)." Indonesia now has set a target to install eight thousand Megawatt (8,000 MW target) by 2030 and remains optimistic about using this type of energy source. Today, Indonesia has 16 Geothermal Power Plants that generate about 2,130.7 MW of electricity (Richter, 2020).

Geothermal activities for indirect utilization include 3 (three) aspects, namely Exploration, Exploitation, and *First*, exploration. Exploration is a series of activities that include investigations of geology, geophysics, geochemistry, test drilling, and drilling exploration wells that aim to obtain condition information on subsurface geology to find and get an estimate of reserves geothermal. *Second*, Exploitation. Exploitation is a series of activities in a certain working area, which includes drilling wells, development and reinjection wells, construction of field facilities and their support, as well as geothermal production operations. *Third*, Utilization. Utilization is activities to take advantage of geothermal for electric power generation for self-interest or public interest (Azar & Suhartoyo, 2015). Geothermal plants as a renewable source of energy will alleviate the problem of producing renewable energy; however, there is an environmental concern as well, such as the impact on the quality of water near the plant and the changing landscape use.

3. Methodology

This research used a qualitative method with a phenomenological approach. Qualitative research aims to understand the phenomena experienced by the research subjects social phenomena from the perspective of participants (Moleong, 2007; Sugiono, 2005). Meanwhile, the phenomenological approach provides the theoretical guidelines for researchers to understand certain phenomena at the level of subjective reality from informants in the field. Subjectivity perception and personal knowledge interpretation from informants are greatly important to obtaining relevant data. Thus, phenomenological research aims to take a closer look at social phenomena from the research subject's point of view (Qutoshi, 2018).

3.1 Data Collection

The data sources used in this research were both primary and secondary sources. The primary data were information received from the affected communities by using a purposive sampling method. Six informants were interviewed related to their experiences and feelings about the impacts of Geothermal Power Plant exploration stages. Meanwhile, the secondary data sources were obtained from journal articles or mass media related to the issues. The research data were collected using two activities consisting of in-depth interviews and secondary data collected in the form of news, reports, and policy documents related to the research topic.

3.2 Data Analysis

Data analysis was conducted through several characteristics, such as analyzing the descriptions by openly reading the phenomena, reducing the data by sorting and selecting the meaningful data, or finding the essence of meanings from various data. The researchers also conducted an inductive analysis by summarizing the data from in-depth interviews and content analysis by describing and interpreting the secondary data sources. The researchers then analyzed the data using gender or gender-based analysis, which assessed the different impacts of policies, programs, and legislation on women and men, in this case, the impact of geothermal exploration.

4. Results and Discussion

The PLTP project is a national strategic project as expressed in Presidential Regulation Number 3, the Year 2016, on the Acceleration of National Strategic Project Implementation and Presidential Regulation Number 4, the Year 2016, on the Acceleration of Electricity Infrastructure Development. Baturraden PLTP is located in Baturraden, Mount Slamet, Central Java, Indonesia, which is administratively under Banyumas Regency and Brebes Regency and under the management of PT. Sejahtera Alam Energi (SAE). In December 2017, the construction of PLTP Baturraden entered an exploration phase by drilling an exploration well. The previous phase was the construction of road access or infrastructure from Cilongok District. The planned Commercial Operation Date (COD) is targeted to be in 2022 and 2024 (Wijatmoko, 2017).

The Geothermal Power Plant exploration construction project in Baturraden, Banyumas Regency, is located in the Protected Forest Mount Slamet. The company that won the tender for the PLTP Baturraden Project was PT. Sejahtera Alam Energy (PT. SAE). PT. SAE holds a Geothermal Permit (IPB) under Decision of the Minister of Energy and Mineral Resources Number 1557 k/30/MEM/2010, which is renewed to Decision of the Minister of Energy and Mineral Resources No. 4577k/30/MEM/2015. The Mining Work Area (WKP) of PLTP Baturraden is 24,660 hectares, covering Brebes Regency, Banyumas Regency, Purbalingga Regency, Tegal Regency and Pemalang Regency; and 90% of the location is protected forest area. (MITRAAKSI, 2020).

