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Economic Policies and Incentives to Expand the Geothermal Energy Industry in Indonesia

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Thesis for the fulfillment of the
Master of Science in Environmental Management and Policy
Lund, Sweden, September 2012

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Published in 2012 by IIIEE, Lund University, P.O. Box 196, S-221 00 LUND, Sweden,
Tel: +46 – 46 222 02 00, Fax: +46 – 46 222 02 10, e-mail: iiiee@iiiee.lu.se.
ISSN 1401-919

Acknowledgements

It would not have been possible to complete this master's thesis without the help and support of the kind people around me, to only some of whom it is possible to give particular mention here.

Above all, I would like to thank my parents, brother, and sister who have given me a full support on my study especially for all the moral encouragement. With all the support I got from them, the completion of this thesis and this master's program becomes much easier and meaningful.

This thesis would not have been possible without the help and support from my supervisor, Kes McCormick, and not to mention all his advices and knowledge in the field of renewable energy policiy. I would like to thank alsothe other IIIEE teachers who have been sharing all the knowledge in the past 2 years and mentoring me to become a better intelectual.

I am very grateful to all my classmates in IIIEE for the time we share from the moment we step foot for the first time in IIIEE building until now. Without you guys, my life in Lund would have been sucks. Thank you for all the happy, sad, stupid, and crazy moments and experiences we have shared in the past year. I thank you all also for all the encouragement, knowledge and information sharing, comments and feedbacks from the begining of this EMP course until the completion of this thesis. The memories in the past year with you is a treasure.

Finally, I would like to thank my best friends in Indonesia and Japan, Tamarind Indra, Arisyi Raz, Josephine Darmaja, Magdalena Gunawan, and others whose name I cannot mention one by one here. I thank you for all your support throughout my study, all the cheering when I was down, and all the knowledge you have shared.

Abstract

Indonesia is a country with a growing economy and in pararrel with economic growth, energy demand in the country is increasing rapidly. However, energy supply in the country is becoming an issue since Indonesia's energy supply mainly depends on fossil fuel resources which is non-renewable and the national reserve of fossil fuel itself has been decreasing. At this rate, Indonesia will have to import a significant amount of energy because of insufficient domestic production. Moreover, Indonesia's energy industry will contribute more to greenhouse gases emission if the country kept depending on fossil fuel resources.

Renewable energy has to be developed rapidly in order to reach energy security and to ensure economic development as well as to tackle environmental issues such as climate change. Currently the Government of Indonesia is setting goal to significantly increase renewable energy share on final national energy mix.

Geothermal energy has a large potential to help Indonesia in achieving this goal. The Government of Indonesia has been putting effort to support the development of geothermal energy industry through econormic policies and incentives such as Feed-in Tariff, tax incentives, and banking policies. However, are these economic policies sufficient to create a better investment environment in geothermal energy industry?

This thesis tries to describes the current condition of geothermal energy development in Indonesia, and discuss whether the current implemented economic policies are sufficient to encourage further development on geothermal energy.

Keywords: Renewable Energy, Geothermal, Economic Policy, Indonesia

Executive Summary

To enhance economic development while promoting sustainability, renewable energy sources such as solar energy, wind energy, geothermal energy, and biomass energy are an important part of the "answer" for the replacing fossil fuels and responding to climate change. Renewable energy is a clean energy source with a more stable production cost compared to fossil fuels. Currently the development of renewable energy has been rapid and spread globally especially in developed countries. In 2010 the total global investment in renewable energy was USD 211 billion, which increased significantly from 2009 total investment of only USD 160 billion.

With a large population and growing economy Indonesia consumes a large amount of energy, which is projected to increase over time and this growing energy demand is still being supplied mostly by fossil fuel sources. Huge fossil fuel consumption also burdens the government since it is highly subsidising fossil fuel energy and electricity. Indonesia, as a developing country, also needs to invest in renewable energy to support its development. Indonesia has very promising renewable energy potential from different sources namely solar, hydro, geothermal, and biomass. Currently, renewable energy development in Indonesia has been rapid and significant compared to the past decades. Even though in 2009 only around 7% of total energy consumption comes from renewable energy, the government of Indonesia has set a target to increase the share of renewable energy in the national energy mix to 15% by 2025. The government is triving to achieve the target through policy intervention and incentives.

