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POWER AND INTEREST MATRIX STAKEHOLDERS OF THE GEOTHERMAL DEVELOPMENT PROJECT IN INDONESIA

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ABSTRACT

Indonesia has 23 GW of geothermal reserves and is ranked second with the largest geothermal installed capacity in the world. Currently, the electricity generated from geothermal energy is 2,418 MW, that only 10% of geothermal energy utilization in Indonesia. This is because geothermal projects are capital-intensive, complex, and sensitive to uncertainty and risk thus make the investment less viable. Based on the literature review, simplifying the geothermal development process can reduce project costs and accelerate project completion to make it more attractive One of them is the effectiveness of coordination between stakeholders related to geothermal development. This research aims to identify key stakeholders and map them based on the power and interest of each key stakeholder involved in geothermal development using the Stakeholder Analysis approach. The Delphi method is employed in this study, a group of experts contributes insights, revealing a clear pattern in identifying and mapping stakeholders in geothermal development in Indonesia. The final round result of expert validation led to the inclusion of 14 stakeholders in the key stakeholder category from 30 identified stakeholders initially. Among the 14 key stakeholders, an assessment based on power and interest was conducted. The results showed that 11 stakeholders were categorized as players, while 3 key stakeholders were classified as context setters.

INTRODUCTION

Renewable energy sources play an important role in meeting people's energy needs and geothermal energy is one of them (Ganjehsarabi et al., 2012; Kuzgunkaya, 2018). Geothermal energy has the potential for sustainable development because of its lower carbon emissions than fossil energy.

Indonesia is located between three active earth plates, namely the Pacific plate, the Indo-Australian plate, and the Eurasian plate Indonesia has approximately 240 volcanoes, nearly 70 are still active making it one of the most active mountain ranges in the world (ring of fire), spread from western to eastern Indonesia (Suharmanto et al., 2015). Makes Indonesia blessed with geothermal with resources reaching 23,060 megawatts (MW). The installed capacity to date is 2,355MW, meaning that the utilization of geothermal energy throughout Indonesia is only 10.2%.

Table 1 Geothermal Resources in Indonesia

No	Island	Number of Locations	Resources (Mwe)					Installed
			Speculative	Hypothesis	Reserve			
					Possible	Expected	Proven	
1	Sumatera	101	2187.5	1567	3514	867	1169.4	926.55
2	Jawa	77	1164	1270	3121	363	1855	1253.8
3	Bali	6			104	110	30	0
4	Nusa Tenggara	34	215	146	731	138	33.5	19.08
5	Kalimantan	14	151	18	6	0	0	0
6	Sulawesi	90			996	180	120	120
7	Maluku	33	560	80	496	6	2	0
8	Papua	3	75	0	0	0	0	0
Total	**361**	**361**	**5774.5**	**3444**	**8968**	**1664**	**3209.9**	**2355.43**
					13841.9			
			23060.4					

Source : Laporan Kinerja Badan Geologi Tahun 2022

The General Plan for Electricity Supply (RUPTL) 2021 - 2030 which has been approved by the Ministry of Energy and Mineral Resources with No.188.K / HK.02 / MEM.L / 2021, it can be seen in the table below that the government plans to increase the target installed capacity of Geothermal Power Plants (PLTP) by 3.3 GW within 10 years.

Table 2 RUPTL 2021 - 2030

No	Generator - EBT	Unit	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
1	PLTP	MW	136	108	190	141	870	290	123	450	240	808	3.355
2	PLTA	MW	400	53	132	87	2.478	327	456	1.611	1.778	1.950	9.272
3	PLTM	MW	144	154	277	289	189	43	-	2	16	6	1.118
4	PLT Surya	MWp	60	287	1.308	624	1.631	127	148	165	172	157	4.680
5	PLT Bayu	MW	-	2	33	337	155	70	-	-	-	-	597
6	PLT Bimasa/ Sampah	MW	12	43	88	191	221	20	-	15	-	-	590
7	PLT EBT Base	MW	-	-	-	-	-	100	265	215	280	150	1.010
8	PLT EBT Peaker	MW	-	-	-	-	-	-	-	-	-	300	300
	Total	MW	752	648	2.028	1.670	5.544	978	991	2.458	2.484	3.370	20.923