The research location was in Panembangan Village, Cilongok District. The villages were adjacent and originated from the source of the Prukut River flow. The people in these villages depended on the spring of Mount Slamet as livestock farmers, farmers, fish farmers and producers of tofu. In 2017, the PLTPB Baturraden construction entered the exploration phase. This phase consisted of some activities, such as well platform construction, road construction for access to the well platform, land clearing for piping installation, disposal area, pool, and temporary building. Based on the UKL-UPL document of PT. SAE, the location needed for the exploration phase was 6,757,770 square meters (675.7 hectares). (MITRAAKSI, 2020). In 2017, initial drilling efforts and infrastructure construction were carried out. However, the initial drilling caused the water of Prukut River to be cloudy and muddy, affecting the people from Sambirata, Panembangan, Kalisari, Pernasidi, Cikidang, and Karanglo, the six villages on the southern slope of Mount Slamet who depended their clean water necessity on the springs that flowed through Prukut River (BBC News, 2017).

The results of the interview with 6 women from Panembangan Village were relatively uniform. All informants stated that they had a loss or negative impact during the PLTP exploration in Banyumas. In 2017, during the exploration, the lives of people in Panembangan, specifically, drastically changed because the water of the Prukut River that was close to them and the source of their daily needs was cloudy and muddy. This occurred for months. The mud mixed in the river water could not be deposited; thus, it could not be used for daily needs at all, such as for baths, cooking, drinking, washing, and livestock or fish. As a consequence, mothers or women should search for water in other villages or other springs whose debit was not high. The water from the local water company (PDAM) was also cloudy because the source of Prukut River water was cloudy. In Panembangan villages, some

women were also involved in the secondary economic sector, which was small scale fishery. Example of their work includes fish processing and tofu making. These fishery and tofu businesses were also greatly affected by the PLTP exploration. PT. SAE indeed gave compensation to the fish farmers and some tofu producers. However, the compensation was not fair and incomparable to their loss.

In the context of gender and environment, there are three things that need to be elaborated related to the geothermal exploration of PLTP Baturraden, namely a) Formal and informal constraints, b). Division of Labor, and c) Access to and Control over Resources (Swedish Society for Nature Conservation, 2015).

4.1 Formal and Informal Constraints

Formal problems in the context of the relationship between environmental management and gender can be seen in Law No. 32 Year 2009 Article 2 on Environmental Protection and Management. The article that contains the "Justice Principle" shown in the explanation section of "environmental protection and management must reflect proportional justice for each citizen either across regions, generations, or even genders". However, this "gender" phrase is not included in Article 2 but only in the explanation section, which is less binding to implement. Meanwhile, in the context of geothermal, Law No. 21 Year 2014 on Geothermal has mentioned in Article 2 that the Implementation of Geothermal activities contains the "justice principle" yet without including words or phrases related to women or genders. Similarly, the explanation section also shows that regulations on the Environment and regulations related to Geothermal in Indonesia are gender neutral, not adopting a gender perspective. This is in line with the Gender Mainstreaming (PUG) efforts made in Indonesia in the Development through the President Instruction No. 9 Year 2000, in which the planning and evaluation of development policies and programs must be integrated with a gender perspective. The implementation of rules or regulations without a gender perspective at the local level will affect how women are positioned or how genders are related to policymaking and the impact of policies on the environment. In the environmental context, environmental damage is considered to have the same impact on men and women, so the response and mitigation mechanisms are inadequate and do not comprehensively answer women's needs. In the context of the Baturraden Geothermal Power Plant, no environmental policy with a gender perspective is a huge constraint in creating equality between women and men to enjoy the results of Geothermal Power Plant development and mitigation of the possibly resulting impacts.