Indonesia is a country that has many volcanic features and it has the largest geothermal potential in the world. The potential capacity of geothermal in Indonesia is estimated around 28000 MW, which accounts for 40% of the world's total geothermal energy reserve. However, despite the huge potential, current exploitation and development of geothermal energy in the country is fairly small. Currently, Indonesia is putting considerable effort to develop this sector quickly. The Indonesian Ministry of Energy and Mineral Resources (MEMR) announced the goal to develop geothermal energy production capacity to 4500 MW by 2015, more than twice of the current capacity in a short period of time. In the long run, the Indonesian target is to have 9500 MW of geothermal energy production capacity in 2025.

This thesis reviews and analyses the economic policies and incentives implemented by the government to promote geothermal energy, and discusses whether these policies are enough to rapidly expand geothermal energy development in Indonesia. There are two objectives of this thesis: (1) To review and understand the current conditions, national energy policies and initiatives that are affecting investment in geothermal energy production in Indonesia, and (2) To analyse and discuss the economic situation of geothermal energy production in Indonesia and the business risks and opportunities related to the surrounding policy context.

Currently Indonesia is enjoying its stable economic growth and in parrarel with that energy production and consumption in the country is also increasing. eEectricity sector in Indonesia in particular is also growing. Most of the installed power plants are run by the state owned electricity company, Perusahaan Listrik Nasional (PLN) or National Electricity Company. Subsidies are one of the main feature in policy framework for energy and electricity sector.

Electricity production capacity in Indonesia is still far from enough to meet the growing demand of electricity. Moreover, for such a big economy, Indonesia has a low electrification rate which is only 51% in 2005. . In order to cope with the increasing demand and the target to increase electrification rate, the GOI introduce the Crash Program in 2006 aiming to add 10,000 MW

power generation capacity. With the goal to add 10,000 MW new generation capacity, electricity sector in Indonesia entered the new phase of IPPs activities. The first phase of the program will be to add 10,000 MW new generation capacity using new coal fired power plants. The second phase is to add another 10,000 MW new generation capacity using alternative sources. Renewable energy resources were to contribute a significant amount of new capacity.

Geothermal is expected to contribute a significantly in the 10,000 MW new generation capacity. To achieve the target capacity, GOI implementing several economic instruments and financial incentives in geothermal energy sector. These policies are including Feed-in Tariff (FIT), tax incentives, banking policy, and governmental fund and guarantee.

FIT is probably the most important policy that support the development of geothermal energy because it is the single source of income for geothermal energy producer in Indonesia. In July 2012, Ministry of Energy and Mineral Resources (MEMR) set a new FIT price that is expected to create a better investment environment in geothermal energy industry. Another economic instrument used is in taxation. To promote rapid development of renewable energy industry, GOI also introduced tax incentives. Renewable energy developers get five different tax incentives which includes incentives for: (1) corporate income tax incentives in the form of 10% investment tax credit and accelerated depreciation (2) Value Added Tax (VAT) exemption, and (3) custom duties exemption. Tax incentives are given to geothermal energy developers as a mean to reduce the cost of capital of geothermal energy project investment in order to make geothermal energy industry in Indonesia more attractive. Finally, governmental funds and guarantees and banking policies also helps shaping the better policy framework for geothermal energy development in Indonesia.

In summary, The Government of Indonesia is proactively supporting the development of geothermal energy through policies and initiatives especially from the financial point of view. Economic instruments and incentives implemented by the government are proving to make geothermal energy investment in Indonesia more attractive. However, there are still some policies that need to be adjusted such as Feed-in Tariff remuneration model and income tax incentive period. Besides economic policies, there are other conditions that need to be improved to make geothermal energy project development more promising. These conditions includes the complex bereaucracy system in Indonesia that makes administration matters difficult and delayed, the lack of national level commitment, and the lack of awareness among energy consumers on the importance of renewable energy development.

If these issues could be removed, the investment environment of geothermal energy projects in Indonesia will certainly become more attractive and the 2025 goal to develop 9500 MW of geothermal energy capacity can be achieved.