Source : RUPTL 2021 - 2030

Reference to above table, the addition of installed capacity 2023 shall be 434 MW. Meanwhile total installed capacity in Indonesia was 2,133 MW by end of 2020. Ideally, total installed capacity shall be 2,567 MW in 2023. However, there was shortage of 149 MW.

Previous literatures mentioned contribution factors which become obstacles in developing geothermal in Indonesia. One of it related to bureaucracy as mentioned in several articles (Putra, 2020; A. D. Setiawan et al., 2022; H. Setiawan, 2014). Indonesia's geothermal regulatory framework is not well defined yet due to lack of coordination between different agencies causing difficulties in implementation. However, the effective dedicated institutions with supportive policies and regulations are needed for the successful geothermal development.

Overlapping regulations between the relevant parties, namely the Ministry of Finance and the Ministry of Energy and Mineral Resources by holding an agreement to determine the authority over geothermal exploration activities. It caused the delay on implementing the distribution of geothermal revolving funds (Wijaya & Waluyo, 2015).

There is still a lack of coordination between the central government and the regions in geothermal licensing even though geothermal is a high-risk project and the benefits can be felt directly by the community (Salsabila & Adharani, 2021). The impact is that the Tangkuban Perahu PLTP cannot be continued because

the conditions are unclear and so the Exploration period has ended. Disharmony of conservation forest regulations in the process of geothermal development is also another condition that occurs. This is caused by the formation of laws and regulations in different periods of time made by different institutions. The impact is the delay of the Baturaden PLTP Project (Zakaria, 2020). Thus creates an unfavourable investment climate for geothermal development.

The 2030 target which is quite aggressive and the existing constraints, a method for managing stakeholders is needed so that the predetermined installed capacity target can be realized. Based on the literature study and conclusions from previous research described earlier, there is no research that combines the stakeholder management approach with the institutional model as a solution to institutional/organizational problems in geothermal development projects in Indonesia

LITERATURE STUDY

Geothermal

Geothermal energy is a source of heat energy contained in hot water, water vapor, and rocks together with associated minerals and other gases that are genetically inseparable in a geothermal system. Geothermal is a source of heat contained and formed in the earth's crust. It requires a mining process and is stored several kilometres below the surface (Wuisan et al., 2022).

It is obtained from geothermal systems that have distinctive component characteristics including layers with faults connected to layers containing hot fluids, cold water inflows to recharge the system and where magma fluids enter and the availability of heat sources (Safitra & Putra, 2018).

As a renewable energy and not depending on climate and weather conditions, geothermal has a high flexibility of utilization to meet the needs of human life and industry. In general, the utilization of geothermal energy can be divided into two, but this research is limited to the indirect utilization of geothermal energy.

Stakeholder Management

Stakeholders are individuals or groups that affect or are affected by an organization or project goal. Stakeholders are parties who are actively involved in an organization or project, so that they can be influenced by the performance of the organization. So, it can be concluded that stakeholders are individuals or groups that can influence or be influenced by the goals and performance of the organization and determine the success of the organization (Sucahyo, 2017).

Stakeholder analysis (SA) is often considered a valuable approach to apply to i) recognize conflicts that can arise between different stakeholders when exploring a complex problem, such as sustainable energy development; ii) understand the positions and complexity of relationships between stakeholders within the system concerning decision-making, and iii) comprehensively understand the relevant stakeholders, their needs, and their objectives. SA provides an excellent foundation for developing a decision support tool, because SA manages to identify key stakeholders and their interrelationships, influence, and objectives concerning decision-making (Aly et al., 2019) Over recent decades, SA has gained increased attention among researchers in various fields of research (Reed et al., 2009) such as renewable energy technology (Ahsan & Pedersen, 2018).

