



Nadia Rayhanna | Engineering and Policy Analysis

Institutional Analysis of Geothermal Energy Investment in Indonesia

Operationalization of the IAD Framework

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by
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Executive Summary

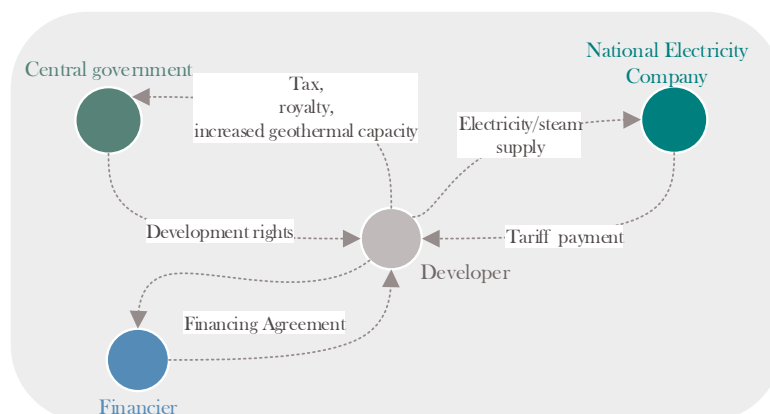
Geothermal energy has an important role in the Indonesian energy sector, especially within the domain of electricity generation. Nevertheless, the development of this resource has faced many challenges. The target to achieve a certain level of geothermal capacity at a specific year has always been unattained. In fact, this target gets lower over time. Currently, the sector is aiming to increase the capacity up to 3170 MW by 2021, approximately 1600 MW away from the current level. In order to achieve such ambitious target, the challenges surrounding the development of this resource need to be addressed. One of the most notable aspect of the sector's development is the numerous reforms in the regulatory framework. Most of these reforms have been intended to improve the sector in ways that would increase the investment activities for geothermal development. Nevertheless, the result is considered to be limited despite all the regulatory efforts.

Considering the past performance, it becomes dubious whether the recent changes in the regulatory framework are able to improve the sector and bring it to the expected speed of development. Certainly, the performance of the sector is not only influenced by the regulations or the formal rules. There are other contextual factors which have different impacts on the stakeholders in the system. These factors, along with the formal regulatory framework, are incorporated in a concept of institutional arrangement which have influenced the way that the sector is developed over time. This study is focused on the investment aspects of geothermal development. Therefore, the research question is given as follows.

How does the current institutional arrangement of the Indonesian geothermal sector affect the investment decisions in the sector?

To answer this research question, the guideline of institutional analysis as proposed in the IAD framework by Elinor Ostrom is used. According to the framework, the analysis must be conducted toward a particular action situation in which the participants make decisions and interact with each other. The actions made by these participants are constrained and affected by the contextual factors which consist of (1) the physical/material conditions, (2) the attributes of the community, and (3) the rules-in-use.

In order to take into account the element of investment into the institutional analysis, it is decided that the action situation at the operational level should encompass the following activities: (1) the transfer of geothermal license from the government to the developer, (2) the settlement of the power purchase agreement (PPA) between the developer and the buyer of the electricity, and (3) the financing agreement between the developer and the financier. The reason of the inclusion of these three processes is because they represent commitments from the participants to make the necessary investment in order to start a geothermal project. The initial construct of the action situation is illustrated in the following figure.



Given the structure of the action situation seen above, the ideal outcome of this particular action situation is when all the resulted agreements/contracts can be obtained: the geothermal license, the PPA, and the financing agreement. The analysis is then conducted by identifying the most crucial aspects in the action situation which have significant impact in obtaining the ideal outcome.

The first step to understanding the how the participants make decisions and interact and reach the outcome is by identifying the contextual factors. All of the relevant physical/material conditions which might affect the investment decisions to be made by the participants are taken into the analysis. This includes the natural physical condition of geothermal resource, the infrastructural condition, the distribution of geothermal resource, and the financing of geothermal projects. Furthermore, the attributes of the community are identified. The analysis under the setting of geothermal development in Indonesia requires some adjustments. Instead of attending to the community members who live nearby and use/consume the resource, the term community here is defined as a group of actors who are involved in the bureaucratic process of the resource development. With this definition, the attributes of the developers, the buyer, the financiers, and some relevant governmental counterparts are analyzed. Lastly, the rules-in-use are carefully identified. In this thesis, since all the processes included in the action situation take place in formal settings, the rules were derived from the existing regulatory framework.

The next step is to conduct an analysis toward the action situation at the operational level. In order to make the analysis focused, the crucial aspects are determined. These factors are (1) the physical conditions of the resource which particularly affect the quality of information available for the potential developers, (2) the process of issuing the geothermal license which determine the credibility and efficiency of the developer, (3) the payoff structure which affect the decisions by the potential developers in participating, and (4) the contractual enforcement which defines the credibility of a party in delivering its obligations. The analyses toward these factors are conducted according to the existing contextual factors which have been identified previously. Based on these analyses, some issues found in the action arena at the operational level are identified.

In addition to analyzing the action situation at the operational level, to enrich the analysis, the action situation at the collective-choice level is taken into account as well. The analysis looks into the arena in which the regulations governing the tariff structure for geothermal energy are made. The analysis at this level results in a better understanding on how the political landscape influences the stability and the continuity of policies in the renewable energy sector.

Furthermore, the information obtained during the analyses of action situation at the operational and collective-choice level is used to develop the recommendations based on the identified issues. The main concern is the payoff structure that is perceived to be insufficient to attract enough participations from the developers or investors in the first place. It is argued that the new regulation on tariff is severely damaging the perception that the participants have regarding the profitability of the sector. In addition to recommendations concerning the payoff structure, other practical suggestions for the sector are also given.

Answering the research question, it is argued the current institutional arrangement can affect investment decisions in many different ways. Eventually it depends on the scope of the analysis itself. In this thesis, the specificity of the analysis makes it possible to point out specific rules (e.g. regarding tender process, settlement of tariff, and so on) and define how they can affect the investment decisions of different participants in the arena.

In addition to answering the research question, the thesis is also aimed at assessing the applicability of the IAD framework in the context of socio-technical systems. For this objective, a discussion is made to understand how socio-technical systems differ from socio-ecological systems in which the IAD framework has been more popularly used to analyze, especially, in the settings of common-pool resources. Eventually, it is argued that the framework itself is already equipped with sufficient features to conduct institutional analysis for socio-technical systems. Further discussion to show how the framework can be used to analyze such systems is given.

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Chapter 1

Introduction

1.1 The Role of Geothermal Energy in Indonesia

Following the Paris Agreement on climate change in 2015, Indonesia has pledged to unconditionally reduce 26% of its greenhouse gases against the business as usual scenario by 2020. The target should be increased to 41% of reduction by 2030, given the availability of international support for finance. With this target, the power sector is planned to contribute through the increased utilization of renewable resources. To achieve its unconditional target, it will require at least 19.6% contribution of renewable resources in the power sector energy mix or a total capacity of approximately 7.4 GW (Government of Indonesia, 2016). For this purpose, the country has embarked on various attempts to fulfill this target. It is within the national agenda, as emphasized in the National Energy Plan (Presidential Regulation No. 22/2017), to increase the use of renewable energy.

Before the signing of the Paris Agreement, the country has attempted to increase the role of renewable energy for the country. The National Energy Policy which has been ratified through the issuance of Government Regulation No. 79/2014 has indicated the goal to reach 23% of renewable resources in the energy mix by 2025. For this purpose, geothermal becomes one of the most promising sources for the country. Although power generation with geothermal energy is not emission-free, with emissions coming from existing geothermal resource gases (Matek, 2013), the CO₂ emission level is much below that of coal and natural gas. The estimate by U.S. Energy Information Administration indicates that coal can emit around 95.35 kilograms of CO₂ per million Btu, whereas geothermal emits around 7.71 kg/million Btu (Energy Information Administration, 2016). Therefore, there is a clear environmental benefit to be exploited from geothermal energy. This should give Indonesia a lot of advantage as one of the countries with the highest geothermal estimates, along with the United States, Philippines, Kenya, Ethiopia, Mexico, Chile, and Japan (GeothermEx, 2010).

Indonesia has a potential of 27,000 MW capacity of the resource, 9000 MW out of which can be further utilized for electricity provision (PLN, 2016). Specifically for the power industry, geothermal energy has contributed for approximately 3% from the total energy mix. Currently, it is the second largest renewable source for electricity after hydropower.

The utilization of geothermal energy for electricity in Indonesia has started since the first geothermal power plant was commissioned in Kamojang, West Java province in 1979. Ever since, the country has seen a steady, yet slow, growth of the resource utilization. Until today, the total amount geothermal-based power capacity has reached around 1500 MW, the third largest in the world, after the United States (3000 MW) and the Philippines (1900 MW). The existence of geothermal resource is widespread across the country. The resources are estimated to exist in the majority of the main islands of the country, especially in Sumatra, Java, Sulawesi and some more parts of the eastern Indonesia. In some regions, the resource plays an ever greater role for the supply of electricity. In North Sulawesi, for instance, geothermal energy accounts for more than 20% of its total power generation capacity, around 80 MW geothermal installed capacity out of 390 MW (PLN, 2016). North Sulawesi and the all other electrified regions in the eastern part of Indonesia relies heavily on oil fuel/diesel for electricity generation. Despite the high level of subsidy given to oil fuels, this resource is still expensive and unreliable. In the past, North Sulawesi had ever experienced 48-hour power cuts (Doaly, 2016). Given the circumstances geothermal energy becomes the most reliable and affordable base load source for electricity in the region, aside from its coal-based and hydro power plants.

Moreover, North Sulawesi still has more geothermal potential to be further developed. Therefore, it is within the agenda of

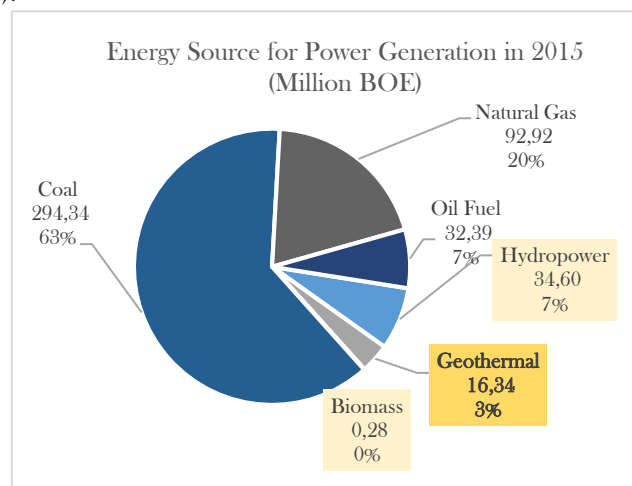


Figure 1 Energy Sources for Power Generation in Indonesia (PLN, 2016)

the local government to keep increasing the contribution of this sustainable resource in the region. Another example, in East Nusa Tenggara province, four power plant units in Ulumbu with a total capacity of 10 MW are able to provide for all the electricity needs in Ruteng and Borong district. The power plant is able to save the use of approximately 150,000 kiloliters of oil fuel per year (Wijayanto, 2016).

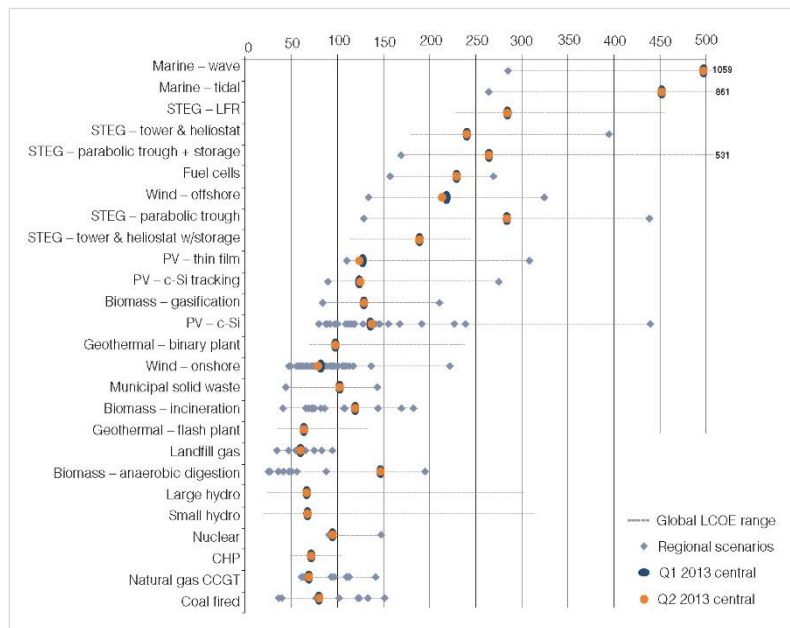


Figure 2 Global Levelized Cost of Energy in Q2 2013, in USD/MWh from World Energy Council (2013)

ranges between 85-90% (World Energy Council, 2013). Geothermal power plants can operate continuously with a steady output, regardless of environmental condition (Matek & Gawell, 2014). The high capacity factor makes the resource to be particularly suitable as the base load electricity source to provide for the minimum system demand at the region (Gehring & Loksha, 2012).

Geothermal resources are often found in remote areas (Loksha & Gehring, 2012), including in Indonesia. Although it poses additional challenges for the early development phases, e.g. concerning permits and mobilization, the development itself can bring a lot of benefits to the local society. In Indonesia, it has been widely known that communities residing in the remote areas are those who are deprived of proper electricity source, if any, and those who live in poverty. Therefore, the presence of energy development can open up the opportunity for employment and increased economic activities in the area, either indirectly or directly through the developer's community development and engagement programs. As an example, in Kamojang, the area is not only exploited for its geothermal resource to produce electricity. Instead, the developer, Pertamina Geothermal Energy has decided to transform the area for nature, educational, cultural, and agro tourism as a means to empower the community (Gunawan, 2016). For instance, in Kamojang, geothermal steam is also used to support the agricultural needs for mushroom cultivation. Moreover, numerous small and medium enterprises have been strengthened through the presence of the developer among the community.

Indonesia's reliance on oil and coal for electricity makes the country vulnerable to price volatility of these commodities. For instance, in 2011, when the international crude oil price reached USD 90 per barrel, the costs for electricity generation by PLN, the Indonesian utility company, significantly increased as well. The initial budget of around IDR 70 trillion for electricity subsidy in 2011 needed to be revised. Eventually, the final subsidy level in 2011 got to the level of around IDR 90.4 trillion (Katadata, 2017; detikFinance, 2011). As a result, not only that the government needed to bear the burden by increasing subsidy level, the society was affected as well through the increase of the electricity retail price (Kompas.com, 2010). Although the current capacity of geothermal for electricity generation is far limited compared to coal and oil, this resource has another advantage of price stability. Due to the fact that geothermal resource usage is localized, its utilization is not affected by the

¹ Capacity factor is the ratio of the net electricity generated to the energy that could have been generated at continuous full power operation at the same period of time.

dynamics of international fuel trade and the inherent political issues associated with it. Therefore, the resource can be a useful hedge against price shocks and therefore, contributing to energy security for the country (Gehring & Loksha, 2012).

This subchapter has presented some of the benefits of geothermal energy and how the resource has contributed to the energy sector and economy of the country. Despite its abundant presence in Indonesia, the development of this resource is not without significant challenges. In fact, given the long history of geothermal enterprise in Indonesia, the progress has been deemed to go rather slowly. The sector faces several diverse issues which are impeding the acceleration of the development. The next subchapter discusses some of the issues around geothermal energy development in Indonesia.

1.2 Issues Surrounding Geothermal Energy Development

As of December 2016, there are already 11 locations of geothermal power plants in Indonesia, with the total installed capacity of 1438.5 MW. This utilization level of geothermal energy is one of the largest in the world; Indonesia comes in the third after the United States and the Philippines. However, the installed capacity only accounts to 5% of the total resource potential in the country (EBTKE, 2016). According to EBTKE (2016), there is approximately a total of 29.5 GW² potential geothermal resources extended across 330 locations in Indonesia. During the course of its development, the target for geothermal power seems to have changed several times. In 2011, for instance, EBTKE set the target of achieving 12,000 MW of geothermal power in 2025 (MEMR, 2011). In 2012, the target was 4,500 MW for 2015 (MEMR, 2012). The most recent target is set in January 2016 in which the MEMR has aimed to increase the installed capacity as much as 1,751 MW within five years (MEMR, 2016). This target will increase the total capacity up to only 3170 MW in 2021. What has been achieved up until this day is remote from what was planned in the past. Setting target does not seem to be able to bring all the stakeholders together in achieving the goal. Despite the slow progress (as seen in Figure 3) relative to its ambitious target, expectations are still high and the reliance on this resource to improve energy mix in Indonesia still stands.

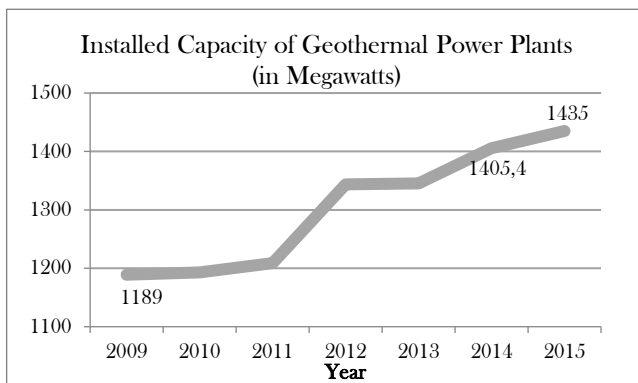


Figure 3 Geothermal Capacity Progress in Indonesia

lack of financial resources. Most of the projects have been stalled for more than five years without significant physical progress being made in the fields. For instance, it was reported that the exploration drillings in Cisolok and Cisukarame, West Java province, would only start at the end of 2016 despite the fact the permit had been issued since 2009 (Richter, 2016). It has taken a long time for the company to start the exploration drillings although the rules unambiguously limit the time period of exploration and feasibility study for seven years at the most. Similar circumstances have occurred in some other geothermal fields.

In the past, the low level of progress has also been attributed to the long overdue power purchase agreement (PPA) settlement between the geothermal license holders and PLN. For some projects, the negotiation process took a long time and could only be finalized following the issuance of MEMR³ Regulation No. 17/2014 which specifically instructed the geothermal license holders to acquire a PPA with PLN as soon as possible at the time. It happened in some projects, such as Sokoria, Sabang, Tangkuban Perahu, Guci, Baturaden, and many more at the end of 2014. The agreements were finally made although they ignored that most of the developers wished to be able to obtain the tariff increase from PLN, causing difficulties in the project financing. Eventually, some of the projects could not move forward despite the settlement of PPA with PLN. The licenses were finally revoked.

² According to Castlerock Consulting, the basis for this number is somehow questionable. The number may have been overestimated and a more rational, systematic, and transparent methodology to determine geothermal energy potential in Indonesia is required.

³ MEMR: Ministry of Energy and Mineral Resources

The development of geothermal energy has been subject to various policy debates among many stakeholders which are involved in it. Since the start of the sector's development, the system has experienced several changes in the regulatory framework. For instance, the way that the business entities can participate in the sector has changed multiple times during the last two decades, e.g. for issues concerning geothermal license ownership, the tender process mechanism, and so on. On the other hand, the more contentious topic has always been about the tariff of electricity purchase by PLN. Multiple regulations have been issued to change the tariff level, from 80-85% of PLN's cost of supply, to USD 9.7 cent/kWh, and to another tariff ceiling mechanism in 2014, until recently it is changed again in 2017 and adjusted back to PLN's cost of supply level. The bottom line is that there has been a great deal of uncertainty revolving around the regulatory framework for geothermal development.

According to Meier et al. (2015), the core issues in the electricity sector, which also applies in the case of geothermal energy, do not lie in the scarcity of the resource, but rather in the inadequate investment across the energy sector in exploration, production, transport, conversion and distribution. There are several reasons for these issues, including unavailability of financing constrained by the regulatory framework and ineffective planning and implementation arrangements across subsectors among government agencies (Meier, et al., 2015). The underinvestment, in turn, leads to more problems, such as the increasing dependency on petroleum products import which exposes the country to higher fuel price volatility in the international market (Tharakan, 2015).

Among the stakeholders, coordination has been challenging as well. As an example, the high level of subsidy on electricity and oil fuel has made the development of renewable energy rather difficult in Indonesia. The low level of electricity retail price and oil fuel impedes the entrance of renewable energy technologies which are costly and unsubsidized. Even after reform attempts have been made to reduce the fiscal burden due to subsidy, some still argue that the subsidy savings have contributed toward the support of coal-fired power generation in Indonesia, which are at odds with the country's renewable energy development target (Lontoh, et al., 2015). The situation has made it seem like there is a limited coordination in regards with the attainment of such targets. According to International Energy Agency (IEA) executive director, Maria van der Hoeven, there are too many agencies with overlapping roles which will make it difficult to hold any party accountable when targets are missed (Darby, 2015). Specifically in the geothermal sector, Meier et al. (2015) also argue that there needs to be a better clarification on the role of the state. The conflicting interests between different ministries, or even between different directorates within MEMR, have slowed down the development of this particular sector.

In conclusion, despite the government's intention to increase the contribution of geothermal resource in its energy mix, challenges remain in a lot of aspects, including, but not limited to the coordination between the stakeholders, the clarity/certainty of the regulatory framework, and the attractiveness of the sector for investment. Furthermore, the research problems and objectives will be determined in order to guide the rest of the thesis development in the subsequent chapters.

1.3 Research Problems and Objectives

Many studies have been conducted to understand why geothermal power industry is constantly experiencing delay to attain the target set by the government. JICA (2011), for instance, identifies that the initial stage of geothermal power development, especially for the drilling of exploration wells, has high technical and financial risks. Most developers are reluctant to assume these risks (Meier, et al., 2015). The condition has hampered the participation of independent power producers and calls for better risk mitigation measures. For this issue, the government has reformed the regulatory framework which might affect the distribution of risks and costs between the government and the developer through the issuance of Government Regulation (PP) No. 7/2017 and other supporting/implementing regulations. Another issue concerning the tender process has also been mitigated through the centralization of the process as stipulated in the new geothermal law, Law No. 21/2014. Along with the development of the sector, as issues surface, there will be changes and reforms in the regulations. As a result, the sector has experienced episodes of reforms in the regulatory framework.

Despite the numerous reforms in the past, some of the issues have persisted and new ones have surfaced from the new arrangements. It becomes dubious whether the recent changes in the regulatory framework will be able to improve the sector and bring it to the expected speed of development. As identified in the previous subchapter, some of the fundamental challenges have resided in the coordination among stakeholders and the quest of finding the right regulatory regime to satisfy different stakeholders in the system. Therefore, it is important that the current institutional arrangement of geothermal sector in Indonesia is to be reviewed and reconsidered.

To conclude, the research problem is the uncertainty of the institutional framework for the Indonesian geothermal sector in regards with its capacity to achieve the expected outcome. In this case, the expected outcome is the increased level of development and utilization of geothermal resource in the country. It is important to note that a sufficient level of participation

from both the public and the private sectors is required to achieve the target. In this case, the participation should translate into the level of investment made by the two sectors. Therefore, an intensive institutional analysis to study the investment situation of the system is required. The research problem is made explicit by presenting the problem statement as follows.

Problem Statement	<i>There is uncertainty whether the current institutional and regulatory framework of the Indonesian geothermal sector has the capacity to achieve the expected outcome of increasing the development and utilization of geothermal resources in Indonesia, through obtaining sufficient investment from both the public and the private sectors.</i>
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Therefore, the first and the main objective of this research is given as follows.

Social Research Objective	<i>To expand the insights regarding the prevailing and relevant institutions and how they affect the investment decisions made by the participants in the sector.</i>
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The geothermal sector is a socio-technical system which can be defined as the linkages between elements which are necessary to fulfill societal functions. In this case, the geothermal sector brings about the function of energy provision for the society (Geels, 2004). Geels (2004) further explains that socio-technical systems “socio-technical systems do not function autonomously, but are outcome of the activities of human actors.” These activities and the perceptions of these actors are guided by the rules and institutions in the system. Therefore, in analyzing a socio-technical system, it is important to take into account all these elements.

Institutions can be arranged in many distinct ways to achieve the same policy result. The challenge is to determine the most efficient set of institutional arrangements that will perform best under all the contextual factors and the competing goals of actors that influence the system (Imperial & Yandle, 2005). In the same paper, Imperial and Yandle (2005) also mention some of the most common pitfalls in conducting institutional analysis, including the failure to use a good conceptual framework. The complexity of institutional arrangement makes it highly important that the analyst works using a certain structure to be able to focus on the right variables regarding the actors, the resources available under different institutional arrangements and other factors or constraints such as the existing policies, values, and shared strategies.

Elinor Ostrom has developed a framework for institutional analysis: the Institutional Analysis and Development (IAD) framework (Ostrom, 1994). This framework, emphasizes the importance of rules and recognizes the roles of different actors in the network which can influence the outcome of a certain institutional arrangement. The comprehensiveness of this conceptual framework can become a good point of departure in analyzing the case of geothermal power investment in Indonesia. Therefore, the analysis of the socio-technical system of the Indonesian geothermal sector will be undertaken using the concepts of the IAD framework.

The IAD framework has been used in various social-ecological systems, especially those of resources which are identified as the common-pool type (Anderies, et al., 2004; Ostrom, 2009). The use of the framework has been intended to explain the dynamics between the resource, the users, the infrastructure (both the engineering components and the institutional rules) and infrastructure providers. The application of the IAD framework by numerous scholars have been focused on the sustainability of natural resources and services derived from them—how user communities organize themselves to govern the management of the common-pool resource (Oakerson & Parks, 2011). On the other hand, despite it being a natural resource which needs to be managed sustainably, the geothermal power development in Indonesia do not really concern the organization of the resource by local users. Instead, it involves a centralized organization by the infrastructure providers (the government, the developers, and the utility company). Nevertheless, the extended use of the IAD framework has been attempted by more scholars in order to prove the usability of this framework for settings other the social-ecological systems. For instance, Baldwin (2013) applies the framework to analyze the governance the electric sector in two states in the United States which poses the principal-agent problems, rather than collective action dilemma, and presents a different degree of institutional complexity.

The IAD framework, after all, draws on the concept of an action situation which describes the choices made by actors involved based on the information available to them (McGinnis & Ostrom, 2014). The issues concerning the socio-technical systems, as in the case with the development of geothermal sector in Indonesia, require an understanding on the interactions between the participants (governed by both informal and formal rules) in order to unravel the complex institutional arrangement which have prevailed in the system. Only then a clear and informed decisions for future policies can be made properly. In regards with the use of the IAD framework, another objective of this research is presented as follows.

Scientific Research Objective	<i>To assess the applicability of the IAD framework to analyze issues within socio-technical systems</i>
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1.4 Research Questions

Based on the background information presented subchapter 1.1 and 1.2 and the identification of the research problem, the main research question is formulated as follows.

Research Question	<i>How does the current institutional arrangement of the Indonesian geothermal sector affect the investment decisions in the sector?</i>
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The answer to this main question will be constructed based on the findings to the following set of sub research questions:

- (1) *What are institutions and how can they be analyzed under the context of geothermal development in Indonesia?*

This question addresses the need to specifically define what is meant by ‘institution’ in this research and to understand the ways that institutions can be analyzed, especially using the concepts of the IAD framework. Furthermore, given the fact that the use of the IAD framework has been especially used in the socio-ecological settings, its application in the research might need to be adjusted.

- (2) *How can the Institutional Analysis and Development (IAD) framework be operationalized to identify the critical aspects in the institutional framework which affect the attainment of the expected outcome?*

The answer to this question presents the application of the IAD framework itself. The elaboration will carefully depict each of the framework’s elements from the identification of the precedent conditions of the framework (physical/material conditions, rules-in-use, and the attributes of the community) until the analysis of the outcome.

- (3) *How can all the information gathered according to the guidelines of the IAD framework be integrated to develop some meaningful recommendations for the sector?*

Following the analysis of an action situation and linking them to the outcomes, this sub research question attempts to identify elements in the current institutional setting that would be worthwhile to explore in order to improve the system. This part makes reference to the last part of the IAD framework in which evaluation towards outcomes and interactions is conducted. In the end some recommendations, based on certain theories which are backed with the empirical finding from this research, will be given.

1.5 Research Methodology and Outline

This section presents the building blocks of this thesis report. Chapter 1.5.1 shows the relations between the research questions and the chapters. It outlines the development of the report. Chapter 1.5.2 digs deeper into the methodology used in the research.

1.5.1 Thesis Outline

This research puts forward the importance of understanding how institutions can be analyzed using the IAD framework and how to properly apply the existing framework into the actual socio-technical setting of geothermal development in Indonesia. In order to do that, the first sub research question is investigated throughout the development of **chapter 2**. This chapter mainly explores the theoretical foundation on institution and institutional analysis. It specifically elaborates on the concept of the IAD framework and how the framework can be used to analyze a particular situation. The development of this chapter is based on an extensive literature study on the relevant concepts, including the New Institutional Economics and the building blocks of it.

The second and the third sub research questions are explored throughout the development of chapter 3 and chapter 4. **Chapter 3** specifically identifies the precedent conditions or the contextual factors of the action situation: the physical/material conditions, the community attributes, and the rules-in-use. The chapter begins by understanding how investments are made in the sector in order to start a geothermal project and achieve the goal of increasing geothermal power capacity. The intention is to incorporate the investment decisions to be made by various stakeholders in the system into the action situation at the operational level of analysis.

Chapter 4 uses the data and information identified in chapter 3 to analyze the action situations. The emphasis is given on the operational level of analysis first. It focuses on how all the contextual factors affect the actions of participants in a certain position in the arena. Furthermore, some of the most crucial aspects which affect the investment decisions and the

achievement of the expected outcome in the arena will be further analyzed. The elaboration is intended to identify the loopholes in the current arrangement, given all the contextual factors, and the way these gaps can be better handled. The same kind of analysis is also conducted at the collective-choice level. Eventually, based on the findings, a set of recommendations to the existing institutional framework will be given. This chapter is developed based on the understanding of some similar experiences in the past and the relevant knowledge to better explain the issues found in the institutional framework.

Chapter 5 is developed to discuss the application of the IAD framework in this research and to assess the generalizability of the framework to be used in other socio-technical systems. It also attempts to show how the IAD framework has been utilized in this research and provide the readers with a synthesis of structure which represents the framework utilization itself. Lastly, the concepts of institution and institutional analysis, as gathered in chapter 2, are briefly revisited to analyze issues which are found in the sector.

Lastly, **Chapter 6** serves as the concluding chapter to present the answer to the main research question, the recommendations, and the reflections on the research. The outline of this thesis is presented in Figure 4.

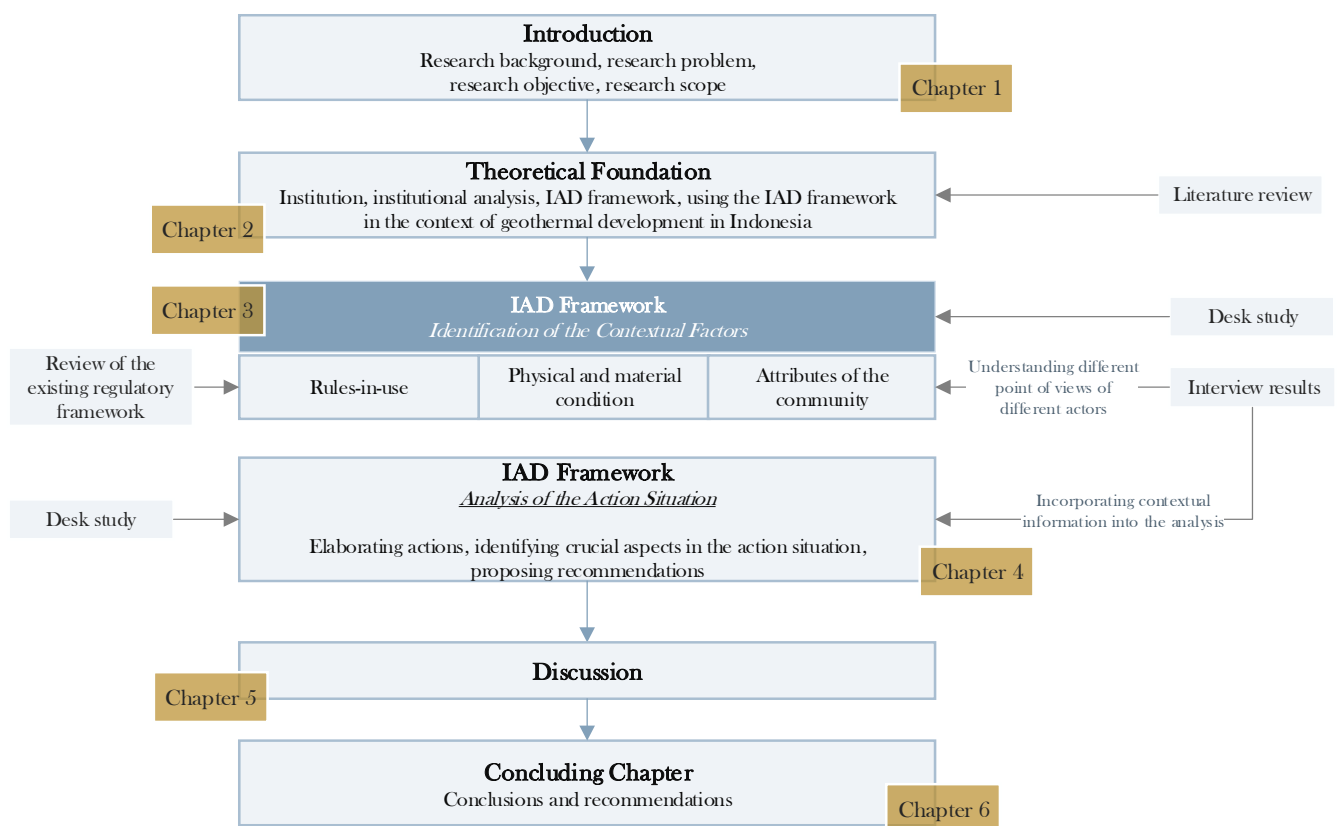


Figure 4 Thesis Outline

1.5.2 Research Methods

The application of the IAD framework is central to the development of the thesis report. The concept of action situation as the unit of analysis requires the analyst to attend to all the relevant information which can affect the play of the game in the action arena. Action situation at the operational level needs to be specific enough in order to make the actions and choices taken by the actors explicit. In doing that, it will become obvious why the outcome of an action situation will be predicted in a certain way and not in another way instead.


In the case of geothermal power development, there are multiple stages in the project that need to be completed. Each stage requires some level of investment. For instance, a developer needs to reach a series of milestones, such as obtaining the geothermal license, obtaining environmental and forestry permit, conducting exploration and feasibility study, obtaining drilling contractor, developing the power plant, and so on. It indicates that the discussion of geothermal investment can become really broad, depending on the number of actors included in the analysis. In order to carefully employ the IAD


framework, the investment decisions incorporated in the analysis need to be limited as well. The selection of actions to be further analyzed will be presented in the beginning of chapter 3 during the conceptualization of the action situation.

Analysis of the Contextual Factors of the Action Situation

IDENTIFICATION OF THE PHYSICAL AND MATERIAL CONDITIONS

Sources

 Official report, regulations, news, previous studies of geothermal development in Indonesia

 Additional information from the interview to emphasize the findings of the desk research

Based on the construct of the action situation, all the contextual factors affecting the participants and situations at the action arena are identified. First, the physical and material conditions of geothermal resource are analyzed. Two main methods will be used. The first method is literature study or extensive desk research which include various sources such as literatures on geothermal development (handbook of geothermal investment), reports, official government documents, and the existing regulations which affect the governance of relevant physical conditions, such as the distribution of the resource. Second, in order to give more emphasis to the information obtained during the desk research, more information derived from the interview result will be given.

Second, the rules-in-use in the action situation at the operational level of analysis are identified. The elaboration of the rules refers to the existing regulatory framework which directly governs the activities and other relevant aspects within the action situation. Nevertheless, it is important to note that there are more invisible or informal constraints outside the scope of the regulations which might affect the actions/decisions taken in the action situation. In this case, relevant information obtained from other sources, including the interview will need to be incorporated as well.


IDENTIFICATION OF THE RULES-IN-USE


Sources

 Various regulations which govern the operations within the selected action situation

IDENTIFICATION OF THE COMMUNITY ATTRIBUTES

Sources

 Official report, news, relevant regulations constraining the actors' decisions

 Interviews to identify the different PoV of the stakeholders

Third, the community attributes are identified. In this research, the community consists of different stakeholders with different roles and interests in the sector's development. Therefore, the analysis will be conducted toward each of the most critical stakeholders in the Indonesian geothermal development. The elaboration of this section is based on the desk study and the interview result. The desk study uses various sources including reports, regulations, and news. The news and reports will be used to identify the perceptions, interests, and goals of certain stakeholders under the current circumstances of the sector's development. On the other hand, to some stakeholders, the regulations can directly serve as constraints which affect the resources and decisions to be made consequently. Furthermore, several interviews are also conducted to understand the different point of views of some of

the most central actors in this sector and to clarify on the findings during the desk study. The interviewees consist of different stakeholders which have crucial information regarding the actual operational situation of geothermal development in the country and the challenges perceived by them.

Analysis of the Action Situation

The analysis of the action situation requires the analyst to identify the patterns of interactions and eventually the outcome of the action situation according to the information obtained before in the analysis of the contextual factors. Such predictions can be made through the use of various theories and/or models (Ostrom, 2005). This thesis is intended to identify whether the current regulatory framework/institutional arrangement can resolve some of the issues in the past to finally obtain the final goal of increasing geothermal power capacity in the country. Therefore, the analysis of action situation will be made based on some of the relevant performances in the past by comprehending how the past arrangements induce certain results before. It indicates that, to some extent, the analysis will be based on multiple case studies of actual geothermal field developments which have taken place before. This is intended to understand the challenges and the consequential decisions made by similar actors in the past.

The methodology employed in analyzing the action situation is explained as follows. According to Yin (2012), there are four types of designs for case studies. A case study can be a single- or multiple-case study. For each type, the analyst can choose to keep the case holistic or to have embedded subcases within the whole case, as shown in Figure 4. In this research, one general case of investment in the geothermal sector under the context of Indonesia will be investigated. However, as mentioned in

the beginning of this section, in order to thoroughly employ the IAD framework, only a number of the most crucial aspects will be discussed in this research.

The intention to zoom into only a number of aspects here indicates that the analysis will incorporate embedded subcases which are chosen based on the similarity with situations under scrutiny here. The information will be used to carefully analyze the current institutional arrangement in comparison to the past arrangement. To conclude, the analysis of the action situation will be conducted using the design of case study as depicted in the lower-left quadrant in Figure 5.

The information on such past occurrences will be based on the result of the desk research from sources such as official reports, past studies, and the news, as well as the interview results. Therefore, not only that the analysis will rely on some of the most relevant theories and knowledge to explain and to make recommendations toward the dynamics occurring in the arena, it is also based on lessons learned from the past cases. The relation between the IAD framework and this embedded single-case methodology can be depicted in Figure 6.

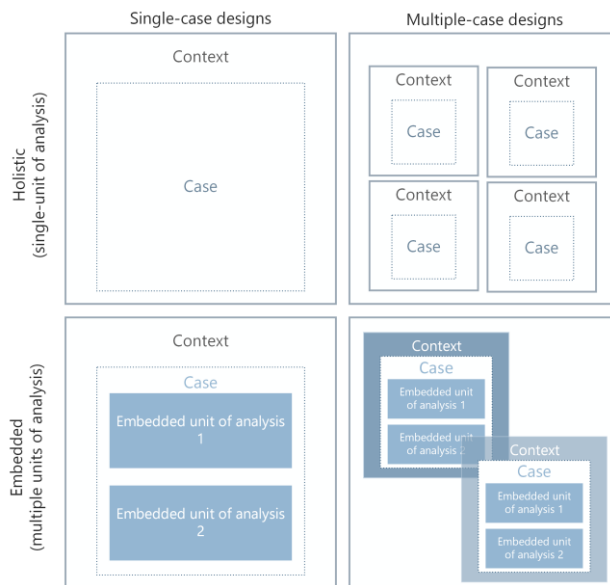


Figure 5 Basic Types of Designs for Case Studies (Yin, 2012)

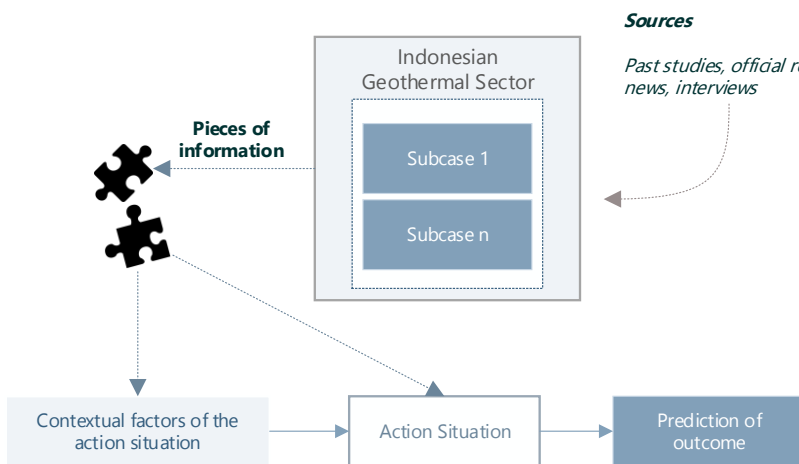


Figure 6 Case Study and the IAD Framework

In Figure 6, a subcase refers to a specific activity that is part of the entire geothermal power development. Pieces of information which portray how similar actions occur in the past will be used to explain how similar situations affect the decisions and actions taken by the participants in the arena. Therefore, the outcome of the action situation in the current context can be better predicted. Consequently, across the development of the report, various subcases from the past geothermal projects will be identified and incorporated in the

analysis. As an example, one of the milestones in a single geothermal project is the transfer of the license to conduct the development from the government to the business entity. For the analytical purpose, cases of the license transfer in the past covering the challenges and the outcomes of the previous arrangement will be identified. The method will be applied toward other activities which are taken into further analysis in this research.

Assessing the Applicability of the IAD Framework for Socio-technical Systems

Other than conducting the institutional analysis toward the investment decisions in the sector, the scientific research objective is fulfilled by assessing how the IAD framework will assist along the process. If the framework is found to be useful in this research, the generalizability of the framework to analyze other cases in other socio-technical systems can be assessed. It will be done by first identifying how the framework has/has not helped in answering the research question and constructing meaningful recommendations to the actual system. If it is considered to be useful, the methodology employed in this thesis will be explained in order to show how the IAD framework can be utilized.

1.5.2.1 The Use of Interview in the Research

In developing this research, qualitative research methods are employed through the use of literature study, extensive desk research, and several interviews. The interview stage serves as an important complement to support the analysis of both the precedent conditions of the action situation and the action situation as such. Therefore, the interviews were used to clarify and to dig more information based on the initial findings obtained in the preliminary literature/desk study. It was concluded that in order to obtain a comprehensive understanding of the sector's development, interviews with the following stakeholders

need to be conducted: (1) the regulator, (2) the geothermal developers, (3) the buyer of geothermal resources, and (4) the financiers. The reason is because, in general, these groups of stakeholders have direct involvement in the sector's development. Therefore, they are believed to have the capacity of explaining how the sector has evolved and how the current institutional arrangement will affect their actions and decisions in the arena.

The questions were constructed uniquely to different interviewee in different groups of stakeholders. The purpose was to obtain as much information possible due to the fact that every respondent represents different organization with a unique set of knowledge based on the experiences in the past. For instance, some of the interview questions for the representative of PT Supreme Energy and PT Star Energy (both are geothermal developers in Indonesia) were specified accordingly in order to obtain information on the distinct projects which have been conducted by each company. All of the interviews were semi-structured. It means that a set of questions for each respondent was prepared beforehand, yet the discussions could still flow depending on how both the interviewer and the interviewee elaborate on the topic. All of them were conducted directly (personal communication) during the author's visit to Jakarta in May–June. To summarize the overview of the interviews conducted is presented as follows.

Table 1 Overview of the Interviews

Type of Stakeholder	Main Purpose of Interview	Method	Medium
Regulator	To understand why some decisions in regards with the regulations were made and to understand the challenges faced by the specific part in the government that is responsible in the governance of geothermal resource in the country.		
Geothermal Developers	To obtain more information regarding the past experiences of the developers based on the previous institutional arrangement and to understand the perception of the stakeholders toward the current regulatory framework	Semi-structured	Face-to-face interaction
Geothermal Resource Buyer (the national electricity company)	To understand the role of the electricity company in the sector and the challenges perceived by the national company to serve as the only buyer in the sector.		
Financiers	To understand the financier's perception regarding the current regulatory framework		

Other than the main purposes mentioned in Table 1, the interviews were also intended to understand the perception of each type of stakeholder toward the other stakeholders in the system. This is particularly important to analyze the reciprocity or the affinity among participants to cooperate. Eventually, the author managed to conduct nine separate interviews.

1.6 Research Scope

This research is constrained to the institutional analysis upon the development of geothermal energy for indirect use or power generation. This is because in Indonesia the sector has been mainly focused to contribute in the electrification effort by the government and PLN. In the case of electricity generation, the increase in the capacity can be the result of the development of new power plants in an older geothermal fields or new ones. In this case, a new geothermal field is defined as a location in which geothermal resource is estimated to be prospective, yet no significant study (through exploration drilling), nor development has been made on the location. Upon these fields, the government will distribute a geothermal license in which further exploration, exploitation, and utilization will have to be undertaken by the new license holder. This thesis is limited to the analysis of geothermal development in those new fields.

Moreover, the use of the IAD framework in this study also sets constraints in the analysis of aspects which affect the investment decisions as such. In this thesis, the aspects include the process of transferring the geothermal license, settling the power purchase agreement, and obtaining financing support. Certainly, the latest regulatory framework does not only cover these three aspects; for instance it covers stipulations regarding geothermal fund, environmental issues, permits, and so on. Although they must have influence on the sector's business environment, this study does not address these concerns.

Chapter 2

Theoretical Foundations

2.1 Definition of Institution

North (1990) defined institutions as “...the rules of the game in society or, more formally, are the humanly devised constraints that shape human interaction. In consequence they structure incentives in human exchange, whether political, social, or economic...” With this definition, North (1990) mentioned that institutions or the rules need to be distinguished from the players, in which he emphasized that “...if institutions are the rules of the game, then organizations and their entrepreneurs are the players.” Here, institutions are recognized as rules, while organizations are understood as players bound by some common purpose (Dombrowsky, 2007). According to Voigt (2013), the definition of institution by North encompasses elements of implicit constraints, formal rules, and enforcement mechanisms. In this case, the implicit constraints might serve to support, complement, or contradict the formal rule.

Ostrom (1986) defined rules as the “... prescriptions commonly known and used by a set of participants to order repetitive, interdependent relationships. Prescriptions refer to which actions (or states of the world) are *required*, *prohibited*, or *permitted*.” According to Ostrom (1986) rules have key characteristics: (1) they can be changed by humans and (2) the prescriptive force of rules leads individuals to comply. Based on the definition by Ostrom (1986) and North (1990), Voigt (2013) defined institutions as “commonly known rules used to structure recurrent interaction situations that are endowed with a sanctioning mechanism.”

Some important points can be derived based on the definitions above. First, institutions are fundamentally rules which are devised by humans to govern the actions and interactions between them. Second, institutions do not only involve formal and written rules, but also informal constraints or rules which might affect the implementation of the formal rules. Third, institutions include an enforcement/sanctioning mechanisms in order to make the participants recognize the consequence of their in compliance.

2.2 Institutional Analysis

Institutional analysis has gained more importance since it has been observed in many occasions how different institutional environments (of firms) can affect firms’ performance in some countries and within some industries (Hollingsworth, 2000). When the intended outcome of an institution does not materialize, for instance, it might be subject to further analysis in order to find ambiguities that may have hindered the progress in the system. In order to perform a structured analysis, one needs a framework to identify the elements and relationships among these elements that need to be considered in the analysis.

The New Institutional Economics (NIE) scholars give emphasis on the importance of institutions, given the proposition that, as North (2008) has put it, profitability, viability, and the continued existence of the organizations depend on the existing institutional arrangement. There needs to be a good understanding on how the complete structure of institutions is built as the foundation of the organizations in the society. Note that policies are blunt instruments which consist of formal rules only, whereas the performance of an economy is a result of formal rules, informal constraints, and their enforcement characteristics (North, 2008). As institutions are, to different extents, subject to changes and reforms, the analysis of institutions in regards with its influence over the economic performance becomes significantly important.

Campbell (2007) summarizes the three approaches to institutional analysis: (1) rational choice institutionalism, (2) organizational institutionalism, and (3) historical institutionalism. Rational choice institutionalism emerged under the notion that institutions are integral parts of the economic activities and therefore cannot be ignored. The scholars disagree that unfettered markets were the most efficient arena for economic activities and want to bring back the analysis of institutions back into economics. Rational choice institutionalists argue that informal constraints and more formal institutions are

enforced as a result of self-interest behavior. Much attention has been given on how individuals build and modify institutions in order to achieve their interests. On the other hand, organizational institutionalism puts more emphasis on normative and cognitive ideas. It is viewed that organizations act appropriately in regards with its cultural environments, rather than instrumentally in regards with their goals. Organizations will conform to whatever practices which are deemed legitimate according to their institutional environment and not because of the view whether or not these practices increase efficiency or reduce costs, as argued by the rational institutionalists. The last one, in historical institutionalism, the focus is on the broader societal and state structure. The scholars using this approach have tried to understand how political and economic decision making has been affected by the institutional arrangement, to which it is argued that decision-making reflect historical experience. Therefore, there is a path-dependency in the process of policy making and institutional change.

Many of the studies of institution have stressed the importance of basic institutional infrastructure for the economic order to function, particularly regarding the property rights and the rule of law. Moreover, according to Jackson (Jackson, 2010), institutions also affect the modes of governance over transactions, including markets, hierarchies, networks, and so on. The literature on institutional analysis has expanded and many of them concern the governance structure of transaction which lead to studies on hierarchies and integration (Joskow, 2005), principal-agents problems (Miller, 2005), contractual arrangements (Klein, 2005), and so on. Most of which are based on the ideas evolving around the concept of transaction costs which have initially presented the notion of markets and hierarchies (Williamson, 1973). Nevertheless, Ostrom has argued that it is important to look beyond the issues of markets and hierarchies, as will be further elaborated in chapter 2.2.2.

2.2.1 Levels of Institutional Analysis

Regardless of the approach undertaken for analyzing the institutions and the domains in which the studies focus on, one must recognize that there are different levels of analysis due to the fact that institutions as such are comprised of wide range of rules. According to Menard and Shirley (2008), institutions include (1) written rules and agreements to control relations and corporate governance, (2) constitutions, laws and rules that govern politics, government, finance, and society in the wider term, and (3) unwritten codes of conduct, norms and beliefs. The definition by Menard and Shirley indicates that there are levels of analysis of institutions, as Williamson (2000) proposed, which have different scope and steadiness in terms of the frequency of change to the institution.

Williamson suggested that at the first level, there is embeddedness which consist of informal institutions, customs, traditions, norms, and religions. At the second level is the institutional environment which consists of formal rules of the game (polity, bureaucracy, judiciary, etc.). The third level of institutions is governance. This level is characterized by the existence of contracts which align governance structures with transactions among multiple actors. Finally, the fourth level refers to areas of neoclassical economics and agency theory, such as resource allocation and employment (Dombrowsky, 2007). At this level, it is acknowledged that decisions are made constantly by market participants at the margin that determine the proper input and output levels (Whaples & Parker, 2013).

Modifying the notion of economics of institutions which are present in different levels of analysis, Koppenjan and Gronewegen (2005) developed a four-layer institutional analysis framework. In this adapted framework, (1) a layer of actors and their strategies is added and (2) the model allows for interaction between layers. This modification to the earlier framework emphasizes the importance of the first layer of actors and games in socio-technological systems that is linked to the action arena as in the IAD framework (den Hurk, 2013). The framework presented in Figure 7 highlights the importance of congruity between institutions at different levels since they are embedded in the higher institutions.

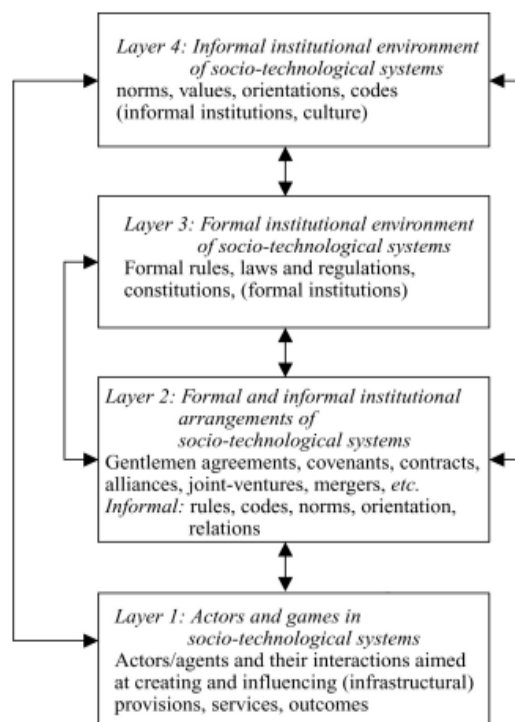


Figure 7 Four-Layer Institutional Analysis Framework (Koppenjan & Groenewegen, 2005)

2.2.2 Ostrom: Digging Deeper than Markets and Hierarchies

According to Ostrom (2005a), all along markets and hierarchies have been presented as two fundamentally different types of institutional arrangement which entail its own explanatory theory. Ostrom argues that the formal study of these two types of

structures have been conducted rather distinctively while the question remains if there exists “universal building blocks of organized life” in understanding institutions. To that question, Ostrom believes there are such underlying components of markets and hierarchies which shape the fundamental parts of multiple theories to explain regularities in human behavior within a complex situation. It is argued that there is no single cause of human behavior. Therefore, it is important to dig deeper and look beyond the distinct theories of markets and hierarchies.

Ostrom suggests that there needs to be an attempt to employ the foundations of different disciplines in order to explain various situations of human interactions. For this purpose, Ostrom and her colleagues have developed the Institutional Analysis and Development Framework which she believes to have the capacity to assist scholars facing wide diversity of empirical settings to undertake systematic analysis of the *situations* that individuals face. This framework is intended to enable individuals to solve problems democratically. Certainly, as a framework, it should be used to identify the elements and the relationship among these elements in order to conduct the institutional analysis. Furthermore, when the analyst needs to explain certain phenomenon or processes and diagnose the outcome out of the dynamics among the elements, certain theory/theories are required.

2.3 The Institutional Analysis and Development (IAD) Framework

The IAD framework was originally developed by Elinor Ostrom and her colleagues at Indiana University in the 1980s. Over time, the framework has evolved tremendously and has been used to myriad institutional analysis purposes by many scholars. Ostrom describes IAD as a conceptual map that is meant to “...integrate the work by political scientists, economists, anthropologists, lawyers, sociologists, psychologists, and others interested in how institutions affect the incentives confronting individuals and their resultant behavior.” As a framework, it should help the user identify the elements and the relationships among these elements that need to be taken into consideration for institutional analysis. Furthermore, depending on the issue of interest, different theories and models can be used to analyze these elements under study.

2.3.1 Action Arena

In the IAD framework, action arena include two elements: action situation and the participants in that situation. What is meant by an action arena is any place or medium in which interactions between participants occur. The structures of these arenas are affected by some exogenous variables, generating interactions that produce outcomes. Evaluative criteria are used to evaluate the performance of the system by examining the patterns of interactions and the outcomes. The framework recognizes the prospect that the outcomes of interactions feed back into the system and may transform the participants and/or the action situations over time. In addition to that, these outcomes may also slowly affect the exogenous variables. This constitutes a feedback loop from Outcomes box to the “exogenous” variables. Cole (2014) suggests on using the term “social and ecological context” or “precedent conditions” to represent these exogenous variables. Figure 8 depicts the schematic diagram of the IAD framework. In this thesis, the term contextual factors will be used.

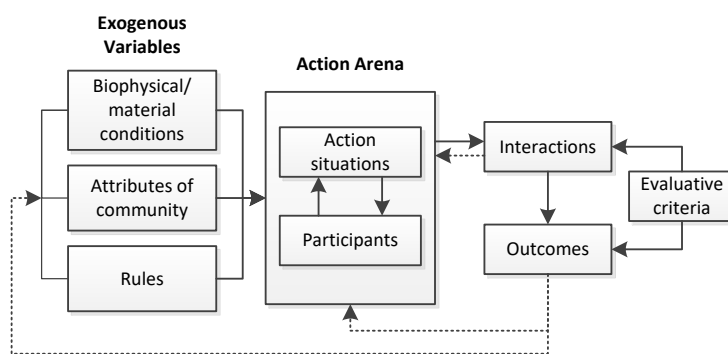


Figure 8 Schematic Diagram of the IAD Framework

As defined by Ostrom (2015), an action situation is a state in which two or more individuals are “faced with a set of potential actions that jointly produce outcomes.” The structure of the situation can be described and analyzed using a set of variables which altogether shape the structure of an action situation, as depicted in Figure 9. Those variables given are as follows:

- (1) the set of participants;
- (2) the positions to be filled by participants;
- (3) the potential outcomes;
- (4) the set of allowable actions and the function that maps actions into realized outcomes;
- (5) the control that an individual has in regard to this function;
- (6) the information available to participants about actions and outcomes and their linkages (to decide if participants interact in the same action situation, the analyst need to ensure that these participants have the access to some common information);
- (7) the costs and benefits which serve as incentives and deterrents in a situation.

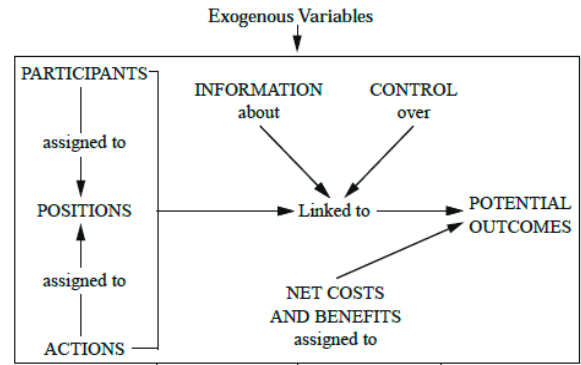


Figure 9 Structure of Action Situation

2.3.2 Precedent Conditions/Exogenous Variables of Action Arena

The action arenas are conceptualized using the assumptions regarding the *rules* that are used by participants to organize their relations (rules-in-use), the attributes of the *biophysical world*, and the *nature of the community* within which the arena takes place. Ostrom emphasized the importance that the three variables are taken into account because they jointly affect the types of actions undertaken by the participants, the benefits and costs of these actions, and the likely outcomes achieved.

The concept of rules is central to the analysis of institutions. Ostrom (2005) defines rules as “the set of instructions for creating an action situation in a particular environment.” They are combined and eventually build the structure of an action situation. In another paper, Schlager and Ostrom (1992), define rules as “generally agreed-upon and enforced prescriptions that require, forbid, or permit specific actions for more than a single individual.” Based on this definition, rules can be decomposed into two elements:

- (1) Deontic⁴ specification: the rule specifies actions that the specified actors may, must, or must not perform
- (2) Levels of compliance: the rule must be obeyed/enforced to some minimal level below which it should not be considered a rule

This decomposition implies there may be a difference between the rules that are (formally) written and the rules in use. For the latter case, the level of enforcement plays a crucial role. Ostrom (2005) uses the term “working rules” to describe the set of rules which are referenced by the participants to explain and justify their actions toward other participants. These working rules are the ones that actually structure the game in an ongoing action arena. Once the working rules are understood, the next step is to identify the source of these rules. When a society is governed by a rule of law, their actions originate from constitutional, legislative, and administrative settings augmented by rule-making decisions taken by individuals in many different settings. In this case, the likely conclusion is that the rules-in-force are the rules-in-use as well. In a system that is not governed by a rule of law, the rules-in-use may not be consistent with the rules-in-force and there is a considerable effort to enforce them.

The important note about rules is that there should be a shared meaning/understanding when a rule is formulated. This is to avoid confusion about what actions are required, permitted, or forbidden among the participants who, in practice, may have different interpretations about the rules. Moreover, even after there is a shared understanding, the application of rules may alter when there is a transformation in technology, in shared norms, or in any kind of circumstances. As a result, there can be a considerable difference between the predicted and the actual behavior in a rule-ordered relationships. The stability of these relationships depend greatly on the enforcement efforts made by the participants.

To what extent do we need to understand rules in conducting an institutional analysis? Ostrom (2005) argues that one needs to explore more in addition to the commonly studied rules which distinguish between government-, private-, community property or open access setting. Considering the myriad specific rules that structure an action arena, it becomes really challenging to sort and to select the relevant ones. The IAD framework tackles this problem by classifying rules according to their impact on an action situation.

⁴ Deontic: relating to duty and obligation

The rules are classified based on the elements in the action situation that they have most impact with, although some rules can indirectly affect other components. In the end, Ostrom specifies seven broad types of rules: (1) position, (2) boundary, (3) choice, (4) aggregation, (5) information, (6) payoff and (7) scope.