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Abbreviations

ADB: Asian Development Bank

BI: Bank Indonesia

BOE: Barrels of Oil Equivalent

EIA: US Energy Information Administration

ETS: Emission Trading Scheme

FDI: Foreign Direct Investment

FIT: Feed-in Tariff

GDP: Gross Domestic Product

GOI: Government of Indonesia

GW: Giga Watt

GWA: Geothermal Working Area

GWh: Giga Watt hour

IDR: Indonesian Rupiah

IEA: International Electricity Agency

IIA: Indonesia Investment Agency

IPCC: Intergovernmental Panel on Climate Change

IPP: Independent Power Producer

IRR: Internal Rate of Return

kWh: Kilo Watt hour

LPG: Liquified Petroleum Gas

MEMR: Indonesia Ministry of Environment and Mineral Resources

METI: Masyarakat Energi Terbarukan Indonesia (Indonesia Renewable Energy Society)

Mtoe: Million tonnes of oil Equivalent

MW: Mega Watt

MWh: Mega Watt hour

NPV: Net Present Value

OPEC: Organization of the Petroleum Exporting Countries

PLN: Perusahaan Listrik Negara (National Electricity Company)

PEUI: Pengkajian Energi Universitas Indonesia

REN21: Renewable Energy Policy Network for the 21st Century

UNDP: United Nations Development Program

USD: US Dollar

VAT: Value Added Tax

1. Introduction

1.1. Background

Over the past decades, the Earth's climate has been changing due to the rise of greenhouse gas (GHG) emissions such as carbon dioxide, methane, and water vapor in the atmosphere. Since the beginning of industrial revolution, human activities have put more pressure to the Earth and causing temperature rise. A big portion of greenhouse gas released to the atmosphere was caused by human activities that are mostly related to economic activities such as deforestation, transportation, electricity generation, and waste management. According to Intergovernmental Panel on Climate Change[1] (IPCC), based on the source of emission, energy supply accounts for 26% contribution of greenhouse gas emissions, while industry accounts for 19%, forestry 17%, agriculture 14%, transportation 13%, commercial and residential building 8%, and waste and waste water treatment 3% (IPCC, 2007). In this sense, energy sector is responsible for the current state of climate change issue.

Obviously the rise of mass energy production in the past is one of the biggest factors boosting the global economic development. Production of energy in a big scale allows people to produce more food, to produce industrial products, to transport from places to places, to build infrastructure, and finally to develop civilization. Despite of its obvious contribution to the global economic development, the energy sector has been contributing a significant amount of emission to the atmosphere; therefore it plays an important role in climate change. Changing the current pattern of energy production and consumption to a more sustainable one, may significantly help in solving climate change without jeopardizing the global economy.

According to US Energy Information Administration (EIA), the world's energy consumption in 2008 was 12,728 Million tonnes of oil equivalent (Mtoe), and it is projected to increase to 14,463 Mtoe in 2015 and 18,195 Mtoe in 2030 (EIA, 2011a). Until now, energy production to meet the demand has been mostly generated from fossil fuel resources which emit an amount of carbon dioxide and other gases when combusted. In 2008, 81.2% of total world energy production came from fossil fuel sources which are 33.2% oil, 27% coal, and 16% natural gas (EIA, 2010). With this current pattern of energy production and consumption, energy sector will put more pressure to the Earth by emitting more greenhouse gases to the atmosphere and thus accelerating the temperature rise and climate change.

Not only the environment but also economic development jeopardized by the current pattern of energy production. Uncertainty of energy production cost, which determines final energy price, has been a common feature in the current economic development. This is the consequence if the world depended too much on non-renewable energy sources to support the economy. Crude oil price for the past decade, for example, has been extremely fluctuating in the short-term trend and steadily increasing in longer term trend. Moreover, looking at the longer timeframe, current crude oil price had tripled since 1980 (EIA, 2012). In this sense, fossil fuel is not a dependable energy sources for economic development especially in the large developing countries that will have an increasing projected energy demand. On the other hand, renewable energy sources are more reliable to promote development (Miller and Spoolman, 2009).

[1] A scientific intergovernmental body, set up at the request of G7 member countries that has a role to assess the scientific, technical, and socio-economic information related to climate change

Renewable energy sources such as solar energy, wind energy, geothermal energy, and biomass energy are believed to be the "answer" for the growing energy demand and for solving climate change problem. Never in the past 30 years the development of renewable energy production has been this fast. In 2010 the total global investment in renewable energy was USD 211 billion, increased significantly from 2009 investment which is only USD 160 billion. The total capacity of global renewable energy in 2010 is approximately 1320 GW, increased by 8% from 2009 capacity and accounts for about 25% of total global energy production (REN21, 2011). In the future renewable energy sources are expected to become even more competitive than fossil fuel sources because of the decreasing initial investment cost and advancements in technology. However, it is still important that the government support the development through policies and initiatives (Mankiw, N.G., 2007).