Informal rules and norms include ideas related to what and how things should be performed by women or men. Informal norms shape the actors' behaviors in society, gender relations, and identity. Women and men are often assigned with different gender norms and roles. In a patriarchal society, hierarchies in gender relations appear in social roles within communities. Women and men do not have the same rights and positions in society. Even in the context of gender inequality, women experience economic marginalization, subordination, stereotype, and double burden, making them vulnerable to gender-based violence. In the environmental context, women are considered identical with the environmental maintaining (nurturing) functions in accordance with the characteristics attached to women as feminine human beings, full of love, and close to nature. This gives women the burden of responsibility when damage to nature occurs. On the other hand, development policy making, which has an impact on natural destruction, never involves women. In the context of Baturraden Geothermal Power Plant impacts, this can be seen in the informal rules which place women responsible for activities in the private or domestic arenas in the family. Thus, women have the duty to fulfill their family's needs for water.

4.2 Division of Labor

Unfair formal and informal rules, as mentioned above, then formed an unfair task division in society, both in public and private domains or households. The need for clean water sources is a responsibility that "must" be fulfilled by women or housewives to do their domestic tasks, such as cooking, washing, bathing, etc. Prior to the Geothermal Power Plant project, mothers and women highly depended on Prukut River clean water. Some informants were interviewed, explaining that the river was their source of life since it provided free water from nature for drinking, cooking, bathing, and washing in the river. After the Geothermal Power Plant exploration was made in 2017, the Prukut River became muddy, and the water flow decreased. Consequently, mothers and women had to find free clean water by walking far from the other villages. Even though there was PDAM water assistance, this PDAM water had high turbidity because the water source originated from the Prukut River. The other effort made by mothers was that they had to stay in a long line to obtain water distributed by the local government, yet limited. This long line was also prone to social conflicts since they fought to adequately fulfill their needs for water for their households. Thus, many women or housewives had to pay or spend money to buy water. These tasks, which were "only" performed by women, of course, make women experience a double burden since adding women's domestic tasks. They had to struggle to find clean water sources by bringing large buckets or gallons without men's assistance, and this had become their daily phenomenon. Frictions of social and psychological conflicts were also obtained from these women in fulfilling their needs for clean water sources due to resource scarcity.

4.3 Access to and Control over Resources

There are access and control differences in the decisions between women and men in the local context. The policy makers, which are the village heads and village officials in Panembangan Village, were male and had no female leadership. It shows that there was a lack of women's representation and voice in policy making at the local level. On the other hand, all women who were not heads of families in the socialization process related to the Geothermal Power Plant were not involved, and thus, it shows that the women had low access to decisions. Although many women do work directly related to the use of clean water in the Prukut River, they are not included in negotiations involving the company, local governments, representatives of community groups and local village heads. This limits women's access and control of resources from the utilization to managing the impact of resource scarcity.

5. Conclusion

The affected communities, especially women in Panembangan village, experienced significant impacts due to the geothermal energy exploration of the Baturraden Geothermal Power Plant. Women, who mostly worked in the domestic domain and were responsible for fulfilling their household needs, especially those related to clean water, were greatly affected by the Geothermal Power Plant exploration since the clean water sources from Prukut River had high turbidity and could not be used to meet people's daily needs for months. Thus, women in Panembangan village and the surrounding areas, especially in the Cilongok district, economically experienced material losses as they had to buy clean water; energy losses since they had to take the clean water far from their homes; and psychological impacts due to the frictions in social conflicts to fight for obtaining clean water sources. Although energy is a major need for developing countries, resource extraction should be based on environmental sustainability to be enjoyed by future generations. Renewable energy is the main alternative to fossil energy extraction, which is highly damaging to the environment, yet in the process of extracting renewable energy resources, such as geothermal, it is necessary to pay better attention to environmental sustainability and minimize the destructive impact on society.

This research has limitations or problems that we faced during the study. Due to the COVID-19 pandemic, we were only able to interview six informants in 2020; however, these six informants are both public figures and female home workers. Based on the findings of this study, the researcher proposes several avenues that need to be considered for future research. First, it is recommended to gather a bigger sample from all affected villages to gain richer information and achieve much variation in perspectives. Second, it is recommended to do comparative studies or case studies to get a better understanding of different contexts and get better insights into what strategies or policies might be most effective to mitigate the environmental destructions of geothermal explorations. It is particularly important to maintain clean water resources that meet the basic needs of the local population while enhancing the sustainability of the environment.

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