Table 2 Classification of Rules (Ostrom, 2005)

<i>Rules</i>	<i>Role</i>
<i>Boundary Rules</i>	Affect the number of participants in the arena, their attributes and resources, and the cost/consequence of entering or leaving the market
<i>Position Rules</i>	Establish positions in the action situation, e.g. position of owner, seller, buyer, etc.
<i>Authority Rules</i>	Assign sets of actions that participants in positions must, may, or may not take
<i>Scope Rules</i>	Delimit the potential outcomes that can be affected and delimit actions linked to specific outcome.
<i>Aggregation Rules</i>	Affect the level of control that a participant in a position exercises in the selection of an action
<i>Information Rules</i>	Affect the knowledge-contingent information sets of the participants
<i>Payoff Rules</i>	Affect the benefits and costs to the particular combinations of actions and outcomes; establish the incentives and deterrents for actions

The attributes of biophysical and materials affect the action arena in which they constrain the types of actions which are physically possible, the outcomes that can be produced, how actions are linked to outcomes, and what is contained in the actors' information sets. The importance of these biophysical attributes in analyzing the action arena depends on the system under scrutiny or its type of setting. When a study is conducted to explore a game, such as chess, the rule configuration becomes the most important variable and the biophysical attributes become insignificant. On the other hand, when the focal interest involve the goods or services in a specific marketplace, the physical attributes of these goods might be highly relevant to determine the resulting actions situations in the arena. For instance, the subtractability and excludability of goods or services being analyzed can affect how the provision and distribution of these items are managed.

The effect of biophysical and material conditions is not limited to the distinctions of goods/services into the four clusters as extensively incorporated in the IAD framework. Ostrom also mentions some other characteristics that may affect the outcomes in certain setting, such as the size of the resource, the mobility of the resources units, the presence of storage in the system, and other kinds of physical features. The important implication coming from the diversity of biophysical and material effects to the structure of an action situation is that different kinds of incentives are required in order to produce the expected outcomes.

The attributes of the community is the next set of variables that affect the structure of an action arena. The term is used to incorporate the relevant aspects of the social and cultural context within which an action situation takes place. The IAD framework has been frequently used in studies of small-scale communities that successfully established their own working rules to manage common-pool resources. In this kind of settings, the community holds a crucial position in the governance structure. At this point, it is not known to what extent and in what forms that these community attributes can affect the action situation in the context of geothermal energy development. However, community is considered an important element in any policy issues, especially in the case of energy provision. Therefore, a set of prominent attributes of the community is listed in the following (McGinnis, 2011):

- (1) **Trust:** a measure to which members of the community feel confident that other members or players will not take maximum advantage of their vulnerabilities
- (2) **Reciprocity:** a norm of behavior that encourages cooperation among the community members
- (3) **Common understanding (shared understanding):** the extent to which the community members share the same core values/goals
- (4) **Social capital:** a support or assistance that an individual can obtain in the community as a result of a stable network of important interactions among the community members.

2.3.3 Guideline of Using the IAD Framework

Aside from the identification of the elements of the framework which primarily consist of the action arena and the precedent conditions of the arena, it is important to understand the steps required to conduct an analysis using the IAD framework. For that purpose, the paper by Polski and Ostrom (1999)—from the Workshop in Political Theory and Policy Analysis, Department of Political Science, Indiana University—gives a clear guideline on the application of the IAD framework in policy analysis and design.

This guideline incorporates all the elements of the framework and shows the way an analysis could be initialized given the policy problems/objectives. The guideline is presented in Table 3.

Table 3 Using the IAD Framework

	Activity	Remarks
Step 1	Define the policy analysis objective and specify the analytic approach	Decide how the framework is going to be used: (1) as a diagnostic tool in which the process is going to be backward (starting from an observed policy outcome to the identification of relevant physical/community attributes) or (2) as a design/comparative analysis tool between policies in which the process moves forward from describing the physical/community attributes to the outcomes. Some questions to ask in this step include: <ul style="list-style-type: none"> • What is happening in the policy arena? • How do observed outcomes compare to policy objectives? • Which outcomes are satisfactory? Which are not? Which outcomes are most important? • When and where are these outcomes occurring? • How are policy outcomes occurring?
Step 2	Analyze physical and material conditions	Physical and material conditions refer to physical, human resources and capabilities related to providing and producing goods/services. It includes production inputs: capital, labor, technology, source of finance, and distribution channel. Some questions to ask in this step include: <ul style="list-style-type: none"> • What is the economic nature of the policy activity? • How is the good/service provided? • How is it produced? • What physical and human resources are required? What technologies and processes are required? • What are storage requirements and distribution channels?
Step 3	Analyze community attributes	This part analyzes the degree of common understanding potential participants share about activities in the policy area and the degree that the participants share the values, beliefs, and preferences about policy-oriented strategies and outcomes. Some questions to ask in this step include: <ul style="list-style-type: none"> • What knowledge and information do participants have about the relationship among policy-oriented strategies, actions, and outcomes? • What are participants' values and preferences with respect to the strategies, actions and outcomes? • What are participant's belief about other participants' strategy preferences?
Step 4	Analyze rules-in-use	The rules-in-use represent the minimal but necessary set of rules that are needed to explain policy-related actions, interactions, and outcomes. The focus shall be given to the operating rules that the participants use and to the sources of these rules, rather than on rules that can be articulated.
Step 5	Integrate the analysis	This is the part where the analysis gets into the action arena. The action arena consists of two aspects: action situation and actors. The situational elements are elaborated by determining (1) the positions/roles in the situation, (2) the participants, (3) the actions that the participants can take, (5) the level of control that the participants have over the situation, (6) the possible outcomes in the situation, (7) the information about the action situation that is available to participants and (8) the costs and benefits incurred by the participant when an action is taken.

		As for the actors, the goal is to understand the decision-making capabilities of the actors in the action arenas by considering their resources, valuations, information processing and selection process.
Step 6	Analyze patterns of interaction	Patterns of interaction is the structural characteristics of an action situation and the conduct of participants in the resulting structure. At this point, the analyst can make predictions about the likely patterns of behavior. At times, it can be difficult to infer such patterns, given the broad range of strategies that the actors can take. Nevertheless, trying to make inferences about the behavior in the arena is important narrow the range of predictions in the policy design.
Step 7	Analyze outcomes	At this stage, the performance of a policy system is analyzed. In order to do that, a range of evaluative criteria is needed.

2.3.4 Multiple Levels of Analysis in the IAD Framework

The previous sections in subchapter 2.3 have pointed out the basic structure of the IAD framework to conduct an institutional analysis. The IAD framework is complemented with another Ostrom (2005a) suggests that aside from digging deeper into the contextual factors of an action arena (rules, physical attributes, community attributes), one can go further by examining how the nested levels of rules affect the arena. The idea is that rules are nested in another set of rules. In the context of institutional analysis, Ostrom mentioned that there are three broad levels of social interactions: (1) constitutional level, (2) policy level/collective-choice and (3) operational level. Ostrom uses the term of “vertical approach” to depict the interrelatedness between these three levels of social interaction. The participants in operational situation are affected by the operational rules. The operational rules are crafted in a collective-choice situation, structured by the collective-choice rules. And finally, the collective-choice rules are crafted in a constitutional situation.

According to Ostrom (2005a), when someone addresses the question of institutional changes, he/she needs to bear in mind that the changes occur within a currently ‘fixed’ set of rules at the higher level (with the operational situations being in the lowest level). Therefore, during the analysis, it might be relevant/important to also understand the action situations which shape the rules to be used the operational situations. Figure 10 shows the linkages among these rules.

According to Imperial (1999), operational rules affect decisions in regards with the actions to be taken (who, what, where, when), how actions should be monitored, how and what information should be exchanged, and the distribution of costs and benefits assigned to the combinations of actions and outcomes. Therefore, this level comprises of the processes of appropriation, provision, monitoring, and enforcement. On the other hand, the rules used in this level of analysis are affected by the collective-choice rules which define how operational rules can be changed and who can participate in the decision-making. The deeper levels of analysis (collective-choice, constitutional, meta-constitutional, and so on) can have its own influence toward the operational level of analysis. The nestedness of rules can go deeper since, according to Ostrom (2005a), there is no justification for any specific number of levels.

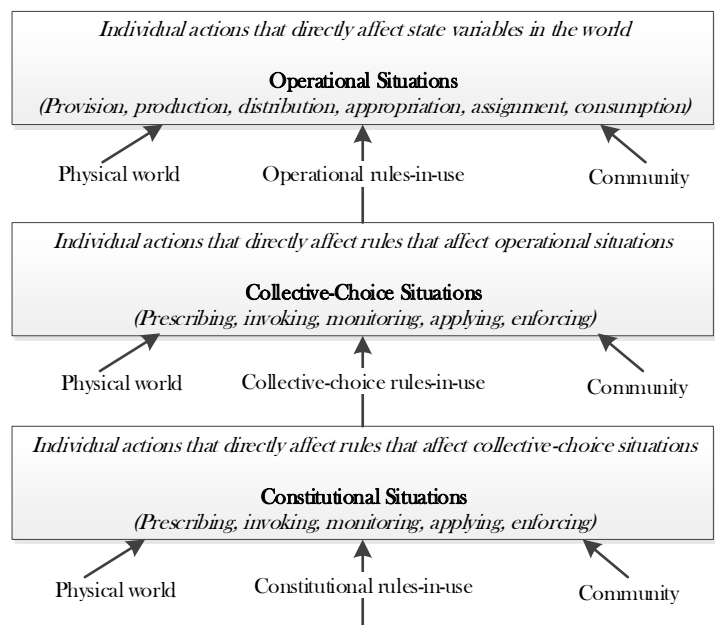


Figure 10 Levels of Analysis in the IAD Framework (Ostrom, 2005a)

2.4 The Approach of Using the Framework in this Research

The framework has been applied in many different sectors, especially in the socio-ecological settings. Scholars have used the framework in many different ways and different levels of details. A study by Mansee Bal on Understanding Urban Lake Governance and Sustainability in India has used the IAD framework in a very meticulous way (Bal, 2015). In her study, Bal (2015) obediently identifies the physical and material conditions, the rules-in-use, and the attributes of community which drive the lake governance. In the end, the details of her research has helped the reader to, among others, see the complexity of the network of adjacent action situations. In one lake governance system, for instance, it should be expected to find the action situations of lake monitoring, sanctioning (restriction), provisioning (development of facilities), production, financing, and many more. In her study, the use of the IAD framework could be easily observed through the thesis structure itself.

In other studies, the framework has been used as a superstructure in which the elements of the framework are subtly used throughout the report. One example is the work of Margaret Polski on the study of reform in the U.S. commercial banking sector (Polski, 1999). The identification of the elements of the framework is incorporated along with the use of other frameworks for analysis and throughout the discussion of economic and institutional change in the banking sector. For instance, the physical element is represented through the description of how the institutional and economic context affects the geographical deployment of commercial banks at the time. In one case, the banks' ability to respond to competition through diversification or expansion geographically could be limited by the regulation.

This research, among other purposes, is aimed at identifying the applicability of the IAD framework to analyze a socio-economic and technical setting using the contexts of Indonesian geothermal sector development. Therefore, it is important that the framework is applied thoroughly based on the principals and guidelines that have been proposed by Ostrom and her colleagues. For this purpose, careful identification and analysis of the elements of the IAD framework, as elaborated in Table 3 will be conducted throughout this research.

2.4.1 The Precedent Conditions of the Action Situation in the Context of Indonesian Geothermal Sector

The IAD framework has been built and refined over time along with its growing application across numerous and various settings (Ostrom, 2005). However, as mentioned before, since most of the past applications of this framework have been primarily focused on the management of common pool resources, the use of this framework in the context of geothermal energy development must be done with caution. The following simple illustration will show the difference between the two types of systems.

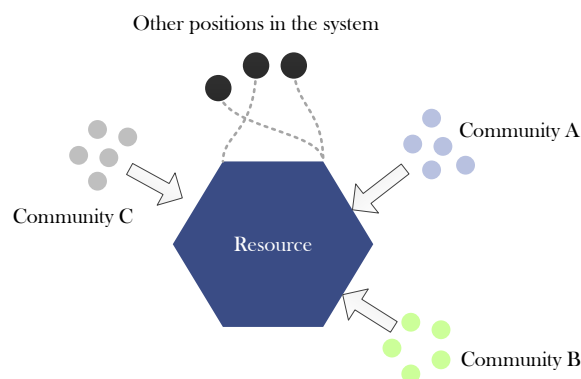


Figure 11 Illustration of Common Pool Resource

Consider a common pool resource (e.g. lake, forest, or irrigation system), as illustrated in Figure 11. In this kind of system, there are individuals/households from the community whose actions affect the resources directly and whose lives, to some extent, depend on these resources as well. In this case, the community can be defined as a social group of people sharing specific locality adjacent to the resource, which also probably shares cultural and historical heritage. Understanding the attributes of the community is important to describe how these communities, for instance, develop their own rules and norms in appropriating the resource (Ostrom, 2005a). Certainly, there are other positions in the system, e.g. the guards of the resource, the regulators, infrastructure providers, etc. These positions are not part of the community as such. However, the interactions between the communities and the individuals/organizations in these positions will certainly affect the outcome of

the action situation. In this case, the expected outcome of the interactions is to be able to achieve a sustainable consumption of the resource, avoiding the overharvest.

On the other hand, geothermal energy development for electricity production, has different characteristics. Figure 12 illustrates the simplified process of geothermal resource utilization. If the same definition of community as above is used, then the community would be a group of households/other organizations which buys the electricity from the utility company. In this case, the communities do not have any direct impact to the resource itself. Their influence can come, for instance, through the demand of electricity or the other kinds of involvements which affect the way the developer operates in the area (e.g. social disinclination to geothermal power plant development, partnerships, and so on).

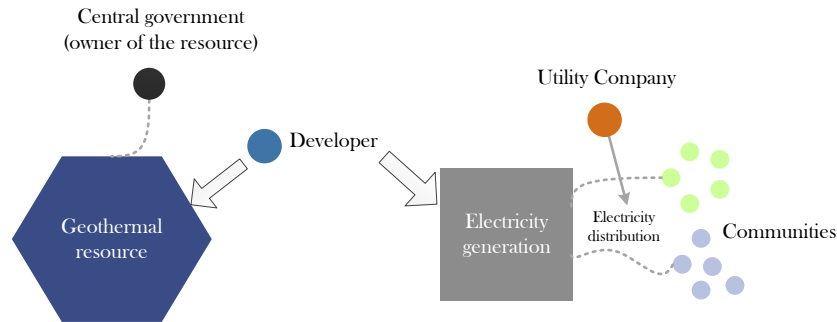


Figure 12 Illustration of Geothermal Resource Utilization in Indonesia

This thesis is aimed at understanding the impact of the institutional arrangement on the investment decisions made in the geothermal sector. Therefore, the analysis should be made within the context of the geothermal development which focuses more on factors which affect the developers whose actions (of provision, production, and distribution) have direct impact to the resource and to the outcome of the sector's development. Therefore, in identifying the attributes of the community, it becomes more crucial to understand these developers and other actors with whom they have direct interactions during the course of the development. Consequently, understanding the attributes of the community described as the final electricity consumers, becomes less relevant in the context of investment in geothermal energy development.

Within the prescribed investment context, the system should be seen as comprised of agents whose actions collectively affect the deployment of geothermal energy projects for electricity generation in the country. In a brief and general manner, the main players consist of the government as the owner of the resource, the developer, and the direct buyer of the (transformed) geothermal resource. Therefore, the analysis of the community attributes later should be conducted towards these agents/players and other relevant stakeholders whose connection with these agents will be explained further later.

Due to the fact that the indirect utilization of geothermal resource is overseen entirely by the central government, it becomes obvious that the rules-in-use in this setting should be originated from the existing regulatory framework. This is the part where the research objective of this thesis corresponds to the concept of institutional analysis using the IAD framework. In chapter 1, it has been mentioned that there is an uncertainty whether the current regulatory framework has the capacity to encourage more investment in geothermal sector in order to increase the role of this energy source in the power sector. This sector is governed by a specific rule of law, therefore in identifying the rules-in-use, the formal regulatory framework will become the main reference for that purpose. This is not to say the informal rules are not relevant. In fact, as mentioned in chapter 2.3.2, it is possible that the rules-in-force (according to the regulatory framework) are not the same as the rules-in-use, indicating a lack of enforcement. In such case, the informal rules will become the more influential determinant of the outcome of the action situation. Therefore, these informal rules will be identified as well along with the elaboration of the action situation.

The preceding paragraphs have briefly indicated how the rules-in-use and the community attributes will be elaborated in this research. The other contextual factor of physical/material condition will be identified as well. Certainly, the characteristics of geothermal resource utilization is not the same as common pool resource. The resource will be developed by a single licensed developer which will bear the costs and risks such undertaking. The elements which affect such costs and risks are part of the physical and material characteristics inherent to geothermal energy development. More specifically, the natural and infrastructure conditions of the resource in Indonesia also have a large impact to the investment decisions in the sector.

2.4.2 The Action Situation in the Context of Indonesian Geothermal Sector

An action situation needs to be specific enough to achieve rigorous analysis and to avoid oversight and simplifications which could lead to policy failures (Polski & Ostrom, 1999). There are numerous actions to be taken by different actors in different

positions in the system to be able to finally increase geothermal power capacity in the country. The current regulatory framework centralizes the management of the resource, giving more authority to the central government to handle various affairs in the sector. Nevertheless, the actual development stages which comprise of exploration, feasibility study, exploitation, and utilization of the resource, will be undertaken by the assigned developer or other parties. To study how the institutional arrangement affects the investment decisions, the selected action situations should cover the interactions between agents in the public sector and the developers. It is because within those exchanges, some commitments will be made, including the future investment to be had by the interacting parties.

According to Ostrom (2005), the IAD framework can be presented at a range of different scales, distinguished by the depth of analysis of the system. In this research, since the focus will be made toward arena(s) in which the developers interact with agents in the public/government sector, the initial analysis will be conducted at the operational level. In doing so, the analysis can be strengthened by looking into specific operational aspects which affect the feasibility of geothermal investment in the country, given all the contextual factors. The exact situations to be further attended will be discussed and analyzed in the subsequent chapter. Furthermore, to be able to better analyze the patterns of interactions and presume the outcome of the action situation, references will be made to the past and similar action situations in the past. By putting together the contexts elaborated using the IAD framework, it is expected that noteworthy experiences from the past can be more explicitly analyzed and the current regulatory and institutional framework can be more critically explored.

The rules-in-use at the operational level strictly depend on the stipulations in the prevailing regulatory framework. Changes in the regulations will directly affect the operational aspects of the sector. In the Introduction chapter, it has been described how the sector has experienced multiple changes in the regulations which might have reinforced or disrupted the progress in the past. The motivation behind these changes might vary. Nevertheless, it might be worthwhile to understand the situations at the higher level of analysis, i.e. the collective-choice/constitutional level. The action situation at the higher level consists of stakeholders with the authority to change the regulatory framework or influence the decision-making process. In doing such analysis, it is important that the political-economic context surrounding geothermal sector is taken into consideration as well. It is because the political actors do have an important role in shaping the decision making process, moreover in sectors which largely affect the public interest, including the energy sector. Such political factors might be elaborated as part of the attributes of the community which structure the arena of regulation making. All in all, the use of the IAD framework in this research can be depicted as follows.

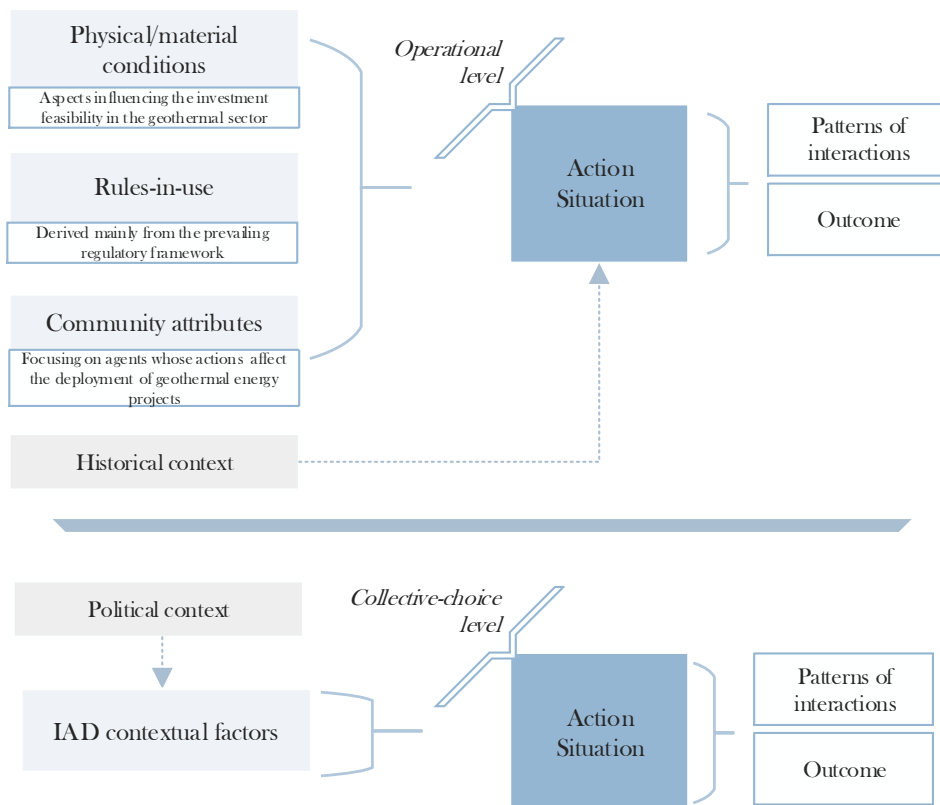


Figure 13 Framework of the Research

As seen above, the use of the IAD framework in this research will be complemented with both the historical and political contexts exhibited in the sector. How these two factors will help the analysis of the action situation in any level will be explained further in subsequent chapters. Chapter 3 will elaborate on the contextual factors preceding the action situation at the operational level. Chapter 4 will analyze the selected action situations with more emphasis given to the operational level first and, to lesser extent, discuss the action situation at the collective-choice level.

2.5 Concluding Remarks and the Application of the IAD Framework in this Research

This chapter is intended to understand what is meant by institutions and how they can be analyzed. Institutions which serve as the constraints for the participants within a system, have an important role in shaping the final outcome. Therefore, the analysis to understand how these constraints or rules affect the decisions made by the different participants become crucially important. In the end, it comes back to the notion that institutions matter. The institutional analysis itself has expanded over time and covers a broad range of topics. For this matter, Ostrom has presented a framework with which the arrangement of institutions can be analyzed deeper by making the action situation as the focal level of analysis. Not only that this framework puts forward the importance institutions (rules/constraints) as such, it also takes into account the influence of the other contextual factors of community and physical attributes.

Furthermore, the chapter has been closed by giving an overview of how the IAD framework is to be applied in this research. In doing so, the elaboration and analysis to be conducted in the following chapters will be based upon a clear and solid theoretical background.

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Identification of the Contextual Factors of Geothermal Development

This chapter is primarily intended to identify the contextual factors of the action situation to be attended in this research. Prior to the identification of these factors, the direction of the analysis needs to be clarified—on which aspects the analysis should be focused on. Therefore, chapter 3.1 is developed to show the initial construct of the action situation, both at the operational and collective-choice levels. Based on the initial construct, the relevant contextual factors are identified in the chapter 3.2 (physical/material conditions), 3.3 (rules-in-use), and 3.4 (community attributes). Finally, chapter 3.5 summarizes the analyses and findings in the preceding chapters.

3.1 Conceptualization of the Action Situation

Prior to the identification the contextual factors surrounding the development of geothermal energy in Indonesia, a common understanding toward the concept of investment in the sector has to be achieved first. By doing so, the selection of action situation(s) to be attended in this research can be conducted in a sound manner. First of all, geothermal development in Indonesia has certain characteristics and circumstances which shape its market. For example, the commercialization of the indirect utilization of geothermal resource cannot be separated from the electricity sector. In this case, the main player in the electricity sector, namely the national electricity company which has almost an exclusive control over the sector, holds a defining role in the success and sustainability of the geothermal sector. Therefore, the notion of investment within the scope of this research should not be constrained to investments made by the developers or their financiers. Instead, it has to encompass the investments or expenses incurred by other parties whose collective actions also contribute to the entire geothermal project life.

The investment to be made by the developer is obvious. Once a developer is appointed by the central government (the owner of the resource), it has the obligation to undertake the development process, along with the inherent risks and costs of geothermal project. Normally, this developer will eventually serve as the seller of geothermal resource, in the form of steam or electricity. At the other side of the transaction, the national electricity company will serve as the (sole) buyer. For this electricity company, the investment can be roughly seen as the expenditure to be incurred in purchasing the electricity that later will be sold to the final consumers through its distribution network. Lastly, as the owner of the resource, the central government also has its contributions which depend on the type of support it gives for the resource development. As an example, the support might be direct, e.g. through government exploration program involving its state-owned companies. Otherwise, the support might be indirect, e.g. through giving the national electricity company additional support to purchase geothermal resource from the developers. In brief, the support by the government is intended to facilitate further development undertaken by the assigned developer. Note that the developer can either be a state-owned or a private company.

3.1.1 Initial Design of the Action Situation at the Operational Level

The three main players which have been mentioned above are connected in a network—indicating the mutual dependency among them. As shown in Figure 14, the central government issues geothermal license and entrusts the resource development to a company through a certain license issuance mechanism. The involvement of the national electricity company comes later through the power purchase agreement settlement with the developer. These two processes yield commitments between the transacting parties. In line with the discussion in chapter 2.4.2, the selected action situations should be able incorporate issues regarding such investment commitments. Therefore, it seems appropriate that the following processes are to be further investigated in the research: (1) the process transferring the geothermal license, (2) the process of settling the power purchase agreement (PPA).

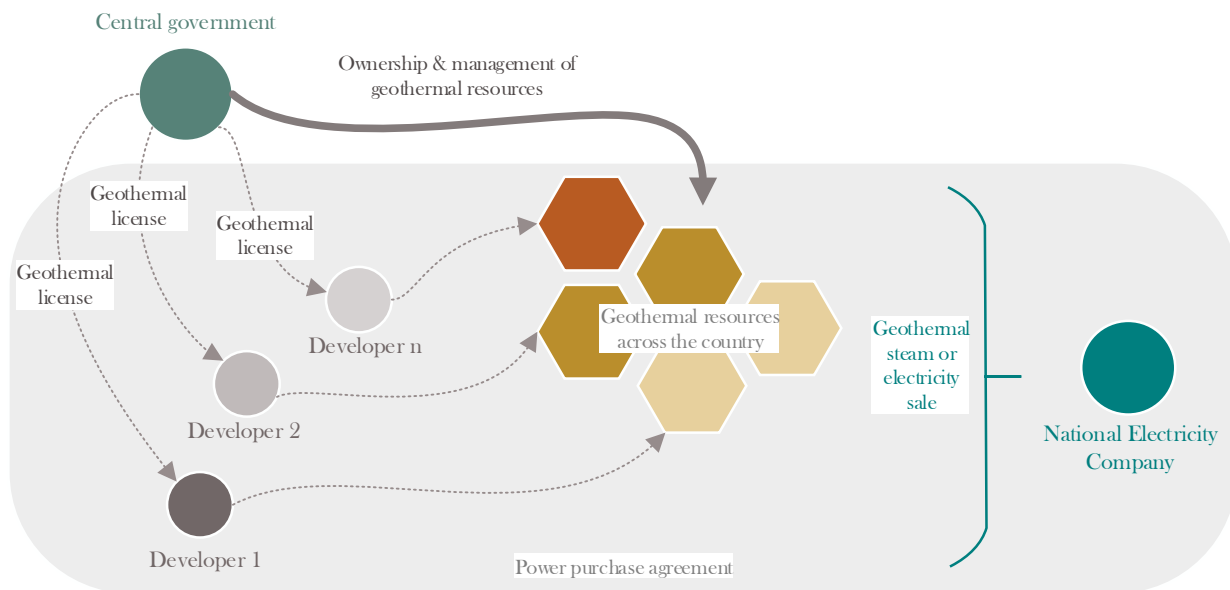


Figure 14 Interactions between the Government, the Developer, and the National Electricity Company

Certainly, there are other commitments which together build up the whole story of geothermal development in the country at the operational level, such as through the drilling or EPC contract between the developer and other companies. Nevertheless, the two processes can be regarded as two milestones which cover both the beginning (geothermal license issuance) and the commercial part of the project (as governed in the PPA). What happens in between the two ends is the implementation of the development plan which should have been taken into consideration during the process of the license transfer and PPA settlement. The issuance of geothermal license entails the rights and obligations of both the central government and the developer. It comes with the estimation of costs and benefits to be obtained by both parties, e.g. concerning tax or royalty. The same thing applies with the settlement of the PPA. The most important aspect in the agreement concerns the electricity purchase price that eventually affect the investment return for the developer and the costs to be borne by the electricity company.

In addition to these two processes, experiences have shown the significance of the developer's financial circumstances toward the success of the project. Many geothermal projects in the past have been mostly delayed or cancelled due to financial issues. Therefore, the discussion should also concern the financial aspect as an inseparable attribute of the developer. This factor can be incorporated by taking into account another important milestone: the settlement of commitment between the developer and its financiers.

Text Box 1. The Sarulla Project

The Sarulla project has been under development since the 1990's. According to the report by JICA (2009), in 1993, a Joint Operation Contract (JOC) was signed between Pertamina (the national oil company who had the monopoly right over geothermal development in Indonesia) and Unocal—now Chevron. The agreement gave Unocal the right to exploit the area located 300 km south of Medan in North Sumatra. In the JOC, Unocal agreed to allocate 28 million USD during the first seven years of exploration. Eventually, Unocal spent \$45 million USD in resource exploration and the drilling of 13 exploration wells in 3 different prospective areas. From this process, Unocal obtained a total of 330 MW of proven resources. A feasibility study was conducted and PPA with PLN has been secured for further development. However, the Government of Indonesia stopped the project in 1998, most probably due to the political turbulence inside the country and the financial crisis which hit South East Asia in 1997. The project was postponed until finally PLN took over the Sarulla project and paid for 60 million USD in 2003.



In 2004, PLN opened the area for the independent power producers through a tender process. The tender was won by the consortium of Medco-Ormat-Itachu in 2006. Kyushu Electric Power Co Inc. joined the consortium. Sarulla Operation Limited (SOL) was established by the consortium to act as the operating company for steam resource development, construction and operation of plant facilities under the JOC with the concession holder, Pertamina Geothermal Energy (Ganefianto, et al., 2015). Upon winning the tender, SOL agreed to pay 70 million USD to compensate for the exploration works that have been conducted previously.

From this point, the project experienced a long process of renegotiation regarding the JOC and the Energy Sales Contract (ESC), including the revision of tariff due to the financial crisis in 2008. The new tariff was finally agreed in 2011 with the approval by the MEMR. PGE, PLN, and SOL signed the new amendment of the JOC and ESC in April 2013. A loan agreement was signed in March 2014, followed by the financial close in 2014 (Sarulla Operations, 2016). In total, it has taken 20 years from the first signing of the JOC between the developer and the concession holder until the financial closing. In 2014, construction for the exploitation phase was finally resumed. Since March 2017, the first power plant unit with the capacity of 110 MW has operated commercially. The other two units are planned to be ready in 2018.

Source: (JICA, 2009)

Text Box 1 illustrates the significance of the three commitments mentioned before. For the Sarulla project to finally produce a power plant with a capacity of 110 MW and more in the future, there has been a very long process involving many different parties. Despite the complexities of the development, some milestones are marked as follows:

- The investment was made for exploration and drillings after the previous contractor, Unocal, secured a joint operation contract (JOC) with Pertamina. In the current context, the JOC represents the commitment made between the government and the developer.
- In addition to the JOC, Unocal also obtained an energy sales contact (ESC) or power purchase agreement (PPA) with the state electricity company, PLN. In the current context, the arrangement of this kind of agreement remains more or less the same.
- Finally, the loan agreement is the third important commitment to be made in the case of Sarulla and many more similar geothermal projects. With this agreement, SOL could move forward with the project and continued with the power plant development. In return, SOL is obliged to repay the loans with certain interests within specific period of time, according to the agreed terms.

To incorporate the three aspects into the analysis at the later stage, the discussion needs to be centered on the contexts, rules, policies, and regulations which shape the intricate process of obtaining these three commitments. As the initial attempt to operationalize the IAD framework, the incorporation of the three types of commitments is simply depicted in Figure 15. This initial concept will serve as the point of departure to identify the contextual factors, according to the research framework as shown in Figure 13.

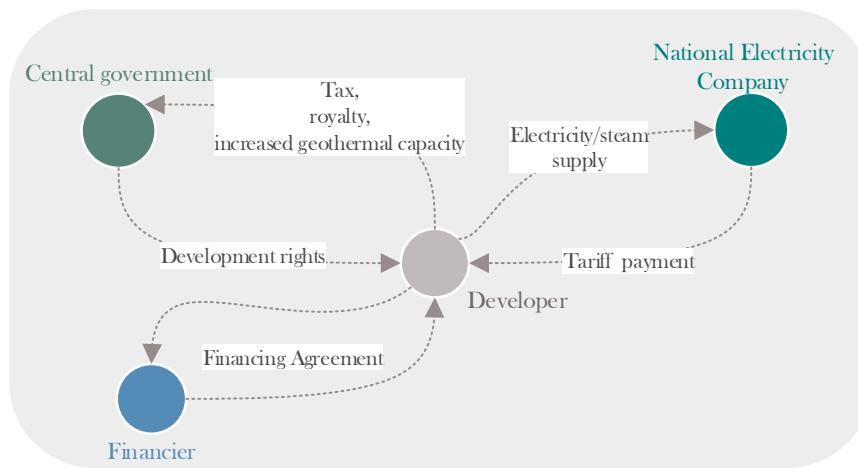


Figure 1.5 Initial Construct of Action Situation at the Operational Level

It is important to note that initial concept of action situation at the operational level is rather simplistic. For instance, the central government itself comprises of ministries which might influence the course of geothermal energy development in different ways. The objective of the Energy Minister concerning geothermal sector might not be in line with the goals of the Finance Minister concerning the state budgetary issues. Therefore, in addition to the elaboration of the contextual factors according to the IAD framework, a more thorough analysis of actors in the system is required. This will be useful for the analysis of action situations at the operational and the collective-choice (or higher) level. The reader may refer to Appendix A to see the identification of actors influencing the geothermal sector.

3.1.2 Initial Design of the Action Situation at the Collective-Choice Level

At the higher level of analysis, the discussion should focus on situations in which the rules governing the operational aspects of situation as shown in Figure 1.5 are negotiated, designed, and made. The cooperation between the government and the developer through the issuance of geothermal license and the arrangement of power purchase agreement are strictly regulated in geothermal law and further governed in various legislations. On the other hand, the third type of commitment (financing agreement) can be arranged in many different ways—depending on the preference and capability of the developer—and governed through contracts between the cooperating parties. Since the emphasis to be made will be given to actors (and their actions) in the public sector and other stakeholders involved in the regulation making, the subject will be made on regulatory issues regarding (1) the transfer of geothermal license and (2) the settlement of PPA.

At the heart of this action situation is the entity which has the authority and the responsibility to manage geothermal resource. In Indonesia, this task is mandated to the Energy Minister. The minister is in charge of the entire Ministry of Energy and Mineral Resources (MEMR). Within this ministry, there is a specific directorate that is in charge of the renewable energy development: the Directorate General of New, Renewable Energy, and Energy Conservation (EBTKE)⁵. EBTKE has responsibilities in regards with the formulation, implementation, control, and monitoring of policies in the renewable energy (RE) sector. Specifically for geothermal energy, the formulation of these policies as a collective action would normally involve other stakeholders outside the public sector, such as the Indonesia Geothermal Association (INAGA), study teams from the World Bank, Japan International Cooperation Agency (JICA), and so on. However, eventually the ratification of the policy (putting the policy design into force) is within the authority of the Energy Minister.

In the scope of this research, the development of geothermal energy cannot be separated from the electricity sector. Therefore, at the higher level of analysis, it is strictly relevant to include stakeholders who are in charge in shaping the regulations and policies for the electricity sector as well. Referring to the initial construct of the action situation at the operational level, the issue will affect the dynamics between the developer and the National Electricity Company (PLN). In the public sector, also within the MEMR, the specific directorate that is in charge of the electricity sector is, the Directorate of Electricity (DJK)⁶. In addition to that, PLN as the sole buyer of geothermal electricity at the moment is presumed to have a significant impact as well in the discourse of this topic.

⁵ In Indonesia, the Directorate of New, Renewable Energy, and Energy Conservation is translated into Direktorat Energi Baru, Terbarukan dan Konservasi Energi or simply abbreviated as EBTKE.

⁶ In Indonesia, the Directorate of Electricity is translated into Direktorat Jenderal Ketenagalistrikan or simply abbreviated as DJK.

Geothermal energy development is capital-intensive and requires a high level of investment. As mentioned before, despite the attempts to attract private capital into the sector, government investment plays a significant role and is still very much needed as well. The direct and indirect support from the government for geothermal will greatly depend on the state budgetary constraints as well. For this matter, the Ministry of Finance (MoF) has the authority in designing the state budget allocations. Therefore, it is important to include the MoF into the discussion as well.

Up to this point, the arena at the collective-choice level of analysis can already be roughly constructed, as seen in the following.

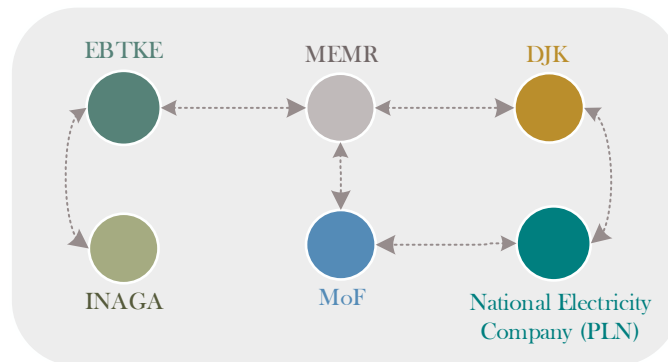


Figure 16 Initial Construct of Action Situation at the Collective-Choice Level

The interactions between actors in this level are less obvious compared to the interactions in the operational level. Consequently, the complexity increases due to the fact that the arena accommodates discussion on a wide range of subject with the purpose to change the play of the game at the operational level through altering regulations and policies. The arrows in Figure 16 merely indicate the proximity between the connected actors, e.g. between the geothermal association and EBTKE or between the electricity company and the Directorate General of Electricity (DJK). In the actual setting, each of the participants might interact with any other participants. Note that not all of the actors depicted in Figure 16 will be present in the decision-making arena at the same time. It depends on the political circumstances and issues under scrutiny. With this initial construct, it will be easier to identify the contextual factors and to analyze the action situation itself the later stage.

The following subchapters will elaborate on the precedent conditions which shape the course of the action arenas in both levels of analysis according to the research framework shown in Figure 13. The guidelines provided by Polski & Ostrom (1999) as presented in chapter 2.3.3 will be used to structure the process.

3.2 Identification of Relevant Physical and Material Conditions

Geothermal energy development faces particular physical (natural and infrastructural) conditions of the environment that will affect the feasibility and the profitability of the project. Development difficulties are found in various forms and they might lead to cost overruns. The situation depends on the success rate of exploration wells, the depth of the reservoir, the steam productivity of the reservoir, the chemical characteristics of the geothermal fluids, and so on. When no proper anticipation is given to these physical conditions, the project might fail at generating the expected return. In addition to the natural and infrastructural conditions for the resource development, physical and material conditions are also elaborated by discussing of the economic nature of the policy activity, the source of finance, and the distribution channel.

3.2.1 Natural Physical Conditions

The subsurface features of potential geothermal fields contribute a significant level of risks for the resource development endeavors. It is important that these risks are mitigated and managed well in order to attract investment. To achieve that, the physical characteristics of geothermal resource in a specific field have to be properly understood. Indonesia is the location of the convergence of several tectonic plates of the Philippine Sea plate, Indian-Australian plate, and Eurasian plate and several other minor plates (DPRI, n.d.). These tectonic collisions produce a significant level of geothermal resource in the country.

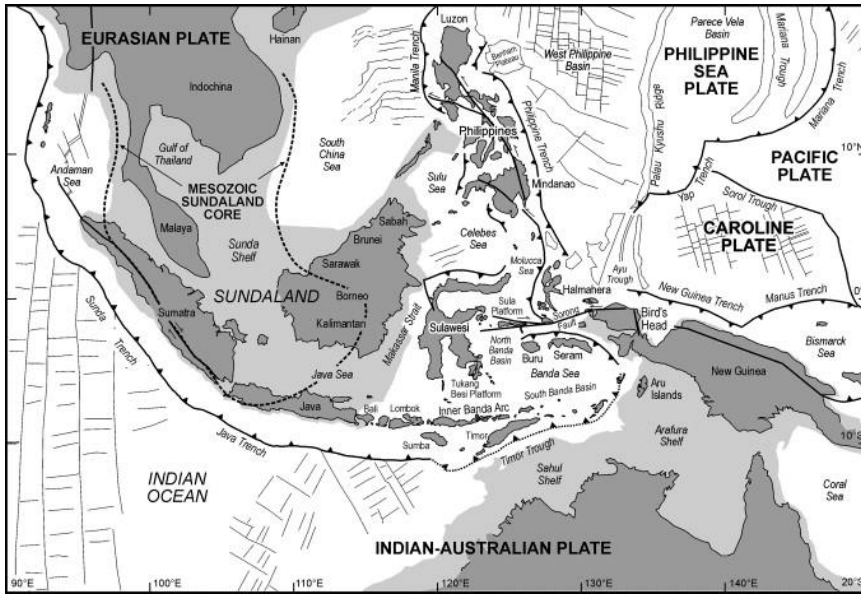


Figure 17 Principal Geographical Features of the Region

The collision between Indian-Australian plate and Eurasian plate created a subduction zone at the depth of 160-210 km below Java and Nusa Tenggara Islands and at 100 km below Sumatra Island. The difference in depth distinguishes the magmatic features of different regions. The geothermal reservoir in Sumatra is usually located in sedimentary rocks at lower depths compared to the ones in Java and Nusa Tenggara which are found in volcanic rocks at deeper locations. Northern part of Sulawesi exhibits the same geological characteristics as in the Java Island (Saptadji, n.d.). Geothermal reservoirs in Sumatra are generally located inside sedimentary rocks which have endured several tectonic deformations, giving

more porosity or secondary permeability onto the rocks. Therefore, geothermal reservoir permeability in the region is higher compared to the fields located in Java or Sulawesi. In Java and Sulawesi, the geothermal system is associated with volcanic activity in which the heat is situated inside or close to calderas (Saptadji, n.d.). The location and characterization of permeability structure are important in determining the productivity of a reservoir (Brehme, et al., 2016).

The use of geothermal resources is influenced by the nature of the system that produces them (Loksha & Gehringer, 2012). Geothermal system in Indonesia is mostly made of hydrothermal system with high temperature or more than 200°C and a few with medium temperature (150-200°C). There are a number of factors that determine the optimal use of geothermal resource, including the type (hot water/steam), rate of flow, temperature, chemical composition, pressure of geothermal fluid, and the depth of geothermal reservoir. Furthermore, Loksha and Gehringer (2012) suggest the following types and uses of geothermal resources, as seen in Table 4.

Table 4 Types and Uses of Geothermal Resources (Loksha & Gehringer, 2012)

Resource type based on temperature	Geographical and geological location	Use/technology
High: > 200°C	Globally around boundaries of tectonic plates, on hot spots, and volcanic areas	Power generation with conventional system, flash, double flash, or dry steam technology
Medium: 150-200°C	Mainly in sedimentary geology or adjacent to high temperature resources	Power generation with binary power plants
Low: < 150°C	Exist in most countries (average temperature gradient of 30°C/km means that resources of about 150°C can be found at the depths of about 5 km)	Direct uses (space and process heating). Power generation is possible, yet costly.

According to Micale, et al. (2014), the levelized investment cost of geothermal projects seems to decrease along with the increase of resource temperature. Using a sample of 46 projects, from Bloomberg New Energy Finance (BNEF), Micale et al. (2014) estimated that flash or dry steam technologies, associated with higher temperature, require average costs of 3.6 USD cent/kWh and 3.2 USD cent/kWh. On the other hand, binary technologies, suitable to utilize resources with lower temperature, requires higher average cost of 10.3 USD cent/kWh. This example exhibits how the natural physical condition of a geothermal field influence the type of technology required which eventually affects the investment costs of the project.

The bottom line is that capital costs of geothermal projects are very site- and resource specific. The resource temperature, depth, chemistry, and permeability are the major factors which affect the cost of this power project. Moreover, the nature of the project also needs to be considered, whether it is a green field or an expansion project. For a green field project, the costs of exploration and prospect evaluation take a large part of the total capital investment. In Indonesia, most of the fields which

were tendered after the issuance of Law No. 27/2003 could be roughly categorized as green fields in which no exploration drillings to reduce the resource risk had been overtaken beforehand.

According to Hance (2005), the more recent projects are focused on more difficult areas and they tend to be smaller. This condition usually corresponds to higher exploration cost in the end. Although the report by Hance (2005) is prepared using the information of geothermal development in the United States, similar condition exists in Indonesia. The report by ADB implies that the currently operating geothermal projects are relatively of higher quality or, as they put it, the low hanging fruits (Meier, et al., 2015). It makes sense because the earlier projects must have been focused on the most prospective areas which require lower logistical costs and have high demand of electricity. For example, Gunung Tampomas in West Java was already considered as unattractive for exploration drillings after additional data was collected by Pertamina in the early 1980s (see Appendix B). Hence, the exploration was discontinued and Pertamina focused on other more attractive areas. Nevertheless, Gunung Tampomas was still opened for tender in 2009 with an estimated potential of 20-50 MW.

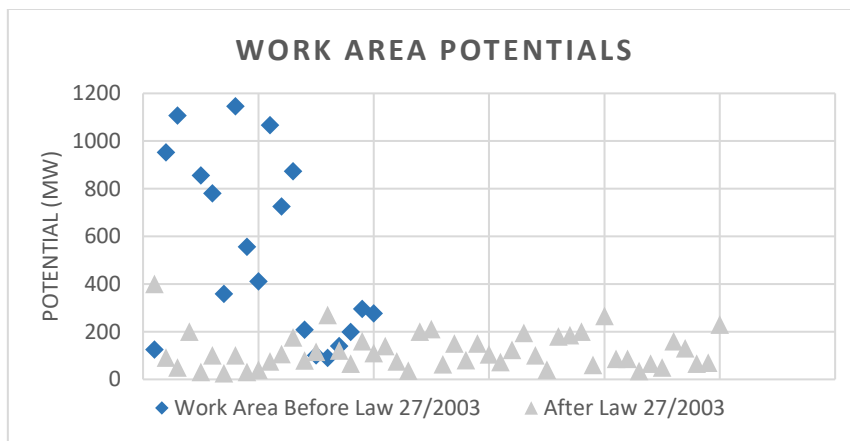


Figure 18 Development Potentials in 69 Geothermal Work Areas (EBTKE, 2016)

Figure 18 shows the potentials of 69 geothermal Work Areas in the country, as reported in EBTKE Statistics Report for 2016. Based on this information, it can be seen that the number of Work Areas after the issuance of the Law No. 27/2003 have increased significantly (note that not all of these Work Areas are under development). However, the potential of these prospects is generally lower than the older fields which have been developed prior to the issuance of the geothermal law in 2003. However, the information regarding these fields’ potential is considered unreliable and overestimated according to Castlerock Consulting’s reassessment of the Work Area potentials (Meier, et al., 2015). For instance, according to the statistics by EBTKE, Darajat has a total potential of 855 MW. Currently, the field has a total installed capacity of 270 MW, leaving hypothetically almost 600 MW underground. However, according to the Castlerock reassessment and an interview with the representative of the operator of Darajat field, the resource utilization in the area cannot be further expanded (Yudha, 2017). As reported by Meier, et al. (2015), out of the 51 Work Areas potentials that have been reassessed in 2014, only 10 fields show no change and 7 show an increase in the potential capacity. Meanwhile, the other 20 fields show a decline and 14 show zero potential. Regardless of the information accuracy given by EBTKE, there is a clear indication that resource development is likely to become more challenging and consequently more expensive compared to the past projects.

3.2.2 Infrastructural Conditions

Geothermal resource is location-constrained because the power plant cannot be placed too far from the resource. This limits the choice for efficient location of the power plant. The constraint on the locations often entails the need for grid expansion and reinforcement. If the resource is located in remote areas with poor infrastructure access, the development cost can rise significantly following the logistical activities that need to take place. PwC Indonesia (2016) also mentions infrastructure as one of the biggest challenges within the industry. The limited infrastructure, such as ports and roads in rural areas, sometimes requires the developers to incur additional infrastructure cost (e.g. access road). According to Meier, et al. (2015), in Indonesia the cost of exploration drilling and well testing for two to four wells is estimated at USD 25 million. However, since the easiest prospects in the country have already been developed, infrastructure cost in remote locations should be expected to rise to as high as USD 50 million.

A case example is the development of Muara Laboh Work Area in West Sumatra. Based on the interview with the representative from PT Supreme Energy Muara Laboh (SEML), the Work Area was a green field that is located in a very remote mountainous area. Obviously, no infrastructure was readily available to reach the place. The transmission lines from

the plant site to two 150 kilovolt substations near Muara Laboh and Sungai Rumbai—to be built by PLN—will extend to as long as 80 km (ADB, 2017). Although the costs of transmission lines construction are relatively low, even negligible for the determination of the tariff (Meier, et al., 2015), the length of the transmission line for the case of Muara Laboh can be an indication of the challenging infrastructure condition for geothermal development in Indonesia.



Figure 19 Muara Laboh (Source: Supreme Energy)

Currently there are 69 geothermal Work Areas located in various places across the country—only 26 of which are situated in Java. As mentioned before, up to this day there are only 9 productive Work Areas—five of them are located in Java. Most of the national infrastructure developments have been concentrated in the Java Island. This can be observed, among others, through the distribution of electrification in the country. In 2015, the country has a total of 48,065 MW power generation capacity—33,824 MW in Java and Bali; 10,091 MW in Sumatra; 4,150 MW in the eastern part of Indonesia (PLN, 2016). These numbers indicate a clear imbalance of development in Indonesia. Given all the advancements, Java has become the easiest prospect for further development, hence the better progress in geothermal resource utilization.

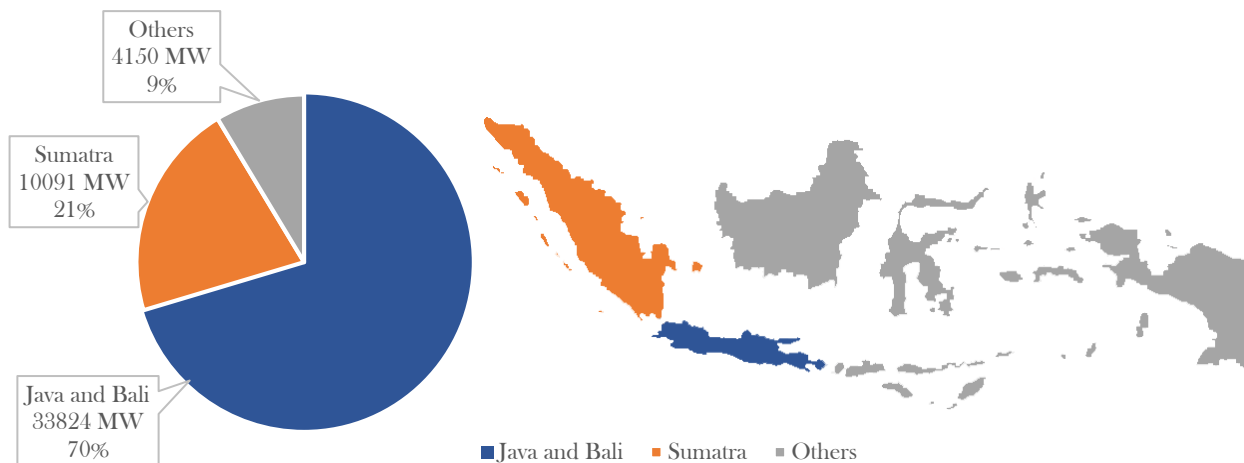


Figure 20 Distribution of Power Generation in Indonesia

In the eastern part of Indonesia, there are only two recently operational Work Areas: Ulumbu and Mataloko in East Nusa Tenggara province. In 2015, East Nusa Tenggara has the electrification ratio of only 58.91 percent (GOI, 2015). The developments of geothermal power plants in these Work Areas were conducted by PLN, the national electricity company, using the fund obtained from Asian Development Bank (ADB) and the National State Budget (Ciptaningtyas, 2016).

3.2.3 Distribution Channel and the Implications

The utilization of geothermal energy for electricity requires the resource to be directly transferred from the power plant into the transmission system before it is being distributed for the final consumption. Similar to the other renewable energy resources such as wind and water, the use of geothermal energy is constrained by its location. Therefore, its use as electricity can only become commercial after it is connected to the electricity network. Obviously it is not the case for conventional

resources, such as oil and coal which can either be exported or domestically traded for various purposes, including power generation. From the point of view of energy security, the site-constrained nature of renewable energy such as geothermal should be a considered as a benefit. The sustainability and the constant reliability of geothermal energy makes it a sound renewable baseload power source. Moreover, its use can be a hedge against the volatility of conventional fuel price. However, the side note is that the developer of geothermal resource is left with the only option to channel the product, i.e. the steam or electricity, to the power transmission and distribution owners. To whom can the developers sell their product?

In Indonesia, the regulation governing the business of electricity is Law No. 30/2009. Electricity supply business which consists of generation, transmission, distribution, and sale can be performed by any entities (public—state and local government—private). However, the law also stipulates that PLN, representing the state, acts as the main executor of the power supply business and it has the first priority (first right of refusal) in the provision of electricity for the public. Only when PLN is unable to serve the area that the private companies, and the other cooperatives can be involved in the electricity enterprise. Moreover, the law also indicates that the power generation, transmission, distribution, and sale can be provided in an integrated manner: one business area for one state-owned entity (PLN). The business area restrictions also apply for supply businesses which only include the distribution and the sale of electricity. The business area is determined by the government.

According to the General Plan of Electricity of PLN, its business area consists of the whole territory of the republic of Indonesia, except for areas which belong to other state- and regional-owned enterprises, private companies, or other cooperatives.

Table 5 PLN Business Area

Java and Bali	Sumatra	Eastern Indonesia	Kalimantan	Sulawesi
PLN Jakarta Distribution	PLN Aceh Region	PLN East Nusa Tenggara	PLN West Kalimantan	PLN North-Central Sulawesi and Gorontalo
PLN Banten Distribution	PLN North Sumatra	PLN West Nusa Tenggara	PLN South-Central Kalimantan	PLN South-South East-West Sulawesi
PLN West Java Distribution	PLN West Sumatra	PLN Maluku and North Maluku	PLN East-North Kalimantan	
PLN Central Java and Jogjakarta Distribution	PLN Riau and the Archipelago	PLN Papua and West Papua		
PLN P2B	PLN South Sumatra - Jambi-Bengkulu (S2JB)			
PLN Transmission Unit for Western Java	PLN Lampung Distribution			
PLN Transmission Unit for Central Part of Java	PLN Bangka - Belitung			
PLN Transmission Unit for Eastern Java	PLN Sumatra Distribution and Load Control Center (P3B)			
PLN Power Generation Tanjung Jati	PLN Power Generation for Northern Sumatra			
PT Indonesia Power	PLN Power Generation for Southern Sumatra			
PT Pembangkitan Jawa Bali				

Color Legend
Distribution, sales, small-scaled generation
Transmission
Generation
Distribution, sales, transmission, generation
Only distribution and generation

Table 5 shows the business areas under the jurisdiction of PLN. Every main region in Indonesia is controlled and managed by PLN for its power distribution, sales, transmission and generation. In accordance with the law, once the business area has been assigned for PLN, only PLN can organize the power distribution and sales in that certain area. Therefore, although the regulation allows for the involvement of private sector, the participation is limited. Consequently, PLN can be considered to hold the monopoly over the distribution and sales of electricity in the country. This is the case of electricity supply business for public needs. For private uses, the law actually allows for direct transaction between private entities. For example, according to one of the respondents from EBTKE, there is a possibility to sell geothermal power directly to a private company which will need the energy to for the smelter factory in one of the eastern region in the country (Riyanto, 2017). However, despite the promising opportunity, this kind of arrangement is still nonexistent.

Due to the constraints in the distribution channel, PLN becomes the single buyer of steam and electricity produced by the independent geothermal power producers in Indonesia. The term when there is a buyer's monopoly who controls the market and has the ability to drive prices down is called monopsony. Theoretically, a monopsony is another form of market failure. In this setting, the resulting price for the goods or services will reflect the buyer's willingness to pay. According to Blair and Harrison (2010), the economic objections to monopoly and monopsony is similar in which it reduces social welfare. At the point where the marginal revenue cost (MRC) is equal to the marginal revenue product (MRP), the resulting price should be P*. However, due to the fact that there is only a single buyer, the utility/electricity company, the price can be pulled down to

the level of P_M . The deadweight loss as seen in Figure 21 is resulted from the loss surplus that the suppliers would have gotten at the equilibrium price P_C .

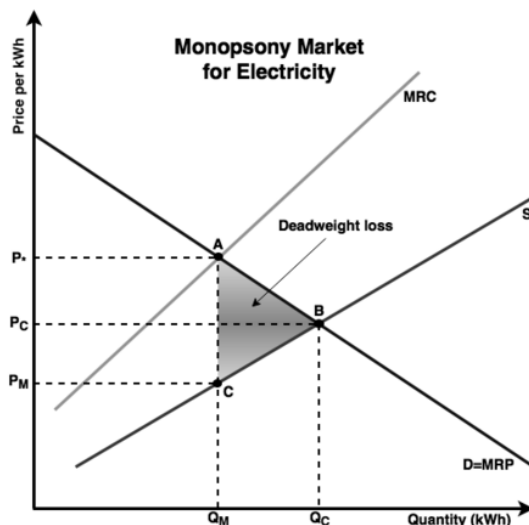


Figure 21 Monopsony Market or Electricity (Lyndon G. & Hanania, 2015)

In the past, the situation in which the monopsony nature of PLN might have harmed the electricity suppliers occurred during the financial crisis in 1997. After the crisis, PLN renegotiated the purchase price of electricity with the existing power producers and set the cap of only 5 cent USD/kWh. This was the case of Wayang Windu field which was just being acquired by Star Energy. Star Energy built the second power plant after settling the price negotiation with PLN. The side note was that even after negotiation, the resulting price was still below the economic return requirement for Star Energy as a private developer. However, at that time building the second plant of 117 MW would result in better revenue than only operating one 100 MW power plant (Yudha, 2017). Although the price adjustment was undertaken during a crisis when the financial capability of PLN was hurt as well, the past event indicated PLN’s power over the price determination as a single buyer in the market.

Regardless of the challenges of this particular mechanism, in Indonesia the monopsony setting for electricity market is intended to control the electricity tariff which will be charged to the final consumers, or the society as a whole. When the price is determined using the market mechanism, it will be difficult to keep the prices low and for the government to guarantee affordable electricity for everyone. Therefore, this market failure requires the intervention from the government to compensate for the potential deadweight loss.

3.2.4 Financing of Geothermal Project

Geothermal projects are characterized with its high upfront costs and risks prior to the commercialization of the resource. The development of a geothermal field consists of several steps, from the early preliminary survey to power plant commissioning stage which would take approximately seven to ten years (Gehring & Loksha, 2012). Obviously, along these years of development, there is no cash inflow from any electricity sale. The long project development cycle, coupled with the high development risks, add more challenges to the financing of geothermal projects. As an illustration, a study by the World Bank indicates that for a 50 MW green field project with drillings around 2 km in depth has cost of USD 2.8–5.5 million per MW installed (Loksha & Gehring, 2012). A large portion of the costs are expended prior to the power plant construction, especially for the drilling costs. From Loksha & Gehring (2012), Figure 22 exhibits the investment cost estimate for each stage of geothermal power development.

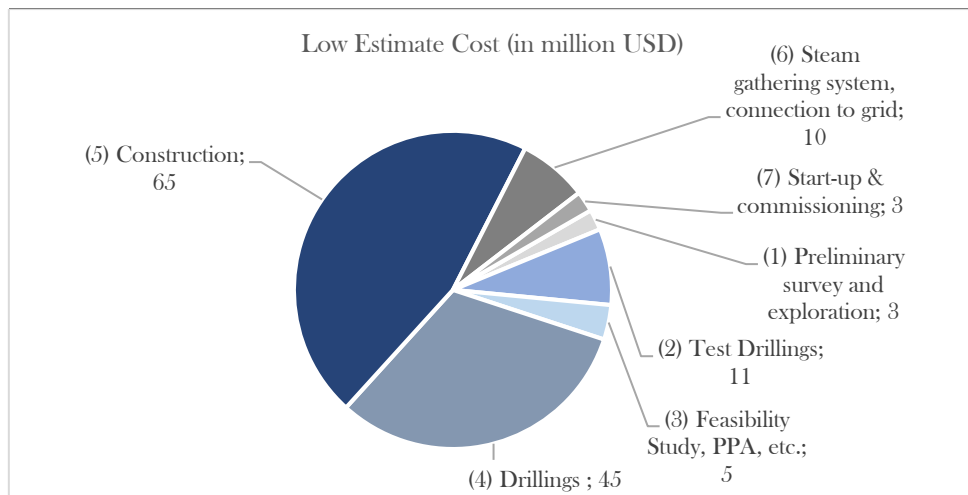


Figure 22 Investment Cost Estimate for 50 MW Power Plant Capacity (Low Estimate)

Geothermal projects are associated with high risks—one of them being the resource or exploration risk. The viability of the resource for further development can only be identified after a series of costly exploration activities ranging from surface exploration and further subsurface drillings and studies. It is difficult to predict the exact depth of the reservoir or the exact steam output from drilled wells. Accurate values can only be obtained after test wells and production wells are drilled. This was the case for the development of Muara Laboh field in West Sumatra. Earlier calculations of the electricity tariff agreed between the developer (SEML) and PLN was based on the estimate of particular reservoir characters and steam output capacity of approximately 2 x 110 MW. However, during the first stage of development, it was found that the reservoir characteristics were different compared to the earlier assessment. As the result, the total capacity of the first stage development was limited to only 80 MW. Consequently, the electricity purchase price had to be adjusted through another negotiation with PLN. To generalize, the level of resource risk which gets lower as the project progresses through the stages of exploration and drilling activities corresponds to the bankability of the project itself, as illustrated in Figure 23.