Based on the sixth edition of PMBOK issued in 2017, stakeholder management consists of four stages, namely Identify Stakeholders, Plan Stakeholder Engagement, Manage Stakeholder Engagement, and Monitor Stakeholder Engagement.

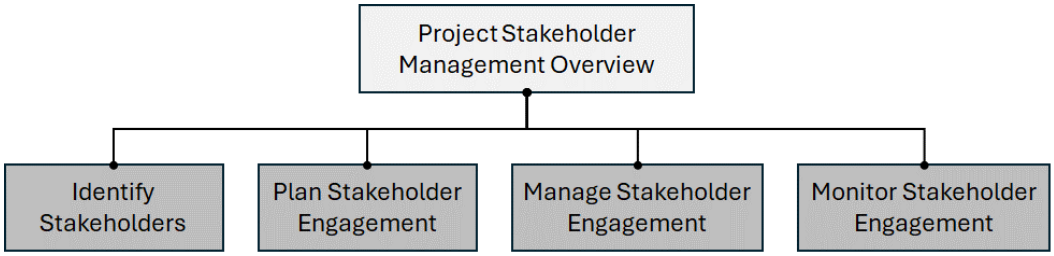

Figure 1 Project Stakeholder Management stages (PMBOK 6th Edition, 2017)

1. **Stakeholders Identification**

Stakeholders identification is the process of identifying project stakeholders regularly and analysing and documenting relevant information regarding their interests, involvement, interdependencies, influence, and potential impact on project success. The key benefit of this process is that it enables the

project team to identify the appropriate focus for engagement of each stakeholder or group of stakeholders. This process is performed periodically throughout the project as needed. The inputs, tools and techniques, and outputs of the process are depicted as shown in the following figure 2.

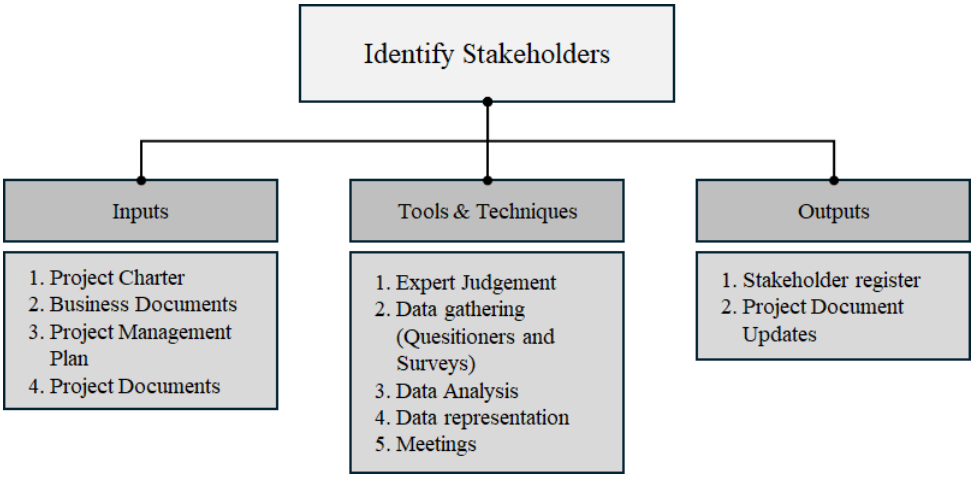

Figure 2 Identify Stakeholders (PMBOK 6th Edition, 2017)

Stakeholder Identification is the process of identifying project stakeholders, i.e. people, groups or organizations, on a regular basis and analysing and documenting relevant information regarding their interests, involvement, interdependencies, and potential impact on project success (Wardani & Khamim, 2021).

