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Between Steam and Scenery: An Analysis of Social Dynamics in Geothermal Power-Tourism Nexus in Indonesia

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Abstract. The intersection of renewable energy development and tourism has gained increasing attention, as nations strive to balance sustainability goals with economic growth. This short article explores the dynamic relationship between geothermal power projects and tourism through a systematic review of existing studies. By synthesizing global case studies and theoretical frameworks, the analysis highlights key themes, including the dual role of geothermal sites as energy sources and tourist attractions, community perceptions, and potential conflicts over land use and environmental impacts. This study identifies gaps in research, particularly regarding stakeholder collaboration and long-term socio-economic effects, while proposing pathways for sustainable co-management. Finally, this review discusses the need for integrated policies that leverage the renewable potential of geothermal energy without compromising the cultural and ecological values underpinning tourism.

Keywords: Renewable Energy, Geothermal, Tourism, Governance.

1 Introduction

Energy transition is currently one of the development outcomes that countries around the world are aiming for. This target is written and designed in SDGs point 7 on "*ensuring access to affordable, reliable, sustainable, and modern energy for all*" [1]. More specifically, the goals are to a) by 2030 ensure universal access to affordable, reliable, and modern energy services, b) by 2030, increase substantially the share of renewable energy in the global energy mix, c) by 2030, double the global rate of improvement in energy efficiency, and d) enhance international cooperation and expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries [2]. Furthermore, in relation to this energy development goal, the narrative is expanded with the concept of sustainable energy transition to achieve SDGs on energy issues. According to the UNDP, the sustainable energy transition is a transformative shift in how energy is produced, distributed, and consumed, aiming to move away from fossil fuels towards a system centered on renewable energy sources [3]. Therefore, in addition to changing energy sources from those that were previously not environmentally friendly, the current energy development goal seeks to change them to be environmentally friendly, and in

the process of change, it must be sustainable even to the process of distribution and consumption of energy. This process implicitly requires a system that integrates people's social lives into changes in energy infrastructure.

Regarding the social aspect of energy transition, several articles have shown a correlation between the two. Previous research has mentioned that several types of renewable energy sources have positive or negative social impacts [4]. Positive impacts include providing opportunities for gender equality in developing countries, and opening jobs for the surrounding community, as many as 3.5 jobs per 1-gigawatt hour (GWh) of an environmentally friendly energy source [5]. Despite the positive impact, some sources of electricity still have a negative impact, among the various renewable energy sources (Fig. 1.) The most significant negative impact was that of geothermal energy. These negative impacts occur in two phases: exploration and exploitation phases. In the exploration phase, the drilling process can disrupt the activities of surrounding communities, whereas in the exploitation phase, the construction of power plants can cause social conflicts, especially in the land acquisition process. In the operational phase, negative social impacts can be in the form of air disturbances from gas emissions, noise, and changes in local ecosystems [4, 6–9].

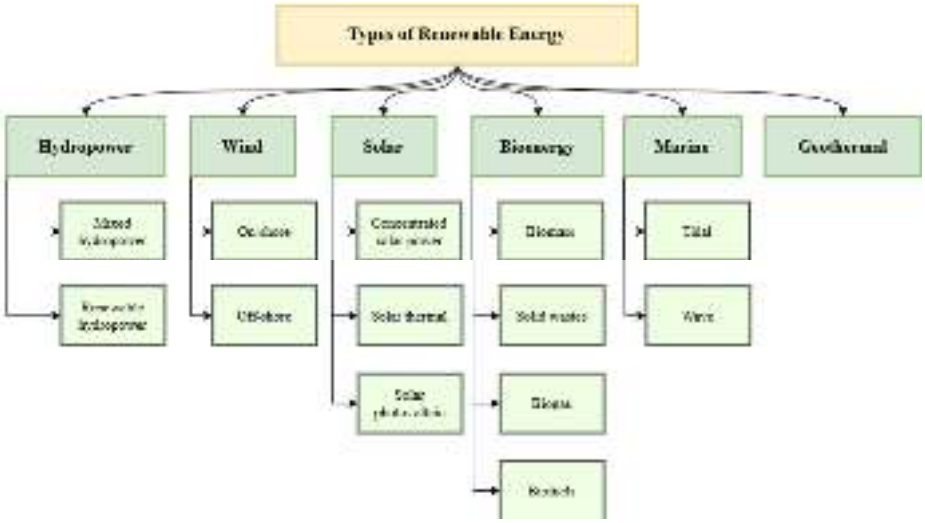

Fig. 1. Different types of renewable energy sources (4).