Many countries around the world have also started to emphasize renewable energy development in their national energy policies and targets. Sweden for example, with its comprehensive policies including electric utility quota obligation, tradable emission credit, capital subsidy, and investment tax credit had achieved 50.2% renewable energy shares in final energy mix, slightly above its target of renewable energy share in national energy mix (REN21, 2011). Many other countries are also increasing the portion of renewable energy into their national energy mix to achieve energy security as well as to achieve environmental quality improvement. Most countries set 10-30% target for their renewable energy shares in electricity generation in the next 2 decades (REN21, 2011).

Indonesia, as a developing country, also needs to develop renewable energy to support its economic development. With a large population and growing economy, Indonesia consumes a large amount of energy and it is projected to increase over time. The energy consumption in Indonesia in 2009 was approximately 104.5 MBoe, almost doubled the consumption level in 1999 (EIA, 2011b). However, this growing energy demands is still being supplied mostly by fossil fuel sources. In 2009, about 93% of energy consumption in Indonesia comes from fossil fuel sources where petroleum oil contributes the biggest share of around 44%, coal 35%, and natural gas 14% (EIA, 2011b).

This unsustainable pattern is jeopardizing the country's energy security. Indonesia's oil reserves have been declining in the past decade but the oil demand has been increasing. In 2004, the country's domestic oil production couldn't meet the domestic oil demand and forced to import the oil from abroad. Indonesia has become a net oil importer since then and in 2008 Indonesia suspended its OPEC membership (EIA, 2011b). Moreover, the country's policy on giving huge subsidy on fossil fuel has been giving more burdens to the government budget. Therefore Indonesia needs an immediate action to develop its renewable energy potentials to achieve energy security and secure economic development.

Even though in 2009 only around 7% of total energy consumption comes from renewable energy, Indonesia has been developing renewable energy industry rapidly. President Susilo Bambang Yudhoyono, through Presidential Decree no. 5, set a target to increase the share of renewable energy in the national energy mix to 15% by 2025 (US Department of Commerce, 2010). Since then, there are many policy adjustments and initiatives implemented to support renewable energy development. In 2010 the ministry of energy for example introduced 5% tax cut over six years to renewable energy producer (Ali, M., 2010). Feed in tariff policy for in the country was re-evaluated and renewed in June-July 2012 to provide more incentives for renewable energy producer and prospective investor and developer (Fadillah, R.D, 2011a).

Actions have also been taken in the past years to promote renewable energy development. From the solar power industry, recently the government signed cooperation contract with Sharp Corporation to develop a large scale 100MW solar panel within one year in the country (MEMR, 2012b). As for geothermal energy, the government set aside USD 39 million to guarantee the development of geothermal energy projects in the country (Fadillah, R.D, 2011b). Moreover, in April 2012 the country signed an agreement to cooperate with New Zealand to develop geothermal energy resources in Indonesia together (Saragih, B.B.T., Fadillah, R.D., 2012). Indonesia has a significant potential on geothermal energy production. If all the geothermal potential fully exploited and developed, this sector may give a significant impact for economic development in the country. According to Raz et al, a 1% increase in geothermal energy production in the country may give a 0.9% direct impact to GDP growth (Raz, A.F., et al, 2011).

However, despite the promising potential and recent movements in the country, there are still barriers for renewable energy industry, and geothermal in particular, to fully develop. Indonesia still has much work to do in order to achieve the full development of renewable energy.

1.2. Problem Statement

With a growing population and economy, Indonesia needs to expand its energy sector significantly to support its development. Pengkajian Energi Universitas Indonesia (PEUI) in its report states that the population in Indonesia will grow to 265 million in 2020 and 280 million in 2025, and the total energy consumption of this population is projected to grow up to 1,604 million Barrels of Oil Equivalent (BOE) and 2,028 million BOE respectively which is more than double the 2006 total energy consumption in the country (PEUI, 2006). The domestic supply of fossil fuels, which is the energy sources that the country currently highly depends on, is decreasing as the demand keeps increasing. In this sense, the country will soon have to import its energy needs from other countries if it does not change its energy production and consumption pattern.

The problem with importing energy, especially fossil fuels, is the risk of poor energy security. The country's energy supply will be dependent on the economic, political, and natural situation of the exporting countries. Moreover, especially in the case of importing fossil fuels, uncertainties on energy costs cannot be avoided, putting the country into even more risks. It is obvious that the renewable energy sector can be part of the answer to avoid such risks in Indonesia. Indonesia, as a biggest archipelago country in the world, has an exceptionally large potential in renewable energy. Almost all renewable energy sources namely hydro, solar, wind, tidal, biomass, and geothermal energy are present in the geographical area of the country. Geothermal energy especially is a very interesting energy source in Indonesia.