Some stakeholders may have limited ability to influence the work or outcomes of the project or may have significant influence over the project and its expected outcomes. The ability of the project manager and team to properly identify and engage all stakeholders can mean the difference between project success and failure. To increase the chances of success, the process of stakeholder identification and engagement should begin as soon as possible after the project charter has been approved, the project manager has been assigned, and the team is starting to form (Wardani & Khamim, 2021).

Then, according to Maryono et al. in Handayani F. and Warsono H. (2017), stakeholder identification is divided into 3 (three) groups, namely:

1. Primary stakeholders, i.e. stakeholders who are directly affected by both the positive and negative impacts of a plan and have a direct interest in the activity. Stakeholders who have influence and interest are considered primary stakeholders and must be fully involved in the stages of the activity.
2. Secondary or supporting stakeholders, who do not have a direct interest in a plan but have a great concern for the project implementation process. Secondary stakeholders become facilitators in the process of developing an activity and influence decision-making.
3. Key stakeholders, namely stakeholders who have legal authority in terms of decision-making. Key stakeholders are stakeholders who are responsible for project implementation (Handayani & Warsono, 2017).

2. Power And Interest

According to the Project Management Institute (2017), the power interest grid, power-influenced grid, or impact-influenced grid technique supports grouping stakeholders based on their level of power, level of concern for project outcomes, ability to influence project outcomes, or cause changes in a project. This classification model is useful on projects that are small or have simple relationships between stakeholders classify stakeholders into four groups according to their power and interests, as follows.

1. Players, namely stakeholders who are actively involved in policy implementation. These stakeholders have a high interest and influence on the development of a policy program.
2. Subjects, i.e. stakeholders who have high interest but low power. Although they support the activity, their capacity to impact may not be there. These stakeholders can become influential if they form alliances with other stakeholders.
3. Crowds, which are stakeholders who have low importance and power in policy implementation. However, these stakeholders have an influence on the desired results, and this is a consideration for

including them in decision making. Their interests and influence will change from time to time, so they need to be taken into consideration by policy implementers.

4. Context Setters are stakeholders who have a high influence on policy implementation but little interest. Therefore, it is important to monitor them closely throughout the policy implementation process.

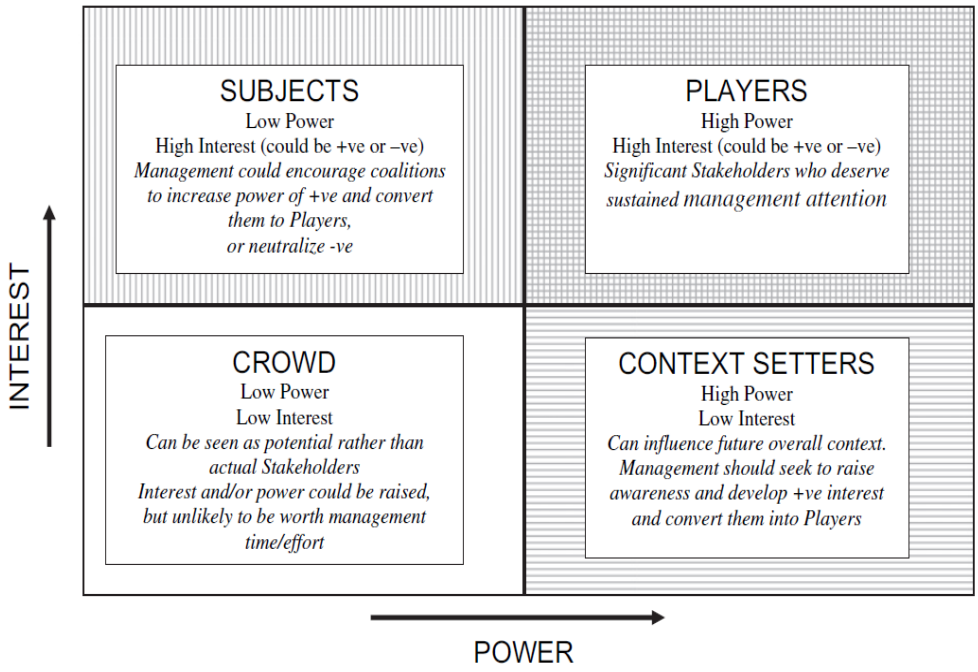

Figure 3 Power and Interest matrix (Ackermnann et al., 2011)