Among countries that rely on geothermal energy as one of their energy transition strategies, Indonesia is projected to have the second largest percentage of geothermal energy mix in the world (2,289 Megawatts) after the USA (3,700 Megawatts) [10, 11]. This is due to Indonesia's position in the Ring of Fire, which stretches from western Sumatra to the Banda Islands [12]. This unique position not only has the potential for

geothermal energy development, but at the same time it is also a potential tourist destination, with several studies linking the presence of mountainous areas with tourism development trends [13], calling it geothermal tourism. This article specifically explores how tourism has emerged alongside geothermal energy in Indonesia, how policy dynamics can inform the development and growth of geothermal energy and tourism, and how social impacts arise from the policy and development of both geothermal energy and tourism.

2 Methods

This research uses the Integrative Literature Review method [14], which is a type of literature review that focuses on the process of criticizing and synthesizing existing literature with the aim of forming new frameworks and perspectives on a specified topic [15]. In this study, the synthesis to be achieved is a new research agenda [15], especially related to geothermal energy development and tourism. The literature search was conducted in the journal repository subscribed by Diponegoro University (specifically Elsevier, Jstor, Wiley, and Taylor & Francis) using the keywords Geothermal Energy AND Social AND/OR Tourism.

3 Result and Discussion

From all the compiled literature on geothermal energy, social aspects, and tourism, the literature was then categorized into three categories: a) policies on geothermal energy in Indonesia that have social and tourism impacts, b) trends in social aspects in geothermal energy development, and finally c) trends in the development of tourism aspects in geothermal energy development.

3.1 Geothermal Energy Policy in Indonesia

In Indonesia, various regulations are being prepared to accelerate the development of geothermal power plants. According to Walhi & Celios, along with the issuance of the omnibus law (or Cipta Kerja Law) in 2023, several administrative procedures for the development of geothermal energy have been simplified. This potentially poses several social and environmental impacts[1], especially regarding renewable energy mix targets, which sometimes fail to carefully consider these social and environmental aspects [7]. From a socio-cultural aspect, indigenous communities in some cases oppose the development of geothermal energy, such as one case that occurred in Manggarai, East Nusa Tenggara [16], where the indigenous community believes that geothermal development will damage their land sovereignty and livelihood. In terms of tourism, the discourse on geothermal energy in Indonesia is even more complex. Prior to the

[1] Further discussion on this matter can be found at: https://celios.co.id/celios-x-walhi-geothermal-energy-economic-and-environmental-impacts/

development of geothermal energy, many regions in Indonesia took advantage of their natural beauty for tourism (eco-tourism) purposes. Although geothermal energy development is projected to help boost tourism, some communities have rejected its development, believing it will lead to decreased environmental quality, which, in turn, could also affect the eco-tourism industry sector [17].

Thus, the development of geothermal energy as part of the energy transition effort faces its own challenges, one of which is the trend of social acceptance among communities. The following section describes how several cases in the previous literature illustrate trends in the social impacts of geothermal energy development.

3.2 Social Aspects and Trends

Several articles mention that the social aspect plays an important role in the development of geothermal energy projects. The table below compiles findings related to the social aspect.

Table 1. Comparison of Research Results from Several Relevant Studies (Social Aspect)

Research	Social Aspect Findings	Reference
Prakoso A.P, Rostyaningsih D., Sundarso, Marom A. (2016)	The impacts of geothermal energy development are divided into three categories: a) individual, such as exposure to air and noise pollution from the power plant, although residents also benefit from business assistance; b) organizational, in the form of support for farmer groups; and c) community, including economic improvement and assistance for religious rituals. Negative impacts include behavioral changes brought by company workers.	[18]
Mahendra B., Susatiningsih H. (2022)	The article highlights aspects of human security. In the development of geothermal energy, there are conflicts of interest as well as opposition from local communities. It recommends good governance in the energy transition.	[19]
Vargas-Payera S., Martinez-Reyes A., Ejderyan O. (2020)	The article focuses on social perceptions in the development of geothermal energy. These social perceptions vary in each phase of development and among various stakeholders. The conclusion emphasizes the importance of intensive community engagement that is sensitive to stakeholders' interests.	[20]
Spijkerboer R.C. *et al* (2022)	The article, which is a systematic literature review, concludes that an intensive study of social aspects is needed in the development of	[11]

	geothermal energy. It recommends more collaborative social studies with the hard sciences.	
Farghali M. *et al* (2023)	Emphasizing the positive aspects of developing renewable energy sources. These positive aspects include gender equality, increased job opportunities, and an estimated 4.18 million jobs created from the development of renewable energy.	[4]
Kunze C., Hertel M. (2017)	Emphasizes the social movement protesting geothermal energy development. It states that the social movement is closely linked to the opposition government structure in Germany, and is also related to several earthquake incidents associated with geothermal energy development.	[21]
Prambudi N. A., Nanda I. R., Wahyudi, Suharno. (2025)	Research on Indonesian students' perceptions of geothermal energy. The conclusions show that Indonesian students have a high level of knowledge and perception of geothermal energy, but this does not correlate with their acceptance level. It emphasizes the importance of education about sustainable energy at the secondary school level.	[22]