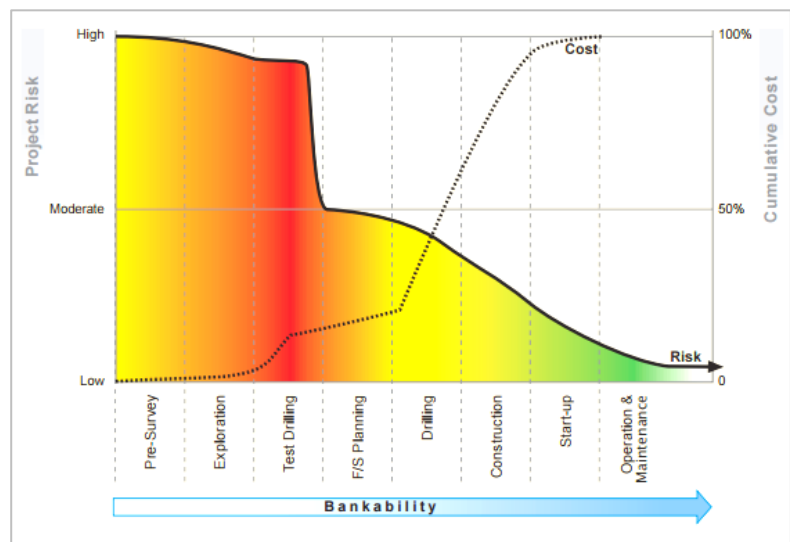


Figure 23 Level of Risks and Bankability of Geothermal Projects (Loksha & Gehringer, 2012)

Bankability is defined as the ability to attract financing from commercial sources. When the risks are too high, banks or other financial institutions can be reluctant to engage in the project. Therefore, obtaining debt financing at the earlier stage of the project becomes really difficult. Consequently, earlier phase of geothermal projects requires a substantial amount of equity financing. As an example, for Muara Laboh project SEML spent almost USD 20 million from its own equity since it obtained the concession license in 2010 until the completion of six exploration wells in 2013. Only after a feasibility study had been undertaken and a more concise field development plan had been obtained that the SEML managed to receive loans from various sources in 2017, including Japan Bank for International Cooperation (JBIC), Asian Development Bank (ADB), Japan International Cooperation Agency (JICA) and some other commercial banks (Supreme Energy, 2017).

The combination of equity and debt financing results in a particular threshold of return indicated by the weighted average cost of capital (WACC). The magnitude of WACC depends on the cost of equity, the interest rate of the debt, and the proportion of equity/debt in the total firm's financing. Equity financing is generally more expensive than debt financing. This is because the cost of equity is usually higher than the common level of interest rate of debt. Moreover, in debt financing, the interest rate paid is tax deductible. According to the CAPM (capital asset pricing model), cost of equity can be approximated based on (1) the level of risk-free rate, (2) the risk level of the individual project volatility relative to the wider

market and (3) risk premium (market rate of return minus risk-free rate). Therefore, the higher the perceived risk of a project, the higher the return required by the investors.

WACC is one of the determinants of profitability of the project. Therefore, it is important that the developer can obtain an efficient financing scheme across the project cycle. This was demonstrated in the case of Ulubelu and Lahendong field development which was partially financed using the loans from the World Bank. Before getting into the agreement with the World Bank, the project was faced with several challenges: (1) there was a financial gap viability given the likely tariff to be offered by PLN at USD 6.4 cents/kWh, (2) with full equity financing and a particular required equity rate of return by PGE, the project NPV would have been a negative USD 269 million (Jayawerdana, et al., 2014). To tackle this challenge, the government got involved by convincing PGE to accept a lower equity rate of return of only 14% (lower than most investment undertaken by its parent company, Pertamina). Moreover, the government assisted the negotiation process between PLN and PGE which resulted in a final tariff of USD 7.53 cents/kWh. With the new arrangement, full equity financing still resulted in a highly uninteresting NPV of negative USD 126.2 million. The situation required PGE to obtain financial assistance through the means of concessional loans⁷ from the World Bank. The very low interest rate, compared to the equity rate of return, from two of the World Bank groups, International Bank for Reconstruction and Development (IBRD) and Clean Technology Fund (CTF) were able to ease the financing burden for PGE. As the result, with a total of USD 300 million concessional loan package, the NPV for the combined project of Lahendong and Ulubelu became USD 51.4 million (Jayawerdana, et al., 2014). From this illustration, it becomes apparent how different financing schemes can result in different returns for the project.

The availability of loans becomes very crucial for the development of geothermal sector. The loans can ease the financial burden faced by the developers and, more importantly, accelerate the development of geothermal power in Indonesia. According to a report by ADB, the availability of concessional finance has motivated developers to complete more challenging exploration programs and reach financial close. The concessional loan is particularly needed to offset the high costs associated with the early-mover risks faced by the private sector (Yoi, et al., 2016). The Muara Laboh project was partially financed using a concessional loan from CTF. However, it is worth noting that the project was also financed using the loans obtained from some commercial banks, such as Mizuho Bank and Bank of Tokyo-Mitsubishi UFC. (Supreme Energy, 2017). The project was the first project to move beyond the exploration activities since the issuance of Geothermal Law in 2003. More projects can be expected to follow, assuming there is sufficient financial support and increased maturity of the players within this sector. In the future, the reliance on concessional loans can be gradually decreased as the industry moves toward a more solid financial viability.

In Indonesia, there is already a considerable level of support and interest from the (potential) investors to participate in the industry. From the financial perspective, many international entities have been involved in the form of share ownership or loan financing. This has helped elevate the financial capability of the local players to achieve the expected progress for the sector. For instance, SEMML, the license holder of Muara Laboh Work Area, is a private entity sponsored by three companies: Sumitomo Corporation (35% of share) from Japan, Engie (35%) from France, and PT Supreme Energy (30%) from Indonesia. With its strength in equity financing in the beginning of the project cycle, SEMML has been able to manage the early resource development risks. As for the loan financing, the presence of international development finance institutions, such as ADB, the World Bank, and JICA has provided a significant contribution for this matter. They provide various financial products for both public and private sectors which have been widely utilized in many Indonesian geothermal projects. Moreover, these institutions have also been providing technical assistance and numerous studies to improve the sector, including its institutional and regulatory framework.

Some financial support has also been given through grants. Only recently, CTF has agreed to channel USD 49 million to support infrastructure development and exploration drillings in the country. At the same time, Global Environment Facility (GEF) is also providing USD 6.25 million to support the technical assistance program in order to improve the capacity in geothermal exploration. In the past, this kind of support was reasonably common and had contributed significantly in the development of geothermal resource in Indonesia, including throughout the early exploration activities since the 1970s.

⁷ Concessional loans, also known soft financing or concessional funding, are loans issued by Development Finance Institutions (DFI) and non-governmental finance organizations. Compared to the loans issued by the commercial banks, concessional loans offer conditions which ease the financial burden of the borrower by applying, e.g. longer maturities, longer grace periods, lower collateral requirements, lower interest rate (usually for sovereign lending), etc.

3.2.5 The Influence of Physical and Material Attributes to Investment Decisions in the Operational Action Situation

This section will attempt to capture the influence of the physical and material characteristics of geothermal energy development toward the investment in the sector. In doing so, it becomes more apparent how these contextual factors affect the situation in the action arena. At the operational level of analysis, the dynamics within an action situation is influenced by the condition of one particular resource. In the case of geothermal development, one resource can be represented by a single Work Area where one geothermal system exists. Obviously, every Work Area possesses certain characteristics which require a unique set of technology, supply chain, and other means to handle all kinds of circumstantial affairs. In regards with investment, information on the resource and other relevant aspects attributed to it becomes very important.

From the point of view of the developer, the information will be used to estimate the required investment. Better quality of information can help increase the accuracy of this estimation, e.g. when sufficient test drillings have been conducted. Otherwise, when there is a considerably high development risk, the developer will anticipate any possible failure by increasing the future expense estimation. Moreover, with only a single buyer for its electricity/steam, the developer will assess whether or not the buyer will be able to purchase its product at a rate that will be sufficient to cover its investment later, given its cost of capital (depending on its debt and/or equity arrangement).

The resource risks inherent to the physical and material conditions of the geothermal development have clear and direct impact over the investment of the financier/lender. The complexity of geothermal projects require the lenders to be familiar with the nature of the investment. For these lenders, there needs to be assurance that the resource development would be able to reach the target capacity and sustain production over the project's life cycle (Rakhmadi & Sutiyono, 2015). For this purpose, the lenders might need to conduct due diligence and procure technical assistance to estimate the feasibility of this resource. To conclude, to a different degree and depending on the time of its involvement during the project with the developer, the lenders are exposed to the development risks as well.

For the central government, its investment is intended to facilitate the developer to undertake the projects. Given the particular physical and material conditions, the government will assess whether or not the resource to be offered to the developers are attractive enough. Certainly, these factors are not the only determinants to attract private capitals. Nevertheless, experiences in the past have shown that challenges inherent to the physical and material conditions, such as geological state, logistical-, environmental-, forestry-, and financing issues have a significant impact toward the feasibility of geothermal investment in Indonesia. As the owner of the resource, the government has the authority to decide which physical/material conditions to be attended to as the attempt to facilitate the development as such.

From the point of view of the buyer (PLN), the physical and material conditions may not have as much impact toward its investment decision, compared to the developer or the owner of the resource. Nevertheless, eventually the costs incurred by the developer will be translated into the electricity purchase price to be charged to the buyer. Moreover, as the integral part of the electricity system, PLN will need to develop a transmission interconnection. In this case, the physical and material conditions associated with the location of the resource will have a direct impact toward PLN's investment decision.

The physical and material characteristics of geothermal development have different impacts toward the investment decisions for different participants in the action arena. Nevertheless, simply identifying these factors is not sufficient to understand nor analyze the actions and decisions made by participants inside the action arena. To get the complete picture, as part of the institutional analysis itself, the rules-in-use within this arena need to be recognized as well. Chapter 3.3 analyzes the rules-in-use for action arena at the operational level of analysis.

3.3 Identification of the Rules-in-Use

As mentioned before, the interactions between participants are directly governed by the rules prevailing regulations. Therefore, it is important that the current regulatory framework is briefly explained in order to give an overview of the rules governing the geothermal sector itself. Furthermore, the rules which are specific to the action situation will be identified and classified according to Ostrom's horizontal division of rules (Ostrom, 2005).

3.3.1 Current Regulatory Framework

The current regulatory framework consists of the formal national laws and regulations which have a direct and indirect impact to the development of the sector. Therefore, this sub chapter is presented in three parts. The first part identifies regulations which have been specifically issued for geothermal sectors. These rules are strictly relevant for the analysis of action situation at the operational level. The second part identifies regulations which are not exclusively intended to govern the geothermal sector, but have a significant impact toward the sector. Specifically, these regulations govern the distribution of geothermal resource from the producer to the electricity company. Finally, the last part identifies other relevant laws and regulations which have indirect impact to the sector's development. It includes regulations and policies concerning the energy and electricity sector.

3.3.1.1 Geothermal-Specific Regulations

Geothermal sector is governed according to the latest geothermal law, **Law No. 21/2014**, which replaces the preceding Law No. 27/2003. In general, the law describes the authority of the government (central, provincial and municipal) over the resource. This includes the determination of geothermal Work Areas, the issuance of license/permit, the conduct of geothermal activities (preliminary survey, exploration, exploitation and utilization), the indication of entities that can participate in the sector, the responsibilities of the license holders, the time period to conduct geothermal activities under the license, and other provisions related to environmental and forestry issues.

The new law expands the authority of the central government (MEMR). Previously, both types of utilization (direct and indirect) are managed and government by the local government, depending on the location of the geothermal system. The arrangement was made in accordance with the decentralization efforts made across the country in the beginning of 2000s. According to Law No. 27/2003, the central government was only authorized to issue geothermal development permit toward cross-provincial geothermal work areas. This procedure is changed in the new law whereas now the central government has the authority over all activities related to indirect utilization of geothermal resource. This includes the centralization of the tender process for geothermal indirect utilization projects.

The law stipulates that the more detailed regulations regarding specific activity in the sector, such as the conduct of the tender process, determination of geothermal Work Area are to be provided in the supporting government regulations. Until recently there are already several supporting/implementing regulations issued by the government. Since the focus of the thesis is the utilization of geothermal resource for power generation, the most relevant supporting regulation is **Government Regulation (PP) No. 7/2017 regarding the indirect utilization** of geothermal energy, replacing PP No. 59/2007. In general, this regulation provides the details on each stage of geothermal development arrangement in Indonesia (preliminary survey, exploration, determination of Work Area, tender process, direct assignment, exploitation, utilization, and so on). It also specifies, among others, on the different procedures for the license (IPB)⁸ to be issued to business entities. Furthermore, this PP is complemented with several ministerial regulations, including (1) MEMR Regulation No. 36/2017 regarding the procedure of preliminary survey assignment and preliminary survey and exploration assignment, (2) MEMR Regulation No. 37/2017 regarding the Work Area for indirect utilization. The details of these regulations will be used as the basis to identify the rules-in-use of the action situation at the operational level of analysis, especially for the interactions between the central government and the developers during the process of the transfer of the IPB.

3.3.1.2 Regulations Concerning the Distribution of Geothermal Resource

The regulatory framework for geothermal development (indirect utilization of the resource) cannot be separated with the rules governing the electricity sector. Therefore, some rules concerning the arrangement of electricity sector, especially those which influence the exchange between the IPB holder and PLN will be identified as well. There are two recent MEMR regulations which directly affect the course utilization of geothermal resource for electricity generation: (1) MEMR Regulation No. 10/2017 and (2) MEMR Regulation No. 12/2017.

⁸ Geothermal license or *Izin Panas Bumi* is commonly abbreviated as IPB.

MEMR Regulation No. 10/2017 specifically administers the power purchase agreements between PLN and other private power producers. The issuance of this regulation denotes the first attempt by the government to legislate the commercial and legal aspects of the PPA between the two parties. Before this regulation, the terms under the PPAs were largely left to the discretion of PLN which had standardized some forms of PPA which are to be further negotiated with the developers. Among other things, the regulation governs the risk allocation between PLN and the power producer as can be seen in Table 6.

Table 6 Risk Allocation in PPA (MEMR Regulation No. 10/2017)

Types of Risks	PLN	Power Producer
Political risks	Yes	Yes
Electricity demand	Yes	No
Transmission capability	Yes	No
Force majeure	Yes	Yes
Land acquisition	No	Yes
Permits	No	Yes
Fuel availability	No	Yes
Development punctuality	No	Yes
Power plant performance	No	Yes

Despite the government’s attempt to regulate the PPA mechanisms, the regulations still leave some room for interpretation by PLN. For instance, it is not clear yet how future PPA will accommodate the principle to share the risks under force majeure situations and under changes in the laws and regulations (political risks). Therefore, aspects which are not yet governed the current regulation are subject for negotiations between PLN and the power producer. Some other regulated subjects include (1) the maximum PPA period of 30 years since the COD, (2) the basis of build-own-operate-transfer scheme for all the projects, (3) provisions regarding price adjustment due to technical and cost factors, (4) rights and obligations of both parties under the agreement.

The next regulation, **MEMR Regulation No. 12/2017** governs the purchase of electricity from renewable resources. With this regulation, PLN is obligated to purchase electricity from renewable energy producers. Specifically for geothermal projects, PPA negotiation can only be conducted between PLN and geothermal developers which have proven the existence of geothermal resource in their Work Areas following the completion of the exploration activities, including exploration drillings. The new regulation pushes the developers to perform exploration drillings and properly estimate the capacity of the resource before conducting PPA negotiation with PLN. Moreover, this regulation becomes the latest valid reference to determine the tariff for the purchase of renewable energy by PLN. In brief, the new tariff arrangement reduces the level of the tariff ceiling to equal PLN’s cost of supply for generation activities.

3.3.1.3 Other Relevant Regulations and the Policies

The development of geothermal energy involves various stakeholders which are embedded within a larger environment constrained by different rules. Therefore, the regulatory environment has a profound effect on this sector as well. The identification of these regulations is important to give more clarity toward the current situation surrounding geothermal development in the country.

Regulations and Policies in the Energy Sector

The development of the energy sector in Indonesia is based on **Law No. 30/2007 on Energy**. This law emphasizes the importance of national energy independence, security of energy supply, good governance in energy management, efficient utilization of energy across all sectors, and increasing access to energy for lower-income communities or those located in remote areas. Specifically, the law becomes the basis of National Energy Council formation and its obligation to issue National Energy Policy that, among others, specifies energy development priorities. Of particular relevance to geothermal sector, the law stipulates that the supply of energy from renewable resources are eligible to obtain more facilities from the government in order to obtain its economic value. It also states that the utilization of renewable energy must be increased by the central and the local governments.

The National Energy Policy was ratified through the issuance of PP No. 79/2014. The regulation puts forward the state’s National Energy Policy that will become the guideline for the country’s energy development for 2014–2050. Among other attainments, the policy directs the country to the following objectives:

- achieving the new paradigm to utilize energy resources as national development assets
- achieving universal electrification rate (close to 100%) by 2020
- achieving an optimal primary energy mix:
 - a minimum of 23% renewable energy in 2025 and 31% in 2050 as long as the economic value is achieved
 - a maximum of 25% oil in 2025 and 20% in 2050
 - a minimum of 30% coal in 2025 and 25% in 2050
 - a minimum of 22% natural gas in 2025 and 24% in 2050

As mentioned in Law No. 30/2007, the National Energy Policy sets the country's energy utilization priorities. The principles of this prioritization requires maximization of renewable energy use by taking into account its economic value, minimizing the use of oil, optimizing the use of natural gas and new energy sources (e.g. liquefied coal and hydrogen), optimizing the use of coal for national consumption.

The policy also regulates the determination of energy price and subsidy. For renewable energy, the price is set according to the following rules.

- The calculation must be based on the requirement to compete with the price of oil source by excluding the subsidy for oil fuel.
- The calculation must be rational in regards with energy provision using renewable resources in order to supply energy to remote areas with underdeveloped infrastructures, high susceptibility to weather disturbances and proximity to the national border.

If the resulting price is higher than that of using oil fuel, a subsidy will be provided. This subsidy must be well targeted to the less fortunate part of the society. It is also mentioned that the subsidy for oil fuel and electricity will be reduced gradually until the purchasing power of the people is improved.

To conclude, Indonesia has recognized the importance of renewable energy implementation in the country. The problems associated with renewable energy development have identified and there is already an intention by the government to give more support for this sector. Furthermore, the implementation of such policies is yet to be known and discussed in the next chapter.

Regulations Concerning State-Owned Enterprises

Second, geothermal energy development in Indonesia involves several state-owned enterprises, such as PLN, Pertamina, and other companies which have different roles in the sector. However, as the representatives of the government in the business sector, these companies are regulated according to a specific law, **Law No. 19/2003 on State Enterprises**. The law encompasses provisions regarding the establishment, performance management and corporate governance of state-owned enterprises (SOE). SOE is a business entity that is wholly or largely owned by the state through direct investments using the state assets. The important note about this law that is strictly relevant to the development of geothermal sector comes in several points. First, SOE has the mandate of public service. It means that the government can assign an SOE to perform specific functions for public benefits, considering the purpose of the SOE itself. If an SOE is formed as a liability company, then it has the purpose of (1) providing high quality and competitive goods/services and (2) pursuing profits in order to increase the value of the company. Special assignments entails more support from the government, including through subsidy.

Second, the government has the mechanism of State Investment (*Penanaman Modal Negara* or PMN) to channel its assets in order to provide more capital for the SOEs. The capitals can come from the State Budget, capitalization of reserves and other sources. PMN is further regulated in PP No. 44/2005 (revised with PP No. 72/2016). It is intended to fix the capital structure of SOE and to increase its capacity as a service provider. In the context geothermal development, additional PMN for a specific SOE, such as PLN, can be made at the initiative of the MoF, MEMR, and MSOE.

Regulations in the Electricity Sector

The electricity sector is fundamentally governed according to **Law No. 30/2009**. The law defines the principles and guidelines for power development sector, including licensing authorities, electricity price, and tariff setting. In the context of geothermal energy development, the law addresses the downstream part of the geothermal development in which electricity provision is regulated. The law emphasizes the utilization of primary energy sources, especially from new and renewable energy, for national electricity.

This law is complemented with a government regulation, PP No. 14/2012. Among other things, this PP stipulates that public electricity supply has to be conducted based on the General Plan of Electricity (RUKN) and the Electricity Provision Plan (RUPTL) as approved by the licensing authority. Since PLN plays a tremendous role in the Indonesian electricity sector, it

is important that PLN's RUPTL is briefly reviewed too. PLN has issued the RUPTL for 2017-2026 recently. RUPTL is proposed by PLN according to the existing national energy and electricity policies issued by the government. This plan reflects PLN's policies in conducting its future activities on a national scale and in detailed manner across all the regions in Indonesia. According to the document, PLN aims for power generation capacity development that is conducted optimally by using the least-cost principal. It is obtained by minimizing the net present value of electricity supply costs which consist of investment-, fuel- and operation and maintenance costs. On the other hand, RUPTL acknowledges the government's effort to increase renewable energy use. The ambition is to have 25% of renewables in the energy mix. To achieve that, PLN understands that the least-cost criteria should not entirely apply to power generation using renewable resources. However, it is also stated that the development should take into account the balance between supply and demand and the readiness of the renewable energy development itself.

PLN has some policies in regards with climate change mitigation. One of them is to prioritize the development of renewable energy. However, it also puts forward the fact that such commitments will consequently increase its investment cost. Therefore, the utilization of renewables should also take into account the state of the local electricity system and the plan for other electricity generations. RUPTL also has stated its contingency plan that is to use gas if the target of 25% energy mix from renewables cannot be attained in 2025.

3.3.2 Rules of Action Situation at the Operational Level of Analysis

The predesigned action situation consists of a series of exchanges between participants in the system. The final objective is to build a geothermal power plant. It can be achieved, at the minimum, when all of the exchanges shown in the initial construct of the action situation have taken place. In order to see how the interactions and the outcomes will materialize, the rules-in-use within the arena need to be specified. This section elaborates on this subject using the classification of rules as proposed by Ostrom (2005). These rules directly affect the seven components of an action situation as depicted in Figure 9. During the explanation of the rules, references to the prevailing regulations will be made to show the connection between the rules-in-use in the arena and the actual regulatory framework.

3.3.2.1 Position and Boundary Rules

The first type of rule is the position rule. This rule specifically defines the roles that the participants assume in an action situation. The positions in this arena correspond to the activities included the analysis. Based on the initial construct of the action situation, it has been made clear that there are four positions in the arena: (1) owner of the resource, (2) developer/seller, (3) buyer, and (4) financier. Since the positions have been settled, the boundary rules will be used to define how different players can assume or leave a certain position in an action situation. Each position in the arena is bound by different boundary rules.

Table 7 Positions and Boundary Rules

Position	Boundary Rules
Owner	According to Law No. 21/2014 (Article 6), the indirect utilization of geothermal resource is within the authority of the central government. It includes the authority to manage all affairs within the sector and to issue the geothermal license (IPB) for the developer. Furthermore, the law specifies that the authority is to be implemented and/or coordinated by the Energy Minister. Therefore, this position is fundamentally can only be assumed by the Energy Minister. The day-to-day operation is managed by EBTKKE part of the Ministry of Energy and Mineral Resources (MEMR)
Developer/ Seller	<u>Developer</u> The Developer is any business entity which has obtained the IPB from the central government (Law No. 21/2014, Article 23). There are several ways for the business entity to assume the position of the Developer. In brief, the business entities will have to undergo a selection mechanism, e.g. a tender process. However, for state-owned companies, there is another mechanism that allows the Owner to directly assign a state-owned entity to undertake the development using the IPB as well. Therefore, the boundary rules also include the rules governing the selection and direct assignment process. The details of such rules will be explained further to understand the costs for the business entity to enter this action arena. Under this position, the business entity is exposed to the development and resource risks.

	<p><u>Seller</u></p> <p>The same business entity assuming the Developer position will also take the Seller position. In this case, the position is opened when the process of PPA settlement/negotiation is to be conducted. The business entity can only become a Seller after developing a power supply proposal to be reviewed by the Buyer. In this case, the proposal has to be based on an exploration result that is sufficient to accurately estimate the resource capacity and location (MEMR Regulation No. 12/2017). It means that an investment to cover the exploration costs will be required prior to conducting the PPA settlement. As a Seller, the business entity is exposed to a non-payment/off-taker risk that is the risk of not being paid for as agreed in the PPA.</p>
Buyer	<p>The Buyer is obviously an electricity company that will buy electricity/steam from the Developer. In this case, PLN will assume the position, according to the mandate given to it by the Energy Minister, as stipulated in MEMR Regulation No. 12/2017. Note that the mandate does not give an exclusive right for PLN to assume the position. The development risk for the Buyer is low since, as seen in Table 6 Risk Allocation in PPA (MEMR Regulation No. 10/2017), the development punctuality and power plant performance risks are allocated to the Developer/Seller.</p>
Financier	<p>This position can be taken by any financing agencies with the interests and resources to participate in the sector. During the development phase, the entity assuming this position is faced with development/resource risk and financing risk.</p>

3.3.2.2 Authority Rules

The authority rules directly define and explain the actions taken by participants in different positions and the interactions between them. The authorities which will be elaborated in this section must be within the scope of this action situation.

Table 8 Authority Rules

Position	Authority Rules
Owner	<ul style="list-style-type: none"> • The Owner has the authority to conduct the exploration, exploitation, and/or utilization by itself or to delegate other business entities to conduct the development instead. • To delegate, the Owner may decide on the scheme to select the Developer (restricted tender, open tender, and direct assignment) for the development of geothermal resource in a particular location. • In a tender process, the Owner has the authority to assess and to select the best participant (business entity) according to its own tender requirements. In a direct assignment, it has the authority to approve/reject the proposal from the state-owned company to conduct development in certain locations. • The Owner has the authority to monitor the fulfilment of the Developer's obligations, e.g. concerning the exploration commitment from the tender process or the payment for the data and information of the Work Area, the monitoring of the development according to the time and budget plan, etc. • The Owner has the authority to give sanctions (notification letter, temporary termination of the development, revocation of license) for the Developer's failure to deliver its obligations. • The Owner has the authority to give a mandate to PLN (through an assignment letter) to assume the position of the Buyer.

Developer/ Seller	<ul style="list-style-type: none"> • Under the geothermal license (IPB), the Developer has the authority to conduct exploration, exploitation, and utilization of the resource within time period as specified in the IPB. The total maximum period is 37 years which consist the exploration and feasibility which are to be completed within five years (extendable for 2 x 1 year) and exploitation within 30 years under the Build-Own-Operate-Transfer (BOOT) scheme. • The Developer may sell the resource directly for public or private uses. For public uses, the steam/electricity may be sold to PLN. • In regards with the PPA settlement, the Developer/Seller has the authority to negotiate the electricity purchase price to be paid by the Buyer and other terms concerning its rights and obligations within the transaction. • The Developer/Seller has the authority to choose its own financing scheme.
Buyer	<ul style="list-style-type: none"> • The Buyer has the authority to conduct due diligence toward the Seller to ensure the credibility of the Seller and assess the feasibility of the power supply proposal. • The Buyer has the authority to negotiate the terms within the PPA, including the electricity purchase price.
Financier	<ul style="list-style-type: none"> • The Financier has the authority to conduct due diligence toward the Developer. • The Financier has the authority to decide on the level of return expected for the money invested in the development.

3.3.2.3 Aggregation Rules

The aggregation rule determines how decisions are made in an action situation (Polski & Ostrom, 1999). It shows the level of control that the participants in the positions have over their actions. As mentioned before, the action situation consists of several exchanges between the participants. The costs and benefits entailed by these exchanges are contained within the agreements between the parties which include (1) the geothermal license or the IPB between the Owner and the Developer, (2) the PPA between the Developer/Seller and the Buyer, and (3) the financing agreement. Therefore, the identification of the aggregation rules should focus on how eventually these agreements can be obtained.

The IPB Issuance

To put it simply, the IPB can be issued when the Energy Minister has given its approval for the business entity, as proposed by the EBTKE after a tender process or a direct assignment. Nevertheless, the current regulatory framework governs the level of control that the Owner has in selecting the Developer. This is to guarantee the integrity and the fairness of the selection process. Eventually, it is expected that the best and the most efficient developer will be selected.

The different IPB issuance schemes that can be chosen by the government should be elaborated first. In doing so, it can be seen how the crucial decisions, like selecting the tender winner, are made.

(1) Open tender

An open tender is conducted when the determination of the Work Area is preceded with a preliminary survey or preliminary survey and exploration that is conducted by either the government (using state budget or local government budget), universities, research agency, or other assigned public agencies. There are also existing Work Areas which have already been surveyed through preliminary survey assignment (PSA) conducted by business entities (private/SOE) according to the older regulation (PP No. 59/2007). The new regulation (PP No. 7/2017), however, stipulates that the PSA will only be given to universities and research agencies. For this kind of Work Area, the tender is opened publicly.

Referring to the regulatory framework, a distinction can be made between (1) an open tender preceded by only a preliminary survey and (2) the one preceded by both preliminary survey and exploration by the government (or conducted by an assigned state-owned entity using the state budget). The difference will affect the payoff structure of the action situation. Nevertheless, the tender mechanism is the same.

In an open tender, there are two stages of evaluation. The first stage consists of administrative, technical, and financial evaluation to assess the qualification of the bidder to continue to the second stage. Bidders who pass the first stage will continue to the second stage. At this stage, the first evaluation will be conducted toward the development proposal for

the Work Area. The proposal must consist of (a) an assessment based on the existing geothermal data and information to estimate the feasibility of the project, (b) exploration and exploitation strategy with the budget plan and (c) the expected commercial operation date. The tender committee will score the proposal and only bidders which pass the minimum passing grade will continue in the tender process.

Finally, following the first evaluation of the second stage and after undergoing the protest period (if there is any protest), the second evaluation will be conducted toward the exploration commitment submitted by the bidders. This evaluation is the final determinant to select the tender winner. The exploration commitment is the amount of money with a specific minimum requirement that the bidders agree to submit through an escrow account in a state-owned/local bank later, supposed that it is appointed as the winner⁹. The minimum amount for a 10 MW capacity development (or more) is USD 10 million and USD 5 million for development of less than 10 MW. The rank of the bidders is determined based on the level of the exploration commitment. The winning bidder which will proceed to the IPB issuance is the one which places the highest commitment exploration. Within four months, all of the exploration commitment must be submitted in the escrow account.

(2) Tender with first priority (restricted tender)

Tender with the first priority is undertaken when the determination of the Work Area is preceded with a preliminary survey and exploration assignment (PSEA) that is conducted by a business entity (private/public)—called the PSEA assignee. The tender is restricted only for the PSEA assignee and some selected state-owned companies. Nevertheless, a priority will be given to the PSEA assignee during the tender process considering the investments which should have been made for the exploration activities, prior to the tender process.

There are two stages in this tender. The first one only consists of an administrative assessment and the second is the evaluation of the development proposal. After the first stage, the remaining bidders are ranked. The first rank position is given to the PSEA assignee. Based on the rank order, the evaluation of the development proposal will be conducted. If the proposal of the bidder in the first rank qualifies all the requirements, it will become the winning bidder. Otherwise, the proposal of the bidder in the next rank will be evaluated and so on. If in the end, the process cannot result in any winner, the restricted tender will be cancelled and restarted using the mechanisms of an open tender.

Fundamentally, the company which has conducted the PSEA will have a substantial chance to win the tender and obtain the IPB. Therefore, another important decision to make in this scheme is during the selection of the PSEA assignee itself. Once an area has been officially announced to be opened for preliminary survey and exploration, business entities can submit an application to obtain the permit to undertake the assignment. In case there is only one interested business entity, the only applicant will go through an assessment process for its technical, administrative, and financial capabilities. If there is more than one applicants, the Owner will form a selection committee which will determine the minimum assessment score for the technical and financial aspects for all the applicants. The final score will be used to decide on the winning applicant that will be granted the permit to conduct PSEA.

(3) Direct assignment

Direct assignment is conducted by the government to allow state-owned companies to develop (exploration, exploitation, and/or utilization) a certain Work Area without participating in a tender process. An individual assessment to measure the company's capability to develop the Work Area will be conducted. Therefore, the decision to issue the geothermal license using this scheme is left to the discretion of the Owner.

In early 2017, for instance, PLN asked for the assignment to develop 14 Work Areas with the total potential of more than 1000 MW. According to PLN's Director of Corporate Planning, Nicke Widyawaty, when given the authority to develop the Work Areas, PLN will be able to cut out the exchange between the Developer and the Buyer, that is considered to only add costs into the value chain (Ardhian, 2017). Until today, PLN has been given the assignment by the Energy Minister to develop Atedai in NTT, Songa Wayaua in North Maluku, Ciater and Tangkuban Perahu in West Java (Jawa Pos, 2017).

⁹ Referring to MEMR Regulation No. 44/2016, this exploration commitment should correspond to the exploration development plan because later during the exploration project, the disbursement of this commitment money can only be done in several stages. The stages include (a) survey activities, permit arrangement, and land acquisition which correspond to 10% of the exploration commitment (b) construction of well pad (20%), and (c) exploration drillings that can be divided into two or three parts depending on the development design.

To summarize, the following figure depicts the differences between the different schemes of geothermal license issuance that can be participated by the business entities.

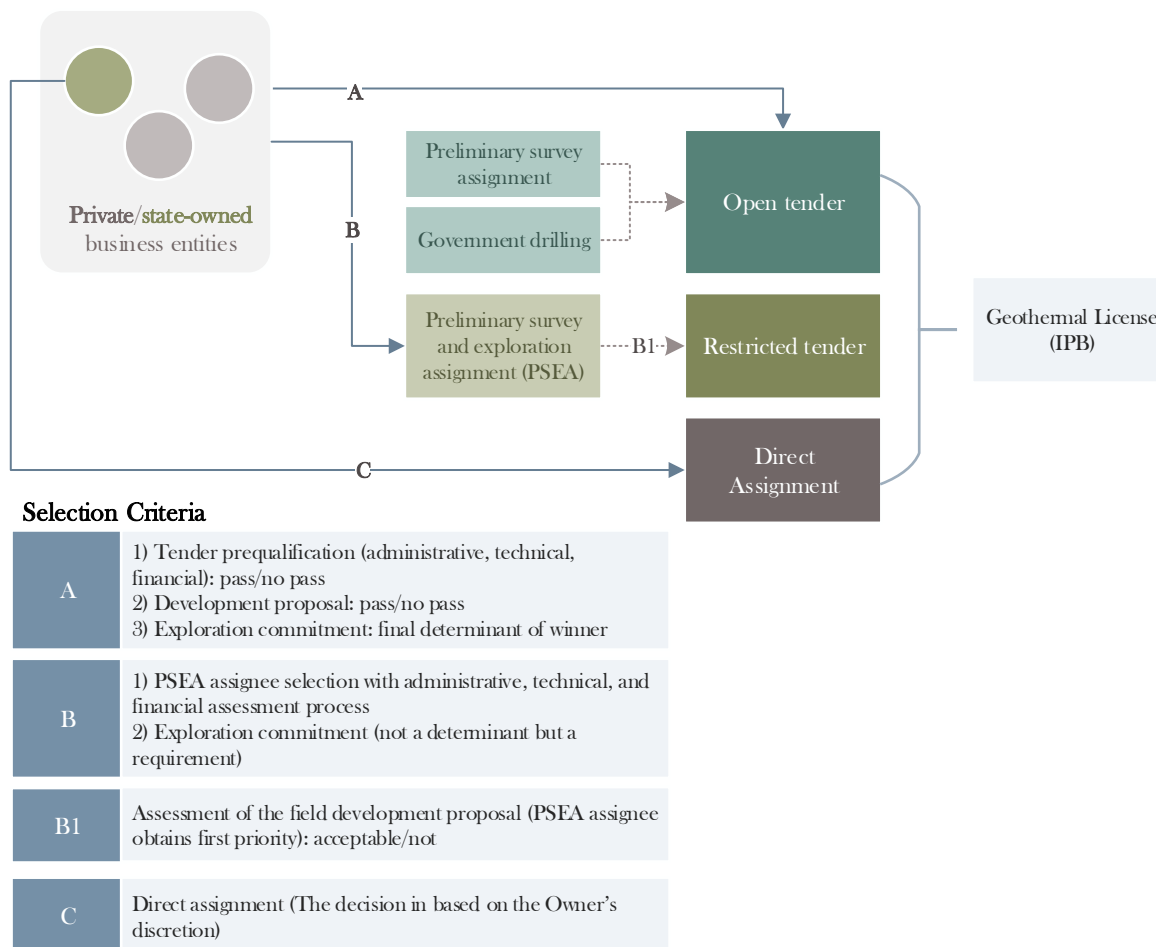


Figure 24 Geothermal License Issuance Schemes

The PPA Settlement

The PPA can be obtained if both parties can agree on all the terms within the agreement. The aggregation rule of this process constrains the negotiation process between the Seller and the Buyer (PLN) to decide on the electricity purchase price. Fundamentally, the tariff is governed according to MEMR Regulation No. 12/2017 in which the tariff is determined by making reference to a specific ceiling value. In the current regulation, the ceiling value is equal to PLN's generation cost of supply (generation BPP). The generation BPP is determined according to PLN's own calculation. With this arrangement, the tariff ceiling might differ in different areas depending on the cost of supply required by PLN for the region/province. Figure 25 PLN's Generation BPP in 2017 shows PLN's generation BPP in 2017.

The regulation stipulates that the actual tariff at regions with Generation BPP above the national average (currently at USD 7.5 cent/kWh) must not exceed the Generation BPP at that specific region. Meanwhile, for regions with generation BPP below or equal to the national average, the tariff can be determined according to negotiation result between the Buyer and the Seller. However, the regulation does not specifically govern the highest limit for the negotiated price. Therefore, despite the fact that the exchange between PLN and the Developer/Seller is initiated through the mandate by the government to PLN (to purchase electricity from renewable energy producers), the regulation leaves the decision-making process during the PPA settlement to be conducted according to a B2B mechanism.

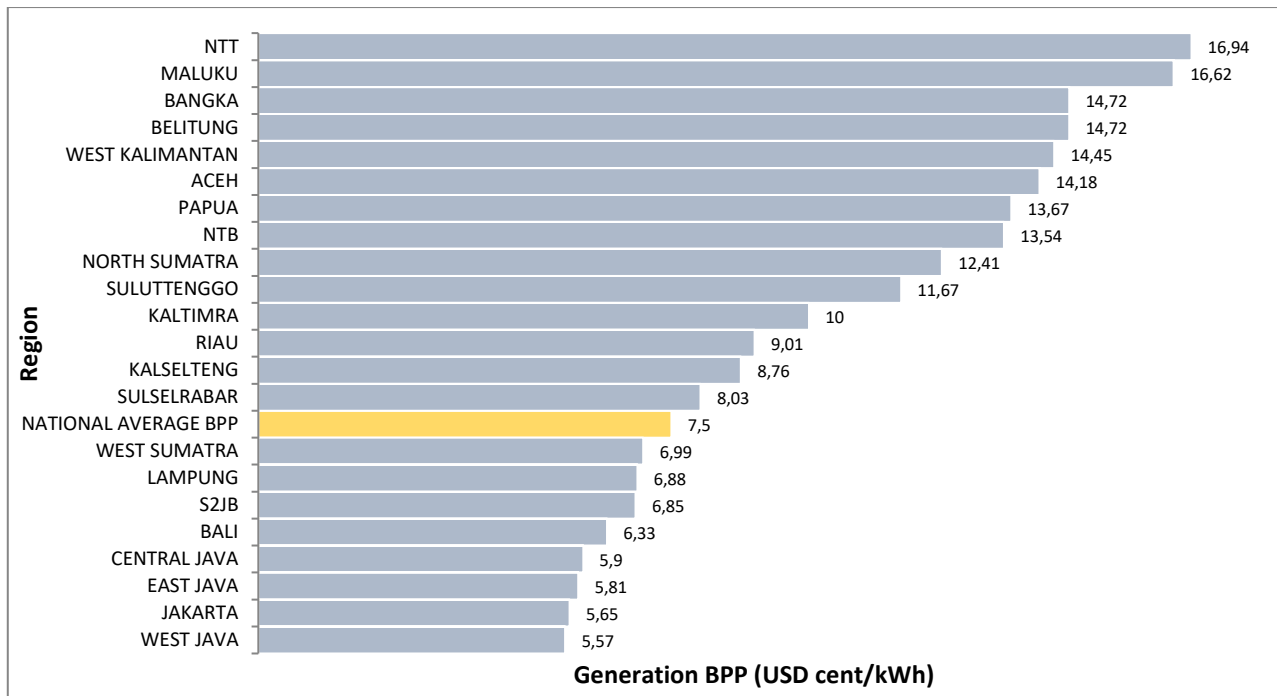


Figure 25 PLN's Generation BPP in 2017

The Financing Agreement

The regulatory framework considered in this research does not govern how decision are made within this particular interaction. Therefore, the financing agreement will take place when both parties have agreed on all the terms and all the required assessments have been conducted and approved by the Financier.

3.3.2.4 Information Rules

The action situation at the operational level of analysis comprises of exchanges between participants in the arena. For the cooperation to take place, the information asymmetry must be avoided as well as possible. First, between the government and the potential developers, all data and information on the resource must be made available. Only with this information that the business entities can decide whether to invest or not.

According to Law No. 21/2014 (article 57), all data and information obtained from any kind of geothermal development activities belong to the central government and that the use of this data or information is controlled by the government. Therefore, legitimately, this information will only be available for business entities or other interested parties when the government opens the information, e.g. in a tender process. However, based on the interview results with the representatives of the EBTKE and the Indonesia Geothermal Association (INAGA), some information regarding the potential of a specific location may already be known among the players in the sector before the information is disclosed during the tender process. For instance, according to Poernomo (2017), the reason why there was not much interest following the opening of several tenders by EBTKE in 2016 was because the companies already had the information that the offered Work Areas were not attractive enough for commercial development. This indicates that, despite the formal regulation which limits the ownership and the use of geothermal data and information to the government, informally, such information is available outside the government and affects the decisions made by the potential developers.

Second, between the Developer and the Buyer, each party needs to be assured that the other party has the capability to fulfill its obligations. The rules, including MEMR Regulation No. 10/2017, allow the Buyer to conduct due diligence in order to assess the financial and technical capability of the Developer. During the PPA settlement process, PLN as the buyer might have less information regarding the physical and technical conditions in the field which affect the level of electricity price required by the Developer in order to obtain a particular level of return. To reduce the information asymmetry, the B2B process, as indicated in the regulations, between PLN and the Developers allows for further technical assessments in order to level the information distribution.

Third, between the Developer and the Financier, the most crucial information is the viability of the business/project. The environmental and social feasibility of the project is important as well. All the requirements need to be fulfilled and reported

by the Developer in order to assure the Financier to make the investment. The Financier can conduct a due diligence to assess all the crucial aspects of the project (technical, economic, social, financial factors). In this case, information solicitation depends on the requirements made by the Financier itself.

In geothermal projects, the quality of the information increases as more studies, surveys, drillings, and other kinds of activities are conducted at the field. Therefore, the information rule should also cover the rules which affect the quality of the resource data and information. Referring to PP No. 7/2017, it can be seen that the government can improve the quality of the resource information through data-adding mechanism. To illustrate, previously, the type of information available prior to a tender process is limited to the result of a preliminary survey (geological, geophysical, geochemical studies). With the rules to improve the quality of the information, e.g. by conducting the exploration drillings before opening a tender or conducting a PPA settlement, the participants can make better assessment regarding the prospective area. This kind of information reduces the resource risk associated with geothermal development.

3.3.2.5 Scope Rules

The scope rules specify jurisdiction of outcomes that can be affected (Polski & Ostrom, 1999). The outcome of this action situation consists of agreements between the participants. Certainly, agreements entail rights and obligations for/from all the negotiating parties. Especially for the developers and their financiers, taking part in this arena requires a lot of investment and exposes them to a high development risks. Moreover, the industry is characterized with a high asset specificity, making it prone to opportunism. The current governance structure takes the form of long-term contract under the power purchase agreement. The IPB itself is valid for a maximum of 37 years and can be extended given the approval of the Energy Minister. Although the long-term contracts help diminish the uncertainty for the companies, it does not completely eliminate other risks, e.g. political risks, which might reduce the payoff for investors.

For this reason, the scope rules for this action situations are those which constrain the actions of the participants in regards with the enforcement of the terms under the initial contracts to preserve the payoff structure. To put it simply, the rules consist of a set of sanction mechanisms enforceable to the participants for not respecting the contracts. The purpose is to safeguard the interests of all participants in the arena once all the contracts have been in place. In some extreme cases, it can include international arbitration.

Text Box 2. A Case of Expropriation

In late 1997, Asian financial crisis hit the economy and significantly affected geothermal development in the country. This event had led to several project takeovers by Pertamina and PLN and renegotiations of electricity/steam price between developers and PLN, decreasing the final price compared to the original plan (JICA, 2009). The case in Dieng and Patuha was one of the most costly disputes between the developer, Himpurna California Energy (HCE), and the government (Pertamina and PLN). Due to the crisis, the development of power plant unit 2 in Dieng and unit 2, 3, 4 had to be postponed in 1998. The first unit was already being developed and under review. HCE filed an international arbitration claim against the government for the postponement which resulted that both Pertamina and PLN had to pay the company a total of USD 575 million for the lost expenditure and lost profit, starting from 2001. Both fields were taken over by Pertamina and PLN. Later, both fields were then transferred to PT Geo Dipa Energi, a state-owned enterprise. Similar cases also occurred in Sarulla field with Unocal and Karaha-Telaga Bodas field with KBC. Pertamina took over Karaha-Telaga Bodas and PLN took over Sarulla.

To summarize, the scope of this action situation does not only cover how the agreements/contracts between the participants are made. Instead, it also encompasses the enforcement of these contracts as well.

3.3.2.6 Payoff Rules

The payoff rules determine how the costs and benefits are distributed in the action arena, based on the actions taken and the outcomes reached. The elaboration of the rules will be conducted to each of the participants in order to better estimate the costs to be borne and the benefits to be obtained by them.

Table 9 Payoff Rules

Position	Payoff Rules
<p>Owner</p>	<p>a) For the Owner (Central Government), the costs depend on the part of geothermal development activities undertaken by it. For instance, if the government decides to assign a state-owned entity to conduct the government drilling program in a certain location, the government will bear the initial costs and risks of early geothermal development. Otherwise, if the government decides to open the area for a Preliminary Survey and Exploration Assignment (PSEA) or to directly assign a state-owned company for the development, the costs of risks of exploration will be borne by the business entity.</p> <p>b) Aside from the development costs, in regards with the exchange between PLN and the Developer/Seller, the current regulatory framework allows PLN to obtain support from the central government. There are two mechanisms. The first mechanism is the subsidy or called Public Service Obligation (PSO) which eases the burden borne by PLN when it experiences deficit due to the fact that the retail price of electricity is lower than PLN's average cost of generation. The second support mechanism is the government guarantee which are applicable to power plant projects under the public-private partnership schemes, called Business Viability Guarantee Letter (BVGL). The BVGL is issued by the Finance Minister to cover the risk of non-payment or termination of agreement by PLN. It is a mechanism to ensure the capability of PLN to fulfill its obligations to the Developer.</p>
<p>Developer/ Seller</p>	<p>a) All business entities which assume to position of the Developer/Seller have the obligations to conduct the development and bear all the risks and costs. Moreover, with the IPB, they must comply and fulfill the following tax and non-tax payments (MEMR Regulation No. 14/2015)</p> <ul style="list-style-type: none"> ○ Fixed exploration fee: since the IPB is issued until the commercial operation date (COD) of the first power plant unit Total exploration area x fixed exploration tariff ○ Fixed production fee: since the COD of the first power plant unit Total production area x fixed production tariff ○ Production bonus (partly for the local government): since the COD of the first power plant unit 1% of gross revenue from steam sale or 0.5% from electricity sale (according to PP No 28/2016 & MEMR Regulation No 23/2017). This bonus however will be reimbursed by the government (see the next point). ○ Government Fee: since the COD of the first power plant unit 34% of net profit which serves as the income tax (MoF Regulation No. 90/PMK.02/2017). A part of this fee will be paid back to the developer to recover the production bonus. ○ Geothermal Work Area Data/Information Price: to be paid before the issuance of the IPB The price is determined by the Energy Minister to recover the expenses of preliminary survey and/or exploration. <p>b) Apart from expenses to be incurred by any geothermal license holders as explained in point a, there are other expenses which can be deemed as the costs of obtaining the geothermal license. Referring to Figure 24, there are four geothermal license issuance schemes (1) open tender preceded with preliminary survey assignment, (2) open tender preceded with government drilling, (3) restricted tender preceded with preliminary survey and exploration, (4) direct assignment. As mentioned before, different scheme entails different payoff structure in the arena.</p> <p>Open tender (preceded with PSA and government drilling)</p> <ul style="list-style-type: none"> ○ Bid bond ○ Exploration commitment: the minimum amount for a 10 MW capacity development (or more) is USD 10 million and USD 5 million for development of less than 10 MW. All of the committed amount has to be paid to the escrow account before the IPB issuance.

	<ul style="list-style-type: none"> ○ For Work Areas in which government drillings have been conducted, the tender winner will be obligated to compensate for all the exploration expenses (including the margin) incurred by the assigned state-owned company. This compensation serves as the payment for the Geothermal Work Area Data/Information Price as mentioned in point a. However, the price must be significantly higher than Work Areas where exploration drillings have not been conducted. <p>Restricted tender (preceded with PSEA)</p> <ul style="list-style-type: none"> ○ Exploration commitment: the minimum amount for a 10 MW capacity development (or more) is USD 10 million and USD 5 million for development of less than 10 MW. Only 5% of the commitment should be submitted to the escrow account before the issuance of the PSEA permit. ○ For IPB issuance using this scheme, the PSEA assignee must bear all of the exploration costs and risks before obtaining the IPB. <p>Direct Assignment: no expenses associated with the selection/tender process</p>
Buyer	By purchasing electricity from the Developer/Seller, PLN will be able to avoid costs fixed and variable costs of power generation. Instead, PLN will need to pay the electricity tariff as agreed in the PPA.
Financier	For participants assuming this position, the cost is the total investment distributed to the Developer. In return, it will be paid back according to the expected return as stipulated in the financing agreement.

3.4 Attributes of the Community

The development of geothermal resource can be seen a means to achieve many different purposes, such as improving energy source diversification, increasing electrification ratio in the country, reducing fossil fuel dependence, and so on. The development itself involves different stakeholders which have different values and preferences with respect to the outcomes and the strategies to achieve the outcome.

Analyzing the community attributes is to understand the cultural context of policy activity as participants themselves understand it (Polski & Ostrom, 1999). As mentioned in chapter 2.4.2, in the context of investment within the Indonesian geothermal sector, it is more important to discuss the attributes of the developers and other influential participants which have direct impact to the resource and the entire development of the sector. In this section, the analysis does not only cover participants in the arena at the operational level. This is because a lot of decisions to be made at the operational level are influenced by the dynamics at the collective-choice/policy level as well.

3.4.1 The Developer

This section will attempt to elaborate on the aspects of geothermal investment from the standpoint of the Developer. As profit-oriented entities, obviously the Developers have the main purpose of obtaining sufficient return for their investment. In addition to that, it is important that the risks are mitigated and that the costs for such mitigation are distributed fairly between the participants. According to JICA (2009), there are two main challenges of geothermal development: (1) high upfront investment, (2) high development risks. In comparison to the development of thermal power plant, geothermal power plant requires a much higher investment at the earlier stages of development originated from all the exploration and drilling activities. Consequently, the time that it takes from the start of exploration until the commercial operation can be significantly lengthy as well. As for the risks, most of them are associated with the outcomes of the upstream development, despite the fact that most of the investment cost is taken up by the downstream development (Hadi, et al., 2010).

Geothermal power plant developments face more or less the same risk as the other types of power production projects, such as completion risk, regulatory risk, off-take risk, operational risk, and so on. However, the development of geothermal power plant has additional risk associated with the resource itself. This risk reflects the difficulty of estimating the resource capacity and the costs associated with the development, with the upstream/exploration phases being the riskiest part of the project. A significant amount of investment is required before knowing whether or not the resource can be developed to cover the costs of development eventually. This is why information on resource becomes the key element for the developers prior to undertaking the project. In Indonesia, through various policy changes over the time, the early stages of resource development have been undertaken by both the private and the public sector. This section will discuss about the scheme in which more of the early resource risks are allocated to private developers. When more of the exploration risks is taken by the private

developer, consequently the developer or the investor will require higher compensation for the increased risk. This can be covered, e.g. through higher off-take price for the electricity. The following part depicts why resource risks can significantly affect the requirement for the off-take price, whether the risks are materialized or not, based on the information from Gehringer & Loksha (2012).

Consider the involvement of a private sector through the PSEA scheme. In this scheme a detailed surface will initially be conducted. Depending on the prospect size and the accessibility of the location, the cost for this stage can expand from USD 1 to 1.5 million. Furthermore, as part of the detailed exploration program, some temperature gradient holes will be drilled. The holes are typically 100 to 500 meters in depth and cost USD 500 to 800 per meter. Following that, the developer will start with the drilling of deep exploratory holes. Typically in Indonesia, the holes are 1.5 to 3 kilometers in depth. The cost per meter ranges from USD 1500 to 2500. In total, 3 exploratory wells can cost between USD 7 to 23 million. Furthermore, the next step is to assess the field size and to determine the recoverable reserves, followed by the corresponding long-term drilling plan for the future development. This study could cost between USD 0.5 to 1 million. In total, a PSEA scheme, prior to the tender process and conducting a PPA negotiation, can cost between USD 9 to 28 million.

The fact that the difference between the lower and the upper limits of the exploration costs expands rather widely should be recognized as an inherent risk of geothermal resource development. The natural and the physical conditions of the fields, particularly for the green fields, are exogenous factors beyond the control of the developers. Moreover, in the context of PPA negotiation, the costs to be considered do not only cover the exploration but also the exploitation and the power plant development as well. Although the exploration activities have reduced the resource risk significantly, the next development phases are not risk-free either. Eventually, a well might turn out dry, the drilling costs might increase considerably, and so on. Therefore, it is important for them to ensure that these factors are accounted for in assessing their investment feasibility.

In the end, the developer’s safeguard mechanism to avoid budget run-out and the consequent insufficient return must be taken into account during the PPA negotiation process, especially regarding the tariff to be paid by PLN. However, according to Effendi (2017), it is rather difficult to communicate to PLN regarding the importance of incorporating the inherent resource risks into the calculation of return required by the developer. It is argued that PLN fails to see the fundamental difference between geothermal power plant projects with the other kinds of projects, e.g. for coal-based power plants. The fact that the provision of the fuel in coal-based power plants can be separated from the development of the power plant itself, the resource risks are not borne the coal IPPs. Certainly this is not the case in geothermal development. In the end, the tariff negotiation process can get really complicated due to the difference in the risk perception between the two parties. However, as suggested by Effendi (2017), the developers understand the challenge faced by PLN to bear the costs of purchasing geothermal-based electricity which can be higher in comparison to other sources, especially coals.

3.4.2 The Buyer

For PLN to able to expand its service and provide for the ever increasing demand for electricity, it needs to maintain or increase its profit, alongside receiving other additional support from the government (e.g. through PMN). The main issue for PLN is that its business revenue from electricity retail sales to the final consumers and other service fees are far below its operating expenses for electricity purchase, fuel costs, labor, and others. This is primarily due to fact that the electricity retail price has always been below the cost of supply for electricity (BPP)¹⁰. Figure 26 shows the comparison between the two factors.

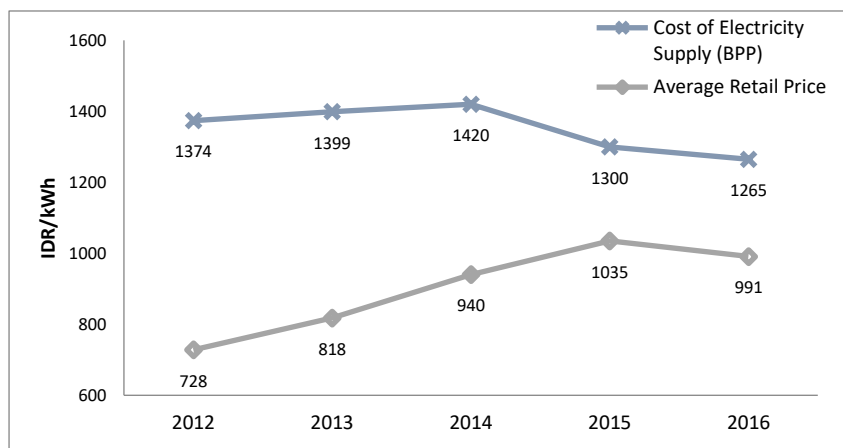


Figure 26 Comparison of PLN’s Average Cost of Electricity and Average Retail Price (PLN, 2016)

According to MEMR Regulation No. 18/2017, PLN may adjust the retail price for some consumer groups based on some factors, i.e. exchange rate of American dollar against Indonesian rupiah, inflation, Indonesian crude price, and inflation.

¹⁰ Cost of electricity supply or *biaya pokok pengadaan* (BPP) is the cost of electricity provision for PLN to undertake its operational activities, starting from generation, transmission, and distribution of electricity, divided by the total amount of kWh sales.

However, the adjustment can only be applied upon the approval from the minister¹¹. This indicates that despite its monopoly over electricity distribution and retail sector, PLN does not have much freedom in driving the price to cover the costs of supplying electricity across the country. Consequently, the government needs to constantly provide PLN with subsidy to cover for its operating losses. Subsidy level is distinguished according to the type of consumer groups which are categorized based on its type (household, business, industry, social, and public) and the level of voltage. As the result, different consumer groups are charged with different retail prices per kWh as well. Eventually, the calculation of the subsidy is based on MoF Regulation No. 44/2017 which takes into account the difference between the retail price and BPP, the margin required, and the volume of sales for each subsidized category of consumer group as seen in the following formula:

$$\text{Subsidy} = -(\text{BPP} - \text{retail price}(1 + \text{margin})) \times \text{volume of sales}$$

In 2016, PLN incurred costs with a total amount of IDR 234,449 billion and only received a total amount revenue of IDR 222,821 billion, resulting in an operating loss of around IDR 31 trillion. However, the company received a total amount of subsidy of around IDR 60 trillion, resulting in an operating income (after subsidy) of IDR 28 trillion as seen in Figure 27. Furthermore, after taking into account other expenses, such as tax and financing expenses, the final income for PLN in 2016 was around IDR 10.5 trillion.

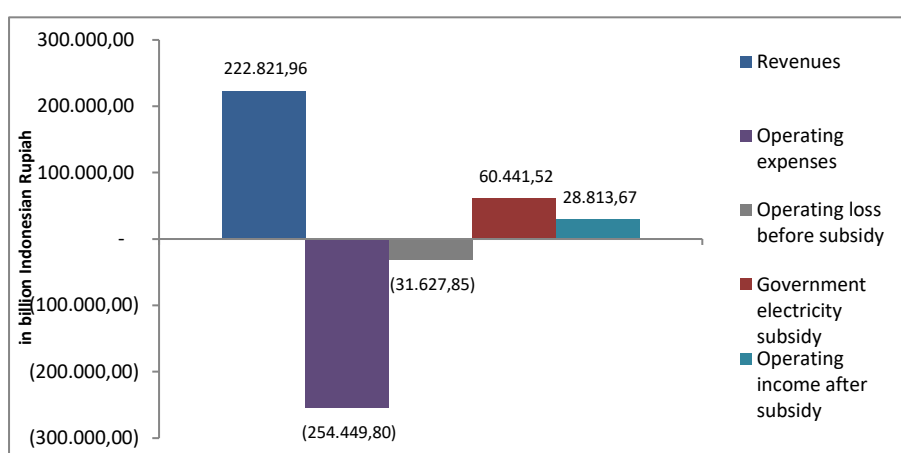


Figure 27 Statement of Profit/Loss for PLN in million Rupiah (PLN, 2016a)

Although PLN can obtain profit eventually, it is not sustainable for the company to keep relying on the government's subsidy. In fact, it has become the agenda of the Ministry of Finance to change the subsidy structure for PLN into a performance-based scheme under the attempt to ease the government's burden on electricity subsidy. A pilot project will be conducted in Bangka Belitung province. In 2015, this kind of arrangement has actually been attempted through the issuance of MoF Regulation No. 195/2015.

Based on this regulation, the amount of subsidy is not based on cost of electricity supply and the required margin but rather based on the income requirement that is established at the beginning. This scheme was intended to incentivize PLN to save costs on the controllable factors of its expenditure items. However, this initiative has been abolished through the issuance of MoF Regulation No. 44/2017.

According to the regulation, the electricity subsidy is a portion the state budget allocated to support the consumers of PLN. For the purpose of budgeting, PLN must determine the cost of supply for each consumer group at the beginning of the year. The number will be based on the calculation of the required subsidy, as seen in the formula. Eventually, the amount allocated depends on the proposal submitted by the MEMR, the margin suggested by the MSOE, and the approval of the MoF. The realization of the subsidy distribution depends on the actual sales growth, sales volume, and the energy mix. Therefore, it becomes PLN's obligation to control the three factors and to stay within the budget.

As a state-owned company, PLN has the obligation to provide affordable and reliable electricity for the nation. The affordability concept of electricity provision has a significant influence over the decisions made by PLN. The concept is aligned with the basic principle of energy resource utilization as mandated in the constitution which states that all natural resources are controlled by the state and must be utilized for the benefit of the society as much as possible. From PLN's perspective, the management of BPP level becomes very crucial. According to (Yunis, 2017), it is important that the costs (BPP) are consistently maintained or lowered because the numbers will always be reflected on the retail price to be borne by the consumers when the subsidy can no longer cover for the operational losses.