METHOD

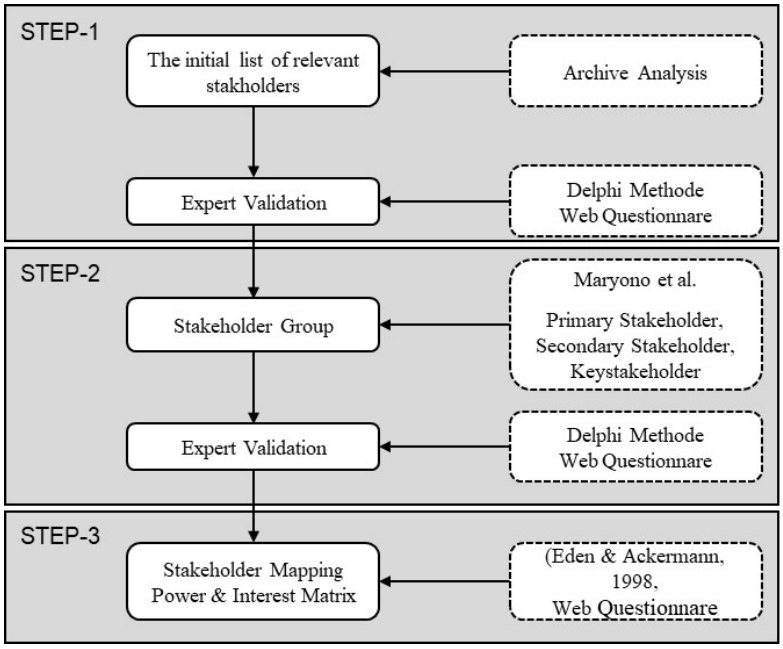

Figure 4 Research step

The first step of the research will involve archival analysis to identify the initial stakeholders involved in geothermal development. The dimensions and indicators will be taken from the literature study, and then expert validation will be conducted using the Delphi method.

The second step is to group stakeholders according to Maryono et al, which is divided into three categories: Primary stakeholders, Secondary stakeholders, and Keystakeholders.

The Delphi method was used to validate this, with input from experts. The Delphi method involves a process of interaction between researchers and selected experts based on their expertise in a particular topic, using a questionnaire as a research instrument (Riswanto et al., 2023).

After selecting the stakeholders, the third step is to evaluate each one to identification their level of power and interest matrix. Mode represents the most frequently occurring value or the one with the highest frequency. The power and interest analysis in this study utilized the statistical formula of mode. Therefore, the data used for power and interest were those with the highest frequency from each expert assessment for each stakeholder.

Data Collection

Data was collected through an online questionnaire sent to five experts in the field of geothermal energy. The purpose was to validate the research variables and eliminate irrelevant ones while adding necessary variables with justifications. The experts included in this study have a minimum of 10 years of experience in geothermal energy and hold at least a Master's degree in the field.

Referring to the figure 1, data collection was carried out in two steps. Firstly, a questionnaire was used to validate the identification of stakeholders involved in geothermal development. Secondly, validation was conducted to determine which stakeholders were key stakeholders. Once the stakeholders were identified, the power and interest of each stakeholder were assessed and mapped in a power and interestmatrix.