Several previous studies have shown that good interaction with the community, especially those living around geothermal energy sites, is a key factor in the acceptance of the energy transition to geothermal energy. This interaction can take various forms, such as education [22], intensive public consultation, and the establishment of good governance [18–20]. When implemented properly, the community will naturally receive the benefits and appropriate advantages [4].

Furthermore, it can be assumed that if public perception and acceptance of geothermal energy are already positive, then other existing industries in the community, such as tourism, will also gain opportunities and be encouraged by the presence of geothermal energy. The next section discusses the results of previous studies linking tourism and geothermal energy use.

3.3 Geothermal Tourism Potential

After discussing the opportunities and challenges in the social aspects of geothermal energy development, it is necessary to review previous studies that address the tourism aspect of geothermal energy to identify potential best practices that can be applied in Indonesia.

Table 2. Comparison of Research Results from Several Relevant Studies (Correlation with Tourism)

Research	Geothermal Energy and Tourism Correlation	Reference
Turnšek M., Kokot K. (2025)	The research was conducted in the context of a location in Slovenia. The results show that tourism located around geothermal energy can promote environmental campaigns. The author refers to geothermal energy as energy tourism. However, there are several potential hazards, namely the visitors' lack of knowledge about the risks surrounding the geothermal energy infrastructure.	(23)
Migoń P., Pijet-Migoń E. (2016)	This article examines the impact of tourism on geothermal sites in New Zealand. The results show that, if tourist flows are well managed (clear tourist flows, good fences and barriers, and informative signage), these geothermal sites will not be threatened.	(24)
Munfarida I., Nilandita W., Auvaria S. W. (2022)	This article examines the development of hotels around geothermal energy sites in Indonesia. The results show that these hotels generate a significant environmental burden, particularly from solid waste production and land use change. Furthermore, another impact is the exploitation of geothermal water used by the hotels.	(25)
Pavlakovič B., Demir M. R., Pozvek N., Turnšek M. (2021)	Research shows that tourism has a positive correlation with the promotion of sustainable energy from geothermal energy. In addition, the presence of geothermal energy is also the main motivation for tourists to visit tourist destinations. This can serve as a pathway for energy transition in the future.	(26)
Soltani M., Kashkooli F. M., Souri M., Rafiei B., Jabarifar M., Gharali K., Nathwani J. S. (2021)	This article mentions several impacts resulting from geothermal energy, particularly in terms of environmental, economic, and social aspects. Tourism is mentioned as having both positive and negative effects, such as creating job opportunities and increasing public knowledge about renewable energy. On the other hand, it also affects public health and disrupts the surrounding ecosystem.	(9)
Yudha S. W., Tjahjono B., Longhurst P. (2022)	In this study, tourism is mentioned as one way to increase geothermal energy acceptance. In several cases in Indonesia, geothermal energy development often faces opposition; direct use	(27)

	of geothermal resources can reduce this community resistance. Besides tourism, geothermal energy can also be used for agricultural purposes.	
Borovič S., Markovič I. (2015)	This article uses the term Tourism Valorisation to refer to the diversification of tourism types stemming from the presence of geothermal waters in Croatia. The presence of geothermal water plays a central role in tourism, including for room heating, balneotherapy, or for spas. Geothermal energy is considered on par with tourism.	(28)

Previous research linking geothermal energy and tourism shows that the two are positively correlated when tourism is managed properly [23, 24]. This positive correlation manifests as job opportunities for local communities and effective education on environmental conservation [26–28]. However, it should be noted that in some cases, excessive objectification of geothermal energy can damage the environment and hinder tourism [25].

4 Conclusion

As is widely known, the Indonesian government is currently aiming to make geothermal energy a key goal in the transition to sustainable energy. This short article shows that in creating a socially just energy transition that benefits communities in the context of tourism, several research agendas can be developed, namely: a) social studies on geothermal energy should be oriented towards improving interaction with communities, both in the form of education, intensive public consultation, and the establishment of egalitarian energy governance, and b) in relation to tourism, studies should focus on efforts to improve tourism governance that can serve as a source of community income and, at the same time, as a means of educating about geothermal energy. Thus, the existence of geothermal energy is not merely an object of environmental exploitation.

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