¹¹ Before the issuance of MEMR Regulation No. 18/2017, the tariff adjustment mechanism was entirely based on MEMR Regulation No. 28/2016 and MEMR Regulation No. 31/2014 (already replaced). The older regulations did not stipulate the minister's authority to approve the tariff adjustment proposal from PLN. However, such arrangement has been considered as a violation of the constitution since the increased tariff might significantly affect consumer's expense on electricity, as expressed by the chairman of the Indonesian Consumers Foundation, Tulus Abadi (Hukum Online, 2015)

The obligation to provide affordable electricity is translated into the least-cost principle for power generation. The concept takes into account the net present value of all the investment costs, fuel costs, operation and maintenance costs, and the costs of energy not served. The least-cost principle, coupled with the need to keep decreasing the level of BPP requires PLN to manage the factors affecting BPP. Among other things, BPP is affected by the purchase of electricity from the independent power producers and the fuel costs for its own plants. Therefore, in the attempt of controlling its BPP, PLN needs to ensure that its expenses over these two factors do not severely affect its BPP. This is the point where the PPA negotiation with the geothermal IPPs becomes contextually relevant. For PLN, geothermal resource is merely an alternative among other resources to generate electricity. Other than geothermal, PLN uses various sources of energy for power generation, including hydro, natural gas, coal, diesel, and other renewable sources. PLN's energy mix can be seen in Figure 28.

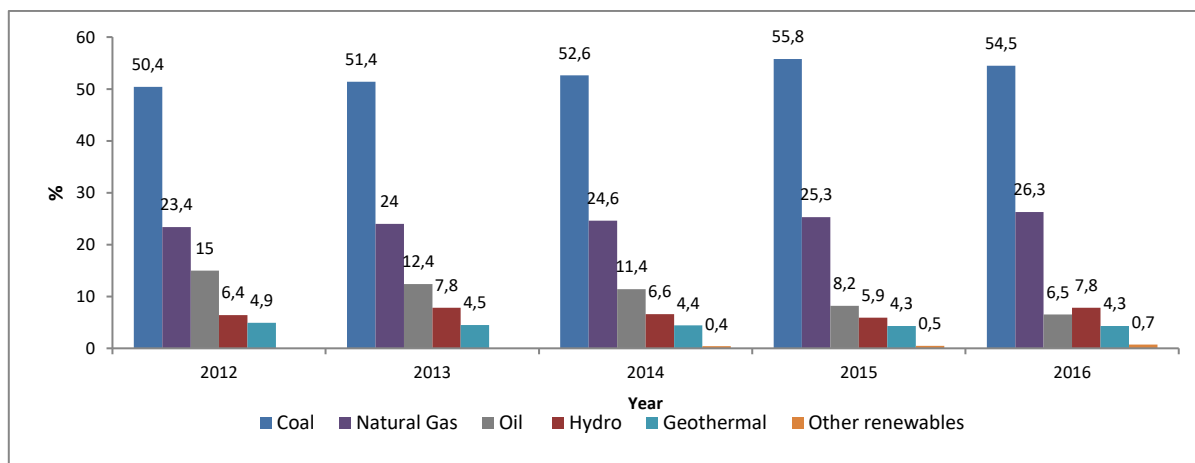
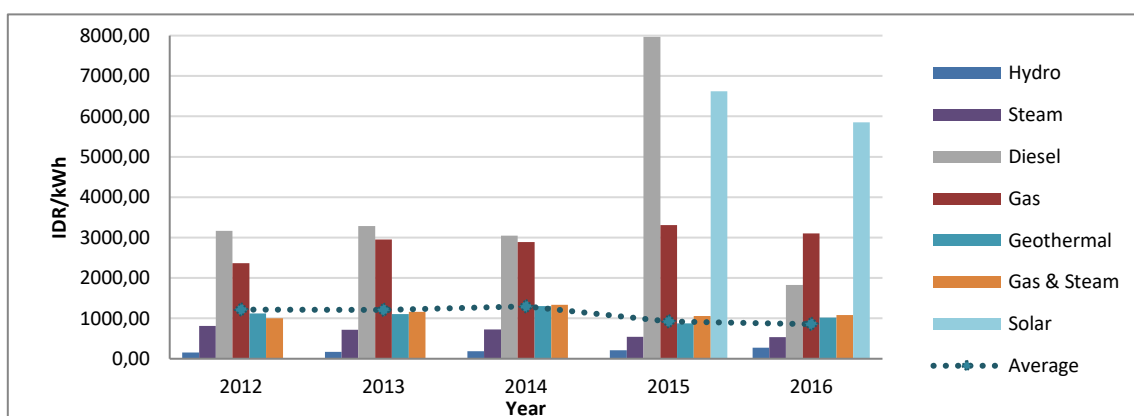


Figure 28 PLN's Energy Mix (in percentage) from

Coal has dominated the energy mix for power generation in Indonesia, not only due to the abundance of the resource in the country, but also due to its lower generation cost according to PLN. In fact, thermal power plants which mostly use coal as the fuel have the lowest average generation cost after hydro power plants. The comparison of average generation costs for different types of power plants is shown in Table 10.

Table 10 Average Generation Costs of PLN (IDR/kWh)

Year	Hydro	Thermal	Diesel	Gas	Geothermal	Gas & Thermal	Solar	Average
2012	155.87	810.14	3168.58	2362.99	1121.50	1001.80	-	1217.28
2013	166.66	719.52	3286.13	2954.28	1103.50	1159.20	-	1206.67
2014	189.19	726.37	3046.30	2892.80	1306.88	1335.74	-	1296.73
2015	211.19	541.38	7969.86	3306.22	879.83	1054.99	6624.36	920.22
2016	271.90	532.28	1828.39	3103.64	1016.37	1085.07	5853.84	856.28



As can be seen, the average costs of generation for geothermal power plants have been consistently close to the average cost. However, the average cost for thermal power plants using coal have always been the second lowest after hydro power plants. This is why the development of coal-based thermal power plants still becomes the priority in the country, as also indicated in the National Energy Policy. Another important note is that Table 10 shows the average cost of generation for power plants owned and operated by PLN itself. In total, PLN is currently operating 15 geothermal power plants with a total capacity of 580.89 MW. Meanwhile, there is already a total of approximate 1500 MW of installed geothermal capacity in the country. It means that the numbers in Table 10 do not reflect the costs for geothermal electricity purchased from the Developers with a total capacity of 900-1000 MW.

Before the recent issuance of MEMR Regulation No. 12/2017, the tariff for geothermal electricity was governed in MEMR Regulation No. 17/2014. According to this regulation, the tariff must fall within to the benchmark price limit that was determined based on the commercial operation date (COD) and the region type¹². The tariff design is shown in Table 11. As can be seen, the benchmark price was high, especially if compared with the level of PLN’s BPP. This kind of arrangement has been considered to be rather difficult for PLN. Moreover, before the issuance of PP No. 7/2017, the tariff was determined during the tender process. Since PLN is mandated to purchase electricity from the Geothermal Producers, eventually the company must pay according to the bid price at any cost. The process could become even more complicated when the tariff needed to be re-negotiated following the exploration and feasibility study at a certain Work Area. In case of renegotiation, the price might be increased even further and at the same time, PLN needed to ensure that the price would not go beyond its own BPP.

Table 11 The Highest Benchmark Price for Electricity Purchase by PLN (in cent USD/kWh) according to MEMR Regulation No. 17/2014

COD	Region 1	Region 2	Region 3
2017	12.6	18.2	26.2
2018	13.0	18.8	26.6
2019	13.4	19.4	27.0
2020	13.8	20.0	27.4
2021	14.2	20.6	27.8
2022	14.6	21.3	28.3

At any setting or with any regulatory framework, the purchase price that goes beyond PLN’s BPP will eventually increase its supply costs. Certainly for PLN, such condition is not desirable. If increasing the retail price to be paid by consumers is not possible and the subsidy mechanism becomes more complicated, PLN will eventually bear the costs. In conclusion, for PLN to able to undertake the mandate of purchasing electricity from Geothermal IPPs with less trouble, it needs to be able to do so at the level that does not add burden to its BPP. Otherwise, PLN will need to be able to readjust its electricity retail prices or to gain more support through subsidy from the government. Unfortunately for PLN, none of those two options can be realized easily or without much disruption.

Another factor to consider in the analysis of the community attributes is the perception that the participant has regarding the strategies and values of the other participants. In this case, it will be seen how PLN perceives its potential partner or the geothermal developers during their interaction, e.g. throughout the PPA negotiation process. According to the interview with Yunis (2017), PLN recognizes the need for the developers to recover the high investment costs and to account for the development risks of geothermal projects. However, the more important thing to acknowledge is whether or not the costs claimed/estimated by the developers are reasonable. According to Yunis (2017), the need to account for the early development risks is used as a justification for some developers to raise the expected costs to a high level, increasing the final tariff to be paid by PLN in the end. To quote Yunis (2017) in regards with PLN’s position to assume the resource risks through agreeing on a higher tariff, he mentioned the following (translated to English by author).

“...when the final costs are not as high (as what have been projected previously), the developers can reap a very high profit from it. When that happens, would they be willing to share such benefits with PLN?”

¹² The regulation distinguished the regions into three types. The first region consists of Work Areas in Sumatera, Java and Bali. The second region includes Sulawesi, Nusa Tenggara, Halmahera, Maluku, Irian Jaya, and Kalimantan. The third region consists of Work Areas located in the first or the second region, yet isolated and the electricity provision is obtained through oil-based electricity generator.

Such question implies that, at least for some cases, PLN still perceives that the costs as claimed by the developers can still be reduced further. Moreover, PLN believes that the development costs in Indonesia is higher than that of the average of the international practices. This is why according to Yunis (2017), the negotiation process needs to be rigorous in order to ensure that more savings can be obtained by PLN.

3.4.3 The Financier

Similar to the Developer, the main purpose of the Financiers is to obtain a generous return from participating in the sector. Therefore, issues faced by the Developers are perceived quite similarly from the standpoint of the Financiers. However, another important aspect which affects the investment decisions of these financiers is worth mentioning. During the interview, Poernomo (2017) argued that the financial crisis in 1997 had caused a significant setback to geothermal energy development in the country. As mentioned in Text Box 2, the situation at the time required the country to change the payoff structure for companies which had been involved and had distributed a large amount of investment in the sector. As a result, for a long period of time, the sector was stagnated with no significant (private) investment was made for the development of green fields in the country. The only exception is the development of Muara Laboh by PT SEML. Other than that, the increase of geothermal capacity in the electricity sector was accredited to developments in the older fields or to public investments (by state-owned companies, such as PLN and Pertamina). It appears that the private sector has been reluctant to distribute its resource, given the circumstances in the past. Since then, the government has been attempting to fix and improve the regulatory framework. Nonetheless, the success of the past efforts is limited.

One of the most important aspects for the investors is the capacity of the regulatory framework to safeguard their resources and interests. Based on the interview with some of the respondents, the regulatory certainty with which the investors can securely interact and make transactions with other parties in the sector, is key to attract investment back in the sector (Poernomo, 2017; Chasani, 2017). Unfortunately, this particular requirement has been poorly accommodated in the sector (Yudha, 2017). In fact, multiple changes toward the regulatory framework in the past have made it more difficult for the business entities to make decisions regarding their participation in the sector.

3.4.4 The Ministry of Finance

The Ministry of Finance (MoF) provides guarantee that is intended to ensure PLN’s capability to perform its obligations to the Developers according to the PPA. As mentioned before, this guarantee can be direct—through the exercise of BVGL—or indirect—through subsidy or PSO. This section will specifically elaborate on the subsidy mechanism.

Although the purpose of electricity subsidy is solely to help the consumers, in the context of this thesis, the distribution of subsidy from the MoF to PLN might convey two things: (1) the electricity retail prices to not increase and/or (2) PLN to be more relaxed in managing its BPP so the purchase of geothermal electricity becomes less troubling. The electricity subsidy has been a long-standing issue for the country. Starting in 2002-2004 the subsidy scheme was designed to subsidize some groups of consumers through PLN. At that time, the subsidy was only used to support small consumers at the power level of 450 VA and only for the first 60 kWh usage. In the end, the required subsidy was only around IDR 3-4 trillion. However, since 2005, the subsidy was given for more consumer groups, even for those at the level of 5,500 KW usage. The decision was made due to the weakening value of Indonesian Rupiah which had hurt the economic capability of the consumers. This kind of arrangement still stands until recently. As a result, the level of subsidy reached the highest point at IDR 103.33 trillion or approximately USD in 2012.

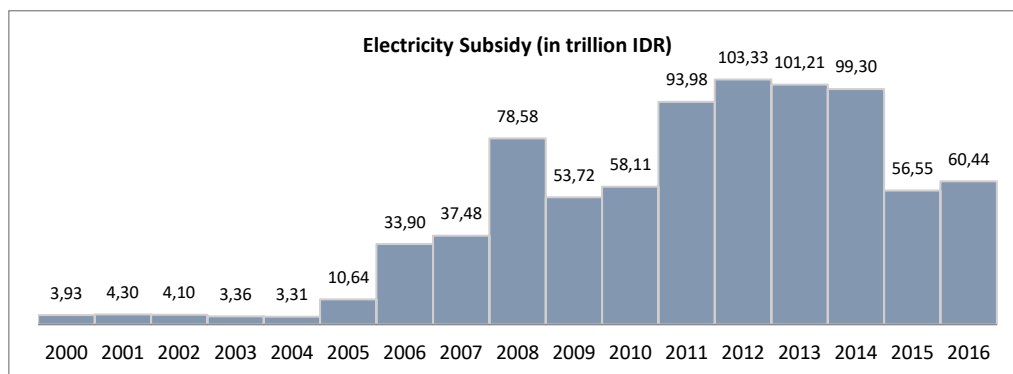


Figure 29 Electricity Subsidy Level (Directorate General of Electricity, 2016)

For the MoF, the electricity subsidy has put too much burden on the state budget. The MoF has also argued that the subsidy distribution is no longer on target. As an illustration, the largest portion of the subsidy has been enjoyed by the consumer group of households using the power of 450 VA and 900 VA. However, according to the Finance Minister at the time, Bambang Brodjonegoro, the majority of the households at the 900 VA level could be considered as capable and therefore not entitled for the subsidy (Artanti, 2015). This kind of reasoning had motivated the ratification of tariff adjustment policy as stated in MEMR Regulation No. 31/2014 (Listrik.org, 2017). This policy goes along with the reduction of the subsidy allocation per se. Consequently, the retail price of electricity has been gradually increasing in the past few years.

Despite the implementation of the tariff adjustment scheme, it is still difficult for the ministry to control the realization of the subsidy allocation. This is partly due to the fact that the subsidy mechanism does entail additional subsidy for every kWh sold by PLN to its customers. For instance, in 2017 there will be additional 2.4 million PLN customers at the 900 VA level who are entitled for the subsidy. This customer addition will require an increase of IDR 1.7 trillion or approximately USD 127 million for the allocated subsidy. As the result, the electricity subsidy in 2017 is estimated to be as high as IDR 52 trillion (Kusuma, 2017).

In conclusion, the MoF has the intention to reduce the country's dependence on the electricity subsidy. Certainly, there are some attempts made by the MoF to reduce the level of subsidy, e.g. through the performance-based regulatory initiative to incentivize efficiency by PLN. However, since it is difficult to control the volume of electricity sales and unethical to prevent the customers from being connected to the grid, it is in the interest of the MoF as well that PLN is able to maintain or reduce its BPP level.

3.4.5 The Ministry of Energy and Mineral Resources

The Ministry of Energy and Mineral Resources (MEMR) consists of several departments, including the Directorate General of New and Renewable Resources (EBTKE) and Directorate General of Electricity (DJK). Both directorates have been mentioned during the initial construction of the action situation at the collective-choice level, given the proximity between the electricity and renewable energy sectors.

Under the EBTKE, there is a specific directorate which serves as the representative of the government to regulate and oversee the development of geothermal resources in the country, the Directorate of Geothermal. As part of the larger structure of the MEMR, the directorate has the obligation to ensure that all participants in the sector conform to the rules as stipulated in the formal regulations (Riyanto, 2017). Therefore, in regards with the execution of any activities and decision-making process in the arena, the directorate will always make references to the formal rules in performing its functions and duties.

Despite the long history of geothermal development in Indonesia, EBTKE (including the Directorate of Geothermal) has only been founded in 2010 through the issuance of President Regulation No. 24/2010. At the time, the sector was managed according to Law No. 27/2003 in which the transfer of geothermal license was still decentralized, within the authority of the local governments. Only in 2014 that the directorate obtains the full authority regarding the development of geothermal sector for indirect utilization. Therefore, many procedures which shape the organization at the operational level are still subject to refinement and reform. To some extent, it affects the capacity of the organization to achieve the expected outcome of the action situation itself.

The elements of the directorate serve as the executing agents who acquire firsthand experience and knowledge regarding the implementation of the formal rules. They understand the challenges associated with the prevailing regulatory framework through various informal and formal encounters with the other participants. It means that the directorate serves as the main hub connecting the ministry and all other participants in the sector (developers, investors, etc.) in dealing with the regulatory issues.

On the other hand, among other things, DJK has the duty and function to support the electrification efforts in the country. The attainment of the directorate's objectives largely depend on the performance of PLN who dominates the electricity sector in the country. Therefore, the actions and decisions taken at the policy level of analysis should be in favor of the attainment of PLN's goals as well. It can include issues which affect the development of geothermal energy as well, such as the tariff ceiling determination, as mentioned in chapter 3.4.2 before. Such decision can be deemed as favorable for PLN, yet less so for the investors. It shows that differences and conflicts exist between departments under the MEMR. Under such conditions, it is within the authority of the Energy Minister to set the direction for the energy sector. In this case, political circumstances might play a significant role during the decision-making process.

3.5 Concluding Remarks

This chapter is intended to carefully identify the factors which will shape and influence the action situations. The chapter was started off with the construction of the action situation in order to incorporate the investment issues within the sector. Eventually, the action situation at the operational level of analysis is designed to capture the interactions between the business entities as the developer, the government as the owner of the resource, PLN as the buyer of the product (steam/electricity), and the financier. Furthermore, the initial construct of the action situation at the collective-choice level of analysis was also made. It takes into account the participants which are involved in the decision-making of the regulations which govern the operational aspects of action situation at the lower level of analysis. By having the initial concept of both action situations, the identification of the contextual factors can be conducted with a clearer direction.

The elaboration of the contextual factors in this chapter takes into account how the circumstances might affect the investment decisions of the participants, especially for the physical/material condition and the attributes of the community. On the other hand, the analysis of the rules-in-use makes a lot of references to the prevailing formal regulations, unless they are not directly governed by rules within the current regulatory framework. How these rules affect the action situation and the outcomes later will be further discussed in chapter 4. Figure 30 summarizes the contextual factors of action situation at the operational level of analysis.

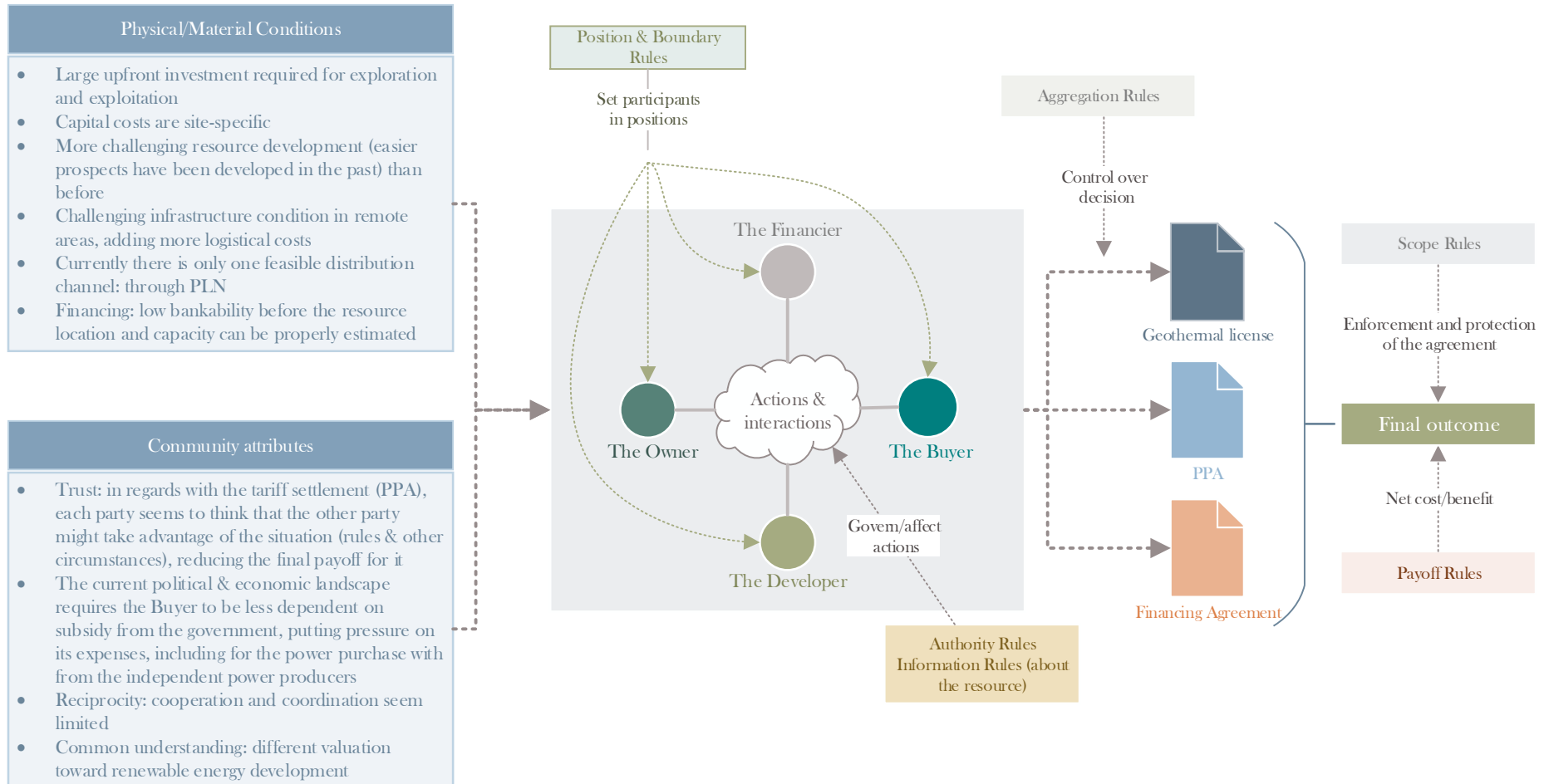


Figure 30 Summary of the Contextual Factors

Figure 30 shows some of the most important physical/material conditions and community attributes which affect the actions of participants in different positions and how they interact with each other. Furthermore, the rules-in-use directly govern the structure of the action situation itself. Eventually all these contextual factors will result in a particular outcome. Under the current regulatory framework, the ideal situation is achieved when all three agreements/contracts are in place. Otherwise, no actual project implementation can be started. Chapter 4 looks into the action situation and find aspects of the current institutional arrangement which might support/hamper the processes to obtain the geothermal license, the power purchase agreement, and the financing agreement.

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Chapter 4

Analysis of the Action Situation

Following the identification of the contextual factors of geothermal energy development in Indonesia, is the integration of the obtained information to analyze the action situation itself. This chapter is divided into two main parts. Using the concept of the IAD framework, this part intends to analyze the action situation at both operational and collective-choice levels. The analysis intends to find the factors affecting the action situation which need to be attended in order to achieve the expected outcome. The general structure of this chapter can be seen in the following.

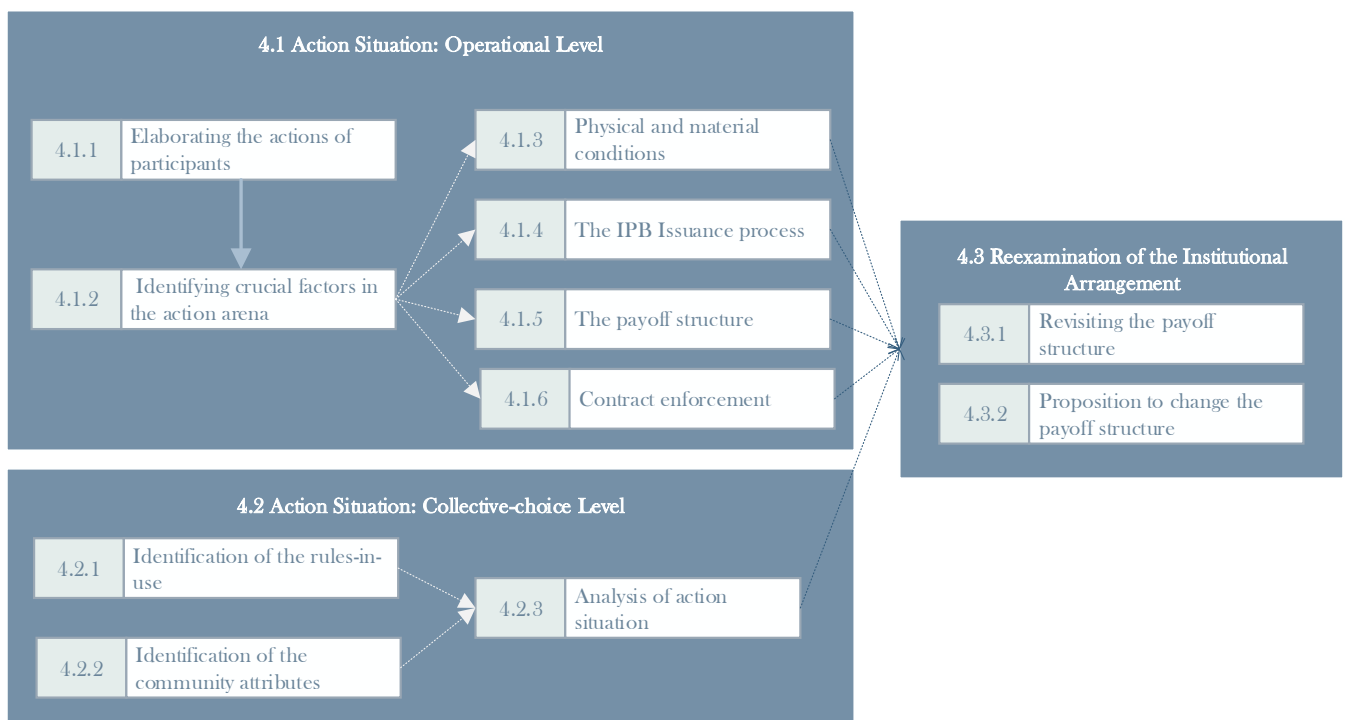


Figure 31 General Structure of the Analysis of the Action Situations

The first part discusses the action situation at the operational level of analysis. To do that, an overview of the action situation will be given through elaborating the actions of the participants. The overview incorporates some of the most significant contextual factors (physical/material conditions, community, and the rules) influencing the interactions between participants in the action arena. The structure of the action situation as illustrated in Figure 32 will be used to identify aspects in the action arena which can be further analyzed. These aspects are analyzed in sub chapter 4.1.3 until 4.1.6.

To help with the analysis, the conditions and outcomes in the sector based on the past institutional arrangement will be used as references. Comparison can be made to assess the capability of the current institutional arrangement in handling some lingering issues in the sector. Furthermore, the second part discusses the action situation at the collective-choice level of analysis. This part is used to complement the analysis at the operational level to obtain a more comprehensive understanding on the sector itself. Eventually, the information obtained in the first and the second part is used to develop some recommendations to improve the action situation and to eventually achieve the expected outcomes.

4.1 Action Situation at the Operational Level

Chapter 3 has provided some fragments of information which still need to be integrated to be able to assess the potential outcomes of the action situation. Only with this integration that the analyst will be able to identify crucial aspects in the action situation which affect the investment decisions of the participants in the arena. To begin with, the elaboration of the actions of the participants will be made in the following section.

4.1.1 Elaborating the Actions of the Participants

Given a particular prospective area, the government as the owner of the resource has the authority to decide its own involvement in the development of the resource. Different level of involvement entails different level of costs which to be borne by the government. Therefore, this decision depends on the availability of the state budget allocated to for geothermal development. Another consideration is the physical condition of the prospective area itself. For instance, supposed that the area has been offered through an open tender before, yet not much interest is expressed by the prospective developers, the government might decide to take over the entire project. In that case, the government will assign a state-owned company and allocate a certain amount of budget, e.g. through state capital participation (PMN) so the state-owned company can undertake the assignment. Under this situation, the government exercises its authority to use the direct assignment scheme to issue the geothermal license. However, given the current political landscape which seems to be less favorable for the renewable energy sector, it is almost impossible for the government to assume the entire risks and costs of geothermal development.

It is important to note that the direct assignment scheme does not only work in a top-down direction in which the government unilaterally mandates a state-owned company to develop the field. In fact, the direct assignment scheme might also be used if a particular state-owned company is interested to develop a field and wish to make its way around the costly and lengthy tender process. Under this condition, the company will need to assure the government that it has the capacity to efficiently conduct the development. In this case, the state-owned company should be able to provide for itself and require less support from the government.

How will the government decide which scheme to use to issue the geothermal license (IPB)? The government, represented by the EBTKE, has the purpose of obtaining a reliable partner which can efficiently and effectively deliver its obligation as an IPB holder. This is important because eventually all the expenses to be incurred by the business entity will be reflected on the level of tariff which needs paid by PLN as the Buyer. Therefore, the consequence of the government's action in selecting the Developer has a direct impact toward the investment decision of the Buyer. The ideal situation is when the government can choose from many alternatives of potential developers. In that way, the government can select the most efficient business entity. Under this condition/requirement, it is safe to assume that the direct assignment scheme will be used as the last resort since under this arrangement the government is left with only one alternative. Therefore, more emphasis will be given to schemes which involve the tender process.

For any selected scheme, considering at least (1) the payoff structure, (2) the information they have over the prospective area, and (3) their own capability/resources, the business entities will decide whether to participate in the selection/tender process. Eventually, some will participate and some will not. For the government, it is important that there are enough participants in the selection process. In 2016, for instance, all the open tenders conducted by EBTKE were failed. As stated in the yearly performance report by EBTKE, eight Work Areas were planned to be publicly offered through the tender process in 2016 (see Table 12). Until the end of 2016, six tenders were started. Eventually, of all the six Work Areas being offered, none was awarded to any business entity that year (EBTKE, 2016a).

Table 12 Tender of Geothermal Work Area in 2016

Work Area	Expected Reserves	Development Capacity	Tender Opening	Result (Latest update December 2016)
Graho Nyabu, Jambi Province	200 MW	110 MW	September	First tender was participated by one bidder, retender process was started in December 2016
Gunung Hamiding, North Maluku Province	265 MW	20 MW	November	First tender was participated by one bidder, retender process was started in December 2016
Gunung Galunggung, West Java Province	160 MW	110 MW	October	First tender was participated by 1 bidder. During the retender, there was no bidder, failed tender

Gunung Wilis, East Java Province	50 MW	2 x 10 MW	October	No bidder
Simbolon Samosir, North Sumatra Province	150 MW	110 MW	November	First tender was participated by 1 bidder, retender process was started in December 2016
Gunung Ciremai, West Java Province	150 MW	110 MW	November	No bidder

It seemed that the potential developers did not find the prospective area and the incentive structure to be attractive and promising for further commercial development. Insufficient information regarding the workability of the underground resource may have made the investment in the sector becomes highly uncertain and risky. The issue regarding the attractiveness of the sector calls for more attention to be given upon the incentive structure for the business entities and the quality of the resource information itself.

Supposed that the incentive and the information quality are sufficient to attract more participations, the process is likely to result in a new geothermal license holder. In this case, one business entity will assume the position of the Developer for a particular prospective area. The next step is to obtain the power purchase agreement (PPA). As mentioned in the boundary rules (see Table 7 Positions and Boundary Rules), to be able to get into the PPA settlement process, exploration drillings at the prospective area should be conducted beforehand, through government drilling or through explorations conducted by the business entity itself. In one way or another, a considerable amount of investment would have been sunk by the time the PPA settlement will be started.

The problem with sunk investment for assets with high specificity is the potential expropriation by the other party in the transaction. As mentioned in chapter 3.4.2 (attributes of the buyer), the common conception of the Buyer is that the Developers tend to claim higher costs than the actual ones. On the other hand, the Developer argues that the Buyer has limited knowledge regarding the challenges of upstream development activities. These differences will put the two negotiating parties at a difficult position. Especially for the Developer, the fact that an amount of investment has been sunk makes it more prone to expropriation risks. Moreover, the new aggregation rule regarding the tariff ceiling may have an implication toward the Developer's bargaining position. Whether or not this situation affects the investment decision of the Developer will be analyzed further later.

Regardless of the difficulty of the PPA settlement process, assuming that eventually a PPA is obtained, the Developer is obligated to continue the development. First, the Developer needs to reach financial close in which all the project and financing agreements have been signed so the project implementation can actually be started. This is the part in which the interaction between the Developer and the Financiers occur. Assuming that all the financiers are profit-oriented, they will take into account all the important factors to ensure that the projects can run smoothly and generate enough capacity to generate the expected return. It can include the assessment toward the capability Developer and its project plan, the availability of insurance (such as Business Viability Guarantee Letter to support PLN by the MoF) to reduce the non-payment risks, and the condition of the resource itself. Eventually, when all the sequential processes of obtaining the contracts and agreements (geothermal license, PPA, financing agreement) have been concluded, the project can be started. The final outcome will be to obtain an actual increase of geothermal power capacity for the country.

4.1.2 Identifying Crucial Factors in the Action Arena

The elaboration of the participants' actions is summarized in Figure 32. The diagram shows the interrelatedness of the actions and interactions happening in the action arena. Therefore, it is important to take a closer look into aspects which significantly affect the investment decisions of the participants. Note that not all factors and how they affect the actions and the decision-making of the participants are depicted in Figure 32. For instance, there are aggregation rules which govern the IPB issuance (tender) process and the scope rules which concern the enforcement of the agreement to avoid expropriation or time inconsistency problems. These aspects are equally important and will need to be attended as well.

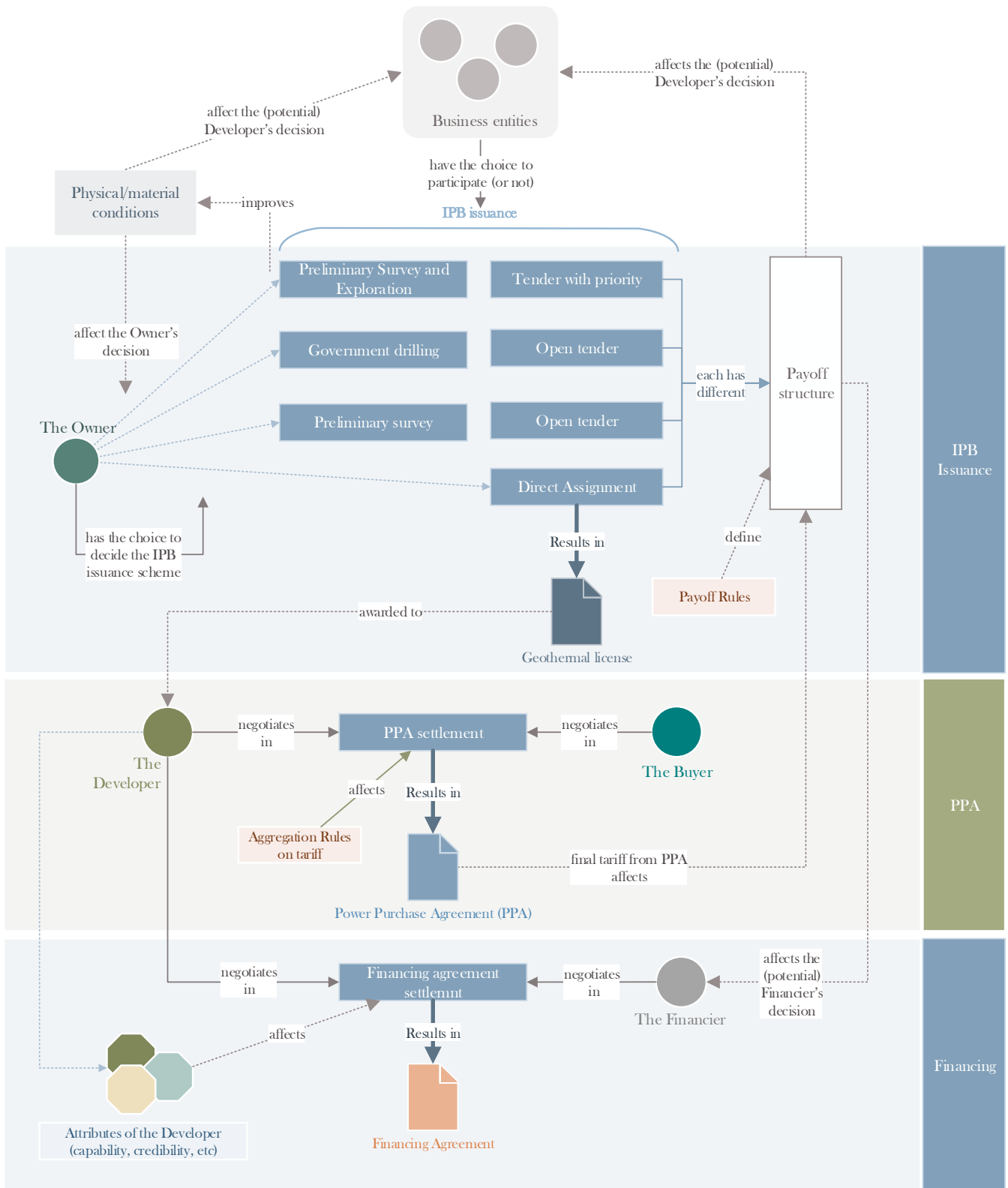


Figure 32 Elaboration of the Participants' Actions & Interactions in the Action Arena

The payoff structure does have an obvious influence over the investment decisions of the participants. For instance, from the point of view of the business entities, the payoff structure consists of the costs associated with the resource development, costs of obtaining the geothermal license and the benefits from electricity sale as agreed in the PPA. Therefore, factors which affect the costs to be borne by the participants and the benefits that can be obtained will be further analyzed in this chapter. Some other aspects have less apparent effect on the investment decisions. One of which is the process of obtaining the Developer

(the IPB issuance) which has an indirect impact for both the Buyer and the Financier. As mentioned before, the capability of the Developer to deliver its obligations efficiently will affect the level of tariff to be paid by the Buyer in the end. Furthermore, the capability and the credibility of the Developer will affect the confidence of the Financier to participate and to distribute its financial resources to support the project.

The physical and material conditions affect the attractiveness of the sector as well. When better information regarding the feasibility of a prospective area is available, it will attract more business entities to participate. Note that, as shown Figure 32, the quality of the resource information is also improved as more development activities take place in the prospective area. Eventually, the attempts to improve the physical conditions will change the payoff structure as well and affect the investment decision of the participants.

To conclude, the following aspects will be further analyzed in the subsequent subchapters: (1) the physical/material conditions in regards with the resource information quality, (2) the IPB issuance process in regards with its capability to assure the credibility and efficiency of the license holder, (3) the payoff structure and its influence toward the investment decisions, and (4) the enforcement of the contracts. These aspects will be discussed in the following sections.

4.1.3 Physical and Material Conditions

4.1.3.1 Resource Information Quality

The quality of the resource information is of high importance in geothermal sector. During the interview with Abadi Poernomo from INAGA, a question was asked regarding the lack of interest from the business entities to participate in some tender processes conducted in 2016. As shown in Table 12, all of the tenders were failed or needed to be restarted since they could not attract enough participants. The important side note is that the tenders were conducted when MEMR Regulation No. 17/2014 was still fully in force. Under this regulation, the governance of the tariff ceiling structure was considered to be highly favorable for the business entities. Nevertheless, the interest was still low. To this question, Poernomo (2017), argued that the lack of interest was not caused by insufficient tariff/incentive structure. Instead, as already mentioned in the information rules (see chapter 3.3.2.4), the business entities did not perceive the tendered Work Areas to be commercially attractive. It means that the available information on the resource obtained by these potential developers has steered them away from participating in the sector.

Looking back at the previous identification of the physical and material condition of geothermal resource, it has been mentioned that in Indonesia the resource development faces natural and infrastructural challenges which can significantly increase the capital expenditure for the development. The resource information here does not only include data/information on factors which affect the capacity of the resource to commercially developed (natural condition of the resource), such as the depth of the reservoir, the permeability, resource temperature, and so on. It should also include information about the infrastructural challenges to be tackled by the developer itself. As mentioned by Yudha (2017) during the interview, the mobilization cost for the equipment to remote areas, such as Jailolo in Maluku, can be very high compared to the costs in Java. Therefore, since the beginning, it is important that the developer is aware of the potential costs in regards with the infrastructure around the resource.

Chapter 3.2 has discussed the physical and material conditions of geothermal development in Indonesia. It has been identified that it might be more technically and financially challenging to utilize the remaining untapped geothermal resources, given the belief that the more easily accessible and exploitable resources have been developed in the past. Moreover, according to Manfred Hochstein, a senior research fellow in the University of Auckland, some of the predictions for the power outputs which are used as the basis for the future development are clearly overestimates. In many cases, the resources have not been proven and only based on surface measurements. According to Hochstein (2016), it is important that such estimates are made when positive evidence, based on at least one or two drillings, has been obtained. The overestimation toward the prospects across the country seems to have ironically instigated the tendency to underestimate the complexity of geothermal development, especially for the policy makers.

The involvement of the business entities in the sector has increased over time. Along the way, their knowledge regarding the general characteristics of geothermal resources in Indonesia has improved as well. A lot of projects may have succeeded in the past. However, many have also failed due to the fact that the physical factors of the field did not allow for a commercially viable development. As a result, the confidence to invest in the sector may have declined. Therefore, when the common belief regarding the viability of most of the prospective areas in the country has started to shift toward the negative direction, the government needs to intervene to change the perception. In this case, the intervention is had by directly investing more in activities to prove the resources. For this purpose, the current regulatory framework has actually been equipped with a mechanism called the government drilling program. This program has been mentioned multiple times as one of the schemes

of transferring the geothermal license (IPB). Using this program, not only that the physical challenges have been reduced (infrastructure should have been developed to conduct the drilling), the risks associated with the early geothermal development will be partially mitigated as well. The next subchapter gives an overview about this program.

4.1.3.2 Government Drilling Program

If the government decides to improve the attractiveness by increasing the quality and reliability of the resource information, it has the authority to conduct the government drilling program. In doing so, the government can assign a state-owned company to undertake the exploration activities (preliminary survey and drilling). Later on, depending on the exploration result, the government may (or may not) open a tender for the specific Work Area. This program is intended to not only increase the quality of resource information, but also to shift the resource risks from the business entity to the government. For this drilling program, the government has entrusted a portion of the state budget to be allocated as the geothermal fund. This fund is managed by PT SMI (see Appendix A regarding actors in the system). PT SMI has been appointed according to the regulation (MoF Regulation No. 232/2015) to manage approximately USD 230 million to support geothermal infrastructure financing in the country. In addition to that, the company has also received a grant commitment from the World Bank for the total amount of USD 55 million under the project of Geothermal Energy Upstream Development Project.

The scheme begins with the issuance of exploration assignment from the government to the state-owned company, e.g. PT SMI. Supposed that the assignment is accepted by PT SMI, there are two conditions that the resource risk born by the government does not materialize: (1) the exploration result is considered as a success, hence feasible for commercialization and (2) the subsequent tender process is able to result in a tender winner who is willing to compensate for the exploration expenses by PT SMI. Failing to meet both conditions will require the government to recover the costs which have been incurred by PT SMI. The fact that there is a significant risk faced by the government and to some extent, by PT SMI as well, entails more caution to be had prior to undertaking the assignment. Consequently, the sustainability of this scheme depends on the availability of resources (human, financial, and technical capitals) of the appointed state-owned company.

Supposed that the exploration assignment undertaken by PT SMI can generate a good result, during the tender process, the bidders will have better quality of resource information and will be able to perform a better and more accurate data assessment. The better accuracy of information can eventually benefit both sides, the business entity and the government. For the business entity, there is a significantly reduced resource risk which enables the company to make a better investment plan. For the government, since the resource has been proven, although there is a high upfront cost to be borne in the beginning, eventually the Developer will require lower return which should be reflected in the tariff agreement with the Buyer (PLN).

4.1.4 The IPB Issuance Process

The government, represented by its state-owned companies, has the capacity to develop its own geothermal sector. However, the appointment of a state-owned company to undertake a field development, for instance, entails extra support and government investment, such as through subsidy or State Participation Investment (PMN). Moreover, experiences in the past have confirmed the importance of private sector involvement considering the large investment and the high-risk nature of geothermal development. The regulatory framework has been changed and refined over time to ease the government's burden in the attempt of developing the sector. The limited state budget to attain its own ambitious target justifies the decision to open the sector for the private sector participation which is attained through a certain selection mechanism, either through an open or restricted tender process. This part focuses on IPB issuance processes in which the government gets to choose from several alternative business entities to assume the position of the Developer. The importance of this process will be exhibited throughout the elaboration in the following sections. The reliability and the quality of the process shape its capability to obtain a credible and efficient developer which will have more implications toward other aspects in the project will be thoroughly analyzed.

4.1.4.1 Reflecting on the Past Tender Arrangement

After the issuance of Law No. 27/2003, the selection process was carried out using solely an open tender process and executed by the provincial/municipal government, depending on the location of the Work Area. It appeared that the contracts resulted from these tender processes were not able to administer the expected performance from the business entity. Despite the fact that the formal rules have been equipped with the measures to impose sanctions, including the license retraction against some underperformance issues, many of the Work Areas were left undeveloped for years until the time limit of seven years for exploration and feasibility study was run out. The delay in the field development due to the failure of the license holder to deliver its obligations can be regarded as a lost opportunity. Supposed that the prospective area had been given to another serious developer or to a particular SOE, the field might have been developed properly, increasing the chance of achieving the government's geothermal target.

Based on a personal communication with Satar (2017), in the past some of the tender winners were never really equipped to develop the Work Area in the first place. Instead, some of them ended up selling the license to another business entity. The opportunistic behavior of the Developer as shown in the past has called for the need to assess the effectiveness of the tender process and the resulting contract in obtaining a reliable Developer for the government.

A tender process is supposed to be used as a means to carefully assess the reliability of the potential partners to undertake the project. The contractor selection process is challenging and attributed with a lot of uncertainties. It requires the authorized individuals or the tender committee to make trade-offs between competing objectives and limited resources (Watt, et al., 2009). The right selection criteria are needed to be able to produce the expected result. For instance, (Holt, et al., 1995) have found the contractor's ongoing workload and its past experiences in terms of size of projects to be among the most important criteria for the construction industry in the UK. As for the case of the prospective area tenders in Indonesia, the mechanism, according to PP No. 59/2007, required the Bidders to pass the administrative, technical, and financial evaluation criteria at the first stage. This stage can be regarded as a prequalification which was used to guarantee that bidders which would be further evaluated and eventually selected as the tender winner in the next evaluation stage had the minimum requirements to be able to deliver its obligations as indicated in the contract.

Looking deeper into the selection criteria of the past tender process, especially for the technical and the financial requirements, the regulation stipulated the fulfillment of the following conditions: (1) the bidders can submit technical details and schedule for exploration and feasibility study (2) the bidders can show their financing capabilities and are able to submit a bid bond of 2.5% of the planned exploration expense at the first year. These criteria showed the intention of the prequalification stage to screen the bidders based on their capabilities to develop a geothermal field technically and financially. However, these criteria are ambiguous, hence they still left room for interpretations. What kind of development proposal was considered as good or acceptable? Due to the lack of clear implementation procedure, the quality of the proposed exploration and feasibility study was entrusted for the tender committee to judge. The reliance onto the capability of the tender committee made the process highly subjective. In the past, the authority to select the Developer was given to the local governments. The implication was the increased difficulty to ensure the quality of the tender process given the fact that more participants were authorized to become the tender committee—different committees for different regions.

Unfortunately, some reports had indicated the incapability of some of the tender committees at the local government level to conduct a prequalification process (Winters & Cawvey, 2015). The situation, combined with the ambiguity of the formal rules have resulted in a poor screening result. Many of the selected developers were not equipped with useful past experiences in geothermal sector despite the common knowledge that experience and credibility are important criteria in such selection process. The local tender committees seemed to have used their own informal rules in the selection process. One of the cases was the development of Gunung Ungaran field in Central Java province. Following a tender process conducted by the Energy and Mineral Resource Department of the provincial government, a geothermal license was issued to PT Giri Indah Sejahtera (GIS) in 2009. Unfortunately, until as late as 2016, the company did not manage to perform any exploration drillings due to financial problems. Consequently, its geothermal license was planned to be revoked. GIS was a private company which was considered as the most feasible candidate during the tender process (Sismanto, 2016). The fact that the tender committee had used the notion of 'the most feasible candidate', instead of referring to a clear tender selection procedure—due to a lack of one—does confirm that the selection process has been an issue due to unclear and immensely unregulated criteria. Given the insufficient regulatory framework, informal and uncontrollable rules dominated the prequalification system.

In addition to a poor prequalification system, the final selection criterion at the second stage of the tender process seemed to have added burden to the selection process. Even though the quality of data and information of the tendered Work Areas was insufficient to make a good estimation for the investment plan and the expected return from the electricity sales, the regulation specified to select the tender winner based on the bid price (the electricity price to be paid by PLN) at the commercial stage of the project. The resulting pattern of interactions was the business entities competing to bid as low as possible, ignoring the feasibility of the project given the low tariff. The condition had obstructed serious bidders which eventually proposed for a higher tariff to win the tender. In the end, many of the Work Areas were entrusted to less capable and less experienced developers which did not put enough attention to some the most important factors, such as the resource and financing risks.

4.1.4.2 Analyzing the Current Selection Mechanism

The new geothermal law and its implementing regulations have attempted to address the issues of the selection process. First and foremost, the new law stipulates that the tender committee is now a function appointed by the central government, or specifically the Directorate of Geothermal under EBTKE. Such arrangement should be able to ease the difficulty in controlling and overseeing the quality of the selection process. However, given the fact that the directorate itself is a new

organization under the government with relatively little experience in the matter, the challenge remains in establishing good selection criteria and strengthening the reliability of the selection process.

Old Rules	New Rules
<ul style="list-style-type: none"> Decentralized tender process (different region, different tender committee) → Law No. 27/2003 Final tender winner selection criterion: lowest electricity bid price → PP No. 59/2007 	<ul style="list-style-type: none"> Centralized tender process under Directorate of Geothermal in EBTKE (Law No. 21/2014) Final tender winner selection criterion: highest exploration commitment (PP No. 7/2017)

Figure 33 Comparison between the Old and the New Selection Mechanisms

One of the most prominent issues of the tender process in the past regulation was the unreliable competition between the bidders which ended up bidding the tariff to be as low as possible to win the tender. The response to this issue was to change the selection criteria. Currently, the tender winner is selected based on the level of exploration commitment for open tenders (see chapter 3.3.2.3 on the aggregation rules for the IPB issuance). The rule is that bidder with the highest exploration commitment will win the tender and obtain the IPB. To what extent can this specific criterion improve the selection process?

Obviously, the effect of the recent changes in the regulation cannot be observed yet since no tender has been opened since the issuance of the new regulation of PP No. 7/2017. Therefore, it is impossible to analyze with certainty how the change will affect the quality of the selection process. Nevertheless, as already elaborated in the physical and material condition section, project financing at early stage of geothermal resource development is considered as one of the most challenging parts in the process. In fact, the delay of Gunung Ungaran field development by GIS was only one among many more projects with similar financial issues (Satar, 2017). In some way, the new criterion might be able to help in selecting the most financially capable candidate. Since the exploration commitment can be withdrawn as the exploration activity progresses, this mechanism might be able to ensure the continuity of the project, at least until the drilling of some exploration wells.

It is important to note that such expectation can be achieved under the condition that the tender committee and the tender winner are able to honor the rule which obligates the tender winner to actually submit the exploration commitment prior to issuing the IPB. Given the past experiences of slackening the compliance of rules associated with the performance guarantee (e.g. failing to enforce the performance bond submission from the tender winner), there is a risk that the same issue will repeat itself despite the attempt to improve the process. The resulting pattern of interactions will be that of the bidders which bid as high as possible under the assumption that this commitment will not be fully enforced eventually. The bottom line is that the lack of enforcement toward the rules will nullify the intention of the criteria change in the first place.

The important side note for this specific issue is that individual/personal interactions and judgments play a significant influence when it comes to the enforcement of rules in Indonesia. As an illustration, the interview conducted with a representative from EBTKE opened up a fact about a case of geothermal development located at Jaboi field in Aceh province. The license for the development has been issued in 2009 to Sabang Geothermal Energy (SGE). However, only in 2016 that SGE was able to start the exploration drilling process. If the decision is entirely made based on the formal rules or the regulations, the license for SGE should have been revoked given the fact that the company has failed to finish the exploration and feasibility study within the time limit of seven years. Despite the failure to perform according to the regulation, EBTKE has decided to give another opportunity for SGE to continue with the project since the company has shown a commitment by mobilizing a drilling rig to the field. For EBTKE, the decision might be justified considering the high transaction cost to be incurred supposed that the Work Area is to be returned and the entire selection/development process must be restarted all over again. Nevertheless, although the case of Jaboi field is different with the issue of exploration commitment enforcement, the illustration has exhibited that personal communications and negotiations might enable the players to slightly distort from the formal rules/regulations and to make exceptions based on justifications which have never been established formally beforehand.

4.1.4.3 Guaranteeing the Reliability of the Selection Process

The previous section has attempted to predict the outcome of an open tender mechanism in regards with its capacity to dodge the past issues concerning the technical and financial capability of the tender winner to undertake the resource development. In brief, it has been argued that the new mechanism of selecting the tender winner based on the level of the exploration

commitment might be able to set aside such problems, under the assumption that the rule which obliges the submission of the exploration commitment is properly enforced. However, the discussion has not covered another important factor of the selection process outcome according to the point of view of the government: the efficiency of the developer. What is meant by efficiency and why should it matter?

Farell (1957) simply defined efficiency as the measure of “...success in producing as large as possible an output from a given set of inputs.” Certainly, different geothermal projects would entail different level of production factors, given the varying characteristics of the fields and their existing infrastructures. Therefore, it may not always be convenient to discuss the efficiency of various geothermal projects across different locations. However, in the selection processes (open tender or PSEA assignee selection), the potential developers are given the opportunity to assess the available information on the same prospective area. Therefore, measuring the efficiency of the potential developers in a selection process should be worthwhile.

Note that all of the costs associated with the *inputs* required to produce the steam/electricity or the *output* of a geothermal project in Indonesia will always be included in the calculation of tariff to be paid by PLN. Eventually, as a state-owned company, the costs to be assumed by PLN, to some extent, will be a burden for the government as well. Consequently, it should be within the interest of the government that the costs to be covered by PLN is as low as possible, through ensuring the efficiency of the developers. However, it is important to note that such interests might be more relevant for some government agencies, such as the Ministry of State-Owned Enterprise (MSOE) as the shareholder of PLN and the MoF as the manager of the state budget, rather than the EBTKE which focuses more on the increase of the renewable energy capacity in the country.

Chapter 4.1.4.1 only discusses the change in the open tender process. However, as mentioned before, the regulation allows for a preliminary survey and exploration assignment (PSEA) by business entities prior to the issuance of the geothermal license. In this scheme, since the tender process is restricted and fairly gives a lot of favor to the PSEA assignee, the more important aspects to consider is the selection of the PSEA assignee itself. As described in the aggregation rule (chapter 3.3.2.3), the selection will be based on the assessment score toward the technical, administrative, and the financial evaluation of the applicants. This kind of selection process uses a multi-criteria approach in which the winner selection is based on more than one aspects. Figure 34 shows the requirements to be provided by all the PSEA applicants. The regulation does not specify how the assessment is arranged, e.g. to determine the weight of the different factors to be assessed. However, it clearly stipulates that the PSEA Assignee will be appointed according to the assessment result toward the technical and financial aspects in its application/proposal.

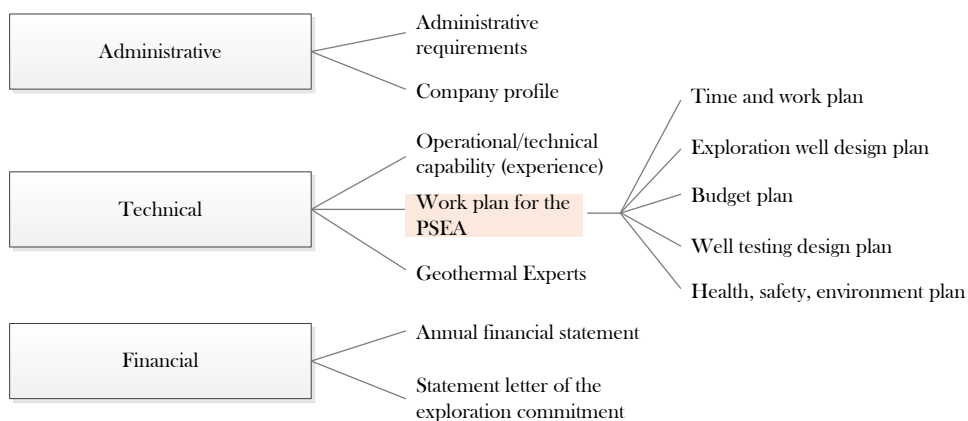


Figure 34 PSEA Application Requirements

Given all the information to be provided by the applicants, especially the work and budget plan, the selection committee will be able to make an assessment toward the credibility, capacity, and efficiency of the developer as such.

In the meantime, the open tender process is slightly different. Figure 35 shows the stages of process. The aspects to be assessed are more or less the same. However, since the tender process is intended to issue the IPB which will be used not only for the exploration, but also the exploitation and the commercial stage, the requirements become more complex. For instance, the bidders are expected to present its exploration and exploitation strategy and the expected COD at the second stage.

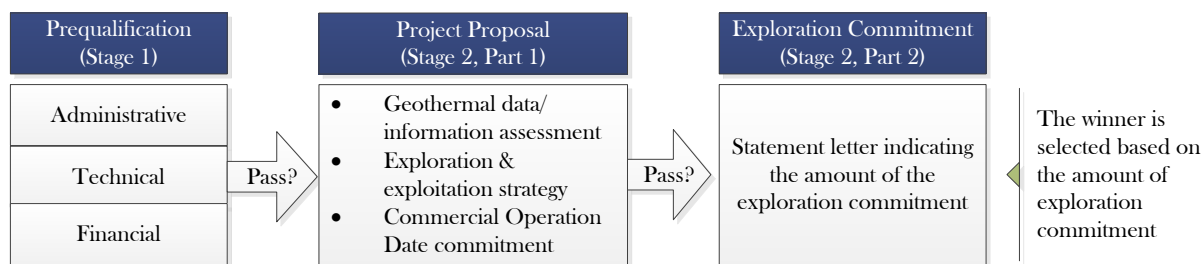


Figure 35 Open Tender Process in the Indonesian Geothermal Sector

The difference between the PSEA selection and the open tender process is the way that these factors are used to determine the final winner. Notice the ‘pass?’ arrows between the evaluation stages. These arrows indicate that the assessment factors of the first stage and the first part of the second stage are used to determine the qualification of the bidders to pass the minimum requirement as set by the tender committee. If the bidders are considered capable to meet the minimum criteria, they will move on the final selection process. Considering that only financially and technically qualified bidders will remain at the second part of the second stage, the Tender Winner will be selected solely based on the amount of the exploration commitment.

The issue under scrutiny in this case is illustrated as follows. Supposed that there are two remaining bidders during the last evaluation stage. Certainly, both of them must have passed the minimum requirements of the previous evaluation stages. Bidder A has better development strategy which requires less resources/capital compared to Bidder B. From the perspective of the government, Bidder A should have higher opportunity to win the tender process. However, the regulation dictates that the final assessment criterion should be the level of exploration commitment, and not include the technical capability per se.

It appears that the selection mechanism of the open tender process gives higher priority on the financial capability of the bidder. This is understandable since, as already elaborated in the previous section, the past tender mechanism has been considered to be insufficient to obtain financially capable developers. However, it is argued here that designing a tender process which only uses an exploration commitment as the only criterion for the final selection seems like an overcorrection against the previous selection mechanism. Selecting a credible developer which can actually deliver its obligations can be achieved in many other ways.

The past mechanism which used the electricity tariff bid price as the final determinant of the tender winner was unsustainable due to several things. First, the selection process was not equipped with a procedure to carefully assess the credibility of the bidders. Second, the tender committee had limited capacity to make technical and financial judgments toward the bidders. Third, the enforcement of some rules governing the performance guarantee of the tender winner was not optimal. Fourth, it was difficult to propose a tariff bid price for a particular geothermal resource which lacks sufficient subsurface information (Meier, et al., 2015). However, this criterion had the intention to guarantee the selection of the most efficient developer—the one which can operate with the least resource requirement for developing the same geothermal field. This efficiency was supposed to be reflected on the level of electricity tariff to be paid by PLN later at the commercial stage of the project. The elimination of this selection criterion might dismiss the incentive for the bidders to propose for the most efficient project plan. Chasani (2017) from the IBRD¹³ group of the World Bank, has argued that the tariff proposal could be a good measure for the selection process, provided that the system was equipped with other measures to ensure the credibility of the bidders. Therefore, it was unfortunate that this criterion has been overlooked in the latest regulation.

When the government transfers geothermal license to a business entity, the transaction should be deemed as a partnership between the two parties. Although it is not always the case that the partnership is made between the public sector and the private sector (i.e. when the license is transferred to a state-owned company), the following explanation will be based on the principles of the public-private partnership (PPP). After all, the state-owned companies are expected to deliver a quality service and maintain their profitability. Therefore, in regards with efficiency, their performance should be expected to compete with the private sector.