Data Analysis

Step-1 (initial list of relevant stakeholder)

After collecting data from literature books, 19 stakeholders were identified. This was later validated and added to by experts, resulting in a total of 30 stakeholders as shown in the following table:

Table 3 Initial List of Geothermal Stakeholders

No	*Initial Stakholder*	*Correction Stakholder (Expert)*
1	*National energy Council*	*National energy Council*
2	*Ministry of Industry*	*Ministry of Industry*
3	*Ministry of Public Works and Housing*	*Ministry of Public Works and Housing*
4	*Ministry of Environment and Forestry*	*Ministry of Environment and Forestry*
5	*Investment Coordinating Board*	*Investment Coordinating Board*
6	*Ministry of Energy and Mineral Resources*	*Ministry of Energy and Mineral Resources*
7	*Ministry of Finance*	*Ministry of Finance*
8	*Ministry of State-Owned Enterprises*	*Ministry of State-Owned Enterprises*
9	*Directorate General of New Renewable Energy and Energy Conservation*	*Directorate General of New Renewable Energy and Energy Conservation*
10	*Directorate General of Electricity*	*Directorate General of Electricity*
11	*PT. PLN*	*PT. PLN*
12	*Financier (Lender)*	*Financier (Lender)*
13	*Local Government*	*Local Government*
14	*Ministry of Law and Human Rights*	*Ministry of Law and Human Rights*
15	*Ministry of Home Affairs*	*Ministry of Home Affairs*
16	*Coordinating Ministry for Economic Affairs*	*Coordinating Ministry for Economic Affairs*
17	*Indonesian National Land Office*	*Indonesian National Land Office*
18	*Ministry of Manpower*	*Ministry of Manpower*
19	*Indonesian National Police*	*Indonesian National Police*
20		*Educational Institutions*
21		*Ministry of Tourism*
22		*Ministry of Education, Culture, Research, and Technology*
23		*Ministry of Agrarian Affairs and Spatial Planning*
24		*Ministry of National Development Planning*
25		*Directorate General of Customs and Excise*
26		*Ministry of Defense*
27		*Coordinating Ministry for Human Development and Cultural Affairs Indonesia*

No	Initial Stakholder	Correction Stakholder (Expert)
28		Ministry of Interior
29		Non-governmental Organization
30		Land Owner

Step-Two (Classification stakeholders)

After obtaining a list of stakeholders, experts proceed to identify them based on three classifications: primary stakeholders, secondary stakeholders, and key stakeholders. The results of this identification can be seen in the following table.:

Table 4 Classification stakeholders

No	Keystakeholder	Primary Stakeholder	Secondary Stakeholder
1	Ministry of Environment and Forestry	Ministry of National Development Planning	National energy Council
2	Investment Coordinating Board	Ministry of Interior	Ministry of Public Works and Housing
3	Ministry of Energy and Mineral Resources	Non-governmental Organization	Ministry of Law and Human Rights
4	Ministry of Finance	Land Owner	
5	Ministry of State-Owned Enterprises		Ministry of Home Affairs
6	Directorate General of New Renewable Energy and Energy Conservation		Coordinating Ministry for Economic Affairs
7	Directorate General of Electricity		Ministry of Manpower
8	PT. PLN		Indonesian National Police
9	Financier (Lender)		Educational Institutions
10	Local Government		Ministry of Tourism
11	Indonesian National Land Office		Ministry of Education, Culture, Research, and Technology
12	Ministry of Agrarian Affairs and Spatial Planning		Ministry of Defense
13	Directorate General of Customs and Excise		Coordinating Ministry for Human Development and Cultural Affairs Indonesia
14	Ministry of Industry		

Step-Three (Stakeholder Mapping – Power and Interest Matrix)

The stakeholder feedback will be assessed using a Likert scale ranging from 1 to 4, with options of 'very low', 'low', 'high', and 'very high'. Expert evaluations will then be categorized based on their roles, classified according to Ackermann & Eden's in 2011, categorization of 'players', 'subject', 'crowds', and 'context setters' (Ackermann & Eden, 2011). The study involved eight experts who had at least ten years of experience in the geothermal field and held a minimum of a Master's degree. The experts' evaluation results are presented in the table below.