The involvement of other business entities to replace the government’s roles in public service provision should be able to complement on the factors which are frequently found to be lacking the public sector, such as innovation, access to finance, technological knowledge, and managerial efficiency (Koppenjan & Enserink, 2009). The decision to have a PPP, such as through the BOOT scheme in the Indonesian geothermal sector, should be based on the concept of the value-for-money. The value-for-money can be defined as what the government deems to be the optimal composition of quantity, quality,

¹³ IBRD: International Bank for Reconstruction and Development

features, and price (cost) over the lifetime of the project (Burger & Hawkesworth, 2011). It is intended to consider the public interest, both as the taxpayer and the infrastructure user. Therefore, in the case of geothermal energy sector in Indonesia, it is worth mentioning again that the partnership between the government and the developer must result not only in the increased generation capacity of geothermal energy, but also in one which benefits the public as well.

A tender mechanism which can generate competition is an important factor in designing a partnership. According to Koppenjan & Enserink (2009), good bidding practices should consist of a tender mechanism in a way that allows competition, transparency, and accountability in the process and that they should result in efficiency advantages. The problem with the current regulatory setting for the public tender process is that it cannot guarantee such efficiency factor. It is not to say that the highest bidder does not possess the capacity to deliver efficient operations. However, the use of highest exploration commitment criterion simply ignores the importance of other aspects, i.e. technical and financial efficiency, which would have been reflected in the offered future tariff.

The most common concept used to select the most efficient bidder is through the lowest-bidder mechanism. In this way, the best commercial proposal from all technically responsive bidders (all bidders who have met the minimum technical requirements) will be selected as the final winner. For the Indonesian geothermal sector, this concept would require the bid assessment to be based on the lowest tariff mechanism, just like the older tender scheme (Law No. 27/2003 and PP No. 59/2007). However, it has been widely recognized that this kind of concept might create too much pressure on the competition which would lead the bidders to be too aggressive and unrealistic in their bids, as was the case for Indonesian geothermal development before. In response to this kind of issue, a rigorous prequalification process is believed to be one of the solutions to dismiss irresponsible bidders. Other than that, it is also necessary to ensure that the seriousness of the bidders/potential developers is properly attended through the enforcement of instruments, such as the bid bonds and the performance bond. In the Philippines, for instance, as reported by Meier et al. (2015), the country enforces the post-award audit which ensures that all the obligations/terms to be fulfilled by prospective winner has been fulfilled before declaring the final winner, e.g. through confirming the submission of the performance. These practices can be effective to offset the risk of bidding too low and unsustainably by the bidders. Regardless of the available safeguard mechanisms, if the lowest-price method had failed in the past, why would the government need to implement it again?

One of the reasons why the previous lowest-price mechanism has failed in most projects was the insufficiency of the subsurface information to make a proper feasibility analysis, including for the commercial aspect, of a prospective area. In many cases, even the basic preliminary survey data (geological, geochemical, and geophysical analyses) is not complete (Meier, et al., 2015). However, this should no longer be an issue for the tender of Work Areas which have been determined based on the result of proper preliminary survey and exploration, i.e. the government drilling program. Ideally, the information obtained prior to opening up a tender process should already be sufficient to make an appropriate feasibility analysis. In this way, both parties (tender committee and the bidders) can make an informed and better decision with respect to the bid proposal. It is important to note that a sound judgment from the committee is required to assess the feasibility of the bid tariff, whether or not it is aligned to the proposed development/work plan. On the downside, this kind of arrangement may not be convenient for selection processes conducted toward prospective areas in which no exploration drilling has taken place, i.e. the PSEA assignee selection or the open tender that is preceded only with preliminary survey assignment (refer to Figure 24 Geothermal License Issuance Schemes).

Aside from the lowest-bidder criterion, there are more procurement/tender practices which use the multi-criteria selection method, including in the Philippines, the second largest geothermal power producer in the world. In the Philippines, the winner is selected using multi-criteria bid evaluation process. The final decision is based on the quality of the work plan, financial and technical qualifications of the bidders. Each of the elements has its own weight percentage. Table 13 shows the key elements and the weight of each criteria.

Table 13 Multi-Criteria Assessment of Geothermal Developer Selection Process in the Philippines (Department of Energy (PH), n.d.)

CRITERIA	KEY ELEMENTS	WEIGHT PERCENTAGE
LEGAL DOCUMENTATION	Legal documents	PASS / FAIL
WORK PROGRAM	Resource exploration/evaluation strategies and methodologies Development concepts	40%
FINANCIAL QUALIFICATIONS	Available working capital Sources of current funds Other source of future funds	30%
TECHNICAL QUALIFICATIONS	Technical resources Experiences and track record of the company Qualifications of key management and technical personnel	30%

Waara and Bröchner (2006) argue that although the lowest bid as an award criterion has been widely used in a tender, the current practice shows the rise in the use of both price and non-price criteria in the procurement process. Wong, et al. (2001) also suggest that the adoption of multi-criteria selection approach should be conducted given their finding that the use of project-specific criteria in the UK construction case was found to more superior in comparison to the lowest-price method. There are many methods that can be employed to assist in the multi-criteria selection process, such as the analytical hierarchy process or AHP (Fong & Choi, 2000) and the fuzzy sets (Nguyen, 1985). However, the use of multi-criteria selection method is not without challenges. The inherent subjectivity in a tender process makes it difficult to explain the determined importance of a particular parameter against the others. Adding complexity to the evaluation formula does not necessarily reduce the subjectivity on this matter either.

The bottom line is that EBTKE must recognize the importance of obtaining efficiency gains in the partnership, aside from selecting a credible partner. It is argued here that such objective cannot be guaranteed using the current tender mechanism. When the issue to fix is the financial capability of the bidder, the selection criterion should not only be based on the capability of the bidders to provide immediate funding (exploration commitment) after the conclusion of the tender process. Instead, the selection should rely more onto the quality of the prequalification and the evaluation stage. Regardless of the methods to be chosen, it is important to note that different selection method requires different sets of knowledge and resources. When the government decides to employ a single-criterion of the lowest-price, the strictness of its prequalification process and the evaluation toward the technical and financial aspects, which reflect the credibility of the bidders, should not be slackened. On the other hand, when multi-criteria selection method is employed, the committee needs to have a good basis on deciding the importance level of different criteria and how they are going to be scored properly in order to reduce the influence of subjectivity in the process.

4.1.4.4 Concluding Remarks for the Developer Selection Process

Through the elaboration of the interactions between the rules and the participants, it has been found that the current regulatory framework might be able to partly fix the past issue with the tender process which had resulted in financially unqualified tender winners. However, it has been extensively discussed as well how the new arrangement cannot guarantee another important factor in the IPB issuance process, from the perspective of the government and PLN as the Buyer: the efficiency of the Developer. Some suggestions have been proposed in which an emphasis is made toward the importance of relying on the credibility of the prequalification and the technical/financial evaluation stage, instead of solely using the concept of highest exploration commitment. Another important side note is that different scheme might need different selection mechanism as well. For instance, when the resource information is sufficient to make a proper development plan, it might be best re-adopting the past mechanism using the lowest tariff bid.

4.1.5 The Payoff Structure of the Action Situation

The ideal situation within the action arena is achieved when all the participants willingly take part in obtaining all the required agreements (IPB, PPA, and financing agreement) to move forward with the projects. For both the government and PLN (respectively as the Owner and the Buyer), their participation in the arena, according to the boundary rules, are strictly required by the regulations. The law gives the only authority to directly manage all matters regarding the indirect utilization of geothermal resources in the country for the central government, represented by the Energy Minister. As for PLN, its participation is obligatory, as mandated in the regulation regarding the purchase of electricity from all renewable energy producers. However, the circumstances are different for participants which are to assume the position of the Developer or the Financier.

Especially for private business entities, the decision to participate in this sector very much depends on their perception on the profitability of the project. If the business is perceived to be highly risky or even unprofitable, their participation should not be expected in the first place. Therefore, it is more crucial to understand how the existing payoff structure affects the investment decisions of the business entities. The knowledge on this issue will be useful to assist the government in strategically planning the development for different prospective areas in the country.

As shown during the elaboration of the payoff rules (see Table 9 Payoff Rules) and as illustrated in Figure 32, different IPB issuance schemes generate different payoff levels. Table 14 shows the different risks and cost components to be covered by the business entities to be able to obtain the IPB.

Table 14 Breakdown of Risk and Cost Components of Different IPB Transfer Schemes for the Developers

Scheme	Risk	Cost components
Preliminary Survey Assignment (PSA)	<ul style="list-style-type: none"> High resource risk 	<ul style="list-style-type: none"> Tender process Full exploration commitment Exploration and development cost (prospective cost)
Preliminary Survey and Exploration Assignment (PSEA)	<ul style="list-style-type: none"> High resource risk Additional risk of long bureaucratic process after finishing the PSEA Risk of opportunistic behavior from the government agency 	<ul style="list-style-type: none"> Lower actual exploration commitment Exploration drilling (sunk cost) by the time of tender Tender process (first priority) Exploitation and other development cost (prospective cost)
Government Drilling	<ul style="list-style-type: none"> Medium to low resource risk 	<ul style="list-style-type: none"> Tender process Full exploration commitment Compensation payment for the exploration by assigned SOE Development cost (prospective cost)
Direct Assignment	<ul style="list-style-type: none"> High resource risk Risk of little political support to undertake the assignment 	<ul style="list-style-type: none"> Development cost (prospective cost)

This section will discuss the payoff structure of each scheme and analyze how they will affect the investment decisions of the business entities (chapter 4.1.5.1–4.1.5.4). The discussion regarding the payoff structure should also include an analysis toward the PPA settlement process. As shown in Figure 32, the resulting tariff of the PPA settlement process also affects the payoff structure of the action situation. Therefore, chapter 4.1.5.5 will look into the factors which outline the interactions during the PPA negotiation process. At the end of the section, some concluding remarks will be given toward the current payoff structure.

4.1.5.1 Open Tender Preceded by Preliminary Survey Assignment (PSA Scheme)

When a location has been specifically designated for PSA, the current regulatory framework stipulates that the government can only offer the prospective area for universities and research agencies to undertake the assignment. For the universities and the research agencies, the opportunity to participate in this scheme is solely for the achievement of educational purposes. Moreover, in regards with the funding source, the participants are ought to finance the preliminary survey independently. Eventually for these universities and research agencies, no economic advantage can be directly gained from conducting the PSA. Therefore, it is within their authority as well to decide whether to join the scheme or not.

The quality of resource information obtained by the university/research agency plays a vital role in the continuation of this scheme. According to the regulation, preliminary survey should consist of geological, geophysical, and geochemical studies, and if required, a gradient temperature survey. According to Loksha and Gehringer (2012), the preliminary survey consisting of these activities should be able to give information such as (a) degree of permeability within reservoir rock structure, (b) the type of heat source, (c) the location and the potential estimation. It is important to note that the exact location and potential of the reservoir cannot yet be specified with certainty at this point. As seen in Figure 23, the project risk will only be significantly reduced from high to moderate level after test drillings are undertaken. It means that in this scheme, the resource risk is still significantly high for the business entities.

This kind of scheme has basically been implemented during the era of Law No. 27/2003 and the arrangement was made clear through the issuance of PP No. 59/2007. The difference is that, the assignment for the preliminary survey was given to

business entities, instead of universities and research agencies as stipulated in the current regulation, PP No. 7/2017. Companies which conducted the preliminary survey would be able to obtain the *right to match* during the tender process, which was the right to reduce the tariff bid price down to the level of the lowest bidder. The right to match was intended to give the company which has conducted the preliminary survey to be able to win the tender. Some companies which have undertaken the preliminary survey assignment include (1) Supreme Energy in Kalianda, Pematang Belirang, and Muara Laboh fields, (2) PT Trinergy in Baturaden field, (3) Spring Energy Sentosa in Guci field, etc.

Today, some of these companies are still making progress in the same fields. For instance, Supreme Energy is still working on Muara Laboh field following its success to reach the financial close in early 2017. PT Trinergy (now PT Sejahtera Alam Energy) has finally started the exploration activities (Eksplorasi.id, 2017), despite the slow progress since the issuance of the permit in 2010. The reason of the slow progress is not caused by the IPB issuance arrangement as such. Instead, many of the Developers (license holders) had withheld the investment/development due to the long process of PPA negotiation after the tender process. With this illustration, it can be seen that the private sector has the willingness to participate despite the high resource risk that it has to assume through conducting the early exploration stage. The more crucial concern has been about the settlement of the PPA negotiation which will be analyzed in the next section.

The main difference between the current and the past arrangement using this scheme is the bid evaluation criterion (lowest tariff bid price vs. highest exploration commitment). The regulations do not really restrict the participation in the tender process. However, the payoff rule clearly indicates the obligation of the tender winner to submit the exploration commitment (a minimum of USD 5 or 10 million) to be able to actually obtain the IPB. For some developers, this rule is considered to be favorable in order to reduce the pressure of competition with smaller companies which, in the past, have made a very low tariff offer during the tender process.

4.1.5.2 Restricted Tender Preceded by Preliminary Survey and Exploration Assignment (PSEA Scheme)

In the past, most of the companies have attempted to negotiate the tariff first before moving forward with the exploration stage. This shall bring the discussion to the second scheme of the IPB issuance, the PSEA scheme. This scheme is probably the riskiest one, considering the fact the PSEA assignee must conduct the exploration drillings (at least for one exploratory well), before it can obtain the actual IPB, not to mention the PPA itself. However, if a comparison is made between the PSA and the PSEA scheme, since both require the business entities to assume the early resource risk, ignoring the other risks of long bureaucratic process and opportunistic behavior, the PSEA scheme actually requires a lower transaction cost. The first reason is because the PSEA assignee obtains the first priority in the tender process. During which, the company will need to present a development plan based on the information that has been obtained by itself. In this case, the company has better resource information and should be able to propose a good development plan. Second, the tender process does not require an exploration commitment. Instead this commitment is requested in the beginning of the preliminary survey and exploration assignment. Moreover, the actual amount of the exploration commitment to be submitted is only a minimum of 5% of what has been promised during the application process. Third, the costs of joining a PSEA selection process should be lower than joining an open tender.

The lower transaction cost is probably why, according to Riyanto (2017) from EBTKE, many companies have expressed their interests to apply for the preliminary survey and exploration assignment, even before the issuance of the implementing regulation (MEMR Regulation No. 26/2017). In addition to that, Riyanto (2017) argued that this scheme would allow business entities to obtain higher chance of obtaining the IPB. In a normal open tender, the competition can be tight, especially when bigger companies, such as Pertamina, participate in the process. Assuming that all geothermal companies have the intention to expand the business and given the fact that their participation in the sector will always be constrained by some regulations, the PSEA scheme is a good option to reduce the transaction cost and the pressure of competition. Whether or not the incentives of obtaining the first priority during the tender process and the lower transaction cost can attract enough interests remain unknown at the moment. However, the following presents a thorough discussion regarding the risks faced by the PSEA assignee.

The PSEA scheme exposes the business entities to more risks which might result from the actions of the government/public agents. First, the time taken by the government (EBTKE) to study the PSEA result and by the tender committee to open the tender process will affect the investment decisions to be made by the PSEA assignee. The regulation (MEMR No. 37/2017) has stipulated the maximum 60 workdays for EBTKE to ratify the prospective area as an official Work Area, prior to the tender process. Nevertheless, given the fact that delays are common within the bureaucratic processes in Indonesia, the formal rules may not be the same as the actual (informal) ones. EBTKE must be able to assure the business entities that their participation in the PSEA would be fairly rewarded, including through delivering a professional and reliable service during both the work area preparation and the tender process initiation. However, any delay which affects the value of investment would increase the required return (tariff) by the business entities. Therefore, the risk may not be significant (probability of

occurrence is low) since it should also be the interest of EBTKE to accelerate the process and to avoid unnecessary burden to the investment.

The second risk comes from the possible opportunistic behavior of the public agents which might cause the PSEA assignee to lose in the tender process. A need to conduct a restricted tender in this scheme is considered to be inefficient and exposes more unnecessary risks for the PSEA assignee. According to Poernomo (2017), this new scheme still needs to be complemented with the mechanism to ensure the fairness of the process. It is due to the fact that other state-owned companies, which do not have any sunk investment by the time of the tender, will participate in the restricted tender as well (see the aggregation rules). Although the outcome of this process will affect the credibility of the government in protecting the conduciveness of the business environment, the geothermal developers still convey their hesitations toward this scheme. However, given the past experience of multiple arbitration cases upon the cancellation of several geothermal projects in the 1990s (see Text Box 2), the government should know better to maintain the integrity of the process in order to avoid similar issues in the future. Therefore, the risk of such opportunistic behavior should be low.

Last, since it might be too risky for the business entities to conduct exploration drillings before getting any assurance from PLN regarding power purchase agreement, there needs to be an instrument to substitute the function of the PPA. For this matter, Yunis (2017) from PLN, has mentioned the plan to use the Heads of Agreement to mitigate the issue. Although it is not known what details to be included in agreements (to be made according to the B2B negotiation between the two parties), this mechanism can be used to reduce the uncertainty from the perspective of the business entities.

4.1.5.3 Open Tender Preceded by Government Drilling (Government Drilling Scheme)

The idea of increasing the quality of resource information by the government, prior to conducting a tender process, has been around for a long time. A study report by JICA in 2009, for instance, has already mentioned some measures to transform ‘green fields’ into ‘brown fields’ in order to increase the attractiveness of geothermal energy in Indonesia for the private sector (JICA, 2009). Figure 36 shows the diagram of this scheme.

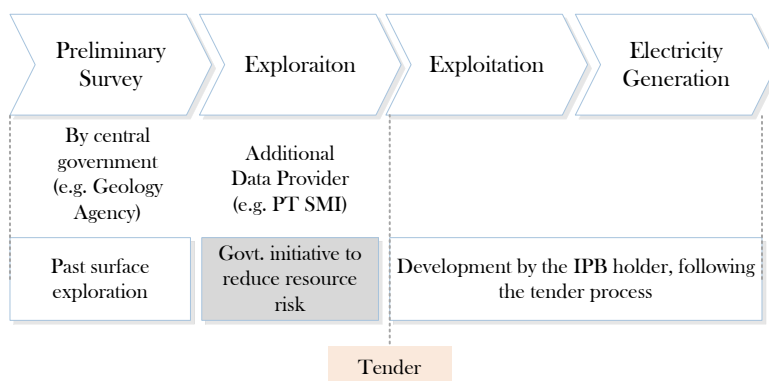


Figure 36 Government Drilling Scheme

Comprehensive exploration (and exploitation) by the government has been implemented, for instance, in the Philippines. In the 1980s, the government, through the Philippine National Oil Company (PNOC) and Energy Development Company (EDC), conducted the exploration and exploitation of the prospective fields. The private sector was involved only during the power plant development in which PNOC-EDC supplied the steam for free to the private company and purchased the electricity for ten years. This kind of arrangement resulted in a fundamentally risk-free business for the private sector. As a result, many private companies participated and the development of geothermal energy in the Philippines at the time increased rapidly.

Certainly, the government drilling scheme does not entirely wipe out the resource risk of geothermal development. However, given the current regulatory framework, this scheme can benefit the business entities due to several reasons, (1) significantly reduced resource risk and (2) the ability to directly settle the PPA with PLN (since the resource should have been proven by the time the tender is opened).

Many of the past projects were actually developed in Work Areas which have been extensively explored before, such as in Wayang Windu by Star Energy (previously developed by Asia Power Ltd.), Sarulla by SOL (previously developed by Unocal and then bought by PLN), also Dieng and Patuha by Geo Dipa Energi (previously taken over by PLN and Pertamina from Himpurna California Energy). When the resource has been found to be prospective for commercial development, there will be an increased confidence from the business entities (public/private) to channel their resources for the investment. According

to Rakhmadi & Sutyono (2015), access to proven geothermal resources can provide a strong incentive for the private developer to participate in the project. This has been exhibited in the Sarulla case in which the current developer, Sarulla Operation Limited, has spent approximately USD 60 million to pay for the resource information from PLN and to receive the geothermal license. Therefore, although the business entities will have to pay and compensate for the expenses (including the margin) during the exploration phase, the interest will still be high.

In regards with the tender evaluation criterion, for companies with the capability to pay for the exploration compensation fee, the requirement to submit a certain amount of exploration commitment should not be deemed as a problem. However, it is important to note that this selection mechanism might only favor bigger companies with immediate source of funding during the tender process. At this point, it is not known whether this kind of arrangement can discourage healthy competition which in turn will decrease the attractiveness of this scheme for most developers. Nevertheless, based on the past experiences, it can be said that proven resources obtained from the exploration drillings can be highly attractive for the potential developers.

4.1.5.4 Direct Assignment

The scheme of direct assignment has been implemented since the early undertaking of geothermal sector in the country. The Presidential Decree No. 22/1981 and No. 45/1991 had stipulated a similar scheme of direct assignment to the state-owned company, Pertamina. The scheme enabled a rapid development in the past through numerous joint operation contracts (JOC) between Pertamina and companies from the private sector. Although it is not known yet whether or not the current regulatory framework allows for the JOC mechanism, based on some experiences in the past, there have been several issues found with this arrangement. For instance, it is argued that the JOC arrangement between the developer of Sarulla field and Pertamina had complicated the attempt of reaching financial close—resulting in an 8-year long process since the award of the tender (Rakhmadi & Sutyono, 2015).

The strategy for further field development should be left for the SOE as the IPB holder to decide. Nevertheless, whether or not it can result in a beneficial partnership between the license holder and the government is the question which needs exploring. From the point of view of the SOE, this scheme allows it to leave out the tender process, saving any costs associated with the selection process. However, the Direct Assignment scheme entails an additional support mechanism from the government to the SOE when required. This corresponds to PP No. 45/2005 which stipulates that the government must compensate for all the incurred costs—with the margin—for the SOEs which receive the assignment from the government, supposed that the assignment does not render any profit. Therefore, the capability and the efficiency of the SOE to undertake the assignment greatly affects the costs to be borne by the government eventually. The possibility for the government to financially support a special assignment must then be accompanied with an oversight mechanism to ensure the capacity of the SOE prior to handing out the assignment.

4.1.5.5 The PPA Settlement Process

The discussion of the payoff structure needs to take into account the benefits of participating for the business entities as well. The only source of return in a geothermal project for the Developers is through the payment of electricity purchase from the Buyer to the Developer/Seller. Along the development of this sector, especially since the issuance of Law No. 27/2003, PPA settlement has been one of the bottlenecks in numerous geothermal projects. The reason varies from uncertainty of the regulatory framework regarding the tariff level to simply prolonged negotiation process between the Buyer and the Developer.

The following part describes how PPA settlement has been a major bottleneck in the system. Despite the past regulation which stated that the power purchase by PLN had to be made according to the bid price proposed during the tender process, many of the Developers still attempted to negotiate the tariff (due to the fact that the bid price was unrealistically low for commercial development). Moreover, the regulations on PPA (including tariff) have been changed several times, causing more uncertainty for both the Developers and the Buyer. Only after the issuance of MEMR Regulation No. 17/2014 that the Developers were 'forced' to settle the contract with PLN using the initial bid price (as offered in the tender) as the final tariff. Otherwise, the Work Area under the license would have to be returned to the government. By the time the PPAs were obtained, all the projects have been postponed for more than three years (some took almost five years), since the issuance of the geothermal license. MEMR Regulation No. 17/2014.

Table 15 shows the list of Developers which have signed the PPA following the instruction in Article 22 of MEMR Regulation No. 17/2014.

Table 15 PPA Signing between PLN and Developer in 2014 (PLN, 2014; PLN, 2014a; Sukarna, 2012)

Field	Developer	Geothermal Permit Issuance	PPA Signing
Guci	PT Spring Energy Sentosa	Apr-11	29-aug-14
Tangkuban Perahu II	PT Tangkuban Parahu Geothermal	Nov-09	
Cisolok Cisukarame	PT Jabar Rekind Geothermal	Nov-09	
Baturaden	PT Sejahtera Alam Energy	Apr-11	
Tampomas	PT Wijaya Karya Jabar Power	Nov-09	
Ngebel	PT Bakrie Darmakarya Energi	Jun-11	
Rawa Dano	PT Sintesa Banten Geothermal	2011	
Sorik Marapi	PT Sorik Marapi Geothermal Power	Sep-10	
Sokoria	PT Sokoria Geothermal Indonesia	Apr-10	30-sep-14
Jaboi	PT Sabang Geothermal Energy	Feb-10	

PPA is one of the essential requirements to be able to move forward with the project. The agreement, complemented with a Business Viability Guarantee Letter (BVGL) from the MoF, serves as a guarantee that the steam/electricity will be purchased and paid by the Buyer. Only with such guarantee that the Developer can attract more investors and continue with the development. For instance, the development by SEMI in Muara Laboh was withheld from 2010 until the PPA was obtained in 2012. Between 2010 and 2012, no significant investment (e.g. for exploration drilling) was made by the company, except for other smaller expenses, such as the road access construction (Effendi, 2017).

It is important to note that for the business entities, PPA is intended to ensure that sufficient return can be achieved in the end. This aspect should be reflected in an economically feasible tariff level, given all the expenses to be incurred in the project. Therefore, the PPA settlement process is not only a matter of obtaining the agreement, but also of ensuring that the two negotiating parties can comfortably agree on all of the terms, especially the tariff. As an illustration, not all of the projects mentioned in MEMR Regulation No. 17/2014.

Table 15 are still on progress up until today. For instance, the project in Tangkuban Perahu II field has been reported to be halted due to unknown reasons (Fokusjabar.com, 2016). Based on the interview result, it is concluded that some of the projects were impeded due financial reasons. It suggests that despite the ownership of the PPA, the Developers were still unable to attract any financier, given the infeasible tariff level (Satar, 2017).

Considering the importance of PPA in this sector, it becomes crucial to analyze the capability of the current regulatory framework to facilitate the PPA settlement process and to ensure the quality of the agreement itself. According to Effendi (2017), in a PPA negotiation, despite the many terms to be agreed upon, the issue of tariff level has been particularly challenging. It is not to say that other terms, e.g. regarding the distribution of risks during force majeure, are not important. In fact, despite the standard PPA that PLN has, some terms can still be subject for negotiation and compromises need to be made by both parties. However, since the tariff level will basically depict the stream of cash inflow to be obtained in the future, it becomes the most pivotal element in the agreement.

New Boundary Rule for the PPA Settlement Process

The decentralization attempt in managing geothermal resource, through the issuance of Law No. 27/2003, had loosened and obscured the control over the quality of the developer selection process. Within 2008-2014 (until the issuance of the new geothermal law), numerous tender processes were conducted by the respective local governments. As already mentioned in in chapter 4.1.4, the tender process used a single-criterion for the winner selection: the lowest tariff bid price. The lack of proper qualification checks over the bidders and the limited capacity of the local tender committee to make a sound judgment toward the feasibility of the bidders' proposals had resulted in unrealistically low tariff as proposed by the winning bidder. According to Satar (2017), this outcome had severely affected the bankability of the projects.

As a consequence of the bankability issue, many of the geothermal license holders tried to make their ways to negotiate the tariff again with PLN. However, the regulations simply did not allow for any tariff changes, causing a roadblock in the process. For instance, MEMR Regulation No. 2/2011 did increase the tariff ceiling from PLN's own estimate to 9.7 cent/kWh.

However, the regulation clearly stipulated that the tariff level to be agreed in the PPA must be the same as the one proposed during the tender. Only in MEMR Regulation No. 22/2012 that the opportunity was (ambiguously) opened to conduct negotiation. The regulation did not visibly mention the connection between PPA settlement and the proposed tariff during the tender process. Nevertheless, it appeared that this regulation could not encourage acceleration toward the PPA negotiation process. Instead, it added more confusion given the fact that it did not properly address the issue regarding the possibility to conduct negotiation toward the proposed tender tariff. As mentioned before, the clear and strict arrangement was finally made in 2014 which mandated the geothermal permit holders to immediately settle the PPA, this time according to the proposed tariff during the tender. This regulation, however, allows for tariff adjustment when exploration activities have been conducted, as was the case with the development of Muara Laboh field by SEMML.

Fundamentally, the problem was that during the tender process, the parties made insufficiently-informed and unfounded decisions in regards with the bid tariff which then led to numerous problems at the later stage. In the end, the initially proposed tariff needs to be renegotiated which was not legitimately allowed. The current regulation has attempted to dismiss such problem by changing the boundary rule. This time, before getting into the PPA negotiation, one condition should be met first: the resource must be proven through a proper exploration process, including exploration drilling. This way, when PLN receives the assignment/mandate from the minister to purchase the electricity from the Developer, the proposed tariff is expected to already be based on a proper calculation. The expectation is to avoid renegotiations, which might be necessary, yet wasteful. Currently, the discussion ignores the situation whether the proposed tariff comply with the BPP limit rule or not. Nevertheless, assuming that the Developer is fully aware of the off-take risk and the new tariff requirement, by the time it comes to demand for a power purchase agreement with PLN, it is expected that the proposed tariff does meet the tariff ceiling requirement.

This arrangement definitely benefits PLN as the buyer who is trying to control its BPP level through curbing its future expenses for electricity purchase from the independent power producers, including the from the geothermal sector. Yunis (2017), during the interview, did convey similar opinion that the current regulatory framework is ideal and conducive for PLN to achieve its targets. However, at the same time, Yunis (2017) also realized that this framework might not be as favorable from the perspective of the Developers.

Concerns Regarding the New Tariff Ceiling Regulation

As mentioned in the attributes of the Buyer, for PLN, the agreed tariff should not put too much burden on its cost of supply (BPP). On the other hand, for the Developer, the agreement should be able to cover for its development expenditures (capital, operational, financial) and generate enough return for the company. Whether or not these differences can be settled eventually depends on the level of minimum tariff required by the Developer, compared against the aggregation rules on the tariff.

MEMR Regulation No. 12/2017 introduces a new set of aggregation rules which constrains how the decision regarding tariff should be made. In the current setting, the tariff ceiling has been significantly reduced compared to the previous regulation. For instance, the tariff ceiling in Java and some parts of Sumatra is now set around USD 6 - 8 cent/kWh while in the older regulation (MEMR No. 17/2014) the ceiling tariff for this region is USD 12.6 cent/kWh for commercial operation starting in 2017. Since the capital costs of geothermal development are very site-specific, it is difficult to estimate and generally conclude whether the new ceiling arrangement is sufficient to generate enough return for the Developer. If the proposed tariff is already below the current tariff ceiling, it will be easy for both the Buyer and the Developer to conclude the PPA settlement process. Otherwise, in regions where the local BPP level is above the national average, the rule specifically stipulates that the final tariff should not exceed the ceiling. In that kind of situation, the PPA will not be obtained unless the Developer agrees to reduce the proposed tariff down the BPP level.

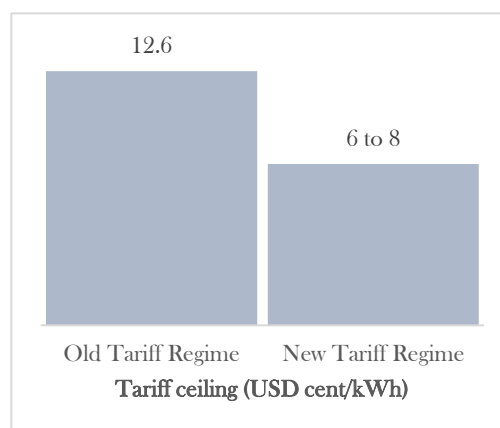


Figure 37 Comparison of Ceiling Tariff (Old vs New Regime) in Java & Sumatra region for Year 2017

For regions with BPP below the national average, tariff above the local BPP. Nevertheless, the lower ceiling in the new regulation implies that the Developer has smaller leverage during the negotiation process to maintain its proposed tariff. The lower ceiling tariff also implies that there is little room for the business entities to obtain higher (or simply sufficient) return.

Interviews with the representatives of the Developer and EBTKE have revealed that the new regulation seems to have an undesirable impact toward the investment decision by potential investors. During the interview, Riyanto (2017) from EBTKE

reported that mentioned that potential investors have expressed their discontent toward the new tariff regulation. Poernomo (2017) from INAGA also revealed that the new arrangement has caused some potential investors to withhold their participation in the sector, at least until the regulatory framework becomes more certain and favorable for the business entities.

The Risk of Opportunism

When the Developer is about to enter the PPA negotiation process, given the boundary rule (proven resource before PPA), it will mean that a certain amount of investment has been expended for the exploration activities (sunk cost). As mentioned before, this number can range between USD 9 to 28 million (Loksha & Gehringer, 2012), depending on the physical conditions of the prospect and other aspects such as those concerning land acquisition and community engagement process. Note that even the minimum exploration commitment to be submitted after an open tender process is USD 5 or 10 million. All the more, if the IPB has been obtained for Work Areas which have been developed under the government drilling program, more expense as the compensation fee for the government drilling, would have also been paid. Therefore, the Developers will have to ensure that this investment will be covered through obtaining the PPA.

From the transaction cost economics (TCE) perspective, not only that the investment for geothermal exploration activities is large, but it is also specialized to a particular transaction (Williamson, 1981). In the case of geothermal sector, the transaction is supposed to be realized through the power purchase agreement. Geothermal enterprise is characterized with what Williamson (1981; 1979) referred to as asset specificity or transaction-specific investment. Furthermore, as already elaborated in the analysis of the physical and material conditions of the resource development, geothermal investment has an inherent attribute of site-, dedicated asset- and physical asset specificity. The site specificity is due to the fact the development can only be conducted at a specific as identified the license (IPB). On the other hand, the physical asset- and dedicated-asset specificity also exist because all kinds of development activities (for road access, exploration & production drillings, steam pipes, turbines, etc.) can only be economically useful for geothermal power production in the end.

Williamson (1985) suggested that the higher the asset specificity, the higher the *probability* of opportunism within the transaction. Likewise, Hubbard and Weiner (1991) made the emphasis that if a "...transaction entails one party committing capital that has little use in other uses, the other party has a strong incentive to appropriate the quasi rents through opportunistic actions." In what ways can opportunism work within the setting of the Indonesian geothermal sector? One example is the case during the financial crisis in 1997 which pushed the renegotiation of tariff between PLN and the JOC contractors. This is not to say this renegotiation was unfounded or simply a manifestation of opportunistic behavior. However, it shows that given the fact the investment had been sunk and that the JOC contractors had no other choice but to trade with PLN, in the end the tariff was lowered anyway. After all, lower income is better than no income at all. This is why, for the Developers, obtaining a long-term PPA and additional guarantees (such as BVGL from the MoF) becomes highly important. This is not only to safeguard itself from opportunistic behaviors, but also from the uncertainty, such as political and regulatory uncertainty, that is commonly perceived in this sector.

It is true that opportunism can always occur regardless of the institutional arrangement or the regulatory framework and that uncertainty is fundamentally inevitable. However, given the prevailing rules in the current setting, it is argued here that both the uncertainty and the probability of opportunistic behavior might become more intense now. First, the boundary rule (proving the existence and capacity of the resource prior to settling the PPA) clearly constrains the Developers to obtain a proper contract before making a significant amount of investment. For this specific action transaction, this should not be a problem for the Developers which obtain the Work Area through the Government Drilling schemes since the initial investment to conduct the exploration has been shifted to the government. However, it remains a problem for the other schemes. For this issue, as mentioned before, the Heads of Agreement (HoA) mechanism will be used. Although it is yet to be known how the HoA is going to be arranged, it is important to note that a HoA is normally non-binding and used only to outline the main issues which are relevant to a tentative partnership.

Supposed that the investment for exploration has been made, the only way the Developer can obtain an actual benefit is through the electricity sale with PLN. The Developer will propose a tariff to obtain a certain level of return on investment. The problem arises when the proposed tariff is above PLN's BPP for the region where the Work Area is located. Since the aggregation rule facilitates PLN to justify its decision to determine the final tariff to be as close as possible to its BPP level, the Developer will have little leverage during the negotiation process to maintain the required return. Furthermore, depending on the impact of the negotiated tariff to the return on investment, the Developer can either decide to continue with lower return (after all, there is still a probability to readjust later, although not guaranteed) or to abandon the project, supposed that it reckons that moving forward will result in higher loss to the company/investors.

4.1.5.6 Concluding Remarks for the Payoff Structure

The discussion above suggests that the combination of the boundary rule and the aggregation rule of the PPA settlement process might increase the risk of opportunism from the Buyer side. The regulatory framework gives smaller room for the business entities to claim benefits from participating in the sector. As rational agents, it can be assumed that the business entities will perceive the situation to be highly unfavorable and uncertain. The circumstances do not only affect the private sector, but also the geothermal state-owned companies, e.g. Pertamina and PT Geo Dipa Energi (GDE). For these companies, state support (through PMN) cannot be expected at all times. Therefore, the decision to invest, as in the case for the private sector, depends on its own financial capability. Eventually, if the perception of the business entities regarding the profitability of the business has been negatively affected, the most likely outcome is underinvestment in the sector.

Despite the issues regarding the tariff and the risk of opportunism, the discussions throughout chapter 4.1.5.1–4.1.5.4 have indicated that, based on the past experiences and the analysis of the costs/risks combination, each of the IPB issuance schemes has the prospect of attracting business entities/investors. For these business entities, as long as the benefits to be obtained can outweigh the costs and risks to be borne, any scheme to obtain the IPB and all the obligations enclosed with the ownership of the IPB will not be the main concern.

The fact that the regulatory framework now allows for multiple schemes of IPB issuance should be seen as an opportunity for the government to strategically plan geothermal development. Each scheme has its own configuration of costs, risks, and benefits which might attract different potential developers, depending on their resources (technical, financial, and resource information) and their willingness to take the risks. The government should be able to see it as an enabler to flexibly control the resources. It must use its discretion to decide which scheme might be the best to develop a specific area with different physical/material characteristics. When one scheme cannot attract enough participants to move forward, the government must be able to be responsive and use another scheme instead. By doing so, the government can reduce the possibility of having idle resources.

Considering the issues and the opportunities with the current arrangement, it becomes important to reexamine the existing payoff structure. The problems with the new regulation, especially regarding the rules concerning the PPA settlement, should be considered by taking into account the interests of all stakeholders, not only the business entities. The reexamination of the payoff structure will be thoroughly discussed in chapter 4.3.

4.1.6 Contractual Enforcement

The enforcement of the contracts specifically corresponds to the scope rules of the action situation at the operational level. The rules should include all the mechanisms to safeguard the interests of all parties who are bound in the agreements (IPB, PPA, financing agreement). This is particularly important since the risks of opportunistic behavior might materialize in any kinds of contracts. According to Muris (1981), in contract governance, attention should not only be focused on whether a contract exists, the meaning of terms in the contracts, and the consequences of a breach. Instead, the discussion should be expanded to the potential situation in which a party performs contrarily to the understanding of the other party, but not necessarily contrary to the agreement's explicit terms. Eventually, the opportunistic behavior of one party will drive away the other party from the expected outcome due to the transfer of wealth. For the purpose of understanding this issue, the perspective of different participants in different position in the action situation should be described first.

The government's interests are of the maximization of social and public interest outcomes. In regards with the development of geothermal sector, the interest is to obtain an increase in geothermal power capacity through credible, safe, and efficient development. By entrusting the development to business entities, the government faces the risk of opportunistic behavior from the Developers which naturally have the incentives to maximize their own interests. The business entities might decide to reduce costs in ways that can be harmful to public interest, such as through reducing the quality of the safety and environmental control or by not paying the tax and royalty obligations.

Under the current institutional setting, this kind of issue is settled based on the terms agreed in the PPA. For instance, the Developer will be held accountable for the performance of the power plant. There is a sanction mechanism in the agreement which will be costly for the Developer supposed that it fails to fulfill the agreed performance level. Through the means of performance guarantee or performance bond, the Developer will have the incentive to comply with all the terms and conditions under the agreement. The compliance is reinforced given the fact that not only the Developer will be responsible for the development of the power plant, but also for the operation of it under the BOOT scheme. Therefore, in order to avoid high operational costs, e.g. due to frequent maintenance or environmental treatment, it also becomes the interest of the Developer to maintain the quality of the project. However, a control/monitoring mechanism will be needed to ensure the consistency of the quality over the project lifetime.

On the other hand, according to Tomz and Wright (2010), all investments are subject to political risks in which after the investment has been sunk, governments can enact policies which reduce the payoffs to investors. Within the oil industry, for instance, Aghion and Quesada (2010) have argued that contract renegotiations might occur during the reign of a new government in the name of sovereignty. This can also happen in the context of geothermal development.

Geothermal resource, however, is different with other natural resources, such as coal and oil. These other resources are subject to changes in the commodity price. In the case of high commodity price, there might be a public pressure to renegotiate the contract under the assumption that the companies are receiving excessive rents under such circumstances (Rigobon, 2010). On the other hand, geothermal resource does not have such characteristics. Its site-specificity and distribution channel makes it less susceptible to expropriation due to rent increase. However, other forms of expropriation might take place. In the case of Indonesian geothermal sector, this can include termination of the concession agreement, change in the tariff structure, new tax regime, etc.

Given the past experiences of expropriation, e.g. through the cancellation of several geothermal projects in the 1990s, it can be said the Indonesian geothermal sector is prone to political risks as well. This kind of case is a particularly crucial aspect to consider from the point of view of the private investors. The act of expropriation has a direct impact on the investment decisions of players from the private sector. According to Hogan, et al. (2010), there are risks of future underinvestment and reputational spillovers that can impact the economic development in the country.

This kind of risks is mitigated through the PPA itself. Within which, the Developer will be paid with a constant level of tariff which will not be impacted by changes in the regulation after the agreement has been settled. Moreover, MEMR Regulation No. 10/2017 has also indicated that renegotiation is allowed when there is a change in the regulations which might affect the payoff level for the Developer, such as changes in the tax arrangement and environmental requirements.

If a conflict arises in which one of the party is aggrieved and the final benefit to be gained is less than what the initial contract has indicated, an arbitration board (Indonesian or international) might be appointed to settle the issues between the two parties (between the government and the Developer or between PLN and the Developer). All of these rules should constrain the involved parties from expropriating or behaving opportunistically. Some developers, usually international companies, can also use a political risk insurance to obtain financial protection from political events. This kind of insurance was provided by JBIC to support geothermal development in Muara Laboh by SEMML.

4.1.7 Concluding Remarks for Action Situation at the Operational Level

The analysis of action situation at the operational level intends to investigate some of the aspects in the action arena which are crucial to achieve the ideal outcome that is to obtain all the required contracts/agreements to develop the resource. These contracts consist of the geothermal license, the power purchase agreement (PPA), and the financing agreement—shown in the green box in Figure 38). The crucial aspects which have been determined in chapter 4.1.2 consist of the resource condition (the information quality), the payoff structure, the contractual enforcement, and the IPB issuance process—shown in the blue box in Figure 38. They are crucial because the condition of these factors will affect the investment decision to be made by the participants, namely the potential developers, PLN as the buyer, and the financier. The things to consider by these participants are indicated by the dashed gray lines. For instance, for the potential developers, they will see whether the payoff structure can yield benefit level that is higher than the cost level. For the (potential) financiers, they will check whether the developer (the geothermal license holder) is credible to be given the required loan, for instance.

The analysis of each of these crucial aspects result in some findings which are worth considering in order to ensure all the required contracts/agreements can be obtained. The summary of the findings can be given as follows.

- Resource conditions

The analysis of this aspect looks into the higher challenge of developing the untapped geothermal resources in the country. At the same time the challenge is complemented with the limited availability of the resource information. The potential developers have access to this limited information about the resource. The information will affect their perception in the profitability of the resource. If the resource is perceived to be too challenging and costly to develop, it will hinder their participation in the sector. In that case, government intervention might be needed in increasing the quality of the resource information. This can be done by utilizing the existing mechanism of the government drilling program.

- IPB issuance process

The analysis has highlighted a problem with the open tender process in which the winner is selected based on the highest exploration commitment. This criterion might be able to tackle the past issue concerning the financial capability (and to

some extent, the credibility) of the tender winner of the developer. However, this criterion neglects the importance of the efficiency the developer itself. Some information regarding contractor selection mechanism has been provided.

- Contractual enforcement

The discussion is made since the risks of opportunistic behavior might materialize in any kinds of contracts. This factor however is not found to be very problematic since there are already some mechanisms in which the interests of the contracting parties can be safeguarded. Especially for the developer, it can obtain a kind of guarantee to protect itself from political risks which might deprive it from its rights (e.g. to conduct the development or to be paid for the electricity that it has produced).

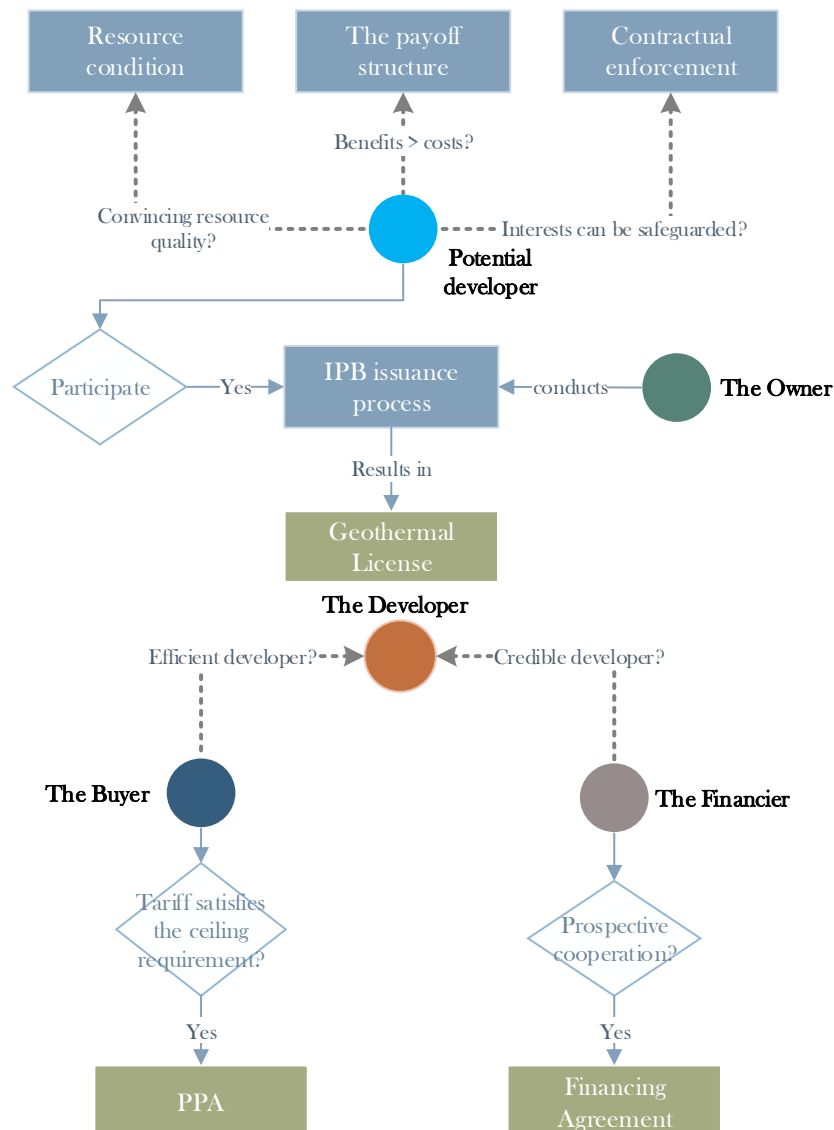


Figure 38 Simplified Interactions in Action Arena at the Operational Level

- Payoff structure

Looking at the payoff rules (chapter 3.3.2.6), a developer has the same payment obligations and has access to obtain benefits through the electricity sale to PLN. However, each method of the IPB issuance processes has unique configuration of risks, costs, and benefits for the developer which affect the payoff structure. Therefore the analysis in this section looks into each IPB issuance scheme. Based on the past experiences, each scheme can attract different kinds of developers, depending on their preferences and capability.

Furthermore, the analysis also looks into the PPA settlement. The issues found include the low level of tariff ceiling which significantly reduce the room for the developer to obtain profit. The second issue is the combination of the low

ceiling tariff and the new boundary rule which obligates developer to make a significant investment (to pay for the exploration drilling costs or to compensate for it in case of government drilling program) prior to conducting the PPA settlement process. Since significant investment has been sunk and there is limited room for the developer to negotiate the tariff, it might increase the risk of opportunism from the side of the buyer (PLN).

4.2 Action Situation at the Collective-Choice Level of Analysis

As mentioned in chapter 2, the IAD framework recognizes the fact that rules are frequently nested in other sets of rules which define how the lower-level rules function (Polski & Ostrom, 1999). The geothermal sector has experienced multiple changes in the regulatory framework. These changes were probably initiated as a response to the outcome of action situation at the operational level. Nevertheless, the decision-making process to change the policies and regulations which affect the sector occur at a higher-level arena. This indicates that there are indeed other forces/authorities at the higher level who decide which rules to use and how things must be arranged at the operational level.

One of the purposes of analyzing action situation at the higher level is to understand the origin of rules at the lower/operational level (Ostrom, 2005a). In this chapter, the analysis will focus on the rules governing the power purchase between the Buyer (PLN) and the Developer/Seller. Since the early development of the resource in the 1980s, the rules governing the power purchase have been subject to a lot of changes and are considered to be the most unsettling issues in the sector, especially from the perspective of the Buyer and the Developers whose payoffs are directly affected by those rules.

Between 1980 and 2000, two presidential decrees were issued to govern the sector (PD 22/1981 and PD 45/1991). With these decrees, most of the developments were conducted under joint operation contracts (JOC) between Pertamina (license holder) and other business entities (international geothermal companies). The electricity sale was governed using the mandate given to Pertamina and its JOC contractors to sell the steam/electricity to PLN. The regulations did not govern issues regarding the level of tariff. In 2000, another presidential decree (PD 76/2000) was issued to replace the two preceding decrees. Under the new regime, any business entities can participate in the sector, i.e. to obtain geothermal license, without having to engage in a JOC scheme with Pertamina. However, the decree did not give a mandate to PLN to purchase electricity from geothermal developers. Instead, these developers must compete (through tender) with other non-geothermal independent power producers. PD 76/2000 did not seem to work out well. In response to that, the first geothermal law, Law No. 27/2003, was issued. The governance of power purchase under this law was changed several times between 2008 and 2014 using several ministerial regulations.

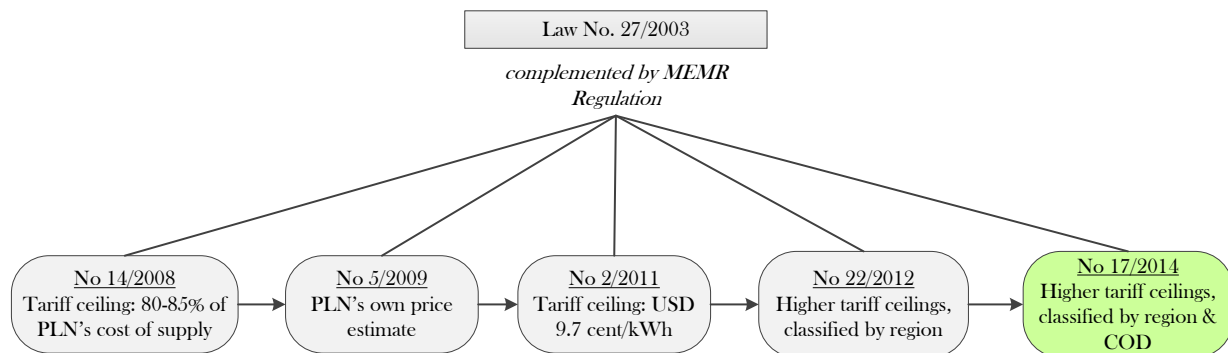


Figure 39 Ministerial Regulations Governing the Power Purchase and Tariff (2008-2014)

As exhibited in Figure 39, the regulations had specified different tariff ceilings over time. For instance, MEMR Regulation No. 5/2009 stipulated that tariff should be determined based on PLN's own estimation. Only projects which could deliver within the limit of this cost estimation would be able to settle the PPA. The latest regulation shown in the figure, MEMR Regulation No. 17/2014, is still valid under the current geothermal law (Law No. 21/2014). However, the governance of the tariff ceiling has been changed through the issuance of MEMR Regulation No. 12/2017. Under which, the tariff has been reduced to the level of PLN's BPP.

During the analysis of action situation at the operational level, the historical context was taken into account to explain the possible outcomes given the current institutional framework. Rules which had governed similar aspects in the past were identified and used in the analysis as well. Nevertheless, the specific action situation at the operational level was analyzed using contextual factors, including rules, which were assumed to be temporarily fixed. However, it is obvious that these rules

can be inconsistent over time and exposed to the dynamics at the policy making arena. Consequently, the sector has been characterized by institutional uncertainty as well.

In chapter 3.4 about the community attributes, it was already mentioned that regulatory certainty is one of the most important requirements for the business entities or potential investors to participate. This particular aspect has not been thoroughly discussed in the previous analysis. It is because issues concerning regulatory changes are not within the domain of action arena at the operational level. However, considering the importance and the influence of this aspect toward the investment decision in this sector. It becomes essential that the origin of rules at the operational level is analyzed too. For this purpose, analysis at the policy/collective-choice level will be conducted. The first step is to analyze the rules governing this arena.

4.2.1 Identification of the Rules-in-Use

In the context of the Indonesian law, the sources which have been used to elaborate the rules-in-use for the analysis at the operational level consists of government regulations (PP), ministerial regulations, and ministerial decrees. These regulations and decrees are part of the entire legislation structure in Indonesia as seen in Figure 40, according to Law No. 12/2011 on the Establishment of Legislation. The ministerial regulation is not mentioned in this hierarchy. However, its existence is recognized as long as the establishment is based on (1) the instruction from a legislation at the higher level or (2) the lawful authority given to minister.

The regulatory framework itself gives the Energy Minister the authority to issue regulations/decrees as long as the subjects being regulated is within the energy domain. Therefore, under any circumstances, the minister has the authority to change the play of the game at the operational level. Moreover, changes in the rules-in-use governed through ministerial decrees and regulations are not subject to the approval of DPR (see appendix A on actors) either. Therefore, the final decision, i.e. the ratification of ministerial regulations and decrees, is solely left to the discretion of the minister. It does not imply that the decision-making process is singlehandedly determined by the minister. On the contrary, the process is normally participated by other stakeholders, including those which have the power in shaping the public opinion. Under the public eye, stakeholder engagement is important and affects the credibility of the minister.

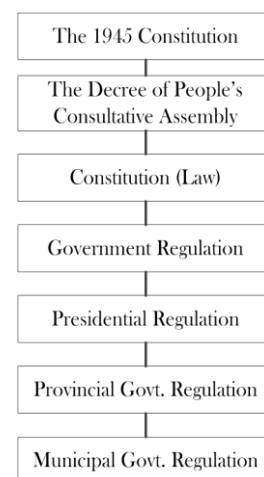


Figure 40 Hierarchy of Legislation

However, to some extent, decisions which can be made at the ministerial level are affected by the personal judgment, belief, and interest of the minister himself/herself. Consequently, it might be the case that a new regulation which has been intended to fix a certain problem turns out to do more harm than good against other aspects in the sector, e.g. due to oversight toward the scope of the policy issue. Eventually, the result (policy/regulation) will depend on the involvement of other parties who have their own take toward the issue under scrutiny. The decision regarding the inclusion/exclusion of certain stakeholders during the decision-making is left under the minister's discretion as well.

The high level of authority given to ministers to issue regulations affecting arenas at the operational level renders some drawbacks. For instance, in 2017, the president of Indonesia conveyed his discontent toward the issuance of some ministerial regulations (not only within the energy domain) which he considered to be hasty, due to the negative response received from other stakeholders in the system (Suhada & Irfany, 2017). It implies that the president himself did not have much control over the governance of details occurring at the operational level. As long as the ministerial regulation does not contradict the stipulations of regulations at the higher level, e.g. the laws and the government regulations (PP), the decision will be legally justified.

4.2.2 Identification of the Community Attributes

Aside from the constitutional rule which gives the authority to the minister to change the rules-in-use at the operational level, it is important to understand the other contextual factors, namely the community attributes. As mentioned in the attributes of the Buyer, power purchase from renewable energy sources can be a burden for PLN if the tariff ceiling is set too high compared to PLN's costs of supply. This was the case for geothermal tariff ceilings governed under MEMR Regulation No. 17/2014. Moreover, the current circumstances put pressure on PLN to reduce its dependence on electricity subsidy. According to the initial 2017 State Budget Plan, the electricity subsidy should be lower in 2017, compared to the previous year. Therefore, as the sole buyer in the system for independent power producers, including geothermal developers, a new mechanism was needed to ensure that electricity purchase from renewable resources, which are commonly more expensive than conventional ones (coal, natural gas, etc.), would not increase PLN's costs of supply (BPP). Otherwise, considering the

less support to be given by the Ministry of Finance (MoF) through the subsidy, PLN might need to increase the electricity retail price. However, increasing electricity retail price at the moment is politically difficult, especially after constantly increasing the retail price (for some types of households and industrial users) within the past few years.

In addition to that, the cabinet reform by President Joko Widodo in late 2016 has also changed the leadership of the ministry. The current minister's focus to safeguard the public interest by dodging an increase to the electricity retail price must have had a strong influence over the issuance of MEMR Regulation No. 12/2017 as such. However, the making of this regulation was certainly not conducted solely based on the discretion of the minister himself. As a political person, the minister's actions and decisions are influenced by the political and economic situation in the country. The capability of certain stakeholders to put their issues/interests into the minister's agenda plays a crucial role in the decision-making process.

Determination of tariff for renewable energy sources is within a territory involving both sectors: electricity and renewable energy. The initial construct of action situation at this level has identified actors which have their own influence within these two sectors. The deliberation of issues on these matters should engage stakeholders from both sectors, such as PLN and Directorate General of Electricity (DGE) from the electricity domain, EBTKE and the Indonesian Geothermal Association (INAGA) or other stakeholders from the renewable energy society. The MEMR, as the umbrella organization for both DGE and EBTKE should be able to accommodate their different interests.

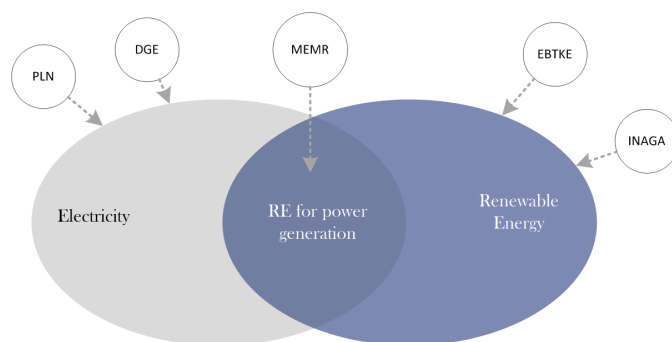


Figure 41 Renewable Energy and Electricity Domain

Unfortunately, the development of MEMR Regulation No. 12/2017 which governs the utilization of renewable energy for electricity provision did not demonstrate a proper stakeholder engagement during the process. EBTKE was included very late in the process at which not much could be done to alter the plan at the time (Riyanto, 2017). Therefore, the interests of stakeholders within the renewable energy sector was not properly taken into account. Similar issue was conveyed by Satar (2017) in regards with the involvement (lack of one) of INAGA during the process. As a result, the latest tariff arrangement was deemed to be unfavorable from the perspective of the business entities. It appears that the decision-making process has overlooked the potential impact of the new arrangement toward the investment decisions of the potential developers and financiers. The differences in values, interests, and goals have made the policy-making arena highly susceptible to conflicts.

4.2.3 Analysis of the Action Situation at the Collective-Choice Level

Two types of contextual factors, the rules-in-use and the community attributes have been identified for the analysis of action situation at this level. In this case, the physical and material conditions are not taken into account since their influence in shaping the interactions between participants in the arena at this level is not direct. Furthermore, the analysis will attempt to examine why changes in the regulations governing power purchase between PLN and geothermal developers have been particularly frequent. The issue might discourage the participation of the business entities, especially those of the private sector, due to negative perception regarding the regulatory certainty. Even more, when the regulations are not well-designed or characterized by the failure to notice the complete aspects within the policy scope, it can directly affect the investment decisions at the operational level.

First of all, as can be inferred from the description of the contextual factors, the policy-making arena is directly exposed to political circumstances. A policy which defines the level of support for renewable energy deployment can be a polarizing issue if the enforcement of one affects the mainstream public interest. The retail price of electricity is a sensitive matter which significantly affects most PLN's consumers—the large amount of which are categorized as poor households. Meanwhile, the purchase of electricity from costlier renewable energy resources is considered to be a burden to PLN's cost of supply. This has made renewable energy development a complex issue. It almost seems that the development of both renewable energy and electricity sector cannot go hand in hand and that the government needs to choose between delivering the affordability and the sustainability of energy.

This particular characteristic associated with renewable energy development in Indonesia affects the decision to be made by the Energy Minister. As a result, different individuals assuming this position might produce different policies for this sector. In fact, the six changes in the past regulations as presented in Figure 39 were made under the reign of five different Energy Ministers. Under the same geothermal law at the time (Law No. 23/2007) the regulations have shifted from being more

favorable from the perspective of PLN to being more advantageous for the developers. As an illustration, the two ministerial regulations issued in 2008 and 2009 set the tariff to be according to PLN's BPP or PLN's own calculation. In that way, PLN would easily maintain or reduce its costs on the geothermal power purchase. Moreover, the two regulations did not explicitly give the mandate for PLN to purchase steam/electricity from geothermal developers. This kind of rule was deemed as unfavorable for the business entities.

After that, the policy makers started to acknowledge the challenge in attracting business entities under the regulatory framework at the time. As a result, between 2011 and 2014, the tendency in the policy was to increase the incentives for business entities to participate in the sector. A high tariff ceiling of USD 9.7 cent/kWh was set in 2011. The tariff was then increased again in 2012 and 2014, now the social and technical considerations were taken into account by classifying the tariff ceiling based on the region of the prospective area and the expected commercial operation date (COD) of the project. However, the tariff regime under MEMR Regulation No. 17/2014 did not last long. In 2017, it was changed again. This time, PLN is given more favors by setting the tariff ceiling to be according to PLN's BPP level again, like in the previous regulations in 2008 and 2009.

During the interview, Effendi (2017) who is also a member of INAGA, described the fundamental difference between MEMR Regulations No. 17/2014 and No. 12/2017. The older regulation was issued when the energy sector had a more positive attitude and interest toward renewable energy. Consequently, the policy was to develop the sector at all costs. That is why the tariff ceiling was set at a high level. However, the attitude changed when the political landscape was dominated by issues concerning the high electricity retail price. The situation put the policy makers under the populist pressure to take actions that could give more benefit to the larger part of the society. The combination of this pressure and the diminishing support for electricity subsidy was followed by the issuance of MEMR Regulation No. 12/2017. The regulation is intended to take some burden off of PLN under its attempt to reduce electricity cost, to be able to reduce the electricity retail price in the end.

At this point, the patterns of interactions within the action arena is already visible. Inconsistency can always be expected given the fact that it is lawfully easy to alter the regulations and adjust them based on the political and economic circumstances at the moment. The decision making within the action arena can be explained using the streams model (Kingdon, 1995). According to this model, an issue is put on a policy-making agenda when there is a coupling of three streams: problem, solution, and politics. In the context of power purchase issue, the problem is perceived by PLN as the only buyer in the sector. The assignment given by the Energy Minister to purchase electricity from renewable energy producers might interfere with PLN's plan to operate using its least-cost principle (see the attributes of the community) when the tariff to be paid is higher than its costs of supply or BPP (Yunis, 2017). For PLN, the solution is simply to set the tariff ceiling according to its BPP level. The third stream of politics occurred when there was a change of leadership in MEMR which faces increasing pressure on electricity retail price and electricity subsidy. When the three streams coupled, a window of opportunity to change the policy on power purchase was opened. This opportunity was grabbed by some stakeholders, e.g. PLN and DGE, to put forward their interests on this issue. Eventually, a new regulation governing power purchase in renewable energy, including geothermal, was issued.

It is important to note that there are more problems and possible solutions perceived/obtained by other participants in the arena. When these problem and solution streams are coupled with the right political stream, it is very much likely that the regulations will be altered again. Consequently, the arena will be characterized by the fabrications of solutions which can be expected to be temporary. In order to obtain a more permanent solution, the differences between participants within the arena need to be aligned. By doing so, the reciprocity between the community members in the context of geothermal development can be improved.

4.3 Reexamination of the Institutional Arrangement

The previous subchapters have identified several factors which have their influence toward the investment decisions of the participants in the sector.

- (1) In chapter 4.1.3, it was mentioned that given the current level of the resource information quality, the sector might require the involvement of the State, through the government drilling program, to increase the quality of the resource information. Otherwise, more incentives might be needed to attract private sector to bear the development risks.
- (2) Chapter 4.14 shows how the current rules governing the developer selection process might be ineffective to obtain an efficient developer. In turn, it might affect the investment decision of the Buyer or the Financier.
- (3) Furthermore, throughout chapter 4.15, the analysis of the current institutional arrangement (concerning the transfer of geothermal license and the PPA settlement process) reveals issues and opportunities to improve the payoff structure.

- (4) Chapter 4.1.6 has exhibited the importance of a good contract enforcement to safeguard the interests of all parties. From the point of view of the private sector, such enforcement important to ensure continued investment in the future given the fact, to some extent, the government must rely on the participation of the private sector to achieve its geothermal targets. The current institutional setting has provided the mechanisms to reduce the risks of expropriation and opportunistic behavior.
- (5) Lastly, in chapter 4.2, the analysis shows the tendency of the system to constantly experience the time inconsistency problem due to the dynamics occurring at the collective-choice/policy arena.

All things considered, given the issues and opportunities under the attempts to attract more investments in the sector, it is argued here that the current institutional arrangement needs to be reexamined and improved.

4.3.1 Revisiting the Payoff Structure for the Developer

To come up with the recommendations to improve the outcome of the sector, Polski and Ostrom (1999) have suggested some factors to consider, including the fiscal equivalence. The concept of fiscal equivalence serves as a means to evaluate the equity of policy outcomes. It suggests that participants who derive greater benefits pay more than those who derive fewer benefits. From this concept, the discussion should now focus on the fact that different Developers will assume different costs and exposures to risks, depending on the developer selection mechanism they need to go through to obtain the IPB.

One of the most noticeable aspects is that, regardless of the IPB issuance scheme being used, all of the developers are constrained with the same rules governing the PPA settlement process. It means that they are all constrained by same boundary rules (having proven the resource location and capacity before conducting the PPA) and the same aggregation rules regarding the tariff ceiling. Moreover, every IPB holder is subject to the same tax and royalty obligations to be paid across the project lifetime. The differences among all the IPB issuance schemes are shown in the following illustration.

Chapter 4.1.3 has explained about the government drilling program which transfers the early resource risk from the Developer to the government. The impact of the government drilling program is yet to be known since the regulation governing the use of the geothermal fund has only been issued in early 2017. However, the program implementation is certainly limited, depending on the availability of the resource and the capability of the government to take on the resource risks. Therefore, in order to achieve its geothermal development target, the government can also choose to offer the prospective area through the PSA or PSEA schemes.

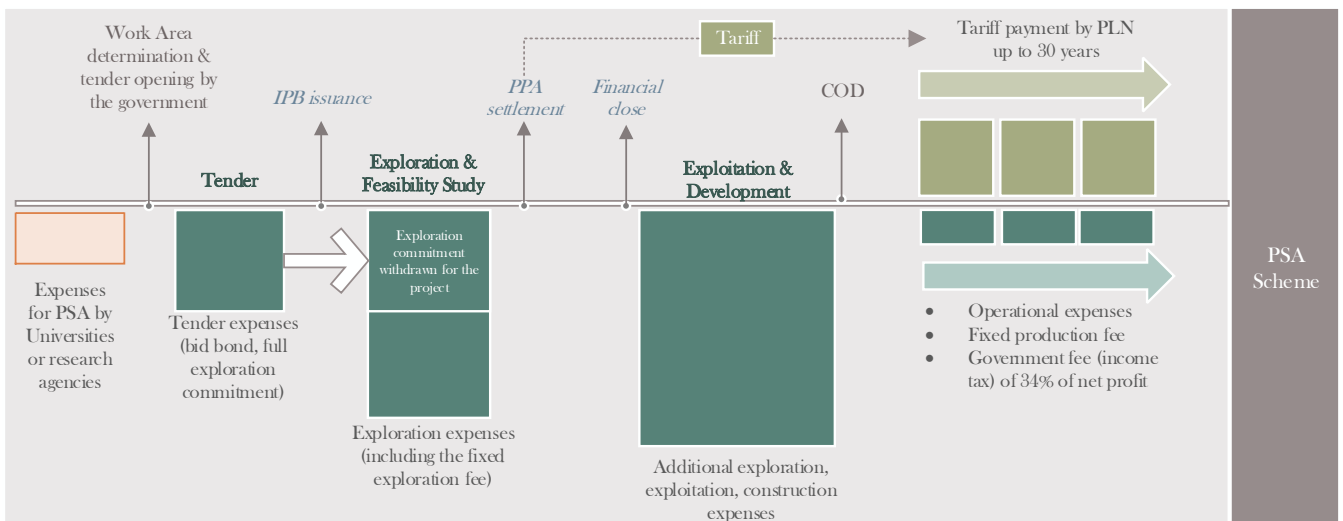


Figure 42 Payoff Structure for the PSA Scheme

The PSA scheme obligates the Developer to conduct exploration drillings and bear the risks associated with the development. To obtain the IPB, the Developer needs to participate in an open tender and submit a full amount of exploration commitment. The exploration commitment will be withdrawn back in several phases across the implementation of the exploration plan. If, based on the feasibility study, the exploration outcome indicates a viable commercial development, the Developer will directly conduct the PPA settlement process. In this case, the development is deemed as viable if the proposed tariff meets the tariff ceiling requirement given the existing payoff structure. Otherwise, the Developer will have to undergo an arduous negotiation process with PLN to be able to obtain the needed tariff. There is a possibility that the agreed tariff will be lower than expected, rendering lower return on the investment. The worst-case scenario for the Developer is having to abandon the project (after

the sunk investment) since no PPA can be obtained with PLN in the end. This kind of case occurred in Jailolo field development (North Maluku province) by Star Energy. The license was issued in 2009, yet in the end the license had to be revoked since up to 2017 Star Energy and PLN could not agree on the electricity tariff despite the fact that some amount of investment (e.g. to develop access road) has been made. Note that under the current regulatory framework, the sunk investment will also include expenses for the exploration drillings.

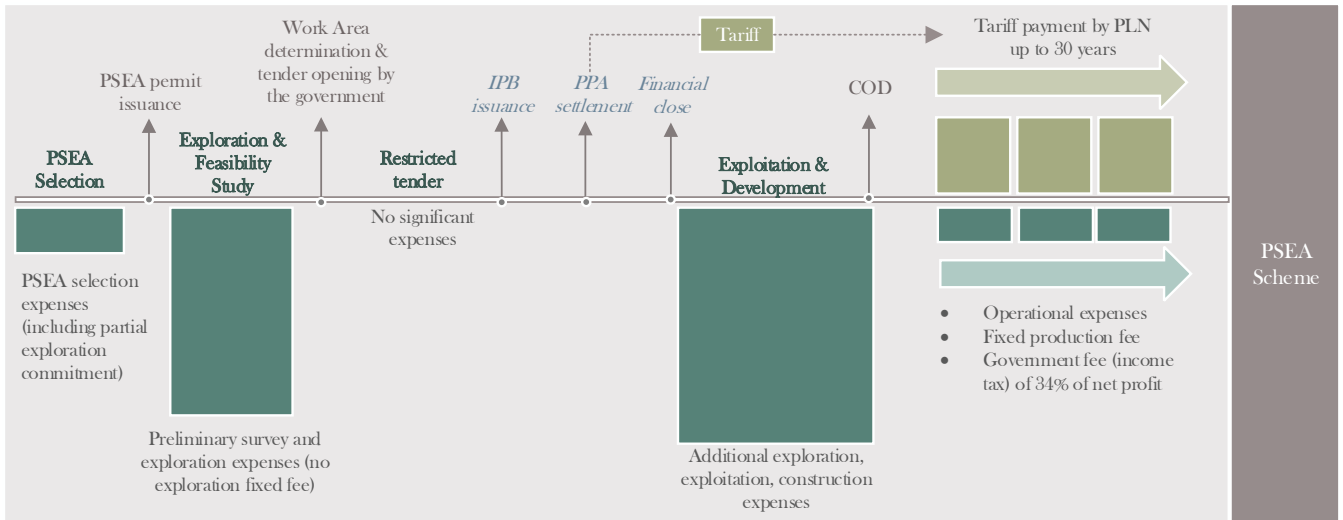


Figure 43 Payoff Structure for the PSEA Scheme

The PSEA scheme is a new arrangement which has only been introduced through the issuance of PP No. 7/2017. In the PSEA scheme, the assignee is not required to pay the full amount of exploration commitment and since the exploration is conducted before the issuance of the IPB, the Developer will be partially relieved from the obligation to pay for the fixed exploration fee (see Table 9 Payoff Rules). Therefore, compared to the open tender scheme (for green fields), the new PSEA scheme is more favorable for the business entities. Under this scheme, the Developer also faces the possibility of obtaining a lower return or cancelling the project. The decision will depend on the exploration result and the outcome of the PPA settlement process with PLN.

The situation is different for developers which have obtained the IPB through the government drilling scheme (Figure 44). Under this scheme, the resource risk has already been reduced through the increased resource information quality provided by the government. The future costs of the project can already be estimated by both parties (the government and the developers) during the tender process with better certainty. If according to the bidder's estimation the required tariff does not meet the tariff ceiling requirement, it may not continue to participate in the tender process. Otherwise, it will try to bid as high as possible to be able to obtain the IPB.

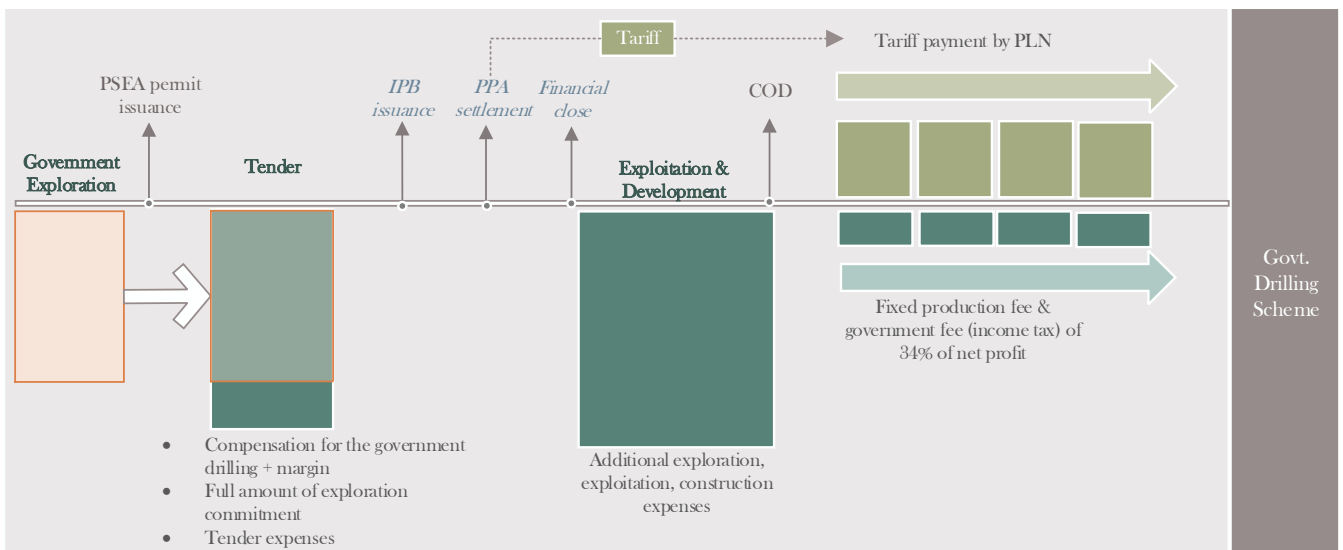


Figure 44 Payoff Structure for the Government Drilling Scheme

A problem will occur if the result of the government drilling program is below the initial expectation, e.g. the development capacity has to be reduced and the project will require a tariff that is higher than the ceiling. Eventually, it might be the case that no business entity wants to participate in the tender process. However, since the government has the intention to recover the exploration expenses, in the end an exception to the tariff ceiling rule might be made. Therefore, not only that the government drilling program can relieve some of the resource risks from the Developer, the sharing of early development costs and risks between the government and the Developer can reduce the possibility of opportunistic behavior from the government.

The last option is for the government to directly assign a state-owned company to undertake the development (direct assignment scheme). Under this scheme, all the costs and risks are borne by the assigned state-owned company. However, since basically the gains and losses of a state-owned company have an impact on the government, especially for the Ministry of State-Owned Enterprise (MSOE), additional support from the government can be expected in this scheme. Eventually, the tariff will be determined based on the negotiation result between the state-owned developer and PLN. Since the negotiation involves two state-owned companies, it becomes the government's interest as well to resolve any issues during the process, including regarding the tariff ceiling.

What should be realized at this point is that the PSA and the PSEA schemes expose the Developer to higher exploration risks. On the other hand, the government is fundamentally relieved from any significant development risks and costs. The government, however, can be aggrieved in case the Developer fails to deliver its obligations in a timely manner. Under such condition, the government will fall behind and further from achieving its renewable energy target. However, as mentioned in chapter 4.1.6, for this kind of issue, the government has equipped itself with a sanction mechanism to monitor the performance of the Developer, e.g. through the withdrawal of the performance bond or the revocation of the geothermal license. Despite the higher burden to be diverted to developers taking the PSA and PSEA schemes, the public sector still receives the same level of benefits compared to the other two schemes: (1) the same tariff ceiling governance which benefits PLN (2) the same tax and royalty obligations which benefit the government.

Using the fiscal equivalence concept, it can be argued that the PSA and PSEA schemes are still deficient in the way that the costs to be borne by the Developers are not proportional to the benefits they can obtain, especially compared to the other two schemes. Simply put, the incentive level seems limited for the business entities to be willing to participate under the PSA and PSEA schemes. The situation can become more problematic if eventually there is only little room for the Developer to gain benefits, given the low tariff level under the current regulatory framework. It is important to note that the issue of tariff ceiling can also severely affect developers which take the government drilling and direct assignment schemes. However, with the government drilling and direct assignment schemes, the Developer will have better leverage to negotiate the tariff because the government has its own stake under these two arrangements.

To conclude, the current payoff structure has not optimally captured the opportunities to be had, given the higher flexibility to arrange the IPB issuance under the current regulatory framework. It is argued that more incentives should be given to developers which will bear the higher risks and costs in the early exploration activities.

4.3.2 A Proposition to Change the Payoff Structure

The payoff for the Developer can be modified in many ways. It can be done by increasing the benefits that can be claimed by the Developer, e.g. by raising the ceiling tariff or distributing grants. It can also be modified by reducing the costs to be borne by the Developer, e.g. by lowering the tax/royalty obligations or by arranging capital costs sharing. Note that changing the payoff structure might benefit participants in one position, yet diminish the payoff for participants in other positions. In this case, increasing the payoff for the Developer might reduce the payoff for PLN or the government, depending on the strategy. Therefore, the implications of such changes need to be complemented with a proper consideration in regards with the capacity of the participants to bear the higher costs or the lower benefits from such arrangement. Moreover, the contextual factors should also be taken into consideration to analyze the feasibility of the recommendation.

4.3.2.1 Reducing the Payment Obligations of the Developer

As can be seen in the Payoff Rules, every geothermal license holder is obligated to pay for a certain amount of royalty (exploration/production fixed fee) and income tax of 34% of the net profit. The idea of reducing the payment obligation has often been stated, especially recently since the tariff ceiling has been significantly lowered. This decision can be an ideal solution for both parties: PLN and the Developer. On the one hand, the tariff ceiling will still be set at a level that is affordable for PLN, while for the Developer, it can still obtain a sufficient return since the costs to be borne have been significantly reduced. This support scheme does not put a direct burden to the state budget. Therefore, the state budget condition does not affect the implementation of such plan.

Tax exemption is one of the most common fiscal incentives. In Uruguay, for instance, a corporate income tax exemption equivalent to a percentage of investment in fixed assets (machinery, equipment, and civil works) is given to support RE projects in the country. The percentage can range between 20-100%, depending on the project's contribution in other aspects, such as employment, exports, clean production, etc. The tax exemption scheme may reduce the government's level of benefit in the future. However, it acknowledges the fact that the societal benefits can still be obtained through the improvement in other aspects, including for the environment.

The development of geothermal energy has actually been exempted from several other tax obligations, including the value added tax (VAT), land and building tax during the exploration, and the import duty for heavy equipment. However, the current Energy Minister has conveyed his inclination toward the idea of reducing the income tax obligation (Gumelar, 2017). Note that it is within the authority of the Finance Minister to decide whether to approve such support scheme or not. Considering all kinds of fiscal support which have been given for the sector's development and the country's strong effort to optimize its tax revenues at the moment, it might be difficult to propose for more tax exemption.

Nevertheless, an argument can be made that an income tax exemption will directly affect the investment decisions of the potential developers. It can encourage a more rapid development in the sector. Eventually, the societal benefits, e.g. through employment, can be experienced earlier. When the actual power plant is already operational, more environmental benefits can be gained as well. On the contrary, supposed that the level of benefits to be gained remains the same (same tariff ceiling and same tax obligations) and fails to yield a positive perception toward the sector's profitability, no investment will take place in the first place. In that case, no benefits (through tax/non-tax revenues or societal benefits from the project) can be gained by any party.

This kind of support scheme, however, puts the Developer at a greater risk of expropriation by the government due to the fact that the regulations on tax can change, e.g. due to a change of government. Given the complexity of the system, there is a possibility that such changes will apply to all of the relevant taxpayers, including the Developers which may have made an amount of (sunk) investment at the time. In that kind of situation, the current PPA governance does allow for a tariff adjustment. However, it will depend on the capability of PLN to make the required adjustment to be able to obtain the same level of return. Note that unlike the tariff level, the tax/royalty obligations are not specified under the PPA. Instead, the obligation is governed by another set of regulations governing tax, outside the scope of PPA. A safer option for the Developer is through having a good tariff level since the beginning which will be secured under the PPA. This way, the political risks can be better mitigated.

4.3.2.2 Increasing the Tariff Ceiling

A Discussion on Tariff and Government Support

The question that needs to be addressed is the following: where does the government stand on renewable energy development? The current political landscape seems to give less favor for renewable energy. Setting the tariff for geothermal energy to be the same as the level of PLN's BPP is an undervaluation of geothermal as a renewable resource. As seen in Figure 28, in 2016 almost 80% of the power generation by PLN was fueled by coal and natural gas. Both of these resources are cheap, especially for coal, as shown in Table 10 (see the average generation costs of thermal and gas & thermal power plants). Unsurprisingly, given the intensity of the use of the two resources in the energy mix, PLN's BPP would be low, compared to the generation costs of geothermal energy. From the environmental perspective, natural gas does generate approximately 50% less CO₂ emission compared to coal. That is why the use of natural gas becomes PLN's contingency plan supposed that the target for electricity using renewable energy cannot be attained by 2025 (see also the National Energy Policy in chapter 3.3.1). Nevertheless, in terms of CO₂ emission level, geothermal energy outperforms both of these resources. Moreover, the energy has other benefits, including its deterrence toward price volatility, as in the case for fossil fuels. Supposed that these benefits are accounted for to estimate the value of geothermal-based electricity, the tariff ceiling would have been higher than the normal BPP of PLN.

The study by Meier et al. (2015), for instance, has proposed a tariff ceiling design which distinguishes the ceiling based on the location of the resource (large grids, isolated grids, eastern islands) and the commercial operation date, just like the previous tariff ceiling arrangement according to MEMR Regulation No. 17/2014. The basis for the tariff calculation is the benefits to be gained by PLN (avoided fixed and variable costs + other benefits) in utilizing geothermal energy. The resulting tariff design (for large grids, e.g. in Java & some parts of Sumatra and commercial operation in 2017) can be seen in Figure 45. Setting aside their basis in determining the value for each of the factors, the estimation conducted by Meier et al. (2015) shows how the advantage of geothermal resource can be captured in designing the tariff.

Notice that based on this design, the tariff ceiling should have been USD 13.5 cent/kWh for Work Areas located in Java. In the meantime, the tariff ceiling according to the latest ministerial regulation and decree for this category is between USD 6.5 – 8 cent/kWh. This number represents merely the avoided variable and fixed cost of PLN itself. From this illustration, it can be inferred that the current regulatory framework fails to acknowledge the benefits of geothermal as a renewable and reliable energy source.

It is argued here that the development of renewable energy that is still underutilized in Indonesia does require more support and not to be left alone to compete with the older generation (and much more commercially successful) technology, i.e. the fossil fuels. When the government sets the tariff ceiling at the BPP level, it means that the government leaves the energy development to the market forces, with PLN being (almost) the only buyer for the electricity generation sector. The belief in this kind of arrangement is that renewable energy will be able to smoothly participate supposed that it suffices the market demand and requirement someday. However, as argued by Mazzucato (2015), the markets are blind and the participants might choose to ignore the societal and environmental concerns. For the Indonesian energy sector, not only that the market failures (monopsony of PLN, environmental externalities, unbalanced competition) are not accounted for, the current regulatory framework might lead to a carbon-intensive path with which the country will be stuck for a long period of time. In that case, it will become more difficult for renewable energy to make its way to the market, let alone to become competitive enough to play a significant role in the country's energy sector, as expected from it.

If the government still wants to achieve its renewable energy target in a timely manner, all the related stakeholders need to join hands and support the development of this sector. The geothermal sector has had its long way to reach the current state. The fact that Indonesia is one of the largest geothermal power producers in the world should indicate that the use of this technology in the country is mature enough to become more economically advantageous for the society in the future. Moreover, as already mentioned in the first chapter, the LCOE of this technology is among the lowest and almost comparable to coal power generation. Therefore, the prioritization of this resource is necessary to achieve renewable energy target in the country. In order to that, this sector needs to be safeguarded from too much political nuisances that would increase uncertainty for the business environment.

With this understanding, given the fact that there are a lot of discontents which have been expressed from the potential investors, it is argued that the regulation on tariff ceiling needs to be reconsidered. However, this kind of arrangement has a particular consequence that can negatively affect the payoff level of PLN as the Buyer. The following sections discuss the implications of tariff change and the recommendations to tackle the issues.

Compromising the Different Views on Tariff

Based on the interview result with Yudistian Yunis, the Senior Manager of Geothermal Energy of PLN, it can be inferred that between the government and PLN, the company bears the higher burden due to the fact that it is obligated to conduct negotiation to ensure the lowest possible tariff to be agreed between PLN and the Developer. This obligation puts PLN under a tight monitoring by a lot of parties to ensure that the public interests are being met. These parties include the MSOE which represents the State as the shareholder of PLN, the Financial and Development Supervisory Agency (BPKP), and the MoF as the State Budget manager. This is the reason why PPA negotiation process can be really arduous and lengthy. Meanwhile, according to Ibnu Riyanto from EBTKE, the role of EBTKE to facilitate during the PPA negotiation process is limited due to fact that the process is intended to be conducted using the business-to-business mechanism. It becomes reasonable for PLN to argue that it faces a high financial pressure to fulfill its role as the Buyer in the arena. This is particularly true due to the fact that the obligation (to purchase power from RE producers) is not equipped with sufficient support from the government who gives the mandate in the first place.

From the point of view of PLN, the company faces the burden of enduring the costs of geothermal development as claimed by the Developer. Given the fact that its participation is somewhat involuntary (through the mandate by the government), without any additional support from the government or any actual benefits to be gained from the cooperation, it has little

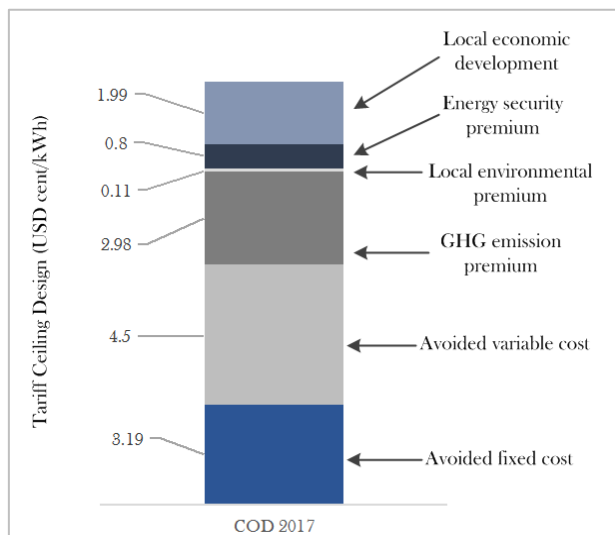


Figure 45 Example of Geothermal Tariff Ceiling Design
Source: Meier et al. (2015)

incentive to buy geothermal steam/electricity above its average costs of electricity supply. Increasing the tariff certainly reduce the payoff level of PLN. Considering the government's plan to gradually reduce the electricity subsidy and the pressure to keep the retail electricity price steady, PLN will have to be able to cut costs from other sources (e.g. its transmission and distribution operational costs) and not from the renewable energy (RE) power purchase, supposed that the tariff ceiling is to be increased.

In regards with PLN's costs, Abadi Poernomo—one of the members of the National Energy Council and the chairman of INAGA—has argued that the attempt to reduce PLN's cost level should not take away the opportunity for the RE sector to grow. Instead, he argued that there are more aspects affecting PLN's cost level, other than the power purchase from RE producers, which can be saved as well. According to Poernomo (2017), there is still no mechanism in the regulatory framework to control the efficiency of PLN itself. Poernomo (2017) has also argued, supposed that the RE target for 2025 can be achieved, it will only account for 23% of the country's total energy mix. Therefore, even if RE resources (excluding hydropower) are more expensive than the conventional ones (coal, natural, and oil), the lower expense, especially of coal and natural gas, should be able to compensate for it. If PLN's own costs can be reduced, lowering the tariff ceiling for RE resources will be unnecessary.

The analysis of action situation at the collective-choice level suggests that differences between participants in the arena need to be aligned in order to obtain a more permanent solution to ensure the regulatory certainty in the sector. First of all, the decision to give the fundamental responsibility to PLN in ensuring the highest efficiency possible to be obtained from the Developer might be the reason why the regulations have been recurrently changed over time. The mandate is permanent (especially since PLN holds a monopoly on the transmission and distribution of power supply business in the country), yet the support from the government tends to change over time, depending on the political and economic circumstances at the time. To this issue, the solution is to partially take the responsibility off of PLN.

What is meant by detaching the responsibility from PLN is not by excluding the company from the action arena. The intention is to give PLN the same mandate to purchase electricity from the Developer without giving it the burden to conduct further negotiation with the Developer. Instead, the PPA negotiation should focus on other terms and conditions, rather than the tariff level. In this way, the PPA settlement process can be conducted more efficiently. Certainly, this arrangement has its consequences. Who should be responsible in ensuring the efficiency of the Developer? In what ways can efficiency be achieved? What are the consequences of the tariff ceiling increase for the government? Why should the government be willing to take such consequences? These questions will be answered and further explained in the following section.

Recommendations on the New Arrangement

First, obtaining an increase in geothermal power capacity is one of the government's means to achieve its renewable energy target. More specifically, this goal is entrusted to the MEMR. The achievement of the target will be attributed to the ministry itself and only to a much lesser extent to PLN. Therefore, it should be within the ministry's agenda to facilitate geothermal development in the country. To answer the first question, given the fact that the achievement of geothermal development target benefits the MEMR the most, this department should be the one who bears the burden of guaranteeing efficiency in the sector. Taking such responsibility means becoming a subject of oversight by other interested stakeholders, such as BPKP or the MoF.

To reduce the nuisance from the oversight, the stakeholders need to agree on the specific rules and procedures to ensure the efficiency of the Developer. As has been discussed during the elaboration of the IPB issuance process (chapter 4.1.4), efficiency should be used as one of the determinants to select the Developer. It is intended to guarantee not only the financial capability of the bidders, but also their ability to use less resource in delivering the same level of performance, compared to the other participants.

For instance, in tenders which are preceded by the government drilling program, the bidders should be able to propose a project development plan and the required tariff level. The most efficient bidder is the one who can offer the lowest tariff to be paid by PLN. Therefore, instead of using the highest exploration commitment to select the winner, it should use the lowest tariff mechanism. Note that this kind of arrangement has not been particularly successful to guarantee the continuity of geothermal development in the past. Therefore, a tender process with a reliable prequalification and evaluation method is required. It is beyond the scope of this thesis to determine the best way to conduct prequalification and bid evaluation in the context of geothermal concession tender. The important thing is for the tender committee to be able to assess the viability of the proposed tariff against the project development proposal. The idea is to avoid an overly competitive setting in which the bidders try to bid as low as possible without considering the financial consequences of such action.

For the other IPB issuance schemes, due to the lack of sufficient resource information, it will be difficult for the participants to already propose for a certain tariff level. In fact, the limited information will only increase the level of tariff required by the bidders, namely to account for the higher resource risk. Instead, the selection mechanism should rely on other measures, such as by assessing the exploration plan and see how the costs are estimated in the plan. When the IPB or the PSEA permit has been issued, the Developer/the PSEA assignee will conduct the exploration activities and the feasibility study. Assuming that the exploration is successful, just like in the government drilling scheme, the Developer will be able to propose a project plan with a certain tariff level.

Here it is proposed that the negotiation on tariff is to be conducted by a special committee under the MEMR, or to be more specific, the Directorate of Geothermal under the EBTKE. This is the part where the responsibility to guarantee the most efficiency from the Developer is shifted, from PLN to the ministry. The purpose is to streamline the negotiation process which have been particularly troublesome in the past. During the elaboration of the community attributes, it has been hinted that there is a limited trust and reciprocity between the geothermal developers and PLN. According to the developers, PLN has an expertise in the electricity sector, yet still little knowledge on the upstream geothermal activities/business. On the other hand, given the past involvement of some agencies under the MEMR in conducting early explorations, the organization has the resource and knowledge to understand the challenges within the sector better than PLN. Therefore, if the negotiation process is shifted to the ministry, given the shared understanding/knowledge and the common goal to have a successful geothermal project, the negotiation process will be able to be conducted with more ease.

The previous discussions have attempted to incorporate the consequences of increasing the tariff ceiling into the recommendation. Another important aspect to consider is the fact that different IPB issuance schemes entail different level of costs and exposure to risks. In this case, developers who bear the higher resource risks (through the PSA, PSEA, or possibly the direct assignment schemes, rather than the government drilling program) should be given higher incentive to participate. For this intention, Meier et al. (2015) have suggested to distinguish the tariff ceiling level for Work Areas which have been explored and studied using the government-funded exploration costs (the government drilling program). In this case, the tariff ceiling should be adjusted downward considering the front-end de-risking given to the project. The adjustment should be based on the amount that makes the net present value (NPV) of the exploration expenditures equal to the NPV of the tariff payment along with the contract period with PLN. The NPV is calculated using the cost of capital of the government. Therefore, the adjustment is made according to the result of the exploration (especially regarding the total amount of investment) itself and other assumptions, e.g. regarding the potential capacity to be developed and the capacity factor of the power plant. The arrangement will be illustrated below.

Period	NPV (Year 0)	1	2	3	4	5	6	7	8	9	10	11	12	...	19	20	21	22	
		Exploration by Government			Tender and development by the Developer				COD										
Government cost of capital	10%																		
Exploration Costs (USD million)	€ 20,70	5	15	5															
Annual generation (GWh)		0	0	0	0	0	0	0	867,2	867,2	867,2	867,2	867,2	...	867,2	867,2	867,2	867,2	
Tariff adjustment payment (USD million)	€ 20,70	0	0	0	0	0	0	0	5,303	5,303	5,303	5,303	5,303		5,303	5,303	5,303	5,303	

Figure 46 Illustration of Tariff Adjustment for Government Drilling Scheme based on Meier, et al. (2015)

Supposed that, based on the government-funded drilling program, the field can be commercially developed at the capacity of 110 MW. The power plant capacity factor is assumed to be 0.9. Therefore, the expected production per year is around 367.2 GWh. The total exploration cost is USD 30 million, spread over 3 years of time span as seen below. The NPV for the exploration expenses in USD 20.7 million. The commercialization starts at year 8, after 3-4 years of development by the Developer. The corresponding tariff adjustment payment starting at year 8 to obtain the same NPV as the exploration cost is 5.3 million USD per year. This amount corresponds to a payment of approximately 0.611 cent USD/kWh. Supposed that the early exploration is funded by the Developer itself, the tariff increment to cover the costs will be higher since obviously the cost of capital of the Developer is much higher than that of the government. Therefore, the tariff ceiling will adjusted downward between 0 to 0.611 cent USD/kWh for all the benefits (reduced risks, avoided financial costs for exploration) obtained by the Developer. Certainly, this is only one method to value the support given by the government to the Developer through its drilling program. There might be other valuation methods that can be used to set the best tariff ceiling.

Regardless of the tariff ceiling, to conclude, efficiency of the Developer is to be guaranteed through (1) credible developer selection mechanism and (2) further negotiation on the tariff level by the assigned team under the Directorate of Geothermal after the resource has been found. Furthermore, the Energy Minister will give the mandate to PLN to purchase electricity from the Developer using the negotiated tariff level. Note that the tariff ceiling is set according to the valuation of geothermal energy as a renewable and clean resource by the government itself (as illustrated in Figure 4.5). If the negotiated tariff by the Developer is still higher than the ceiling, the government has the right to not continue with the project. Nevertheless, since the tariff has been set to be higher, there will be enough room for the Developer to gain benefits and make the necessary adjustments to be able to move forward with the project.

Note that this recommendation does require a commitment from the government to support PLN supposed that the purchase of electricity from geothermal development does increase PLN's costs of supply, i.e. tariff level higher than PLN's BPP. Nevertheless, although outside the scope of this thesis, it is important that PLN is also committed to operate efficiently due to the fact that its costs of supply (BPP) do not only consist of payments for power purchase but other operational expenses, e.g. for transmission and distribution. Under the new arrangement the coordination is now conducted at the higher level between the ministries who are affected by the decisions, namely the MEMR, the MSOE, and the MoF. It becomes the responsibility of the MEMR to guarantee enough support for PLN (through electricity subsidy), when required, prior to giving PLN the mandate to purchase power from the Developer.

The challenge in obtaining commitments from the all the stakeholders needs to be acknowledged. Supposed that a certain amount of budget needs to be allocated to support PLN in purchasing electricity from RE producers, not only that it will require a support from the MoF, the budget plan also needs to be approved by DPR (see Appendix A on the identification of actors). At the end of 2016, during the review of 2017 State Budget plan, DPR rejects the allocation of IDR 1.3 trillion for renewable energy development that will be distributed to PLN to bear the costs of RE power purchase. The reason was due to the fact that electricity subsidy is supposed to be allocated for the people. Although it will be distributed to PLN, eventually the benefits will be enjoyed by the corporations, namely the independent power producers (Dunia Energi, 2017a).

As mentioned by Abadi Poernomo, coordination is the most expensive thing in Indonesia (Poernomo, 2017). It implies the difficulty in aligning the interests between different stakeholders. Moreover, the political landscape might easily change and have direct consequences on a particular sector, as in the current case of renewable energy development. This is so because the development is conducted rather uncoordinatedly between these stakeholders despite their interdependency. Therefore, it is important for the stakeholder to ensure coordination and commitment at a macro level. It can be started by opening up dialogue and obtaining commitment between the stakeholders in regards with the absorption of geothermal potential in the country.

4.4 Concluding Remarks

As mentioned in the beginning, this chapter is divided into three main parts. The first part looks into the action situation at the operational level. The analysis intends to look into the crucial aspects which have significant impact toward the attainment of the ideal outcome. From this stage of the analysis, several findings (issues and opportunities) in regards with the physical conditions of the resource, IPB issuance process, the payoff structure, and the contractual enforcement have been identified and further analyzed. The second part looks into the action situation at the collective-choice level and focuses on the arena of the making of tariff for geothermal energy. The challenges which exist in this particular arena were made explicit. It has been concluded that the regulations concerning tariff will tend to be unstable (frequently changed) due to the fact that the political influence is strong on this particular matter and that it is lawfully easy (for the minister) to change the regulation concerning tariff level.

The findings in the first (operational) and the second (collective-choice) parts are used to develop the third part which specifically focuses on getting the payoff structure right in order to attract more participations in the sector. Nevertheless, the recommendation takes into account other crucial aspects, such as the open tender mechanism and the way that tariff should be distinguished based on the configuration of costs, benefits, and risks faced by the developer in each IPB issuance scheme. The important note is that the proposition to change the payoff structure will require a commitment, especially from the government to support renewable energy development. For instance, supposed that the payment obligations for the developers are to be reduced, it will decrease the State revenue from the geothermal sector. Supposed that, instead of reducing the payment obligations, the tariff ceiling is increased again, it is likely that additional support for PLN to purchase electricity from the developer is required in the form of subsidy.

Chapter 5

Discussion

The previous chapters have introduced the concept of institutional analysis and exhibited how the IAD framework has been used in this research to analyze specific case of geothermal investment in Indonesia. This chapter is intended to revisit some of the most important aspects which have been pointed out throughout the previous chapter and to dig deeper into the IAD framework—its applicability and the reproducibility of the framework interpretation, as employed in this thesis. Chapter 5.1 discusses the use of the framework under the context of this research. Chapter 5.2 attempts to widen the analysis and to assess the applicability of the IAD framework in socio-technical systems. Chapter 5.3 shows explicitly how the IAD framework has been interpreted and used to structure the analysis in this research.

5.1 Institutional Analysis in the Context of Geothermal Energy Investment in Indonesia

In chapter 2, it has been mentioned that there can be numerous approaches and ways in conducting institutional analysis. It is simply because institution is an inseparable instrument in any system. It governs and constrains the way humans make decisions and interact in any kinds of settings. Moreover, the analyst can decide to focus on institutions at a particular layer of institutional analysis as suggested by Williamson (2000). The analysis can dig dive into the informal institutions of customs and traditions, institutional environment of laws and constitutions, institutional governance (transaction costs economics), or into the more operational structure of a specific case. The bottom line is that it is within the analyst's discretion to utilize the available information and knowledge to set the direction of the analysis itself.

With this research, the author has decided to follow what Ostrom has proposed, to dig deeper than using the theories of markets and hierarchies in conducting institutional analysis (Ostrom, 2005a). Therefore, the institutional analysis in this thesis employs the IAD framework to guide the process of identifying the crucial aspects and to allow the author to independently select the relevant knowledge and theories to elaborate the analysis. The use of the framework has shaped this research to be highly specific and contextual. It has looked into the circumstantial data and information in Indonesia and processed them into the analyses using the concept of action situation in the framework. Furthermore, it is worth investigating how this framework has helped in unravelling the issues found in the sector.

5.1.1 Identifying Issues and Developing Recommendations

Within this research, the aspect of institutions is taken into the analysis by operationalizing the rules-in-use factor of the IAD framework. Nevertheless, the IAD framework emphasizes the importance of looking further into other aspects: (1) actors and their attributes and (2) the physical conditions affecting the action situation. The framework itself basically only points out a simple logic of how institutions are embedded in a particular situation and how, given the other contextual factors, they govern and constrain the interactions of actors in an action situation. Despite the simplicity, the framework is particularly useful in obtaining a comprehensive picture of a specific issue.

This research was initiated since there had been several aspects in the sector which were perceived to be problematic and hampering the investments required to develop geothermal energy in the country. Therefore, even prior to the analysis using the IAD framework, the issues could already be identified as pieces of information scattered throughout various sources which had been readily available for the author. However, it does not mean that the use of the IAD framework has been practically useless. Quite the contrary, the role of the IAD framework in this research, as also pointed out by Ostrom herself, has been to assist in collecting these empirical data and information and to systematically analyze them.

Given the concept of the IAD framework, the construction and the analysis of action situations become very specific. In this thesis, in the operational level, the action situation specifically looks into several interactions of transferring the geothermal license from the government, settling the power purchase agreement, and concluding the financing arrangement. The specificity of the action situation makes it possible for the author to identify the contextual factors in a comprehensive and structured manner. For instance, since the analysis in this research has been focused on the interactions between the resource

owner, the developers, the buyer, and the financiers in particular settings, the identification of the community attributes has been rigorously made toward these actors and especially how their attributes affect the interactions between them. Furthermore, the identification of the rules—where the most relevant institutions are determined—has been conducted in a structured way to help make the dynamics in the action situation more obvious. Through this stage, the author has become more acquainted with the existing issues, only that this time, with the concepts around the IAD framework, the author looks at the issues in a more systematic manner—which rules or which attributes affect the actor’s decisions, how they influence the play of the game, and so on.

In the preceding paragraphs, the notion of comprehensiveness has been mentioned. In this case, the term comprehensive does not mean that the research has attended to wide-spread aspects which affect the investment decisions in the sector. Instead, the analysis is comprehensive only to a certain extent, restricted by the boundary of the analysis which has been specified in the beginning. Why is this important? Not only that rich analyses of the contextual factors and a clearer picture of the action situation can be obtained, the comprehensiveness of the analysis using the IAD framework has been particularly important in constructing the recommendations to improve the system. This is illustrated in Figure 47.

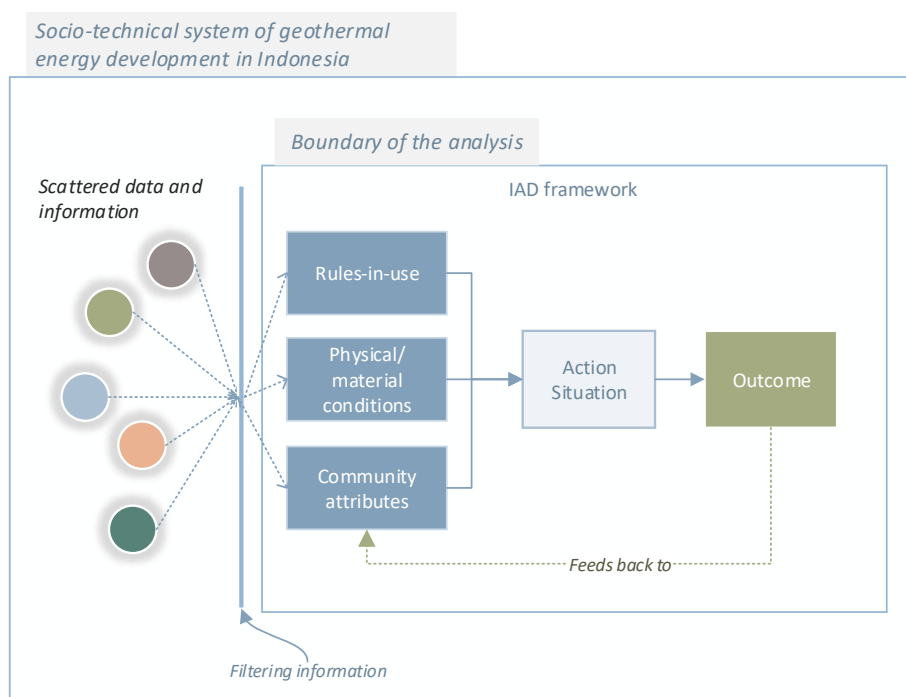


Figure 47 Analysis Using the IAD Framework

Firstly, the IAD framework has forced the author to filter information and classify them into a particular structure, as suggested by the framework. In doing so, a more systematic analysis toward the action situation can be obtained. Conforming to the boundary of the analysis, the process of identification of the contextual factors is attempted to be as comprehensive as possible. The purpose is to be able to get a full picture of a small system (the action situation) within a larger system of geothermal sector in Indonesia. In this research, the analysis has managed to sufficiently identify all the compelling and influential factors of the action situation. Accordingly, during the stage of developing a recommendation, the author can identify the relevant factors to be further attended in order to improve the outcome.

As seen in Figure 47, there is a feedback mechanism in which the outcome of the action situation is supposed to feed back into the contextual factors. This mechanism is explained as follows. When the outcome is perceived to be unsatisfactory, instead of uncritically looking into solutions which are perhaps used in other settings, e.g. in other countries, the attempt to improve the system should depart from investigating the contextual factors per se. When the factors, e.g. the rules, are modified, the dynamics within the action situation will change. Eventually, the outcome will follow. If necessary, the process can be repeated until the ideal outcome is achieved.

To illustrate, in this research, following the determination of the crucial factors in the action arena, the recommendations have been made to change or to look into the previously-identified contextual factors. The rules (policies) are especially the most obvious aspect to change because they are basically constructed by humans and relatively easier to modify. For instance, one of the recommendations is to revisit the payoff structure (payoff rules) to change the perception of the

developers/financiers toward the profitability of the sector. A more challenging recommendation is to alter the community attributes in order to improve the reciprocity between the involved actors. During the analysis, it has been found that there is a social dilemma between providing cheap electricity to the society and developing renewable energy in the country. This dilemma has somehow created a situation which makes the system practically unstable. Based on this finding, the recommendation is to firstly align how the stakeholders view the importance of renewable energy itself. Although this particular recommendation seems vague, the analysis using the IAD framework has pointed out where the tension exists in the system.

Furthermore, although not shown in Figure 47, another important concept of the IAD framework is the embeddedness of institutions within a deeper level of action situation. In this research, this concept has been specifically utilized to look into the making of rules in action situation at the operational level. The important note is that understanding action situations at the higher level does not widen the boundary of the analysis. Instead, it digs deeper into how the institutions affecting decisions and interactions at the operational level are constructed. Therefore, this step strengthens the specificity and the comprehensiveness of analysis of a certain issue, as intended in using the IAD framework. In this research, for instance, in order to understand why the rules governing the ceiling tariff (aggregation rules in the PPA settlement process) have been constantly changing, the action situation at the collective-choice level focuses on the dynamics between the stakeholders who are involved and influential in developing the relevant rules and policies. This step has been found to be useful in enriching the analysis of action situation at the operational level.

The detailed information gathered at the stage of the identification of the contextual factors of the action situation has become key to point out the issues in a structured manner. The analysis of the action situation can be supported with satisfactorily comprehensive data and information in order to define how the institutional arrangement has affected the specified action situation. Eventually, despite the complexity, the issues can be unraveled and the opportunities can be put forward in order to optimize the outcome of the action situation. To conclude, the IAD framework has been found to be useful in obtaining a focused analysis toward particular aspects in the Indonesian geothermal sector. The use of the framework has kept the analysis inside the corridor which has been initially determined by the author herself.

5.1.2 The Applicability of the IAD Framework in this Thesis

In chapter 1, it is mentioned that the limited utilization of this framework to analyze a socio-technological setting, such as geothermal energy development, should entail cautions in regards with the suitability of this framework for this research. Moreover, the use of this framework has been particularly more popular for analysis using models, such as game-theoretical and agent-based model—which is different with the kind of direction that the research was aimed to take. Consequently, the existing literatures, with which the author can make references to be able to properly interpret the use of the framework in a qualitative fashion, are limited as well. However, the framework itself has been developed and refined over time, accompanied with multiple additional guidelines for scholars who want to utilize this framework for a specific subject.

Eventually, the use of the framework has been proved to be useful in undertaking this research. The aspects of the framework have been operationalized carefully. Certainly, adjustments were needed due to the fact that there are different circumstances within the Indonesian geothermal sector, compared to the setting of common-pool resources. For instance, the development of this sector does not comprise of community members which, as in the setting of socio-ecological systems, might have direct control and direct benefits over the resource, such as in the utilization of a lake by the local residents. Certainly, there must be a local community living close to the geothermal resource, which might have a certain influence toward the development. However, in this setting, this community does not have a direct access, let alone control over the resource; at least not for the indirect utilization of this resource (for power generation). Instead, the more important community members to analyze are the ones which interact within the bureaucratic process of the resource development, namely the owner of the resource, the regulators, the developers, the buyer, and the financiers. Therefore, the analysis of the community attributes should be adjusted accordingly. This kind of adjustments is insignificant and does not change the concepts as proposed in the framework.

The main objective of this research is to understand how the institutional arrangement affects the investment decisions in the sector. Needless to say, any kind of investment decisions must be made by a certain actor/stakeholder. It means that, not only that the institutions need to be investigated, the analysis must be able to incorporate the elements of actors and their actions. The central part of the framework, the action situation, specifically intends to analyze how actors make decisions or interact and how their interactions affect the outcome. Certainly, the decisions of the actors depend on certain aspects (e.g. resources, interests) attributed to them. The analysis of such attributes is also taken into account in the IAD framework.

Geothermal resources have unique characteristics which make the economic nature of the development different than other resources. In fact, as indicated in chapter 4, the condition of the resource has a direct and significant impact toward the

investment decisions of the participants. Certainly, the comprehensive review of physical and material characteristics of geothermal resource within this thesis must be accredited to the capability of this framework to capture all the crucial information in an institutional analysis.

In regards with the analysis of institutions within the action situation, the horizontal classification of rules as proposed by Ostrom and her colleagues has been particularly helpful to really identify and structure the most relevant rules in the system. In fact, such classification has pushed the author to look deeper into the existing regulatory framework and other sources to get a comprehensive view of the rules. For instance, the identification of the boundary rule for the participants to assume the position of the developer has signified the importance of the developer selection mechanism (the transfer of geothermal license) in the action situation. All in all, the process of identification of the contextual factors of an action situation has helped in making sense of how the interactions and outcomes would turn out eventually. The emphasis that Ostrom and her colleagues have repeatedly made—in understanding and recognizing the relevant physical condition, the community attributes, and the rules—has become reinforced, as exhibited throughout this research.

The bottom line is the concept and the features of the IAD framework are suitable, and therefore applicable, for institutional analysis as intended in this particular research. The following section discusses the applicability of the framework to analyze socio-technical systems in general.

5.2 Attending to the Scientific Research Objective: Assessing the Applicability of the IAD Framework to Analyze Socio-technical Systems

Throughout the application of the IAD framework in this research, the practicality of this framework to analyze geothermal investment in Indonesia has been thoroughly tested. The previous sub chapter has attempted to mention the advantages of using the IAD framework in a particular setting of geothermal sector development in Indonesia. The clarity of the framework design and the availability of other supporting materials around the concept of the framework have assisted the author to point out some crucial factors regarding geothermal investment in Indonesia which needs to be further investigated. As proposed by Ostrom (2005), the use of a framework is to help “to identify the elements (and the relationships among these elements) that one needs to consider for institutional analysis.” Under this concept, it is safe to conclude that the IAD framework has been well-equipped to serve the purpose of a framework for institutional analysis.

Certainly, as a supporting tool to identify actors and their interactions, the framework is not equipped with any theory to make assumptions about these elements or the outcome itself. Ostrom (2005a) has made it clear that in order to analyze the action situation, one or more theories are required to be able to diagnose a phenomenon, to explain the processes, and to predict outcomes. Within this research, several theories have been subtly used throughout the analysis to explain the phenomena resulted from similar actions/interactions which have taken place in the past. For instance, during the analysis of the payoff structure of the current regulatory framework, the concept of net present value and time value of money is used to explain the investment decision of the business entities. Another example, during the analysis of the IPB issuance process, existing literatures regarding the transfer of authority from government to business entities and the concept of transaction cost economics are used. The theories to be utilized in the analysis will follow depending on the elements which have been identified using the framework. The fact that the process of incorporating theories can be straightforwardly done throughout this research indicates the capacity of the IAD framework to provide the user with a clear line of thinking in order to connect the elements identified with the relevant theories.

The preceding paragraphs indicate that the IAD framework has a generalizability feature while at the same time it provides a structure that is sufficient to function as a point of departure and to guide along the process of institutional analysis. Here it is argued that the framework can therefore be used for institutional analysis under different settings other than socio-ecological settings (i.e. concerning common-pool resource issues), including for socio-technical systems. The application of the IAD framework to analyze a case in a socio-technical system has been done before. Ghorbani, et al. (2010), for instance, have demonstrated how institutional frameworks, including the IAD framework, can be applied to agent-based models of socio-technical systems. The methodology used in Ghorbani, et al. (2010) incorporates a model (agent-based model) to exhibit the interactions between participants in the arena and to analyze the outcome of the action situation. Of course, such approach of utilizing the IAD framework is different from that of this research.

It is important to note that the use of the IAD framework depends on the way the user interprets the concept and the components of the framework itself. Supposed that the framework is to be used by another person to analyze a case (in a socio-technical system) that is exposed to different contextual factors, the approach to utilize the framework might be different as well. This section is intended to show the applicability of the IAD framework for institutional analysis of a socio-technical

system using the approach employed in this research. In doing so, the replicability of this approach of interpreting and utilizing the IAD framework can be made more explicit.

5.2.1 Framework for Institutional Analysis toward Socio-technical Systems

This research is also intended to understand the applicability of the IAD framework to analyze a socio-technical system. As already mentioned in the introduction part of this thesis, the IAD framework has been especially built and refined over time for the purpose of analyzing socio-ecological systems¹⁴. Consequently, the body of knowledge has developed around this type of system, especially concerning common-pool resource problems. Nevertheless, the application of the IAD framework from the perspective of ecologists has not been without challenges either. Ostrom (2011) has mentioned her awareness that some ecologists did not find the IAD framework to be relevant due to the fact that the multiple variables which are crucial in analyzing socio-ecological systems had been packed into one single factor of “biophysical materials”. Because of this reason, Ostrom (2009; 2011) has proposed a general framework for analyzing socio-ecological systems (SESs) in which the core element of the IAD framework (action situations comprising of interactions and outcomes) is embedded into a broader SESs. McGinnis and Ostrom (2014) have refined this framework by incorporating first-tier variables: (1) socio, economic, and political settings, (2) resources systems, (3) governance systems, (4) resource units, (5) actors, (6) action situations, and (7) related ecosystems. Every first-tier variable is to be further elaborated through the identification of the second-tier variables. For instance, the resource system can be explained through identifying the sector (e.g. water, forests, etc.), system boundary, size of the resource system, human constructed facilities, productivity of system, equilibrium properties, and so on. Previously, these features were packed into one category of physical/material condition. Moreover, in this SES framework, the rules-in-use are now to be incorporated to be the part of the governance system. These changes emphasize the comprehensiveness of the new SES framework compared to the IAD framework.

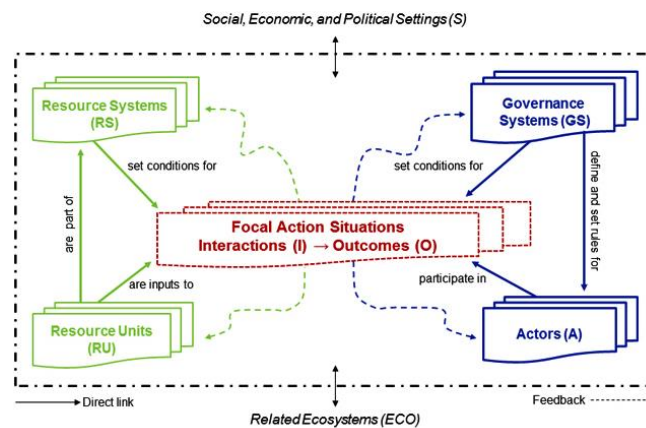


Figure 48 Revised SES Framework with the First Multitier Variables (McGinnis & Ostrom, 2014)

Notice that the adaptation of the core concept of the IAD framework into a revised SES framework has resulted in a significantly more elaborate framework. Certainly, the aspects included in the framework are selected based on the requirement to analyze issues in socio-ecological systems. For instance, the resource unit variable comprises of second-tier variables, such as resource unit mobility, growth replacement rate, spatial and temporal distribution. These variables are highly specific and relevant in common-pool resource problems in which the subtractability of the resource, e.g. in fisheries, forestry, etc., is of high significance. On the other hand, when it comes to institutional analysis concerning infrastructure development or energy investment (as was conducted in this research), some of the detailed variables become less relevant.

A framework can always be improved, developed, and adapted, depending on the subject under scrutiny. Despite the extensiveness of the SES framework, McGinnis and Ostrom (2014) have recognized the need to improve the relevancy and the applicability of the framework, hence the IAD framework, for cases in a social-ecological-technical system (SET). In SETs, there is a human-constructed dynamic process of technical systems which require the analysis to be distinguished, between the construction/maintenance of the SETs and the process of obtaining access to the resource. In order to understand the applicability of the IAD framework for socio-technical systems, it is important to understand what is meant by socio-technical systems and how do they differ from socio-ecological systems? Geels (2004) argues that a socio-technical system consists of

¹⁴ Socio ecological systems (SESs) consist of multiple subsystems (i.e. resource system, resource units, users, and governance systems) which are separated but interact to produce outcomes at the SES level which eventually affect the subsystems and their components (Ostrom, 2009).

basic elements which can be broadly categorized into three sub functions of production, diffusion, and use of technology. Furthermore, every sub function consists of more components/resources which are interconnected with one another. Figure 49 shows the complexity of a socio-technical system, as proposed by Geels (2004).

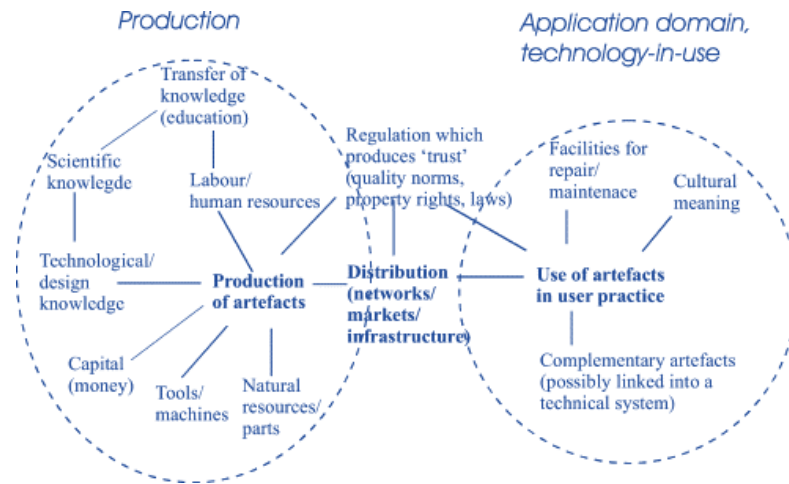


Figure 49 Basic Elements and Resources of Socio-Technical Systems (Geels, 2004)

The main distinction between socio-ecological systems and socio-technical systems is the importance of human-constructed facilities/technologies in each system. In a socio-technical setting, human-constructed technology is one of the central aspects to be attended in the analysis. As shown in Figure 49, the term *artefacts* (in production, distribution, and consumption) which represents the involvement of human-made technologies indicate the importance of this aspect in a socio-technical system. For instance, in this thesis, the entire discussion about investment in the Indonesian geothermal sector has originated from the need to construct and develop technology upon the natural resource in order to utilize the existing geothermal system. On the other hand, in SESs, the human-constructed technology serves as a supplementary element which can even become irrelevant in the inexistence of one. For instance, in a lake sustainability governance, understanding the human-constructed facilities is of less significance in comparison to understanding the resource's natural properties.

The IAD framework was adapted into the SES framework to fulfill the need for a more extensive framework to analyze a complex SES. The next concern is whether it is necessary to adapt the framework to be able to accurately identify basic working parts and critical relationships to consider in studying the socio-technical system. This research has exhibited that it may not be necessary to create a new framework which incorporates all the elements in a socio-technical system. Eventually, it will depend on the extensiveness or the boundary of the analysis itself.