Table 5 Result assessment of Power and Interest

No	Stakeholder	Power	Interest	Clasification
1	Ministry of Environment and Forestry	4	3	Players
2	Investment Coordinating Board	3	3	Players
3	Ministry of Energy and Mineral Resources	4	4	Players
4	Ministry of Finance	3	3	Players
5	Ministry of State-Owned Enterprises	3	3	Players
6	Directorate General of New Renewable Energy and Energy Conservation	4	4	Players
7	Directorate General of Electricity	3	3	Players
8	PT. PLN	4	3	Players
9	Financier (Lender)	4	3	Players
10	Local Government	3	3	Players
11	Indonesian National Land Office	3	2	Context Setter
12	Ministry of Agrarian Affairs and Spatial Planning	3	2	Context Setter

No	*Stakeholder*	*Power*	*Interest*	*Clasification*
13	*Directorate General of Customs and Excise*	*3*	*3*	*Players*
14	*Ministry of Industry*	*3*	*2*	*Context Setter*

After obtaining the power and interest values from each stakeholder, the next step is to create a power and interest matrix. The power and interest matrix for each stakeholder in the geothermal project development institution can be seen in the following figure.

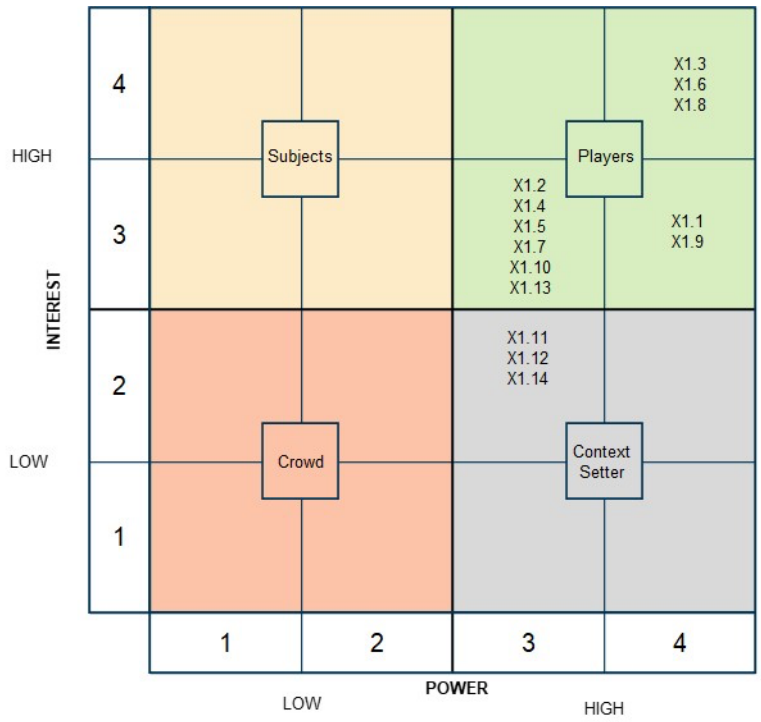

Figure 5 Power and Interest Matrix

Based on the power and interest matrix, there are 11 categories that fall under the Players category in the geothermal institution, namely the Ministry of Environment and Forestry, Investment Coordinating Board, Ministry of Energy and Mineral Resources, Ministry of Finance, Ministry of State-Owned Enterprises, Directorate General of New Renewable Energy and Energy Conservation, Directorate General of Electricity, and PT. The context setters for this category include PLN, Financier (Lender), Local Government, Directorate General of Customs and Excise, as well as three stakeholders: the Indonesian National Land Office, the Ministry of Agrarian Affairs and Spatial Planning, and the Ministry of Industry.

RESULTS AND DISCUSSION

The research results show that the geothermal industry in Indonesia involves various stakeholders who have roles as Players and Context Determiners. This Player Group is identified as the entity that has the most significant level of interest in the decision-making process related to the development of geothermal energy systems in Indonesia. Their presence is considered to have a dominant influence in determining the direction of policies and strategies that influence the development of the geothermal energy industry in this country. This stakeholder group has significant power and a high level of interest in the context of the geothermal industry in Indonesia. The impact of their strengths requires deep involvement and ongoing attention to meet the various needs and expectations they have (Ackermann & Eden, 2011). This level of power is sometimes so great that stakeholders can have the influence to hinder or hinder the development of geothermal energy in Indonesia (A.D. Setiawan et al., 2022).

On the other hand, the Context Setters group is part of the stakeholders involved in the decision-making process. They actively monitor, evaluate and provide support for the status of the geothermal energy system

and its development. Their role is very important in supporting the policies needed to direct the optimal development of this industry. Based on the power-interest matrix analysis, there are 11 institutions involved as players in the development of geothermal energy in Indonesia, but not all of them have the same importance. A total of 3 institutions are known as the main anchors in maintaining the sustainability of this development, combined in Group 1.

The Ministry of Energy and Mineral Resources (ESDM) and the Directorate General of New, Renewable Energy and Energy Conservation (EBTKE) are responsible for formulating strategic plans, while PT. PLN as a utility company is tasked with consuming electricity produced from geothermal energy. The synergy between the three is crucial in determining the direction of plans and achieving geothermal energy targets, noting that challenges such as low production costs and financing renewable energy on a large scale need to be overcome so that these targets can be achieved.

In addition, 2 other institutions, namely the Ministry of Forestry and Finance, are included in the same group with a similar level of interest. Most geothermal locations are located in mountainous areas which are also protected forest areas, presenting a dilemma between energy extraction and environmental preservation for the future. Geothermal exploration and exploitation requires large capital investments with varying degrees of success, so the role of Financiers is very important to reduce the risks associated with development projects, especially by obtaining soft loan assistance to increase project feasibility. The remaining 6 institutions are included in groups that have lower power than Groups 1 and 2, but have an equal level of interest to Group 2. These institutions have an important role as both drivers and inhibitors in the development of geothermal energy. In another classification as Context Setter, there are 3 institutions that have a similar level of significance. Increasing concerns about local content preferences managed by the Ministry of Industry make related policies a major focus for producers, as well as other institutions that influence land use policies, a concern for industry players.

Similar research by (Saryani, 2023) shows that the results of the study of each stakeholder involved in the conflict that occurred were connected to each other and influenced each other, which was marked by the existence of a coordination line for stakeholders who rejected the construction of the PLTPB and was marked by the existence of a convergent communication scheme. . Meanwhile, for stakeholders who accept the construction of the PLTPB, the relationship between these stakeholders is not only shown by lines of coordination but is also more vertical (orders from top to bottom), where the communication scheme implemented is more divergent.

These findings aim to complement the results of previous research which shows that bureaucratic coordination is one of the main challenges in Indonesia. In this context, this approach provides specific insights regarding the geothermal industry, especially in identifying crucial stakeholders and how significant their positions are in the power-interest matrix. This is important because understanding the dynamics of power and interests between institutions can help in formulating effective strategies in making decisions regarding the development of geothermal energy in Indonesia.

CONCLUSION

Currently, the installed capacity of geothermal energy in Indonesia is 2,418 MW, representing only 10% of the total geothermal energy potential. Geothermal energy is a renewable energy source with the potential to significantly contribute to reducing carbon emissions. The government has set a target of 3.3 GW for the installed capacity of geothermal energy by 2030. To achieve this goal, it is essential to engage the active participation of all relevant stakeholders. The final round result of expert validation led to the inclusion of 14 stakeholders in the key stakeholder category from 30 identified stakeholders initially. Among the 14 key stakeholders, an assessment based on power and interest was conducted. The results showed that 11 stakeholders were categorized as "players", They are the most active in the implementation and development of geothermal policy programs. while 3 key stakeholders were classified as "context setters", These stakeholders have a high influence on the geothermal development process but have little interest. This makes monitoring this stakeholder category crucial during geothermal development implementation.

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