Certainly, the complexity of the technological aspects in socio-technical systems still need to be taken into account. Nevertheless, these aspects are part of the physical/material conditions which have already been included in the IAD framework. Supposed that these elements are to be further specified in an enhanced framework, it is inevitable that one specific socio-technical system has different requirements compared to the other systems. For instance, between energy and transport infrastructures, there are stark differences in the way technologies are procured, installed, and so on, until finally the resource or the product can be obtained by the final users. It is not to say that obtaining an enhanced version of the IAD framework that is intended for analysis in socio-technical systems is unimportant. The point being made is that eventually it is the analyst's own ability—in identifying the relevant elements based on the available information and the existing literature on similar systems—that defines the comprehensiveness of the analysis.

It is not within the scope of this research to produce a new/enhanced version of the IAD framework. Instead, it is argued that the framework itself is already equipped with sufficient features to conduct institutional analysis for socio-technical systems. The following sub chapter intends to show why the author argues that the framework, given the established concept and guidelines which exist in the existing body of knowledge, is suitable to analyze any socio-technical issues.

5.2.2 Utilizing the IAD Framework in Socio-Technical Systems

The IAD framework has been found to be a useful foundation for microanalysis of diverse social dilemmas. The use is intended to analyze specific action situations which are embedded within a larger system, be it socio-ecological or socio-technical. The more specific the action situation, the more information will be obtained regarding the relation between interactions and outcomes. Consequently, the recommendations to be made for the system can become more specific. Hence,

it keeps the analysts from oversimplifying the issue under scrutiny. It indicates that the strength of the IAD framework is not in the completeness of the elements incorporated in it, but rather in the emphasis to be concise in setting the boundary or in determining the action situation itself in order to obtain a meaningful recommendation to improve a specific system. Considering the complexity of socio-technical systems which concern not only the utilization and maintenance (like most of the cases in socio-ecological systems), but also the production and distribution in the system, it is argued that having a framework which incorporates all the elements for a single institutional analysis will only make the framework unnecessarily too detailed. What might be the unintended consequence is for the analyst to become lost in details and eventually trivialize the importance of analyzing the interactions between participants in the action situation. It might prevent the analyst from being specific to fix the actual problems in the system given all the contextual factors.

Based on the argumentation above, it can be concluded that the IAD framework has its own advantages which are suitable when an institutional analysis is to be conducted toward specific aspects in a broader socio-technical system. Specifying the policy objective becomes of importance in using the framework. For instance, this research has only focused on a number of aspects within the socio-technical system of geothermal development, namely the capital and the regulations (see Figure 49). Other elements such as the tools/machines, the labors, and technological design have been intentionally left out in the analysis due to the fact that the objective is merely to understand the influence of the institutional arrangement toward the investment decisions, and not the entire system. If the analyst intends to conduct institutional analysis toward the entire system, the best option is to partition the system into smaller fragments of action situations in order to stay practically convenient. As an illustration, supposed that a more comprehensive analysis toward a certain socio-technical system is to be conducted, the process should roughly look as in the following (see Figure 50).

The analyst needs to keep in mind that it is difficult and, at the same time, practically inconvenient to conduct an integrated analysis in one time. Instead, the analysis needs to be conducted by constructing several action situations which, to some extent will be connected to one another (indicated by the blue dashed lines in Figure 50). In the case of geothermal development in Indonesia, for instance, there can be a specific action situation which concerns the transfer of knowledge (e.g. through the use of imported geothermal technologies) to analyze the capability of the national actors to independently manage the resource. Another example is to construct an action situation which focuses on environmental and forestry issues (natural situation) which have been deemed to be troublesome in the case of geothermal development in Indonesia. At the consumption or usage side, it might also be important to understand the interactions between the electricity users and the electricity provider (the national electricity company). In such action situation, the analysis on the attributes the community will be entirely different compared to the one conducted in this thesis. Instead of focusing on the developers, the buyer, and the related ministries, the discussion will mainly turn to understanding aspects concerning the community's buying power, their willingness to use such technology (for previously non-electrified users), the capacity of the electricity company to expand development in remote areas, and so on. Based on this illustration, it becomes obvious that it is possible and perhaps more convenient to create multiple action situations to analyze complex problems of socio-technical systems. When the analyses toward multiple action situations and their relations with one another have been made explicit, a sound and comprehensive study can be obtained.

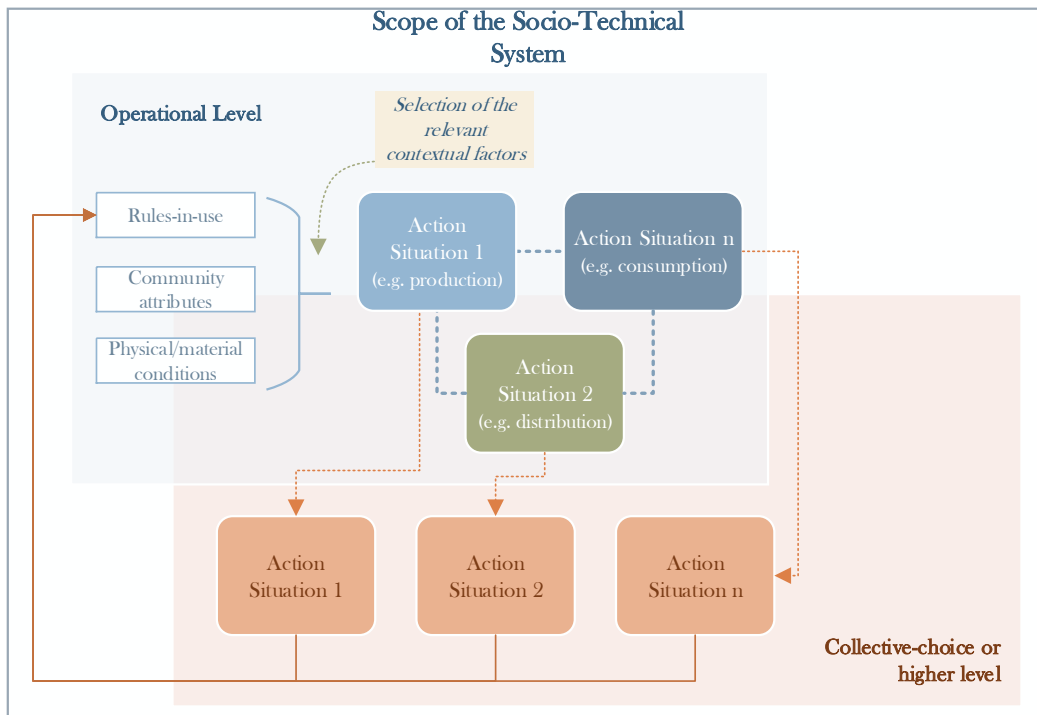


Figure 50 Illustration in Conducting Institutional Analysis for Socio-technical Systems

What needs to be taken into consideration is that each action situation is affected by different sets of rules and different physical/material conditions. Moreover, the configuration of actors which participate in the action arena is not the same as well. It means that the community attributes to include in the analysis will have to be specified for each action arena. This is important due to the fact the issue under scrutiny in every action situation will be unique as well. It means that different perceptions toward different issues will need to be probed. Therefore, the analyst will need to be well-informed to be able to select the most relevant contextual factors into the analysis of a specific action situation. Another important note is the fact that every analysis of a specific action situation at the operational level can always be extended into a higher level of analysis at the collective-choice level. At this level, just like what has been shown in this research, the making of policies and regulations which define the rules-in-use at the operational level can be further investigated. In doing so, the comprehensiveness of the analysis can be improved.

5.3 Explicating the Utilization of the IAD Framework in this Research

In the previous sub chapter, the author has argued that the advantage of using the IAD framework is that it allows the user to zoom into specific issues. The framework itself is not coupled with any particular theory, nor that is it equipped with detailed structure to guide the analysis. Therefore, it obliges the analyst to use his/her own discretion in conducting the analysis. This section is intended to show how the IAD framework was utilized in this research. Note that the analysis was conducted to only one action situation at the operational level and another one at the collective-choice level. Therefore, the discussion here focuses on the development of one action situation and not on the linking between action situations in case a more integrated analysis is to be conducted. In general, the process can be summarized as seen in Figure 51. In addition to it, Figure 52 is given to illustrate the operationalization of the framework in this thesis.

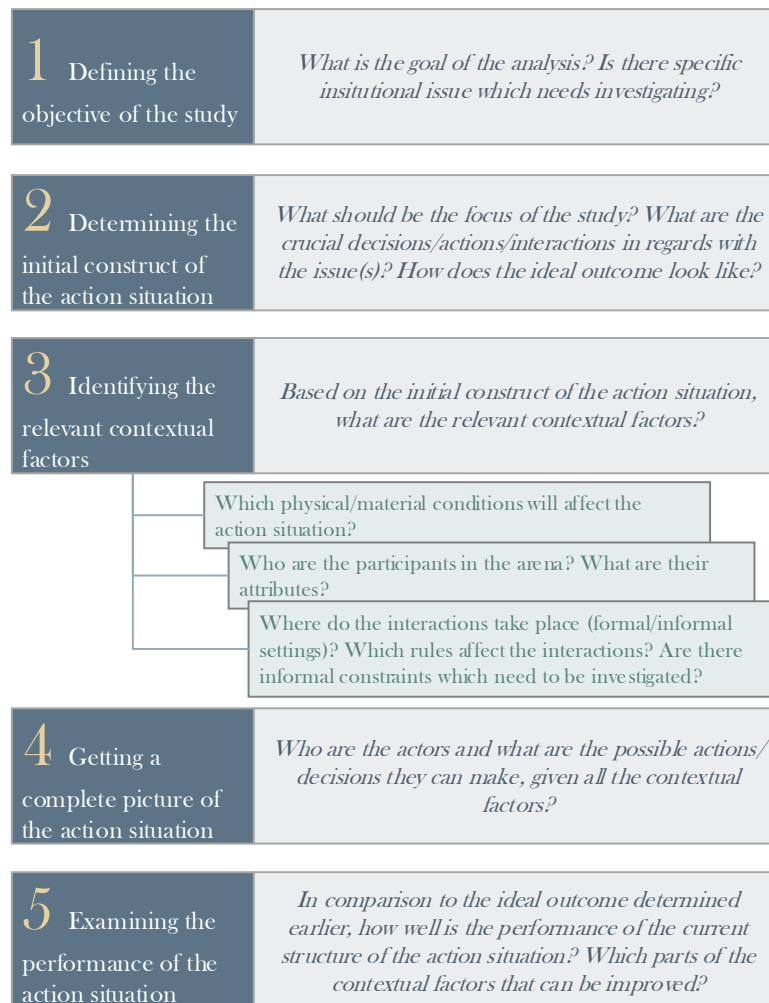


Figure 51 Institutional Analysis using the IAD Framework as Conducted in the Research

First of all, the point of departure of this research is the need to understand the influence of the institutional arrangement, namely the laws and regulations, on the investment decisions within the sector. Many of the previous reports have mentioned that institutional reform is required for the country to catch up with its own renewable energy target. The question which came across was, which part or the institution that needs reforming? The need to point out specific aspects in the existing regulations makes the IAD framework especially suitable for the research. Using the concept of horizontal classification of rules, the framework identifies institutions (rules) in a detailed manner. In doing so the analyst is expected to see how these rules govern and influence the way the actors make decisions and interact with each other. Based on what has been shown this research, the decision to use the IAD framework for institutional analysis should depend on the study objective—does the analyst need to understand how the governance structure affect the outcome of a particular process? Therefore, the first stage is to clearly determine the goal of the analysis.

When the objective has been specified, the next step is to make a preliminary construct of the action situation. This stage is important for the analyst to be able to effectively identify the contextual factors to be considered in the analysis. This can be done by getting familiar with the actual issues going on in the system. The information can be obtained through various sources, such as the news, official reports, and/or past studies. Not only that the analyst will absorb more information (that will be useful at the later stage of the analysis), he/she will be able to define the ideal outcome of the action situation. In doing so, it will be easier for the analyst to determine which actions, decisions, and interactions that are important to be considered in the action situation.

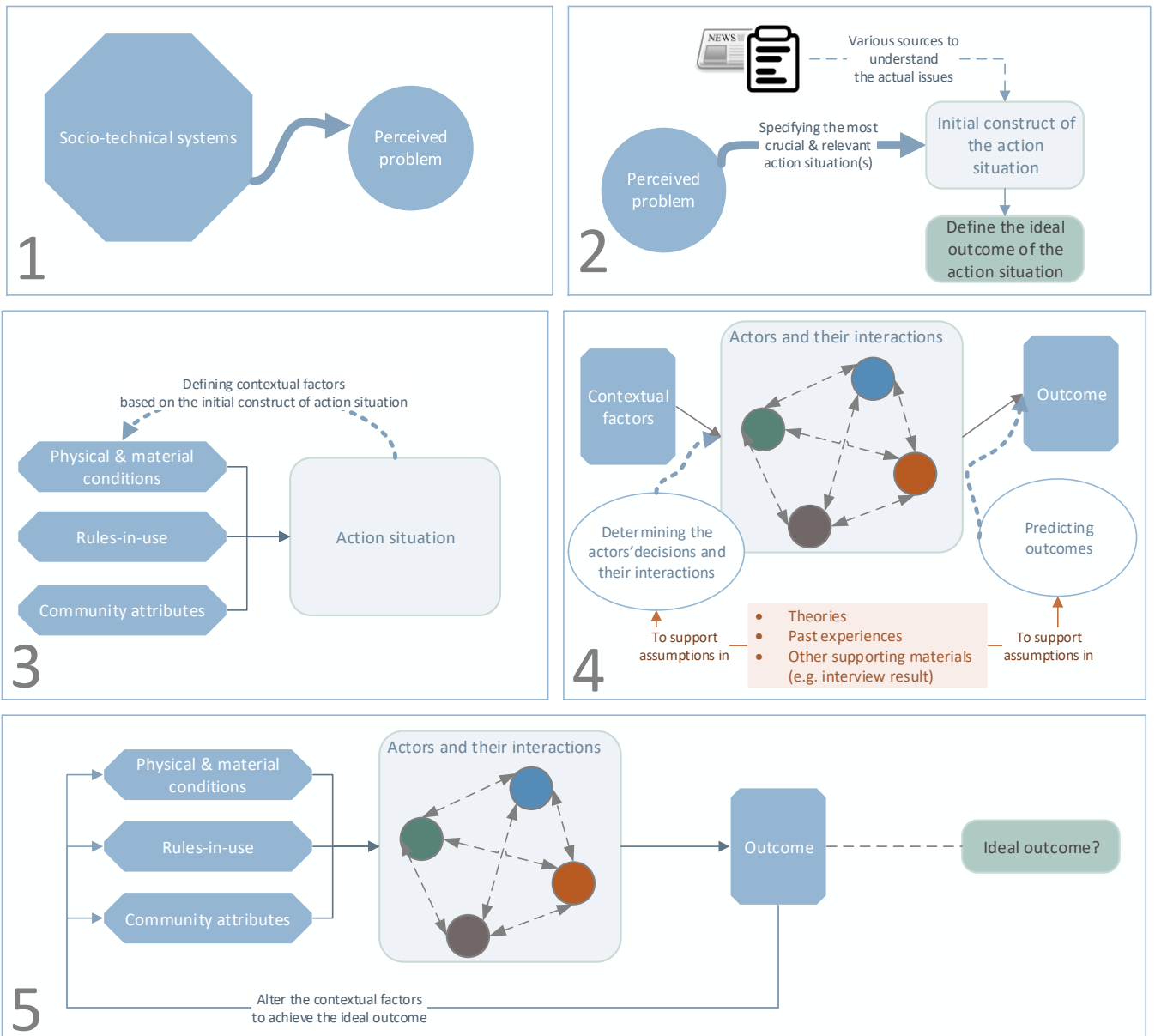


Figure 52 Illustration of the Operationalization of the IAD Framework

As an example, suppose that an analyst is expected to conduct a study on the electrification of rural areas. First, the analyst has to determine the focus of the study. For instance, he/she can decide to look into the procurement of the technology to the rural areas or to the utilization/maintenance of the technology. If there is already sufficient information available, the analyst can conduct a desk research to learn more about the existing problems, as perceived by the involved stakeholders. Based on this identification, the analyst needs to define how the ideal outcome will look like, supposed that the issues are tackled. For instance, the ideal outcome is probably for the infrastructure to be developed and utilized by the local residents without giving too much burden on the household expenses. Based on this, the analyst can define the crucial actions/interactions to be included in the analysis. In this hypothetical case, it can include the process of procurement by the public/private sectors which looks into the selection of the most suitable technology and the financing issues. It can also include the introduction of the technology to the rural users and how to ensure the sustainability of the infrastructure utilization. These aspects can be analyzed in multiple action situations which are connected to each other. It can also be analyzed as one action situation in which the entire processes are required to take place in the arena in order to achieve the overarching objective.

Once the crucial actions and interactions have been determined, the analyst can move on to identifying the relevant contextual factors. For instance, in the hypothetical case, the selection of technology for electrification will depend on the condition of the area itself—whether it has a particular potential of a certain renewable energy technology or not, the challenges in

developing either on-grid or off-grid infrastructure, and so on. Furthermore, in analyzing the attributes of the community, the analyst can investigate the perception of different stakeholders in the system, such as the potential energy providers, the government (local and national), the residents, and so on. This can be done through desk study, direct observation in the location, interview, and other methodologies which are intended to enrich the information to be included in the analysis.

The next step is to identify the rules-in-use. In this research, it was already determined in the beginning that the identification of rules would mostly refer to the existing regulations due to the fact that most of the actions and interactions to be analyzed took place in formal settings which are mostly governed in the formal law and regulations. Nevertheless, it is important to note that not all interactions occur in formal settings. For instance, in the hypothetical case mentioned above, the attempt to introduce the technology to the local residents and to obtain the commitment from them to be able to maintain a sustainable delivery of electricity will most probably take place in informal settings. Therefore, unwritten rules which can include norms, traditions, and other aspects which are not strictly governed in formal regulations (laws or contracts) are of high importance. In that case, the identification of the rules will require the analyst to look outside the scope of the written rules and into the domain of informal rules which can be difficult and tricky to identify without elucidation with the actual actors in the system. The analysis of the rules-in-use is central in an institutional analysis using the IAD framework. The rules have direct impact on the choice of actions taken by the participants in the arena. Since rules are basically social devices constructed by humans to govern the interactions between them, the rules are subject to restructure in order to alter how the game is played in the arena and obtain better outcome in the end.

Following the identification of the contextual factors is the analysis of the action situation. Depending on the initial construct of the action situation, the analyst needs to explicitly define the actors and their actions. At this point, the information obtained at the previous stage (during the identification of the contextual factors) needs to be structured. In an action situation, assumptions need to be made and validated in regards with the decisions or actions taken by the actors in response to the existing contextual factors (physical/material conditions, community attributes, rules) . For instance, in this thesis, an assumption was made that—given the high uncertainty of the resource productivity for further economic development—the developers will be reluctant to invest in the early exploration activities, especially when there is limited room to obtain profit in the end. This assumption was then validated through multiple interviews with the relevant actors. In addition to that, references were also made to the past occurrences as reported in various sources, such as the news and former studies. It may not be always the case that the relationship between the contextual factors and the actors' decisions is as obvious as the above example. Moreover, there is a possibility that these assumptions cannot be validated, e.g. through interviews or observations, or that no evidence from the past experience can be referred to. This is why the analysis using the IAD framework has to be complemented with suitable theories in order to explain the dynamics within the action arena. The bottom line is that this stage requires the analyst's craftiness in processing the empirical information on the contextual factors and selecting the available knowledge or theories to explain the actors' actions/interactions and consequently the outcome.

At this point, the analyses should have resulted in linkages between the actions and the outcomes. The analyst can make the judgment whether the interactions in the action arena, given the contextual factors, will result in the expected outcome as determined in the beginning. If the perceived outcome is less satisfactory than initially expected, the analyst should focus on aspects which are found to be crucial and still need to be further streamlined or improved. These aspects are basically part of the contextual factors which have been previously identified. In order to change the dynamics in the action arena, the existing contextual factors will need to be changed as well. For instance, in this thesis, all three aspects (1) the rules-in-use, (2) the physical/material conditions, and (3) the community attributes, are subject to reforms in order to improve the aspects which are considered to be inefficient or ineffective in yielding the expected outcome.

Not all of the contextual factors can be easily changed. The rules-in-use at the operational level can be changed in accordance with the decision-making process at the collective-choice level. For instance, in this thesis, the suggestion was to reconsider the aggregation rules regarding the tariff level and the payoff rules. Whether or not these rules can be changed will depend on the attributes of the community as well. Can the differences between the participants be overcome? Can the interests be aligned? As already mentioned in the thesis, there should be a shared understanding between the community members to achieve the expected outcome. This kind of conclusion is not new, nor surprising. Nevertheless, the analysis using the IAD framework has helped making the social dilemma explicit—to know where the tension exists, which aspects are problematic and so on. Furthermore, the specificity of the action situation and the richness of the information on the contextual factors have made it possible for the author/analyst to come up with more practically relevant suggestions.

5.4 Revisiting the Concepts of Institution and Institutional Analysis in the Context of Geothermal (Renewable) Energy Development in Indonesia

Chapter 2 Theoretical Foundation has mentioned about some of the existing knowledge and theories in regards with institution and institutional analysis. This research has provided some empirical information with which the existing concepts about institutions can be compared and analyzed. In addition to that, a more enriched analysis about the system in Indonesia can be obtained. The following paragraphs intend to briefly embrace these concepts and relate them to the actual setting in Indonesia.

First of all, institutions are defined as humanly devised constraints to govern human interaction. The important concept about institution, as argued by Voigt (2013) is that it must be commonly known and complemented with a sanction mechanism. This research has particularly focused on the regulatory framework of geothermal sector in Indonesia. Ideally, the stipulations in a regulation are negotiated and developed through a careful assessment involving some of the impacted stakeholders. A regulation is supposed to be the product of collective decision of these stakeholders. In doing so, the acceptability of the regulations or policies can be improved, assuming that the consequences of the rules (which affect the decisions and actions to be taken by the impacted stakeholders) have been understood and mitigated. Nevertheless, the ideal collectiveness of policy/regulation making can only be attained as long as there is a willingness from each stakeholder to align the differences in values and interests.

The recent turmoil regarding the change in the tariff ceiling structure for renewable energy-based electricity has been caused by the failure to take into account the concerns and consequences of the decision for the renewable energy sector. The making of regulations at the ministerial level does not require approval from other counterparts in the government or the legislative body. This is why it becomes common for regulations at this level to be practically unsound, in regards with the acceptability of the institutions by some of the impacted stakeholders. As a result, as exhibited in the case of tariff in geothermal energy, these rules seem to be vertically imposed without having proper dialogues or negotiations beforehand. As a result, not only that it will hamper the participation of the developers/investors, especially from the private sector, the unsustainability of regulations harms the credibility of the government in committing to the development of renewable energy sector in Indonesia.

Obtaining a collective decision which considers all plausible consequences is not an easy task. Within the government, dialogues between departments regarding renewable energy development have been held in many occasions. Nevertheless, it has always been difficult to obtain commitments and political willingness to act on it (Poernomo, 2017). Although the country already has the National Energy Policy—ratified through Government Regulation (PP) No. 79/2014—which emphasizes the importance of renewable energy for the country, the implementing regulations (e.g. ministerial regulations) may not always align with it. Many parties have challenged the new regulation regarding tariff (MEMR Regulation No. 12/2017) using the argumentation that the decision to lower the ceiling tariff down to PLN’s cost of supply level does not heed the intention to support renewable energy development in the country as ratified in PP No. 79/2014.

The fact that there are dissonances between regulations makes it worthwhile to reenter the idea of layers of institutional framework, as mentioned in chapter 2.2.1. According to Williamson (2000), institutions at the higher level (1 being the highest, and 4 being the lowest as seen in Figure 53) imposes constraints on the level immediately below. However, in practice such constraints cannot not guarantee alignment between these levels. The empirical finding in this research will be used to illustrate.

At the second level, there are several government regulations which govern the ordering of renewable energy development in the country. It includes the National Energy Policy and, specific for geothermal energy, the Law No. 21/2014 (Geothermal Law) and PP No. 7/2017. The stipulations of these regulations together govern the organization of renewable energy development in the country. For instance, the National Energy Policy, as mentioned in chapter 3.3.1.3, stipulates that the calculation of renewable energy price must be based on the requirement to compete with the price of oil source. Moreover, the Geothermal Law and PP No. 7/2017 further govern how the geothermal sector can be developed, such as through the mechanism of geothermal license issuance to allow both private and public sectors to participate. It seems that the attempt to *get the institutional environment right* (Williamson,

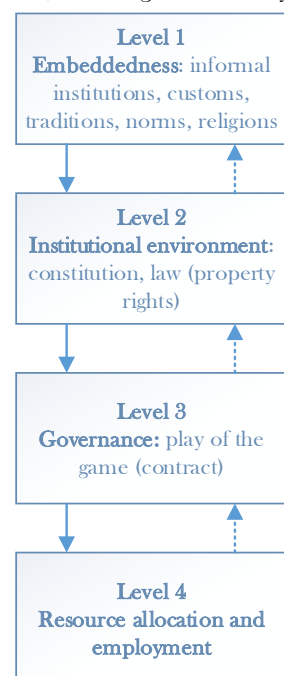


Figure 53 Economics of Institutions (Williamson, 2000)

2000) to support geothermal development in the country is already there. Nevertheless, getting institutional environment right turns out to be insufficient to ensure a smooth implementation of the policy.

In addition to getting the institutional environment right, the governance structure at level 3 must be attended too. At this level, one of the governance structures include the contract between the developers and the utility company (PLN) or the power purchase agreement. The governance of contractual relations in this level is the focus of analysis. The goal is to create order, mitigate conflict, and realize mutual gains. This research has especially focused on the concern regarding tariff which affect the realization of mutual gains between the two parties: the developer and PLN. The tariff itself is governed by the above-mentioned MEMR Regulation No. 12/2017 which has been perceived to be problematic by many parties championing renewable energy development. Eventually, the making of institutions (contracts) at level 3 becomes disrupted. The analysis in this research never intends to look further into the governance structure of the contract itself in which the completeness and the complexity of the contract are attended. This is because, based on the analysis of the action situation at the operational level, the current institutional arrangement is predicted to be steering the developers and investors away from participating in the action arena in the first place. Therefore, the analysis has been focused on the ways to increase the attractiveness of the sector itself.

As also mentioned in the analysis of action situation at the collective-choice level, the failure to obtain a collective decision that is complemented with actual commitments from the involved stakeholders has made the rules in the sector unstable, particularly those concerning the tariff. Fundamentally, the influence of political actor has been found to be very strong on this certain issue. The ratification of MEMR Regulation No. 12/2017 was intended to relieve the burden faced by PLN to purchase the costlier electricity from renewable energy producer. The main purpose is to be able to keep the electricity price low and affordable. It means that the current institutional arrangement seems to focus more on increasing the affordability of energy, and less on improving the sustainability of energy supply. The affordability argument has been recurrently used as a justification to change the rules governing the renewable energy sector since it is a politically sensitive issue. This situation can be explained using the concept of embeddedness as proposed by Williamson (2000).

At the first level of economics of institutions (Williamson, 2000), there is a concept of embeddedness which consists of informal rules, norms, traditions, customs, and so on. The informal constraints are said to have a pervasive influence upon the long-run character of the economies. Institutions at this level are embedded within the society itself. In the case of energy provision in Indonesia, affordability is a more generally-accepted norm in the country, compared to sustainability itself. Affordability in energy implies social justice in energy distribution throughout the country, whereas sustainability does not directly address this particular norm. The notion of social justice is one of the five national principles, also known as Pancasila that is positioned at the heart of the entire institutional framework in Indonesia. Pancasila is complemented with the 1945 Constitution. In regards with energy utilization, the constitution addresses this issue in the chapter of National Economy and Social Welfare. In this chapter, it is clearly stipulated that *“Earth and water and the natural resources contained therein are controlled by the state and used for the greatest prosperity of the people.”*

The strong belief in the importance of social justice and social welfare which can be easily associated with the idea of affordability in energy might be the reason why the House of Representatives (DPR) has simply rejected the proposal of subsidizing renewable energy development in the country in 2016. Somehow, the importance of energy sustainability has less impact in the widespread belief of energy provision in Indonesia, compared to affordability. Consequently, when the two values of sustainability and affordability have to be contested against each other, it is more likely for the mainstream decision made by the people (represented by DPR) to favor the norm of affordability as such. The strong embeddedness of social justice in the nation seems to be one of the reasons why the development of renewable energy (that is found to be costlier) has been occasionally stumbling along the way.

The idea that the nation's embedded norm toward energy provision (level 1) seems to favor cheap rather than sustainable energy development does not mean that the introduction of laws and regulations (level 2) which support renewable energy development to be institutionally flawed. It simply indicates that there needs to be a shift in the nation's mindset about energy provision for the country. What needs to be done is to appropriately frame the value of sustainable energy resources for the country and to deliberately create a stable regulatory framework in which the influence of political biases toward the sector's development can be minimized.

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Concluding Chapter

6.1 Conclusion

6.1.1 Answering the Sub Research Questions

The thesis is started with the elaboration of the importance of geothermal energy along with the challenges that the country faces throughout the years of developing the resource. Geothermal energy development in Indonesia has been characterized with multiple changes in the regulatory framework. These regulations have had different effects on the efforts made by the public and the private sector in achieving the expected outcome. After all, different arrangement instigates different response from the stakeholders within this sector. What the participants choose to do—invest or not, participate in the tender process or not, settle the power purchase agreement now or later, and so on—has had profound consequences toward the actual physical progress that the country has seen so far. Needless to say, the sector has been struggling along with the changes in its regulatory framework.

Given the fact that the past regulatory changes have had different effects to which insights can be gained, it becomes interesting and important at the same time to the latest set of regulations surrounding this sector will affect the future development. Certainly, there are a lot of aspects in a regulatory framework itself. However, the research has been focused on aspects which affect the investment decision in the sector. To be clear, the investment decision in this case concern both the public and the private sector. Given this objective, the following research question is investigated.

How does the current institutional arrangement of the Indonesian geothermal sector affect the investment decisions in the sector?

To answer this research question, three sub questions were used. The answers to these questions will be briefly discussed in the following.

SQ 1: *What are institutions and how can they be analyzed under the context of geothermal development in Indonesia?*

Institutions are rules which are devised by humans to govern the actions and interactions between them. They can include formal and written rules, as well as informal constraints which are shared among them. Institutional analyses have been conducted in many different ways and focused on different aspects of economic interactions. This thesis has been specifically intended to make analysis using the IAD framework to understand the economic decisions within a specific situation. In the IAD framework, the institutions or rules are considered to be the most essential elements to explain actions and interactions of participants in an arena. However, the framework takes into account the significance of physical/material conditions of the resource (and other relevant factors) and the attributes of the community.

The analysis of geothermal development, in regards with the investment decisions of the relevant stakeholders in the system, is based on the elaboration according to the guidelines under the framework. Nevertheless, the use of the framework has been particularly limited in analyzing the economic behaviors around the utilization of non-common pool resource. Therefore, adjustments are necessary. The superstructure of the thesis uses the main aspects as presented in the IAD framework. However, especially in identifying the contextual factors of the action situation, the scope of the issues under scrutiny in this thesis need to be maintained and incorporated during the analysis. In this case, in accordance with the main research question, the issues are related to the investment decisions in the sector. One of the adjustments is especially intended to define community in the context of geothermal investment in the country. In this particular setting, the community and its attributes are focused on agents whose actions affect the deployment of geothermal energy projects, such as the developer, the utility company as the buyer, and the government as the owner. The aspect of investment also guided the way that the

physical/material conditions of the resource are described and analyzed. Furthermore, regarding the institutions or the rules as such, given the fact that the indirect utilization of the resource in the country is governed by the central government, the identification of the relevant rules need to mainly refer to the prevailing regulatory framework itself. Finally, the analysis of action situation at the operational and collective-choice level is conducted based on the actual contextual factors as exhibited in the sector's development. In this case, the historical and political contexts become highly relevant as well.

***SQ 2:** How can the Institutional Analysis and Development (IAD) framework be operationalized to identify the critical aspects in the institutional framework which affect the attainment of the expected outcome?*

The IAD framework was operationalized by carefully utilizing every aspect in the framework as suggested by Ostrom. First of all, the analysis using the framework was started by understanding what is meant by investment decision in the context of geothermal development. From this understanding the initial construct of the action situation, both at the operational and collective choice level can be identified. At the operational level, the interactions between the government as the resource owner, the developer of the resource, the utility company as the buyer, and the financier are to be further studied. The outcomes of this action situation can be simply represented by the agreements/contracts which indicate that formal cooperation has taken place between the participants to conduct actual development in the field. They consist of (1) the geothermal license between the resource owner and the developer, (2) the power purchase agreement (PPA) between the developer and the buyer, and (3) the financing agreement between the developer and the financier. At the collective choice level, the action situation focuses on stakeholders who have the authority and the influence the decision-making process toward regulations and policies affecting the rules which are used at the operational level.

Referring to the initial design of action situations, the contextual factors were identified and elaborated. Chapter 3 was especially dedicated to understanding how the physical/material conditions, the attributes of the community, and the rules-in-use look like and in what ways they will affect the actions and interactions of participants in the arena. Furthermore, in chapter 4, as part of the attempt to operationalize the framework, the analysis of the action situation was conducted. At the operational level, the actions of participants in different positions were elaborated according to the contextual factors identified in the previous chapter. This step was aimed at finding the crucial factors which affect the investment decisions in the action situation. Several factors were identified: (1) the physical conditions of the resource which particularly affect the quality of information available for the potential developers, (2) the process of issuing the geothermal license, (3) the payoff structure, and (4) the contractual enforcement.

Furthermore, the analysis of the action situation at the collective-choice level was conducted. This analysis was intended to understand the arena in which the policy makers and other influencing stakeholders interact and make decisions. Since the purpose of analysis of action situation at this level is to understand the origin of rules in the operational level, it was important that a specific issue was chosen. Therefore, the issue around PPA settlement process was further analyzed. Although the analysis was much less elaborate than that of the operational action situation, it was found that the combination of the contextual factors, namely the rules at the collective-choice level and the community attributes might impact the certainty of regulations to be used at the operational level. As a result, the PPA settlement process, especially regarding the tariff has been recurrently changed over time.

All of the information gathered throughout the analysis of action situation at both levels were finally used to answer the last sub question.

***SQ 3:** How can all the information gathered according to the guidelines of the IAD framework be integrated to develop some meaningful recommendations for the sector?*

At the end of chapter 4, some recommendations were made toward the existing institutional arrangement in order to promote more investments in the sector. First of all, the payoff structure of different geothermal license issuance schemes was revisited. It was found that the payoff structure based on the current arrangement is still limited in capturing the opportunities given in the latest development in the regulations. The most crucial issue is the new regulation governing the tariff level. It is argued that the reduced tariff ceiling only allows for limited room for the geothermal developers to gain benefits. The reduced payoff level for the developers can severely affect profitability perception toward the sector. Therefore, a proposition to change the payoff structure was made. In order to do that, the level of benefits and/or costs can be modified. The more detailed recommendations were constructed in chapter 4. In order to incorporate information obtained before, the contextual elements were taken into account as well. This step was particularly important to identify the further challenges in attempting to change the payoff structure.

6.1.2 Answering the Main Research Question

This section is intended to give an overarching view of the research through answering the main research question. First of all, the following question needs to be addressed. In what way has the current institutional arrangement been included in the discussion? The simple answer to that question is that it has been included through the identification of the rules-in-use for the analysis of action situation at the operational level. The rules have been elaborated based on references made to the current institutional arrangement, especially the current regulatory framework. For instance, the authorities of the participants in the positions are identified based on the stipulations in the regulations. How decisions are made within the action arena are also strictly governed in the regulations. For rules which have been specified in the regulatory framework, their use is presumably enforced properly in the action arena. Therefore, the rules-in-force will be the same as the rules-in-use.

The definition of institution, however, is not limited to the formal rules, but also include the informal constraints. In this thesis, the informal rules have been revealed along the discussion of the action situation itself. The reason is because these rules are not easy to identify in the first place. What can be done is to properly assess how similar interactions between participants have been arranged in the past. For instance, the formal rule might be that the potential developer has to submit a performance bond before receiving the license to conduct the project. The informal rule is that the enforcement of this rule can be negotiated depending on the circumstances at the moment. It is true that the use of the informal rules does not necessarily indicate there is a failure in enforcing the formal rules. However, due to the fact that the action arena is basically situated in a formal setting (for conducting tender, negotiating agreement, and so on), the use of the informal rules is consequently limited as well.

The research question demands a specification in how the institutional arrangement affects the investment decisions. To answer this question, the IAD framework was used. As mentioned before, this framework recognizes the importance of other contextual factors, aside from the rules, namely the physical/material conditions and the community attributes. With the IAD framework, the development of this research has been focused on the dynamics within the sector which affect the cooperation between the most crucial stakeholders in the system, given all the contextual factors. These stakeholders are placed in a specific position in the action arena. Each of them has a certain interests, authorities, attributes, and resources which will define or influence its own actions. Note that the actions of one actor can affect the decisions of the other actors, directly or indirectly. The action situation becomes an interrelated set of actions and interactions which will eventually affect the outcome. In this case, the ideal outcome is to have all the required agreements in place which denote the commitment of investments by the relevant stakeholders.

The findings have been briefly specified in the previous subchapter. A more generalized conclusion can be made that the institutional arrangement can affect the investment decisions of both the public and private sectors in many different ways. It depends on how deep into details the analyst scrutinizes the relevant aspects. Within this research, the analyses were made at both the operational and the collective-choice levels. At the operational level, given the specificity of activities in the action situation, e.g. the issuance of the geothermal license and the PPA settlement, the analysis was able to capture a lot of details during the process. Based on this, the way that the current institutional arrangement affects the investment decisions can be identified in a thorough manner. Some of the most important findings are given as follows.

- (1) The physical/material conditions of the resource which signify the challenges in geothermal projects might require the early involvement of the government in the development, e.g. through the government drilling program. When such involvement is not financially possible due to budget limit, participation by the business entities is required. To ensure such participation, there should be benefits to be gained after making all the necessary investments.
- (2) To all geothermal license holders, the obligations in regards with the field development and the payment obligations to the government are the same, which indicates the same level of costs to be incurred for assuming the position as the Developer. Nevertheless, different issuance scheme of the geothermal license exposes the business entities to different risks and other relevant costs. Regardless of the costs and risks to be borne, the level of benefit to be obtained is the same. In this case, the benefit refers to electricity payment to be obtained from the utility company or the buyer. An adjustment is needed to ensure that the fiscal equivalence (party who endures higher costs should enjoy higher benefits) is achieved.
- (3) The developer selection process determines the kind of business entity which will undertake all the development obligations. The credibility and efficiency of the developer affects the investment decision of the buyer and the financier (directly/indirectly). Therefore, the quality of this process needs to be guaranteed. From the analysis, it is argued that the current arrangement might be able to reduce the risk of selecting financially unqualified developer through the use of the highest exploration commitment to select the winning bidder. However, the analysis suggests that the new selection

mechanism cannot guarantee the efficiency of the selected developer. Using the highest exploration commitment as the final selection criterion does not represent how efficient the bidders (potential developers) would obtain and manage their resources during the development.

- (4) Instead, in the current regulatory framework, efficiency is ensured by setting the tariff ceiling down to the level of the buyer's own costs of supply. In regards with the benefits to be obtained by the developer, the reduced tariff level will severely hamper the perception of profitability of investment in the sector. This conclusion was obtained through desk research and interview with some relevant representatives. The decision significantly changes the payoff level for the developers. Consequently, underinvestment can be expected. Therefore, the entire payoff structure needs to be reevaluated.
- (5) The analysis of action situation at the collective-choice level predicts that regulations regarding tariff will recurrently be changed depending on the political and economic circumstances in the country. It will affect the decisions of potential investors since the regulatory certainty of the sector cannot be guaranteed.

For the issues which have been identified in the current institutional arrangement, a set of recommendations is proposed at the end of chapter 4. The summary is given in the following section.

6.2 Policy Recommendation

As mentioned in the second chapter, when an outcome of an action situation is perceived to be of lower value than expected, the structure of the action situation can be made through changing the structure of the precedent conditions of the action situation. This means that changes can be made not only to the rules, but also the physical/material conditions and the attributes of the community. The following recommendations are presented.

- (1) The government should bear in mind the importance of requiring efficiency from the potential developers, aside from their technical and financial capability to undertake the project. In order to do that, instead of using the mechanism of highest exploration commitment which would also be ineffective in case of weak enforcement toward the actual commitment, the government should rely more onto the capacity of its selection process itself. In this case, it is important that the quality of the selection mechanism (prequalification and technical/financial evaluation) and the capacity of the selection/tender committee are improved. To ensure the financial capability of the developer to bear the costs at the early development stage, a rigorous financial assessment can be used (instead of exploration commitment). For one specific scheme in which the resource has been proven through government exploration and drilling, it is suggested that the public/open tender readopt the lowest tariff bid price mechanism, equipped with better prequalification and evaluation process.
- (2) The government must be able to efficiently capture the advantage of having multiple schemes of the transfer of the geothermal license. It must use its discretion to decide which scheme might be the best to develop a specific area. When one scheme cannot attract enough participants to move forward, the manager must be able to be responsive and use another scheme instead. For instance, the government drilling scheme which entails higher upfront cost for the government, through the use of the geothermal fund, can be used when a public tender preceded by PSA/PSEA cannot attract enough participants. The flexibility in the regulation on this matter should be utilized to avoid having more prospective areas being idle and undeveloped for a long time.
- (3) Upon conducting the analysis of the action arena at the higher level, it is found that the frequent changes in the regulation have been caused by (a) rules which allow for individual beliefs and preferences and the political landscape at the moment to change the play of the game by reforming the operational rules (b) there is a conflict among the stakeholders in regards with the importance of renewable energy development. The combination of these two factors have made the sector rather unstable and uncertain. Therefore, it is important to have a better coordination between the parties and to obtain commitment from the all the stakeholders in regards with renewable energy development. Based on the discussion in chapter 5, it is also important to appropriately frame the value of renewable energy resources for the country and to deliberately create a stable regulatory framework in which the influence of political biases toward the sector's development can be minimized.
- (4) Given the current contextual factors, the payoff structure needs to be modified to be able to attract more investment in the sector. One way to do it is by reducing the payment obligation for the developers. For instance, the existing income

tax can be reduced to compensate for the significantly low tariff ceiling. However, this option exposes the developer at an expropriation risk in case the rules on tax are changed since these conditions are not included in the power purchase agreement. Instead, it is argued that the tariff ceiling can also be increased again. The ceiling should be set based on the government's valuation toward geothermal energy as a renewable and clean resource which should be higher than that of conventional energy resources.

- (5) Upon increasing the tariff ceiling back, there are consequences which can severely affect the utility company as the buyer. For this issue, it is proposed that the buyer should be relieved off of the responsibility to ensure the efficiency of the developer, i.e. by conducting negotiation to reduce the tariff level. Instead, it should become the responsibility of the government itself. To achieve efficiency, the government should improve the quality of the developer selection process and conduct the negotiation itself. It is deemed necessary also due to the fact that the government (the Ministry of Energy and Mineral Resources) possesses better knowledge regarding the upstream geothermal activities, compared to the buyer (PLN)
- (6) Increasing the tariff does entail additional support from the government, e.g. through the allocation of budget to support the utility company in purchasing electricity from renewable energy producers. Given the contextual factors, the challenges have been acknowledged. However, it is important for the policy makers to recognize that such support is necessary to achieve the country's renewable energy target. Therefore, there needs to be an alignment of values and shared understanding in regards with the benefit and significance of geothermal resource for the country. Commitments from all the relevant stakeholders are needed.

6.3 Limitations and Future Research

The limitations of the research can be divided into two broad categories: methodological and practical limitations. From the methodological point of view, the limitations concern the capacity of this research in conducting institutional analysis. From the practical point of view, the limitations concern the scope of the analysis in the context of geothermal energy development. Accordingly, suggestions for the future research are given.

Methodological Limitations

- (1) Institutional analysis can be conducted in many ways and using diverse options of frameworks and theories. This thesis, on the other hand, has decided to exclusively use the IAD framework to conduct institutional analysis as such. The framework itself is developed as part of the attempt to provide universal building blocks in conducting institutional analysis. Therefore, the use of the framework in this thesis is not intended to be steering the analysis into using a certain concept or theory. Nevertheless, it might be interesting to conduct institutional analysis using different frameworks and to see whether the analysis will still arrive at the same understanding toward the analyzed system.
- (2) This thesis uses interviews to understand how and why different stakeholders make decisions and interact with other actors in the arena. The design of the interviews is intended to be balanced in analyzing different perspectives on issues which are considered in this research. Nevertheless, the limitation of time and the author's own network has made it difficult to incorporate all the different perspectives. Consequently, it is possible that the analysis has become slightly biased. For instance, there is only a limited information on the perspective of the Ministry of Finance as the manager of the State Budget in this matter. As a result, the operational difficulties and challenges in distributing support (e.g. subsidy to PLN) were not sufficiently taken into account. Therefore, the future research should attempt to obtain a more comprehensive understanding on the different perspectives within the community.
- (3) The IAD framework requires the identification of the contextual factors. This step has been done quite elaborately in this thesis. The purpose is to give more emphasis to the actual context in the case of geothermal development in Indonesia. Nevertheless, despite their relevance, not all information was used and taken into the analysis at the later stage of analyzing the action situation. Therefore, the future research should attempt to streamline the identification of these factors in a way to ensure its efficiency. This can be done, for instance, through developing a more detailed causal relationship which extend not only for the rules (how they constrain and govern the actions of the participants), but also for the physical/material conditions and the community attributes at the early stage of using the IAD framework. In doing so, the identification of the contextual factors can be made more efficient.

- (4) The use of the case studies in Indonesia has helped in explaining the author's perspective on how a certain context (e.g. the rule) will affect the decision of an actor. However, the role of this method can be further improved by giving more evidences of similar action situations/activities in the past. This requires more intensive investigation toward the actual past geothermal projects in Indonesia.
- (5) This research has relied extensively on sources (various literatures, interview, news, and so on) which are used to investigate how the specific institutional arrangement will affect the development of geothermal sector in Indonesia. The analysis can be made more extensive, for instance, by looking into how similar activities are conducted in other countries and how the arrangements there affect the outcomes. Consequently, the success/failure factors of an action situation can be identified with more confidence.
- (6) In regards with the assessment of the applicability of the IAD framework in analyzing socio-technical systems, the application of this framework in the analysis toward a subset of a large system of geothermal energy is found to be useful. Nevertheless, it cannot guarantee the generalizability of the framework to other subsets, let alone other socio-technical systems as expected in this study. In chapter 5, it was already mentioned that the IAD framework has the advantage of being sufficient and simple to be applied in many settings. Nevertheless, the relevancy of the framework to analyze complex socio-technical systems might be limited.

Practical Limitations

- (1) The thesis was developed to analyze one action situation at an operational level and another one at a collective choice level. The aspects considered in this thesis are also limited while certainly there are many other factors which affect the investment decisions of the participants. For instance, in some of the interviews, the issue concerning permit issuance and bureaucracy has been perceived to be one of the most problematic aspects in the sector. This aspect certainly affects investment decision as well since a long bureaucratic process can prolong the total time horizon of the investment. Therefore, the future research should be able to capture other relevant factors to analyze the investment decisions in a more comprehensive manner.
- (2) In the analysis of action situation at the operational level, limited attention was given to the interaction between the developer and the financier since little information was obtained either through the interviews or other sources. The future research should be able to enrich the analysis to actually show the complexity of obtaining financing support in the sector. It should look further than simply using the credibility of the developer as the determinative aspect for the financier to distribute its resources.

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Appendices

Appendix A – Actor Identification

Actor can be defined as a social entity, person, or organization that is able to act on or exert its influence on a decision. Actor analysis is aimed at identifying the interests and objectives of the actors who are involved in the policy problems, will be affected by the decisions taken, and have the resources that are essential to solve the problems (Enserink, et al., 2010). This attempt recognizes the fact that there is no individual actor that can unilaterally impose a decision without any cooperation with other actors. The interdependency between these actors makes such analysis highly crucial in order to solve problems in a complex structure. It is key to ensure a comprehensive understanding of the policy problem.

This section is intended to deepen the insight about geothermal sector in Indonesia through the elaboration of the actors which are involved in it. Moreover, analysis of actors is an integral part of institutional analysis using the IAD framework. However, at this stage, the comprehensive analysis—by scrutinizing actors at the network and the actor levels—is not going to be undertaken. Instead, the more thorough analysis on the most relevant actors is presented in Chapter 3 during the analysis of the community attributes.

Problem Owner

Directorate General of New, Renewable Energy and Energy Conservation (EBTKE)

The utilization of geothermal resource for power generation requires tremendous efforts from many stakeholders. To begin with, in order to frame the issues in a more well-defined manner, the problem owner must be determined. The significance of institutions in this research makes it pertinent to start the analysis with the party which has the authority to produce and enforce the formal institutions (law, legislation, regulation, policies) in the sector: the government. Within the government structure, the development and the management of geothermal energy is entrusted to the Directorate of Geothermal Energy. The directorate, established in 2010, is responsible for the formulation and implementation of policies, standards, procedures, technical assistance, and supervision of geothermal activities in the country. This directorate is part of the Directorate General of New, Renewable Energy and Energy Conservation (EBTKE) under the Ministry of Energy and Mineral Resources (MEMR).

The making of national regulation and policy in Indonesia is done at the ministerial level or higher. In the case of geothermal energy development, it becomes reasonable to make the MEMR as the problem owner in this research. However, the MEMR consists of other directorates aside from EBTKE, including Directorate General of Oil and Gas, Directorate General of Electricity and Directorate General of Mineral and Coal. These directorates are interrelated with each other under the ultimate goal of the MEMR to attain energy security and self-sufficiency in Indonesia. However, each of them has different mandates, functions and actions that may not be in accordance with one another at all times. Therefore, in order to emphasize the significance of geothermal energy in the Indonesian energy arena, it is best to frame the issues, initially, from the perspectives of the concerned directorate: EBTKE. As the analysis of actor develops later, it will become more apparent how other actors affect the position of EBTKE, in a supportive or impeding fashion.

Expanding the Actor Network

(1) Ministry of Energy and Mineral Resources (MEMR)

MEMR has an overarching goal of establishing energy security and independence to attain greater prosperity for the people of Indonesia (ESDM, 2017). While the problem owner, EBTKE, is part of the ministry itself, it is important that the ministry as a whole is included as an actor in the analysis. In this context, MEMR has the authority to issue ministerial regulations and ministerial decrees which further become the basis in developing related procedures and policies in the energy sector. As mentioned in the problem formulation part before, since the ministry consists of some directorates that may have different approaches in obtaining energy security and independence goal for the country, it becomes the

responsibility of the ministry at the higher level of to align these interests. Further in the analysis, MEMR represents the actor who oversees the conduct of energy sector and makes decision in the policy and legislation levels.

(2) Directorate General of Electricity (DGE)

DGE has the goal of providing safe, reliable, and efficient electricity to strengthen continuous national development in the country. One of its missions is to optimally utilize primary (coal, natural gas, liquefied natural gas, etc.) and renewable energy resources while considering the economic aspect of the utilization. According to the National Energy Policy (KEN). Indonesia is targeted to achieve universal or 100% electrification ratio in 2020. The KEN is then cascaded into General Plan of Electricity (RUKN) and together define the measures to accelerate electrification. Some measures which might be related to the formulated problem includes (1) the design of affordable electricity tariffs level to support population with low ability and willingness to pay for electricity services and (2) the provision of appropriate and effective electricity subsidy.

(3) State Electricity Company (PLN)

PLN is a state-owned electricity company that, along with its subsidiaries, performs most of the power generation activities, owns all transmission, and manages nearly all distribution and retails of electricity in Indonesia. Naturally, PLN is the executor of the electrification programs in the country. In the context geothermal sector, PLN is obligated to buy electricity or steam from geothermal producers. The steam/electricity price depends on the agreement between the producer and PLN.

(4) Geothermal Developers

Independent power producers are business entities which operate under power generating license and sells bulk power to PLN. Due to the ambitious electrification target in the country, the government relies on the participation of IPPs (mostly private) to build plants and feed electricity into the public grid (owned by PLN). Geothermal developers can be categorized into private and state-owned enterprises (BUMN). In Indonesia, some BUMNs which work in geothermal sector include PT Geo Dipa Energi, Pertamina (with its subsidiary, Pertamina Geothermal Energy) and PLN (with its subsidiary, PLN Geothermal). In addition to that, the association of these geothermal developers also exists, Indonesian Geothermal Association (INAGA)

(5) Ministry of State-Owned Enterprises (MSOE)

MSOE is the shareholder of state-owned enterprises (SOE) in Indonesia. The Minister of SOE has the highest authority over the enterprises. SOE consists of two types of companies: limited companies and public companies. The limited companies include PLN and Pertamina with its subsidiary of Pertamina Geothermal Energy. According to Law No. 19/2003, SOEs with the type of limited company have the main goal of obtaining profits. Therefore, the conduct of their business must be implemented in accordance with the principles of economics. The capital for these SOEs comes from the allocation of the state revenues and other sources. MSOE is responsible in the formulation of policies regarding the development SOEs and in the management of the state assets under its responsibility.

(6) Ministry of Finance (MoF)

MOF has the responsibility and the authority in managing state expenditures and revenues (tax and non-tax) to achieve, among others, an efficient and effective allocation of the budget and prudent fiscal policies. MoF makes the decision regarding tax and non-tax revenue arrangement in all sectors, including geothermal, as well as subsidies and state equity fund for the SOEs (e.g. geothermal fund, managed by PT SMI). In the context of geothermal sector, from the point of view of electricity provision, MoF holds the authority to decide on the amount of electricity subsidy allocated for PLN. In addition to that, MoF also decides on the eligibility of certain projects to receive sovereign guarantee. This is particularly important in the case of geothermal development that is widely perceived as a high risk enterprise.

(7) PT Sarana Multi Infrastruktur (PT SMI)

PT SMI is an infrastructure financing company which was established in 2009 as an SOE in which all of its shares owned by the Government of Indonesia that is represented the Minister of Finance. It has the role in facilitating infrastructure financing as well as preparing project and serving advisory for infrastructure projects in Indonesia. PT SMI carries the duty of supporting the Government's infrastructure development agenda for Indonesia through partnerships with private and/or multilateral financial institutions in Public-Private Partnership (PPP) projects (PT SMI, 2017). According to the MoF Regulation No. 232/PMK.06/2015, PT SMI is responsible in managing the assets which were previously administered by the Government Investment Center (PIP). The PIP assets have been transferred to PT SMI as the state equity funds which, among others, include the geothermal fund.

(8) Financing Agencies

There are numerous bilateral or multilateral financing agencies which have shown commitments and interests in the sector. They are agencies which have taken part in the research, financing, and development activities of various segments in geothermal projects, including International Bank for Reconstruction and Development (IBRD) of the World Bank, Asian Development Bank (ADB), Japan Bank for International Cooperation (JBIC) and Japan International Cooperation Agency (JICA). These agencies not only provide loans or funds, but technical assistance as well in order to improve the feasibility of geothermal projects in the country. Other than these international agencies, there are also local banks, such as Bank Rakyat Indonesia, Bank Mandiri, and Bank Negara Indonesia.

(9) National Energy Council (DEN)

The formation of DEN is based on the Law No. 30/2007. The organization includes the membership seven ministers—(1) Finance, (2) National Development Planning, (3) Transportation, (4) Industry, (5) Agriculture, (6) Technology Research and Higher Education and (7) Environment and Forestry—chaired by the Minister of Energy and Mineral Resources. DEN is also comprised of eight stakeholder representatives coming from the background of academics, technology, industry, consumer and environment. DEN is responsible in developing the National Energy Plan for the country. It also monitors the implementation of multi-sectoral energy policies.

(10) Provincial/Municipal Government

The provincial/municipal government, depending on its area of authority, has the authority to issue the permit for direct utilization of geothermal energy. However, the issuance can only be conducted prior to coordination with and approval from MEMR. This is because MEMR has the authority over areas which are designated for indirect utilization (power generation). The provincial/municipal government has the right to obtain production bonus that is a portion of gross income from commercial production of geothermal power.

(11) Geology Agency

The agency—established under MEMR—is responsible to research, assess, and manage the knowledge and information regarding geothermal resource in the country. In the past, the agency has conducted numerous geothermal exploration activities with which the government can make the decision to assign the locations as official geothermal Work Areas that can be further developed by the private/public sector. MEMR is now working to provide more accurate resource data through geological, geophysical, and geochemical surveys which are to be conducted by Geology Agency. Higher accuracy on geothermal resource information, based on better surveys, can increase the probability to obtain geothermal reserve that is economically exploitable. The agency has the expertise and the experience to reduce the risk in the sector from the upstream and technical standpoint.

(12) The House of Representatives of the Republic of Indonesia (DPR RI)

DPR RI has the legislative, budgetary and oversight functions. In regards with legislation, DPR RI has the authority to approve draft laws proposed by the president, as prepared by ministers or other non-ministerial government entities. For its budgetary function, DPR RI issues approval to the state budget bill (APBN), the transfer of state assets and agreements with broad impact to the lives of the people in regards with the state financial matters. Finally, the oversight function determines its responsibility and authority to monitor the implementation of the laws, APBN and other government policies.

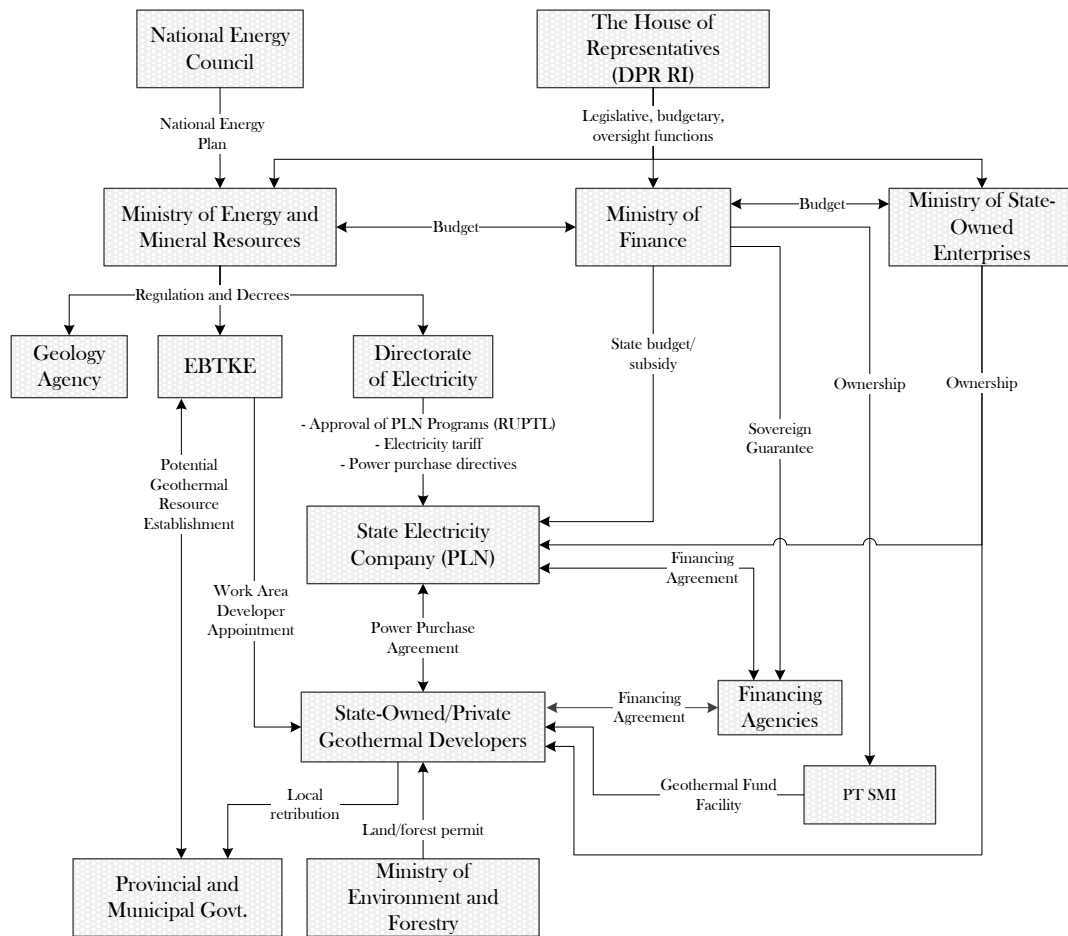


Figure 5A Geothermal Development Actor Network

Appendix B - Interview Result

In total, nine interviews were conducted during May and June 2017. The list of the interviewees can be seen in the following.

Name	Organization	Meeting Time
Sanusi Satar	INAGA	13-May-17
Randy Rakhmadi	Climate Policy Initiative	17-May-17
Prijandaru Effendi	Supreme Energy (Developer)	18-May-17
Novel	EBTKE	22-May-17
Yudistian Yumus	PLN (State Electricity Company)	23-May-17
Ibnu Riyanto	EBTKE	24-May-17
Heribertus Yudha	Star Energy (Developer)	30-May-17
Muchsin Chasani	The World Bank	5-Jun-17
Abadi Poernomo	DEN/INAGA	6-Jun-17

B.1 Interview Set 1: Developers and the Indonesian Geothermal Association (INAGA)

In this set, the results of four semi-structured interviews with four representatives from the geothermal power producers (developers) side and INAGA will be presented. The interviewees of this set are (1) Sanusi Satar, (2) Prijandaru Effendi, (3) Heribertus Yudha, and (4) Abadi Poernomo.

The interview with Sanusi Satar (vice chairman of INAGA) can be regarded as a preliminary interview to point out a brief history of geothermal development in the country and, more importantly, the crucial aspects in the regulation that are important to investigate. For instance, based on this interview, the latest changes in regards with tariff, tender, and PPA settlement were considered important to be further asked to the other respondents. From this interview, more questions were constructed and the interview results can be found as follows.

B.1.1 Interview with Prijandaru Effendi

Interviewee's Brief Profile

Prijandaru Effendi is the Vice President of Relations and Safety, Health, Environment (HSE) in PT Supreme Energy. The company has three subsidiaries: Supreme Energy Muara Laboh, Supreme Energy Rajabasa, and Supreme Energy Rantau Dedap. These companies have the geothermal permit to develop one Work Area each. Currently, the most progress can be seen in Muara Laboh, in which the geothermal power plant is expected to be operational in 2019.

List of Questions

SEML was founded in 2008. It completed the feasibility study in 2009 and obtained the concession rights for Muara Laboh and Rajabasa in 2010. In 2012 the company secured power purchase agreement with PLN for Muara Laboh. The first exploration well for Muara Laboh was drilled in 2012, after a PPA was obtained. Can you tell me more about Muara Laboh project? What happened between 2010 and 2012 before the PPA was obtained?
Did any physical construction/development take place during the said period?
What were the challenges during the early construction phase at South Solok?
How would you describe the physical condition of the field?
Did this condition significantly affect the total costs, hence the investment required for the development?
Muara Laboh was planned to have a total capacity of 2 x 110 MW. However, in the end the resource was only sufficient for the development of 80 MW geothermal power generation.
Could you tell me more about it?
Given the circumstances, what kind of adjustments were required in order to continue with the project?
Community
How would you describe the community engagement process in South Solok? Were there any significant difficulties encountered during the process?

In the decision making process, such as the one related to tariff determination, how are the developers or other related parties (investors, renewable energy community) involved?
PPA Negotiation
Based on the information I gathered from various sources, one of the bottlenecks in geothermal development is the PPA negotiation between PLN and the developers. In fact, many projects are now stalled at this stage, with no physical progress being made.
Could you explain to me the complexity of this process?
Given the challenges as mentioned before (physical and financial), how are these costs reflected in the power purchase agreement?
How were these conditions communicated to PLN as the buyer?
How did the negotiation come to a conclusion eventually? What was the outcome?
Funding
SEML managed to obtain funding from the consortium of JBIC, ADB, Leading Asia's Private Sector Infrastructure fund (ADB & JICA), and other commercial banks for the construction of the power plant.
What and who were really instrumental in making this happen?
What were the challenges in obtaining the financing for the project? How did you convince the investors to take part in this project?
How about the funding for the exploration and feasibility study stage? Was company's own equity was used?
What made Supreme willing to take the resource development risk at the earlier stage?
Regulatory Framework
According to PP No. 12/2017, a power purchase agreement can only be made between PLN and the developer if the resource has been proven (after exploration). In the meantime, many of the current projects are stuck in the PPA negotiation stage with no exploration activities taking place. Do you think this new rule will be effective?
PP No. 12/2017 stipulates that the ceiling price of electricity should not exceed the highest local BPP. The numbers are not fully consistent with PP No. 17/2014 which distinguishes the tariff into 3 regions and according to the commercial operation date. What do you think about this decision in regards with the attractiveness of this sector to developers?
Do you think it can be discouraging for some developers since the ceiling tariffs seem to be lowered?
The PPA will be complemented with a BOOT scheme. A source states that this can be another disincentive for the developer. Do you agree with that? Why?
Do you any other comments regarding the new regulations?
General
Do you think the costs, benefits and risks have been distributed rather fairly between the developers, society, investors and the government?
What do you think of the current business platform of geothermal? Is it conducive enough for the independent power producers to take take on the risks and to reap enough benefits to take part in geothermal projects?
What kind of improvements are needed to accelerate the development of geothermal sector which rely on the involvement of IPP?

Interview Result

- At the beginning of the Muara Laboh project, no drilling activities took place before the company obtained the power purchase agreement (PPA) with PLN and the government guarantee (BVGL) was obtained. However, preliminary activities such EPC and drilling tenders, land acquisitions, and finalization of pre-feasibility study were conducted to ensure that once the PPA and the guarantee had been received, the field development activities (exploration drillings) could be conducted directly.
- Muara Laboh is a remote area with small number of residents. Most of them were farmers. The access to the place is limited—only the provincial road was good enough. The company needed to develop a new road to reach the work area (12-14 km).

- Since 2008, when the company conducted the preliminary survey, the company took the all the development risks. The company understood that without there was no guarantee that the investment would give enough or any return eventually.
- There was a gap of two years between the tender (after the issuance of the geothermal license) until the completion of the PPA settlement process. It was argued that the condition was not ideal. Instead of allowing the company to directly conduct the development (i.e. exploration drilling), PPA negotiation and various permit handling still needed to be conducted. Eventually it expanded the timeframe of the project which, in turn, increase the development costs. According to the interviewee, this situation (of inefficient bureaucratic process) is also one of the reasons why geothermal resource price is higher in Indonesia. Supposed that all the requirements (especially for PPA and permits) can be obtained easily by the time the tender process is completed, there will a significant reduction of time required for the development.
- For Muara Laboh project, the first investment was made in 2008 (for preliminary survey). Only in 2019 that the company will obtain cash inflow from the electricity sale. It means that the development takes more than 10 years. This kind of situation occurred in almost all geothermal projects in the country.
- According to the interviewee, the investors/developers were burdened with a lot of issues in the past. For instance, many development permits (environmental, forestry, electricity production, etc.) needed to be resolved by the developers. For exploration in Muara Laboh, approximately forty kinds of permits needed to be obtained. It was argued that the government could have assisted in the process.
- Social issues (with local residents) are present in most infrastructural projects in the country. The key is to conduct a good socialization process and to maintain a good relationship with the local government. The involvement of the local residents is of high importance, e.g. to explain the benefits of geothermal projects (sustainable electricity, multiplier effect, economic growth, etc). With a good management of community engagement, social issues can be dampened/avoided. Certainly there will always be costs to be paid to engage the community, e.g. through CSR programs.
- The changes in the regulatory framework depend on the vision of the government in power. However, the government does honor the contracts which have taken place before the changes. It means that any reforms (such as in tariff) do not affect the continuity of the earlier projects.
- An important side note is that there has been a shift in the paradigm: previously the development of renewable energy was to be supported at all costs while the current direction in the regulatory framework prioritizes on providing affordable energy to the society.
- Before the shift in the paradigm, the government has always tried to involve the developers in the decision making process, especially the determination of tariff. For the investors, the most important factor is the project return. This particular aspect is not yet agreed between the developers and PLN.
- The information of capital costs can be easily obtained and communicated to PLN. However, it is difficult to agree on the level of return with PLN. For geothermal developers, the determination of tariff at the beginning is of high importance. Unlike in oil and gas industry, it is not possible for the companies in geothermal sector to obtain windfall profit to obtain additional gain. That is why tariff has never been a problem in oil and gas sector. For geothermal companies in Indonesia, the return can only be obtained from PLN (the only market). PLN tends to only see the downstream part of the development. Consequently, the reasonable return expected by PLN merely takes into account the requirement to build a power plant of approximately 10-12%, given the low risks of power plant development. On the other hand, geothermal business has a high risk of upstream development.
- Comparison was made with the oil and gas sector, given the interviewee's own experience in both sectors. For oil and gas industry, it is common to expect a return of 20% even for the development of a brown field (proven resource). In the meantime, the common return in Indonesia is only 12-14%, even for green field development that is much riskier.
- In regards with funding, the credibility of the developer (and its partners) plays a crucial role. Supreme Energy has a Japanese partner—making it relatively easier to obtain additional funding, such as from Japan Bank for International Cooperation.
- For the financiers, other important factors in distributing loans is the capability of the company to attend to environmental and social issues in the area.
- In the case of Muara Laboh project, the early stage of the development (preliminary survey and exploration) was financed using the company's own equity.
- In regards with the new regulation which obligates the developer to conduct exploration drilling before obtaining PPA with PLN, it is understood that the arrangement was intended to avoid unnecessary renegotiation which has happened in several projects before because the result of exploration is different than what is initially expected. The more important thing is to give the developer a certainty that eventually the resource will be purchased by PLN.

- In regards with the new tariff arrangement, it is understood that the intention of the government is to encourage development in the eastern part of Indonesia, since the ceiling tariff there is still high enough.
- Once the PPA has been obtained, it indicates that all the costs and benefits have been distributed fairly between PLN and the developer. However, it is true that the PPA settlement process still needs to be made more efficient in order to avoid too much time being consumed on this stage. Government support is required to ease the burden faced by PLN.
- EBTKE has shown its commitment to improve the sector. Many kinds of supports have been given by the government. However, for the developers, the most important concern is the profitability of the project itself. If it is difficult to obtain sufficient return in the end, developers will be reluctant to participate in the beginning. If increasing the tariff back to the previous level is not possible, the government can look into decreasing the payment obligations (such as tax) to be paid by the developers.

B.1.2 Interview with Heribertus Yudha

Interviewee's Brief Profile

Heribertus Yudha is the Vice President of Operations in Star Energy. Star Energy is the operator of Wayang Windu field in West Java. The company has also just acquired Gunung Salak and Darajat fields from Chevron Geothermal.

List of Questions

In the past, Star Energy has been involved in several preliminary surveys of green fields (Gunung Hamiding and Telaga Ranu) in North Maluku. What motivated Star Energy to take on this project?
What were the costs and benefits for Star Energy?
What are the follow-ups after these preliminary surveys?
Could you give me an estimation of the investment required to undertake this assignment?
Currently, for private business entities, the scheme has been changed in which the preliminary survey has to go together with exploration drilling (PSPE). What do you think about this new arrangement in the perspective of the developer?
In 2009, Star Energy won the tender for Jailolo Work Area.
Did Star Energy undertake the preliminary survey as well for this prospect?
The latest news I received: Star Energy is no longer developing the Work Area. Could you tell me what happened?
Which parts of the process did Star Energy find the most challenging? How did the PPA renegotiation go?
One of the problems mentioned was the permit issuance that have hindered the exploration activities. Was it also a problem in Jailolo?
How about the geographical challenges?
How about the communities? Was there any resistance?
In the past, Star Energy also did a negotiation prior to developing the second unit of Wayang Windu. The negotiation was deemed successful despite the turmoil in the economy at the time. How did the negotiation come to a conclusion?
Recently Star Energy acquired 2 geothermal assets in Darajat and Mt. Salak from Chevron for 31 billion.
Is there any plan in the future to increase the capacity from these two fields?
What will be Star Energy's strategy to realize it? What will be the challenges?
Community
In the decision making process, such as the one related to tariff determination, how are the developers or other related parties (investors, renewable energy community) involved?
What are you perceptions about the other stakeholders in the system, especially EBTKE and PLN?
Who are the other prominent stakeholders?
Do you think there is already a solid common ground in which the differences in values and interests can be communicated at ease?
As a geothermal developer, what are the values that drive the company to stay in the sector despite the challenges and even uncertainties in the regulation?

I had the opportunity to meet Yudistian Yunis from PLN and Ibnu Riyanto from EBTKE which said that most geothermal projects in Indonesia are considered very costly. That is probably why sometimes the B2B negotiation between PLN and developer can become very lengthy. What do you think of this?
What do you think is EBTKE's roles in this setting?
What do you think of PLN's principal of least-cost in electricity provision? Are you aware of this value from PLN?
Regulatory Framework
According to Permen No. 12/2017, a power purchase agreement can only be made between PLN and the developer if the resource has been proven (after exploration). In the meantime, many of the current projects are stuck in the PPA negotiation stage with no exploration activities taking place. Do you think this new rule will be effective?
Permen No. 12/2017 stipulates that the ceiling price of electricity should not exceed the highest local BPP. The numbers are not fully consistent with Permen No. 17/2014 which distinguishes the tariff into 3 regions and according to the commercial operation date. What do you think about this decision in regards with the attractiveness of this sector to developers?
Do you think it can be discouraging for some developers since the ceiling tariffs seem to be lowered?
Do you any other comments regarding the changes in the regulations?
General
Do you think the costs, benefits and risks have been distributed rather fairly between the developers, society, investors and the government?
What do you think of the current business platform of geothermal? Is it conducive enough for the independent power producers to take take on the risks and to reap enough benefits to take part in geothermal projects?
What kind of improvements are needed to accelerate the development of geothermal sector which rely on the involvement of IPP?

Interview Result

- Star Energy has done preliminary surveys (PS) in a few locations. Although PS does not guarantee that there will return in the end. The motivation is for Star Energy to assess locations with geothermal potentials that can be further developed. Many preliminary surveys were conducted to increase the company's geothermal production capacity in the end.
- In the past, the company decided to obtain the geothermal license preliminary survey assignment (instead of directly join an open tender). The purpose is to have better information about the field (the resource's location and potential). Without, PS assignment, the company would not be able to obtain detailed information. On the other hand, by conducting PS assignment, during the tender process, the company will receive a right-to-match which increases the possibility for the company to win the tender.
- In regards with the risks of conducting early development activities (preliminary survey), the company manages by review the location (with any available data) before deciding to formally take on the preliminary survey. Preliminary survey itself is relatively not expensive (less than USD 1 million). If eventually, the location is found to be not very prospective, it is part of the company's risks. However, most companies which obtain the PS assignment, have normally made careful considerations and calculated the risks to be confident enough that the investment made will not be useless in the end.
- In the new regulation, preliminary survey has to be conducted along with exploration. According to the respondent, this rule is intended to ensure that the company which obtains the assignment is serious. This rule is perceived to quite good because anyhow, if the company is serious, exploration is also part of the company's obligation.
- For the company, the obligation to conduct exploration before tender in the PSEA (or PSPE) assignment is acceptable as long as the government can guarantee to buy the electricity with an economically viable price.
- The government expects the developers to be committed with the development. The past tender arrangement requires competitiveness (lowest electricity bid price). The problem for the developer is when it finds the area to be more challenging than what is expected before. This is why in there have been a lot of stagnated projects due to the fact that the developers do not find the agreed tariff (although it was made according to the proposed tariff during tender) is simply insufficient.
- On Jailolo case: Star Energy conducted preliminary survey at the location before obtaining the geothermal license tender process. The license has been returned to the government since the company could not agree on an economically viable tariff. Eventually, the company could not obtain the power purchase agreement (PPA) with PLN within the regulated time of 5 years (+ 2 years). Based on the company's calculation, the required tariff was around USD 15 cent/kWh while the tariff ceiling was set to USD 9.7 cent/kWh.

- The challenge in Jailolo consisted of the following: (1) the power plant to be built was to have small capacity, (2) the location was remote, and (3) the company needed to build completely new infrastructure for the development. The situation eventually increased the average total costs and affected the level of tariff required by the company. From the social point of view, there was sufficient support from local residents and local government. There was no resistance.
- PPA has been particularly challenging because PLN has its own benchmark to buy electricity from another company. Ideally, PLN wants competitive price, especially because they mainly buy from coal power producers (in comparison to the costly renewable energy). On the other hand, the developers require economic price.
- Most renewable energy sources are specific for a certain area/location. Consequently, the price is normally higher. To be able to increase the electrification ratio and sustainability of electricity provision, the government is supposed to look further than simply providing electricity at the lowest cost possible. There is limited understanding on this matter between the government and the private sector (in renewable energy).
- In the decision making process, such as tariff determination, the involvement of the geothermal association is quite significant. EBTKE always intends to involve the developers in the decision making process. However, EBTKE is only a part of the government which has its own dilemma in regards with electricity provision using geothermal resources. The electricity company (the buyer), PLN, is part of the government which has issues in buying renewable energy at the level that is required by the developers.
- The developer somehow understands the problem faced by PLN that is expected to provide cheap electricity for the society. However, it argued that the government and PLN should not only value renewable energy based on the price, but also the sustainability aspect of it. Once compared with coal, it is difficult for renewable energy to compete.
- Currently for remote areas, like in Jailolo, the power plants are still supported with oil-based fuel. This type of fuel is much more expensive. However, the fuel itself is still subsidized by the government which makes it seem cheaper than geothermal or other renewable resources.
- On Wayang Windu case: Star Energy managed to build the second power plant at the time although the political/economic situation in the country was not conducive (Asian financial crisis). The agreed tariff at the time was not the expected economic price (from the point of view of the company). However, that price was acceptable by both parties (marginal price). The decision to build the second power plant was intended to obtain higher revenue.
- On Darajat & Gunung Salak: the company intends to increase the capacity to reach its maximum potential. However, for Darajat field, it is no longer possible. In Gunung Salak, the capacity increase can be up to 50-60 MW. The challenge in increasing the capacity in the future will mainly concern the tariff. The technical challenges are not very significant for the company. In conclusion, tariff is one of the most crucial challenges in the sector before.
- In regards with development costs in Indonesia (in comparison to average development costs internationally), the level of costs in any geothermal projects will depend on the resource and the infrastructure condition. The drilling costs abroad can be lower is because the depth of the geothermal resource is mostly lower. Moreover, the existing infrastructure there is good enough to support the development. In the meantime, in Indonesia, most geothermal resources are located in mountainous areas and the infrastructure is insufficient. Eventually, it requires higher mobilization costs. The cost per well in Indonesia becomes higher.
- Until now, there is no common ground with which the stakeholders in the sector can resolve differences in interests and values in regards with geothermal development. The association (INAGA) has attempted to mediate but the result is not as good as expected. There is no alignment between the stakeholders regarding the idea that the success of geothermal development is for the common good. Currently, the stakeholders still seem to think in different corridors where they tend to put forward their own interests, rather than collective ones. For instance, in regards with permits, different departments in the government are not aligned to ensure the efficiency of the process although it can easily be streamlined.
- The developers are aware of the challenges faced by PLN. Therefore, it is for the government to understand the perspective of the private sector to invest in which certainty (to obtain enough return) is of importance. The private sector expects to be treated as a partner in which there is a mutually advantageous partnership.
- In regards with the obligation to obtain a sufficiently studied area (through exploration drilling) before obtaining a PPA with PLN, as long as there is a certainty in regards with price, there will not be much problem. The issue here is that the price level now is not economic (according to PLN's BPP level). The new tariff level makes it more challenging to achieve economic price level required by the developers.
- During the PPA negotiation process, the differences between the developers and PLN affect the difficulty of the process. One of the differences is that PLN has limited experience in geothermal exploration. Therefore, when the developer intends to communicate the investment level of developing the infrastructure at a certain location, PLN will tend to underestimate the challenges in that location which cannot be compared with other locations. In regards with exploration risks, it is also significantly challenging to communicate the risks with PLN.

- The current business platform is not conducive enough. Renewable energy seems to be prioritized less in the current regime whereas the country has its own renewable target.
- The geothermal association has been very supportive to help the developers in obtaining information and putting forward the interests of the developers. Nevertheless, the government has not been fully committed to support renewable energy itself.

B.1.3 Interview with Abadi Poernomo

Interviewee's Brief Profile

Abadi Poernomo is the chairman of Indonesia Geothermal Association (INAGA). He is also a member of the National Energy Council. Before being a part of the National Energy Council, he was the President Director of Pertamina Geothermal Energy (PGE), a state-owned company which has the most geothermal fields in the country.

List of Questions

The Association
First and foremost, could you explain to me the role of API in this sector?
To what extent has API been involved in the policy making process?
How do API manage the stakeholder engagement (with the government, PLN, investors) to be able to
Community
What are your perceptions about the other stakeholders in the system (e.g. ESDM, Kemenkeu, EBTKE and PLN)?
Do you think there is already a solid common ground in which the differences in values and interests can be communicated at ease?
In the decision making process, such as the one related to tariff determination, how are the developers or other related parties (investors, renewable energy community) involved?
Latest Progress
After the issuance of PP No. 59/2007, the industry started to make progress through the appointment of many private developers for different Work Areas across the country. It was around 2009-2010. Unfortunately, only a few projects which were started after Law No. 27/2003 have moved forward to the exploitation phase or even exploration drilling. What happened?
What were the challenges faced by these developers?
If financing had been the problem. What were the association's measures/roles to tackle this problem?
In 2016, tender for some Work Areas was opened by EBTKE. However, most tenders were failed (or need to be reopened) and it seems like there's not much interest from the industry to take on the project. Why do you think that this happened?
If the interest is low, what do you think is needed to improve the situation?
I had the opportunity to meet Yudistian Yunis from PLN and Ibnu Riyanto from EBTKE which said that most geothermal projects in Indonesia are considered very costly. That is probably why sometimes the B2B negotiation between PLN and developer can become very lengthy. What do you think of this?
What do you think is needed to be able to streamline the PPA negotiation process?
Regulation
With the issuance of PP No. 7/2017 and Permen No. 12/2017, there are some significant changes in the sector, regarding tender and tariff.
Firstly, the current PP does not require the participants to submit the bid price. Instead, they are required to submit an exploration commitment. How is the general opinion from the association regarding this new regulation?
Regarding the new tariff. You mentioned that this new regulation is a setback to what has been achieved previously (going back like the old regime). How do you think will it affect the investment in geothermal energy?
The current regulation also introduced a new scheme of PSPE. What do you think about this new arrangement?
Renewable Energy Development
PLN is one of the key players in renewable energy deployment, including geothermal. It is true that PLN is obligated to purchase electricity from RE producers. However, at the same time, it is also instructed by the regulation to keep electricity tariff low and use the least-cost alternative for power generation. Moreover, in the KEN and RUEN, the use of coal will be diverted or national uses. This might be unfavorable or renewable energy, including geothermal.
How can geothermal energy still strive, given the current challenges?
Is there enough support from the current administration for RE development?

What do you think of the current business platform of geothermal? Is it conducive enough for the independent power producers to take on the risks and to reap enough benefits to take part in geothermal projects?
Many stakeholders have revealed that what is lacking is the certainty in the regulation for geothermal development. What do you think of this?
Aside from tariffs, what are other important aspects in the regulation which are uncertain (subject to changes) and unfavorable for the IPPs?
Lastly, what are your recommendations to improve the investment situation in this sector?

Interview Result

- INAGA is a professional association which comprise of practitioners from various agencies, especially the geothermal developers (approximately 700 people). In policy making, the organization is being involved by the government in order comprehend the interests of the developers. The association is active in opening dialogue with the government.
- Especially for the energy sector, regulations are highly influenced by the political situation in the country. It is argued to be one of the obstacles of the development of energy sector in Indonesia.
- In regards with the new regulation (PP No. 7/2017), the association was involved in the making of this regulation, including regarding the new arrangement of the tender process. Previously, the tender process requires the bidders to bid the electricity tariff to be as low as possible. Since the quality of resource information is not good, the calculation of electricity tariff at the time of tender becomes biased. This is why the tender criteria is changed from the lowest tariff to the highest exploration commitment. Initially this arrangement was to be complemented with a feed-in-tariff. This initiative was cut off through the issuance of MEMR Regulation No. 12/2017.
- The association was not involved during the making of MEMR Regulation No. 10, 11, 12/2017. During the regime of the current minister, the association has not been involved at all in the decision-making process.
- As a response to the latest regulation, the association (developers) argue that this arrangement is still possible for geothermal development in the eastern part of Indonesia in which the tariff ceiling is still high enough. The problem is there may not be enough investors who are interested in the development in such remote locations. For Java and Sumatra, the current ceiling tariff is simply not sufficient for geothermal development.
- The process of PPA negotiation takes a long time because PLN has the obligation to maintain and reduce its cost (BPP) level. The principle of least-cost that PLN uses makes it difficult for the company to take on geothermal projects which are more expensive than coal projects.
- The process of negotiation can be streamlined if there is a standardization of PPA in which only little adjustments are made in case a location has special characteristics. The next step is to ensure that there is a willingness from the government to support geothermal energy development. The mechanism of giving assignment (or mandate) to PLN should be complemented with giving extra support to PLN to bear additional costs required to purchase geothermal-based electricity.
- Many projects in the past have been stuck at the pre-exploration stage. The reason is because the tariff level as agreed with PLN was too low (since the tender mechanism used the lowest tariff bid criteria). Consequently, the projects ended up being not bankable. Due to the lack of financial resource, many project could not move forward. The case with Muara Laboh was different because the developer (Supreme Energy) managed to negotiate with PLN to increase the previously-agreed tariff due to the fact the exploration result indicated a lower development capacity than expected. This was accommodated in the previous regulation (MEMR Regulation No. 17/2014).
- In regards with financing issues, it is argued that international financial institutions are already well-informed regarding the financing of geothermal projects. The challenge is to convince the local financial institutions because they have limited capability in mitigating the risks. The tenure period provided by the local player is also limited whereas geothermal projects require a long tenure period (15 to 30 years). The interest rate offered by the local banks is also high. The association has made the attempt to improve the situation. But it is still found to be difficult.
- The sector still depends highly on the support of international financial institutions. However, it is important to note that obtaining support from these institutions is not easy. These organizations strictly assess the capability and credibility of the developer itself. For instance, Supreme Energy Muara Laboh is a joint venture of PT Supreme Energy (Indonesia) and other big and international companies. The reputation of the partners has made it easy for the company to obtain loans from international financing institutions. However, it is argued that it will be difficult for new and unexperienced local developers to obtain the same level of support.

- For the foreign investors, the sustainability of the regulation is important. It shows the seriousness of the government in supporting geothermal development. Therefore, the change in the regulation, especially in the tariff level, has casted doubts among international investors to participate in the sector. Many of the previously interested investors have decided to postpone their investment in Indonesia. It is also due to the common belief it is difficult to negotiate tariff with PLN.
- Regarding the tariff issue, it is believed that the regulation will be changed again eventually. Therefore, the investors are expected to wait until the situation becomes more favorable for private sector participation.
- In 2016, although the tariff level still used the past arrangement that was more favorable for the developers, many tenders still failed. The reason was not the insufficiency of the tariff level, but rather the quality of the geothermal resource itself. Most developers already knew that the economic viability of the tendered geothermal Work Areas was low. Sometimes, when the government says that an area can be developed up to a certain level of capacity (in MW), most developers already have the information that the possible development capacity is much less than that. Therefore, the area is not prospective enough, especially for the bigger/international investors.
- All of the most prospective areas (high-enthalpy) have been developed, especially by Pertamina. Currently, the sector is mostly working toward utilizing the medium-enthalpy areas. It requires different kinds of technology and different level of investment. In addition to that, the infrastructure costs to these areas are high as well.
- Every region has different characteristics. In the eastern part of Indonesia, the challenge is in the low development capacity, around 10 MW (due to low demand as well). The average cost will become increasingly high (high mobilization costs, low development capacity). Nevertheless, investors might still be interested because, despite the higher technical challenges, there is not much social challenge in the eastern part of the country, compared to the development in Java/Sumatra. This is because electricity is still very much needed in these areas.
- Given the current political circumstances, in order for geothermal sector to still strive, many parties expect to find ways to reduce the development costs (to eventually reduce the tariff to be paid by PLN). This can be done e.g. through producing the required technologies locally. The bottom line is that, the association is committed to align their interests with the current government direction to provide cheaper energy for the society.
- In regards with the statement that the development costs in Indonesia is higher, there are indeed several technologies used in other countries which can be adopted in Indonesia to reduce the costs here. For instance, in Kenya, the development uses the technologies from China which are cheaper and also safe. Moreover, the process of land clearing in other countries is relatively easier than in Indonesia.
- Regarding the latest arrangement of preliminary survey and exploration assignment (before obtaining geothermal license), this initiative is appropriate to tackle the problem of low quality of resource information in Indonesia. Therefore, if the developer has the capability (technically and financially) to conduct the exploration before tender, it is worth trying. Some developers have conveyed their interests to participate in the PSEA scheme. However, the developers (which conduct the PSEA assignment) will require certainty and privilege during the tender process. The existing rules need to be further specified to increase the security of investments made by the developers.
- Regarding the national energy policy, it may seem that the utilization plan of coal for electricity in the future might hamper the development of renewable energy. However, the plan to prioritize coal for domestic use (instead of export) is because the future demand for electricity will keep increasing. Therefore, all sectors (conventional and renewable energy) need to be developed since all of the production capacity will be absorbed in the future. Therefore, the stipulation in the national energy policy regarding the prioritization of coal for national electricity should not be seen as an obstacle for renewable energy development.
- In regards with the support of the government for renewable energy development, it is argued that the political will of the government is important. The intention to develop renewable energy can already be seen in the national energy policy. However, the implementation is not as good as expected. Moreover, the decrease of international oil and gas price makes it more beneficial for the government to develop using conventional resources, slowing down the utilization of renewable resources.
- It is often argued that the development of renewable energy is not in line with the attempt to provide cheap electricity for the society. This is why the process of electricity purchase by PLN can be difficult. For this matter, it is argued that there should be a change of mindset from the government and PLN. Renewable energy only takes a small portion in the total energy mix, compared to fossil fuels. There should be a clear calculation on how much the purchase of electricity from renewable energy (that is more expensive) affects the profitability of PLN. Naturally, it should not affect PLN's profitability too much. Therefore, in order to reduce the costs of electricity provision, instead of reducing the tariff ceiling, the government should have also attended to the efficiency of PLN itself.

B.2 Interview Set 2: State Electricity Company (PLN)

Interviewee's Brief Profile

Yudistian Yunis is the Senior Manager of Geothermal in PLN. He has over 30 years of experience in the business of power supply. Currently he chairs the department in PLN which directly manages all geothermal affairs in the company. It includes the development of geothermal by PLN and the settlement of agreement between PLN and other geothermal developers.

List of Questions

Off-taker Risk
As a state-owned enterprise, PLN has to pursue profits in order to increase the value of the company. On the other hand, PLN is also obligated to buy electricity from IPPs which use renewable resources. However, as we know, renewable energy in Indonesia is still at its early stage and hence it's more expensive compared to conventional resources. To make it economically viable for IPP, PLN may have to pay higher than its BPP for the electricity. What are PLN's strategies to deliver these two mandates?
PLN also has its targets to achieve RE mix in 2025. But at the same time, it also strives to obtain higher electrification ratio. Could you tell me how PLN prioritizes and allocate its limited resources on the two objectives?
In the past, based on what I gathered from the media, some projects were stalled and the investments were constrained due to the difficulty to reach an agreement on the tariff (Lahendong, Kamojang, Muara Laboh). According to some sources, the Jailolo project with Star Energy is also cancelled due to electricity purchase price problems with PT PLN. Is that true?
Why do you think this negotiation process generally takes a long time?
According to the earlier conversations I had with some people from INAGA, it is difficult to reach an agreement regarding the investment return (hence the electricity price) between IPP and PLN.
What is your opinion about this?
To what extent does PLN acknowledge the risks and costs borne by the developers which result in the higher electricity tariff?
I'd like to understand the complexity of this process from the perspective of PLN. As I understand, tariff determination is the most important aspect in the agreement. What is PLN's benchmark or reference to reach an acceptable tariff?
There's a view that for developers the tariff will always be too low. Do you share the same kind of argument?
What do you think is needed to be able to accelerate PPA negotiation between PLN and independent developers in the future?
Government Support
MoF Regulation No. 195/2015 governs the arrangement of electricity subsidy for consumers through PLN. Can you explain to me the process of obtaining this subsidy?
Can this subsidy cover for the loss incurred should PLN buy from RE IPPs with costs higher than PLN's benefits?
As an SOE, PLN should have access to PMN from the Ministry of Finance and obtain more capitals. As I understand, additional PMN for PLN can be made at the initiative of MoF, MEMR, or MSOE. Can you explain to me the difficulty of the process to obtain this additional capital?
If PLN manages to obtain additional PMN, how much of that budget will be distributed for the development of geothermal?
As I understand, according to Perpres No. 4/2016, PMN can only be used to improve PLN's financing capability for PIK Swakelola. Is that true? Does that mean PMN can only be used for that purpose and not to support PLN to perform its financial obligation to IPP?
PLN's Own Geothermal Projects
Can you tell me about the Ulumbu and Mataloko projects? What were PLN's roles in the development of these power plants?
What were the challenges to develop geothermal fields in the eastern part of Indonesia?
How do you describe the community engagement process?
How did PLN manage to obtain the financing for these two projects?
PLN is asking for geothermal Work Areas to develop and PLN believes that the costs will be considerably lower. Is that true? Why do you think so?

In regards with technicality, what is PLN's strategy to take on so many projects in the future?
What's PLN strategy to take on the risks and to finance the capital-intensive nature of geothermal investment?
How confident are you that this initiative can help accelerate the utilization of geothermal in the country? Why?
Ceiling Price
Recently there is a new PP regarding the electricity purchase price for renewable energy producers. Could you explain to me how this tariff is determined by PLN? What factors are taken into account in determining this tariff (local BPP)?
According to my discussion with one of the developers, the financing costs for these independent developers would be considerably higher, e.g. due to higher interests rate for the debt. Does PLN take this into account when determining the tariff?
How would you describe the deliberation process of the determination of BPP?
PPA after drilling
It may not be stated explicitly in PP No. 7/2017, however in Permen ESDM No. 12/2017, it is stipulated that PPA can only be made between developer and PLN only if the resource has been proven (which includes exploration drilling). Does it concern PLN at all?
The concern here is the uncertainty that the developer must face without the PPA. Is there any mitigation to help reduce the uncertainty?
From another respondent in EBTKE, there's a plan for a temporary PPA. What is it? How is it going to be conducted?
Regulatory Framework
What is your opinion of the current political landscape for the development of renewable energy in general and geothermal in particular?
Do you think the risks, the costs, and the benefits have been fairly distributed among the stakeholders?

Interview Result

- On PLN's dilemmatic role in buying electricity from renewable energy (RE) producers while at the same time it is obligated to maintain profitability: Despite the current situation, PLN does have the belief that renewable has the potential to become cheaper in the future. For PLN, it is true that it has to maintain profitability. However, as the representative of the government, the company actually is not obligated to deposit a certain amount of profits (in the form of dividend) to the government, as expected in the other state-owned companies. Instead, the company is given a level of margin (profit) for the company to grow, and not seen as profit.
- PLN has the obligation to maintain its level of production costs (BPP). If the price of RE is higher, aggregately, at the end of the year, it will affect the BPP level. Moreover, PLN is expected to keep reducing the BPP level. This is primarily because BPP will be reflected in the electricity retail price (TDL) to be paid by the consumers (society). The TDL is affected by (1) currency index, (2) primary energy source price, note: RE is not assumed to be primary energy source, (3) efficiency. If PLN manages to operate efficiently, TDL will be low. TDL level is to be determined by the government and the PLN's efficiency (reflected in the BPP level) itself is audited.
- PLN is obligated to make its own plan for renewable energy development. It has its own hydro and geothermal development plan. Other than that, the involvement of the company comes as an assignment from the government (to purchase electricity from RE producers).
- Supposed that geothermal price from a developer is higher than BPP, PLN needs to ask the permission from the government, the Ministry of State-Owned Enterprise to take on the assignment itself. If it is allowed, then PLN will take the assignment. Consequently, the government has to give additional support to PLN. However, the current trend is that the government wants to gradually reduce the subsidy level to PLN. Instead of channeling the subsidy to PLN, the support is given directly to the right consumers who really need the support/subsidy.
- In regards with RE development, PLN intends to be a reference in determining the price for the energy source. PLN understands that geothermal development has inherent resource risks. Currently, the exploration risks are borne by the developers. PLN wants to be involved by conducting explorations itself in order to reduce the risks for the developers.
- For this purpose, financially and technically, PLN will need to cooperate with other parties. The important point is for PLN to centrally manage these exploration activities. This way, the risks will be borne by PLN.
- On PLN's need to prioritize, e.g. between increasing electrification ratio and increasing the share of RE in the country: the main purpose of electricity provision is to support economic activity in the society in order to increase the buying power of the people. Today, the government argues that the competitiveness of Indonesian industry is

affected by the high level of electricity price (compared to other ASEAN countries). Therefore, the government has the interest to reduce electricity price. In doing so, PLN needs to always ensure that the electricity provision complies to the least-cost principle. Therefore PLN attempts to keep reducing the price of electricity that is done by buying the cheapest energy possible (conventional energy source). PLN will keep reducing BPP levels in areas in which electricity price is still significantly higher (currently only in Java and Sumatra that the price is reasonably low, competitive enough compared to Singapore). The problem is that currently, cheap energy sources are only coal and nuclear (natural gas is still expensive).

- Geothermal power plants are operated as the baseload sources while, at the same time, the price is significantly higher. Therefore, there is a burden for PLN in using geothermal resources since it has the obligation to keep balancing electricity provision and distribution at the lowest possible cost.
- On giving PLN the obligation/mandate to purchase electricity from RE producers: the dynamics between different governmental departments (Ministry of Energy, Ministry of State-Owned Enterprise, Ministry of Finance) will affect the continuity of the mandate. If there is an agreement to between the departments to support geothermal purchase (that is more expensive compared to conventional sources), the mandate can be easily be fulfilled by PLN. PLN itself has to accept the decisions made at the higher level.
- Internally, the decisions to support RE development depends on the direction set by the Board of the Directors and the capability of the company to take on the RE projects. PLN has made the attempts to convince the government, especially the MSOE and the MoF, regarding the advantages of renewable energy and the effect of incurring higher costs earlier in order to reap the benefits of having renewable energy sooner.
- PLN has its own planning in renewable energy development which takes into account a lot of factors, including the future energy prices. This plan is included in the RUPTL and is intended to become the guideline how and when certain renewable energy projects should be started. Nevertheless, it is not always the case that the planning (schedule) is aligned with the time that the mandates (to purchase geothermal power) are given by the government to PLN. The situation can be perceived by PLN as a disruption in controlling the BPP level. Moreover, if additional support from the government cannot be instantly obtained by PLN. Instead, PLN is obligated to dampen the costs of purchasing geothermal energy by conducting rigorous negotiation.
- The easy way out is for the government to simply give the mandate to PLN (without having to conducting the negotiation). But that way, PLN will lose the incentive to work efficiently. Instead, PLN is obligated to ensure that the agreed tariff in the end is within a reasonable range. This is why the rigorous negotiation process between PLN and the developer can take a long time. This should be acceptable considering the most power purchase agreements are long-term and therefore have long implications for the company.
- PLN can simply accept the tariff as required by the developers. However, in case that the margin enjoyed by the developers is too high, it simply violates the basic principle of natural resource usage in the country that it is the society that should benefit the most. This is why every negotiation process needs to be cautious and far-sighted. PLN understands that this principle is simply not aligned with the interests of other business entities (the developers). Nevertheless, it is still necessary although it is perceived as obstacle by renewable energy producers.
- On geothermal project/investment return: often times it is argued that PLN does not consider the riskiness of geothermal projects in determining the proper tariff for the developer. For this issue, PLN argues that the company can agree on the level of return (margin percentage) expected by the developer. However, the more important concern for PLN is the level of costs (capital expenditure) as proposed by the developers as such. PLN expects the developers to operate as efficiently as possible. This is where the importance of negotiation lies.
- PLN intends to manage the early resource risks as one of the attempts to reduce the capital expenditure of the developers that is perceived to be too high.
- For PLN, the decision to cooperate with the developers should be simple as long as the costs and the benefits are distributed fairly. Note that PLN has very limited room to obtain profits due the fact that the electricity retail price is regulated by the government. Therefore, it becomes crucially important for the company to ensure the efficiency of the developers.
- In regards with subsidy, ideally the reduction of electricity subsidy should give more room for PLN to manage its own financial requirements. It means that the company has more freedom to set the electricity retail price since later on the subsidy distribution is intended to be right on target (given directly to the poor). It is deemed to be better for PLN due to the fact that financial support through subsidy from the government sometimes experiences delay in the disbursement which, to some extent, affects the operations of PLN.
- It is not always the case that PLN will obtain support from the government in regards with the fulfillment of the obligation/mandate to purchase RE electricity. It is primarily because the process of tariff negotiation uses the business-to-business (B2B) mechanisms. Consequently, if the price is considered to be too high, there is a burden that needs to be borne by PLN. If the tariff level (after negotiation) is agreed by PLN's shareholder (the MSOE),

there should not be any problem. However, if it is not approved, more negotiations will need to be conducted again. The general attitude toward renewable energy in Indonesia is not very conducive for the sector to easily grow.

- For instance, there has been a case in which the plan to distribute subsidy that is intended to support renewable energy (channeled through PLN) is rejected by DPR because of the belief that such support does not benefit the society and it is deemed to only benefit the business entities. It is argued that it is reasonable for Indonesia to still use cheap conventional energy resources due to the fact that the buying power (seen from the income per capita level) of the society is still limited, especially compared to societies in developed countries which have exhibited their aggressive transition to renewable energy.
- The target of achieving the 23% of renewable energy in the energy share, including in the case of geothermal development (in contrast to the common belief that it will be difficult to achieve such target in 2025). The only concern for PLN is for the developer to have a reasonable level of capital expenditure for the development. In that case, it will be easier for PLN to take on the future projects.
- If the PPA negotiation process becomes considerably prolonged, it is not only because PLN needs to verify all the costs as proposed by the developers, but also because the process still needs to be audited by BPKP. For this verification, the completeness of data/information to be provided by the developer becomes important too. The provision of this information takes time as well. Moreover, currently PLN is developing a lot of projects to fulfill the target of increasing electricity capacity in the country. All these projects are subject to audit by BPKP. This is why the process of auditing one project can take a long time. This audit is important to ensure the accountability of PLN. After the audit, there are more bureaucratic processes which need to be taken. These processes take more time.
- The purchase of electricity by PLN takes up a large amount of the state budget. The use of the state budget is always under very close monitor by a lot of interested parties in order to ensure that the utilization is for the benefit of the society. This is why a lot of processes (negotiation, audit, and layers of approvals) are required as part of the attempt to keep the involved party, e.g. PLN or the MEMR, from being accused of misusing the state budget.
- PLN's own experiences in Ulumbu and Mataloko should indicate the capability of PLN to undertake geothermal projects independently. Especially since the issuance of Law No. 27/2003, PLN is now more involved more parts of the value chain of geothermal development, and not only in the downstream part of power plant development.
- According to PLN, the challenges to develop geothermal development in remote areas are not very significant (based on experiences in the eastern part of Indonesia). Moreover, the community and the local government in eastern area are more supportive. As long as the project is feasible and fulfills the concept of least-cost, the project will be taken by PLN.
- A challenge is mentioned that in areas where there is geothermal potential, the demand is considerably low, especially in the eastern part of the country. It reduces the opportunity to use up the geothermal potential in the country. This calls for more fairly distribute economic development in the country.
- On the obligation to conduct exploration before conducting PPA: to reduce the uncertainty for the developers, PLN intends to provide Heads of Agreement which indicates PLN's intention to buy the electricity as long as the price complies with the tariff ceiling (according to PLN's BPP level). This may be perceived to be unfavorable for the developers. However, PLN argues that the level of development cost in Indonesia is still very high in comparison to the international standard. This indicates that the current costs as proposed by the developers can be reduced even further.
- PLN's experiences in Matoloko and Ulumbu have exhibited that even when the development capacity is low, it is possible to incur a reasonable level of development costs that is in line with the international standard.
- In regards with financing challenges faced by the developer, it is argued that if the financing costs faced by the developers is significantly high (especially compared with PLN which has access to lower cost financing—G2G debt scheme), it should indicate that the credibility of the developer is not deemed as sufficient by the financiers. It should also become the responsibility of the developer to ensure the efficiency of their financing scheme to optimize the capital expenditure.
- The current political landscape in the country is conducive from the point of view of PLN (in regards with the latest changes in the regulatory framework). PLN understands that the condition is not ideal from the point of view of the developers. For this issue, PLN itself is willing to commit to develop the work areas (exploration) to reduce the costs for the developers. It is argued that there will be a lot of financial supports obtained by PLN since renewable energy development is getting a lot of attention from the international community recently.
- PLN argues that if the capital expenditure as proposed by the developers complies to the international standard, the current ceiling that is made according to PLN's BPP level should be sufficient. Therefore, it also depends on the intention of the developer in obtaining a reasonable level of profit.

B.3 Interview Set 3: Directorate General of New and Renewable Energy (EBTKE)

Interviewee's Brief Profile

- Ibnu Riyanto is the Head of Geothermal Investment Section in EBTKE.

List of Questions

On New Regulations
Recently, the government issued new regulations for geothermal development in Indonesia. One of the most significant changes is in the tender process. In the new arrangement, the electricity bid price is no longer part of the assessment to choose the winner. What is the purpose of this change?
It may not be stated explicitly in PP No. 12/2017, however in Permen ESDM No. 7/2017, it is stipulated that PPA can only be made between developer and PLN only if the resource has been proven (which includes exploration drilling). What is the purpose of this arrangement?
Does it apply to the projects which are now still at the PPA negotiation stage?
I'm certain that EBTKE has heard from the association or from the media that this can be a disincentive for the developers. This arrangement reduces the bankability of the project. What is your opinion about this?
The concern here is the uncertainty that the developer must face without the PPA. Is there any mitigation to help reduce the uncertainty?
The preliminary survey comes together with exploration (with minimum 1 exploration drilling) What is the purpose of this change?
What do you think is the incentive for the developers to take on the PSPE scenario?
Regarding Article 32 PP No.7/2017: Data Addition for the Work Area It's planned to be done by Badan Layanan Umum or BUMN. Do these agencies have the capability (financially) to take on this task?
There's also Permen ESDM No. 12/2017 regarding the utilization of renewable energy resources for electricity. The numbers are not fully consistent with Permen ESDM No. 17/2014 which distinguishes the tariff into 3 regions and according to the commercial operation date. What do you think about this decision in regards with the attractiveness of this sector to developers? Does this mean the old ceiling tariff arrangement is no longer used?
For IPPs, the financing costs can be considerably more expensive than PLN. However, the new tariff will be based on PLN's BPP. How much do you think it will affect the development in the future? Do you know which factors that are taken into account in determining the BPP?
Stakeholder Engagement Process
Given the complexity PPA negotiation and other measures to enforce more investment and improvement in the sector, could you explain to me the stakeholder engagement process?
EBTKE understands the differences in values, objectives, and resources of the different stakeholders. Could you explain to me the measures that EBTKE has taken to facilitate the communication process?
EBTKE's roles to mediate the negotiation between developer and PLN
Referring to the recent case of Muara Laboh, the new agreement can finally be obtained between PLN and Supreme energy after a clear instruction from the minister to accelerate to renegotiation process. This indicates the importance of government intervention to help with the process. To what extent is EBTKE involved in the B2B negotiation between PLN and the developer? What kind of support does PLN receive from the government?
Support of International Communities
Many of geothermal projects are funded by the international communities (JBIC, JICA, ADB, CTF, etc.). What is EBTKE's role in making this happen? Has the cooperation resulted solely from the developer's effort? If EBTKE is involved, how does EBTKE approach these international financiers? What do you think to be the factors that these investors find important before deciding to take part in geothermal business in the country?

Regarding the relationship among the government agencies
The MEMR consists of DJK and EBTKE that may not always be in agreement, for instance regarding the determination of tariff for RE IPPs. How does EBTKE, specifically Directorate of Geothermal manage to put forward its interests or compromise given such conflicts?
What is your opinion of the current political landscape for the development of renewable energy in general and geothermal in particular?
Latest progress in the sector
Some projects are now still in the PPA negotiation stage (exploration drilling is not in place). The price should have been determined during the tender process. Yet, the PPA negotiation still takes a long time. What is actually happening?
What is expected by the two sides?
What are the actions to be taken by EBTKE on these 'idle' WKP?

Interview Result

- On the recent change in the regulation (for the developers to conduct exploration before PPA): it is true that the latest regulation is being challenged by many developers. Before the issuance of MEMR Regulation No. 12/2017, it was planned that there would be different levels of tariff for different development capacity to reduce the complexity of the negotiation process. Nevertheless, with the issuance of MEMR Regulation No. 12/2017, the plan must be slightly changed. Instead, using the Heads of Agreement (from PLN), with which the developer obtains a guarantee that the electricity will be purchased, the government will try to impose to use the scheme of different tariff level for different development capacity.
- In regards with the new tariff level, it is said PLN's BPP level itself is not absolute. Therefore, there is still a possibility to increase the level, depending on the negotiation result with PLN. It is realized that the high risk in geothermal exploration borne by the developers should be compensated.
- The government has given a lot of incentives to the developers, such as (1) during exploration, the developers are exempt from import duties, (2) no import tax, (3) lower income tax level, and so on. They are intended to reduce the level of costs.
- The issuance of MEMR Regulation No. 12 is indirectly intended to prioritize renewable energy development in the eastern part of Indonesia, such as Maluku, East Nusa Tenggara, and so on. It is because the BPP level in these areas is still very high and it is still economically viable for RE producers to conduct the development there.
- The reason why the tariff level has been reduced significantly is because it is believed that renewable energy development is considered to be very expensive compared to other countries. There are a lot of factors which affect the level of tariff required by the government, including the development capacity. For instance, in Sarulla, North Sumatra, the tariff level can be low since the development capacity is high (at least 2 x 110 MW). Yet, the current regulation may not sufficiently accommodate these factors. It is yet to be seen whether the current regulation can still attract enough interests from the market (developers). It is possible that the regulation itself will be revised supposed that the interest is low. This issue is particularly important especially because geothermal development in Indonesia still depends a lot on the involvement of international geothermal players.
- It is important to note that the previous regulation (MEMR Regulation No. 17/2014 is still valid). That regulation stipulates that negotiation is still possible although the possibility for the developers to obtain higher tariff is low (if the regional BPP level is lower than the national BPP average). However if the local BPP level is higher than the national average, negotiation is not possible. Therefore, supposed that a developer operates in an area in which the BPP level is higher than the national average and, based on the exploration result, a higher tariff is required, it is the risk which has to be borne by the developer.
- In response to this issue, the government intends to conduct the government drilling program with which the early exploration risks are taken by the government. The pilot project has been conducted in Wai Sano, East Nusa Tenggara province. Otherwise, it is true that the developers must bear the exploration risks. This has also happened to companies like Supreme Energy.
- It is true that the latest tariff arrangement will require PLN to be more rigorous during PPA negotiation process. This is the consequence of having a single-buyer system in the country. The developers have no choice but to sell the electricity to PLN with all the rules and limitations faced by the company. This is considered to be one of the most crucial drawbacks of electricity sector in Indonesia.
- For this issue, the respondent argues the high costs of purchasing electricity from RE producers should be compensated with the low costs of buying from conventional resources.

- The country needs to see it from the macro perspective. Energy security should be attended. Currently, the country has a lot of coal, oil, and gas resources but their existence is limited. Therefore, the government should be able to work as soon as possible in utilizing renewable energy resources in the country. Moreover, geothermal development can take 9 to 10 years until it is operational. EBTKE argues that PLN, as profit-oriented company will keep focusing on utilizing conventional resources as long as the price is lower than renewable energy resources, especially because the development risks for these resources is much lower compared to geothermal development. This hampers the development of renewable energy in the country.
- On EBTKE's effort to put forward its interest within the ministry: it is recognized that it is a bit difficult to champion the development of geothermal energy in the country since the cost is significantly high. The state budget simply cannot afford it. Therefore, the development of other RE alternatives, such micro-hydro becomes prioritized, especially because the risk is lower than in geothermal. For geothermal itself the support is only through the government drilling scheme.
- In regards with the support of international community: A lot of support is received, including for the government drilling program. It is also part of EBTKE's role to encourage more international support to assist geothermal development in the country. However, it is important to note that this international support is not to be enjoyed by geothermal or renewable energy sector only. There are other priorities to be attended too.
- For the investors to be willing to participate in the sector, these factors are crucial (1) consistency of the regulations, (2) certainty on the resource price, and (3) efficient permit issuance.
- In regards with the consistency of the regulation, this particular factor has not been ideal in Indonesia. Several negative reactions were received by EBTKE. Nevertheless, for EBTKE, as part of the government, it has the obligation to perform the regulations obediently and to ensure that other stakeholders comply to the regulations. The challenges which emerge from any new policies will be used as references for policy making in the future.
- In regards with MEMR Regulation No. 12/2017 (which affect the tariff level), EBTKE was not really involved in the decision making. The regulation was mainly developed by the Directorate General of Electricity (DJK). EBTKE could no longer change the stipulations designed for regulation since its involvement in the process was really late. In this case, political condition really affects the stability of the sector, especially in regards with the consistency of the policy.
- In regards with PLN's willingness to take on geothermal projects: the respondent thinks that if PLN is really capable to conduct the development, EBTKE will certainly give its support (through direct assignment scheme). In fact, three direct assignments have been given to PLN (Tangkuban Perahu, Atedai, and South Halmahera—all are green fields). However, the respondent believes that PLN has never been involved in any green field geothermal development before. In Matoloko and Ulumbu, the early explorations were conducted by the Geology Agency, not by PLN. EBTKE expects that PLN's early involvement should be able to make PLN understand the challenges of early development phase in the sector. PLN itself already has a green field in Tulehu which has been given to PLN since in the 1996 or 1997. However, this field has never been developed until now. The respondent himself doubts the technical and financial ability of PLN to undertake so many green field development projects.
- In regards with the latest progress of most geothermal projects: Many projects have been impeded due to financial reasons. The developers cannot manage to find a financing partner to be able to conduct the drilling activities. The equity was not good either. The problem originated from the failure of the past tender mechanism in selecting credible developer. As a result, many of the tender winners were not backed with sufficient financial capability to undertake the development. Eventually, many of the licenses were revoked by the government since no development had taken place within 7 years (according to the regulation).
- The time limit of seven years is however not very strict, especially if the developer has managed to find a financing partner and showed its commitment (that exploration drilling will be conducted), although the time limit is almost up.
- This is also why the latest regulation introduces the concept of preliminary survey and exploration assignment (PSEA) in order to see the commitment of the developer to conduct exploration. In the future, EBTKE intends to open an official Work Area based on better level of information (proven resource) through preliminary survey *and* exploration.
- The new PSEA scheme was designed together with the developers. According to the respondent, although it seems to be riskier for the developers (which are obligated to conduct exploration before obtaining the geothermal license), quite many developers have conveyed their interest to participate in the PSEA scheme. PSEA itself is intended by the government to ensure that only serious developer will be given the permit/license to conduct the development.
- On the level of support given by the government to support geothermal: the support has been exhibited through various ways such as more streamlined permit issuance, clearer regulations and so on. In regards with the price, since it is being challenged by many parties, evaluation will be conducted. The commitment from the government

can be seen by the rapid increase in the sector within 5 years (approximately 600 MW of capacity increase). In 2019, it is expected that the capacity will be larger than the Philippines who now ranks the second in total geothermal capacity.

B.4 Interview Set 4: Financiers

Interviewee's Brief Profile

Muchsin Qadir is an energy specialist in the World Bank (IBRD). He has been involved in various studies by the World Bank regarding geothermal development in Indonesia.

List of Questions

Could you explain to me the roles that the World Bank has in the development of geothermal energy in Indonesia?
How does the World Bank manage the engage with the stakeholders in the system? What are the challenges?
In the past, the World Bank has been involved in the financing of Ulubelu and Lahendong projects with PGE. What motivated this cooperation?
Who and what were the most instrumental in making this cooperation happen?
Could you tell me about the mechanism?
What is the benefit for the World Bank to take on this kind of project?
Has this kind of support ever been given to the private sector?
What are the criteria for a project to become eligible to obtain the loan?
Is the resource risk mitigation one of the most important criteria?
Would it be possible for the World Bank to be involved in the financing of green field development?
Does the World Bank have its own strategy regarding the development of green fields?
It seems that the policies related to geothermal development are still taking shape. In 2014, the government issued a ceiling tariff mechanism which now has been replaced with MEMR Regulation No. 12/2017 in which the ceiling is changed to PLN's BPP. What is your opinion about this?
A lot of studies have been dedicated to point out the benefit of geothermal energy. How have these efforts influenced the decision making process among the policy makers? Could you tell me the challenges?
How are the policies affecting the World Bank's strategy to support green energy development in Indonesia?
What factors were crucial/instrumental before the World Bank was convinced to channel the grant or any other financial support?
PT SMI is the manager of the geothermal fund. How important was the company's capacity in this decision? How was the relationship built between the two?
What factors can we improve to the current regulatory framework?

Interview Result

- The World Bank has two main roles in the Indonesian geothermal sector, namely in financing and continues dialogue with the government in regards with geothermal policies.
- As for the stakeholders engaged by the World Bank, there several groups: (1) the government as the policy maker and (2) the developers (private and state-owned), and (3) the financiers. The financiers are of particular importance due to the fact geothermal development requires a very high level of investment. Most commercial banks in Indonesia are not yet familiar with geothermal projects and they tend to be reluctant especially when the resource risk is still considerably high. Therefore, the World Bank intends to assist to tackle these challenges.
- In Indonesia, the World Bank believes that geothermal sector is quite developed already. Previously, the World Bank was involved in many downstream geothermal projects. After some evaluation, it has been recognized that the downstream part is not very risky/challenging and therefore many other financing agencies can/will participate in this part of the development. On the other hand, the more limited access to finance is experienced by the upstream part of the development. Most commercial financiers are willing to channel its resource if the steam has been found at

the level of approximately 50-60% of the total planned capacity. Supporting the financing of upstream geothermal development becomes the current focus of the World Bank.

- In choosing the projects to support, the World Bank will see the entire sector and assess the readiness of the developers. At the time, Pertamina (with Ulubelu and Lahendong projects) were considered to most ideal candidate, especially since the company has a lot of concessions. Moreover, the IBRD focuses on the cooperation with the government or public companies, such as Pertamina. Therefore, financing support from IBRD should be channeled to the government or to state-owned companies. The World Bank has another group of the International Finance Cooperation (IFC) which has given the support to private sector, such as Supreme Energy.
- There are quite many multilateral/bilateral banks which are proactive in financing geothermal development in Indonesia, such as the World Bank, Asian Development Bank (ADB), JICA (Japan), KfW (Germany).
- The World Bank itself serves as a stimulant to encourage green energy development. The World Bank will channel its support if the private sector involvement is still limited.
- In deciding to channel its support to certain projects, the World Bank works with the government. Together they create a country partnership framework (every 3 to 4 years) to see which sectors and projects that need support from the World Bank.
- Ideally, for geothermal projects, financial support should be distributed only when the resource has been proven, however for Ulubelu and Lahendong projects, it was decided to channel the support at an earlier stage even though the steam has not been sufficiently obtained at the time.
- The support given by the World Bank does not only consist of financial support, but also capacity building. The type of support given depends on the need of the client.
- The IBRD attempts to encourage private sector involvement not through financing, but rather through policy making with the government. For instance, by the time of tender, the developers are provided with limited resource information which comes from geochemical, geophysical, and geological surveys. This information is not sufficient for the developers to assess the viability of the resource. Therefore, the World Bank always encourages the government to obtain subsurface information prior to offering the geothermal work areas. The purpose is increase the interests of the private sector.
- Financing by the World Bank can be categorized into two: (1) before tender and (2) after tender when the geothermal license holder has been appointed. The current support by the World Bank in the government drilling program (with PT SMI) is the type of financial support before tender. In the meantime, the government itself already has a mechanism to support financing after tender using the available geothermal fund (there is a specific MoF Regulation which governs the arrangement). It is possible for the World Bank to be involved in the second category of financing. Whether the support will be given directly to the developers or through the government is yet to be decided.
- Within a project, the World Bank serves as a supporting agency. Most decisions, e.g. in technical aspects (location, technology, and so on), fund utilization, and so on, are within the domain of the government and the implementing agency, such as PT SMI.
- In regards with the policy making, the World Bank believes that the government has the obligation to provide reliable public facilities efficiently. It seems to be the case that the current minister has the focus of providing public facility efficiently (low cost). This decision is understandable. However, it is not enough to look at the energy sector only from one aspect (of cost). Geothermal energy has more advantages which should be internalized for the valuation the resource itself. The World Bank was involved in the making of tariff ceiling as governed in the previous regulation (MEMR Regulation No. 17/2014). This tariff arrangement was preferred by the developers.
- Although the benefits of geothermal energy have been clearly conveyed through many studies, it is still difficult to include this information in order to obtain policies which are in favor of geothermal or renewable energy development in Indonesia. The difficulty is found because individual preference still plays a significant role (different minister, different policies).
- The latest issue regarding tariff occurs since PLN faces a lot of financial pressure (due to the plan to reduce electricity subsidy support). That is why the tariff ceiling needs to be lowered to PLN's BPP level. Certainly, such decisions do not only affect the Ministry of Energy and Mineral Resources, but also the Ministry of Finance. If the interests and differences between the two ministries can be aligned, this kind of problem can be dampened.
- In regards with the changing regulations in Indonesia, the World Bank can only open dialogues with the government. For the current issues which are more unfavorable for renewable energy development, discussions are held directly with the minister or the vice minister.
- In order to align the interests, the dialogues turn to action plans which intend to reduce the risks of geothermal development. As long as the risks are still significantly high, the developers will compensate the risks by increasing the capex allocation (e.g. in case the initial exploration plan does not work accordingly). Eventually, the tariff proposed will be high. Therefore, it becomes the focus the World Bank that the management of geothermal

resource risk is properly attended. If in the end it is still difficult to optimize geothermal development in Indonesia, it is possible for the World Bank to focus on other renewable energy sector, such as solar energy.

- On the criteria of the World Bank before distributing a grant (for geothermal fund): the World Bank conducts an assessment toward stakeholders which will be involved in the project. In the case of financing before tender (government drilling), the stakeholders consist of the MEMR (Directorate of Geothermal and Geology Agency), the MoF, and PT SMI as the fund manager. PT SMI was chosen (to manage the grant) because, as a state-owned company, it has more flexibility to manage geothermal projects and has more suitable human resources, compared to the MEMR.
- The arrangement made between the World Bank and PT SMI was intended to encourage the utilization of geothermal fund which has been idle for a long time. The improvement was made by changing the rules governing the use of this fund, to make it commercially interesting (for PT SMI as the implementing agency and to other developers which are interested to obtain financial support from the fund). The change of rules require a change of mindset of the government in regards with the utilization of the state budget for geothermal drilling. It was framed that the drilling is intended to obtain information (whether the resource is productive or not), rather than to obtain profit from the project.
- The important thing is for the government to ensure the following: (1) sufficient resource information, (2) transparent tender process, and (3) fair tariff level. In regards with the tender process, it is important that the mechanism is capable of ensuring the competitiveness of the bidders.