Indonesia, as a country that has many volcanic features, has the largest geothermal potential in the world. As already mentioned, the potential capacity of geothermal energy in Indonesia is estimated around 28000 MW, which accounts for 40% of the world's total geothermal energy reserve. Despite the huge potential, current exploitation and development of geothermal energy in the country is fairly small. In 2009, the country only has the running capacity of 1,189 MW. On the other hand the Philippines that have smaller potential have been successfully installing more than 2,000 MW capacity of geothermal energy production and stands in the second place of geothermal energy producer country after the United States. Indonesia is currently in the third place of geothermal energy producer countries after the Philippines..

Despite the limited development in geothermal energy sector, Indonesia is now putting considerable effort to develop geothermal energy sector quickly. The Indonesian Ministry of Energy and Mineral Resources (MEMR) announced the goal to develop geothermal energy production capacity to 4500 MW by 2015, more than twice of the current capacity in a short period of time. In the long run, the Indonesian target is to have 9500 MW of geothermal energy production capacity in 2025. In order to achieve the target, huge investments, both domestic and foreign, in this area are needed. Currently, there are many initiatives and movements both from the governmental and private industry sectors towards geothermal energy development such as a partnership with New Zealand, protection for geothermal energy projects, and new geothermal energy policy (including tax breaks and new feed-in tariff policy). However, are these policies and initiatives sufficient to reach the 2015 and 2025 target? Will the private sector respond and make the necessary investments in geothermal energy or does the government need to play a more significant role?

1.3. Aim and Objective

The aim of this thesis is to contribute to advancing the development of geothermal energy in Indonesia. There are two main objectives of this research which are:

1. To review and understand the current conditions, national energy policies and initiatives that are affecting investment in geothermal energy production in Indonesia.

2. To analyse and discuss the economic situation of geothermal energy production in Indonesia and the risk and opportunities related to the surrounding policy context.

1.4. Scope and Limitation

This thesis reviews and analyses economic policies that may affect the investment environment and development in the geothermal energy industry in Indonesia. However, only economic instruments and financial incentives that may encourage or discourage geothermal energy development will be covered. Policies that regulate the geothermal energy industry from operational as well as legal perspectives will be excluded from the review and analysis.

The analysis and calculation of the economics of geothermal energy projects in Indonesia will be taken within a 30 years of timeframe, which is the contract period for geothermal energy project in Indonesia. The thesis will focus on the implementation and investment issues relevant to geothermal energy.

1.5. Methodology

The thesis is based on a literature and stakeholder interviews to collect primary and secondary data for the analysis of the geothermal energy industry in Indonesia. From the secondary data collected, the thesis reviews policies related to geothermal energy industry. Analysis on how the policies may impact the investment environment in general and geothermal energy projects feasibility in particular is made based on the reviewed literature as well as primary data gathered through interviews.

1.5.1. Literature Review

The literature review covers an in depth review on the energy sector in Indonesia and geothermal energy development. Literature such as from newspaper articles, journal articles, and organization reports is used to provide a diverse source of information for this thesis. The literature review aims to provide understanding of the current energy development in the country especially how geothermal energy development is positioned in the current energy sector.

It will also cover a comprehensive review on the existing policies that are affecting geothermal energy production in Indonesia. It will review the situation of each current policy feature such as feed in tariffs and tax breaks and analyse how these policy features may affect the geothermal energy production in Indonesia.

1.5.2. Stakeholder Interviews

Stakeholder interviews were conducted to help gather information on how the private sector is reacting to the implemented government policy. The interviewees are mostly people from private companies that enganged in geothermal energy industry in Indonesia such as Chevron Pacific Indonesia. Interview with one of the staff from Indonesian Renewable Energy Community (METI) was also conducted. Opinions and suggestions from interviewees regarding the possible adjustment for policies to support geothermal energy industry is also discussed. Interviews were conducted in the form of informal interviews, semi-formal interviews, and phone interviews. Information gathered during the interviews is used to support the analysis of the geothermal development in Indonesia.

1.5.3. Analytical Framework

Qualitative analysis was conducted to identify and understand risks and opportunities as well as other factors that may affect the business performance of geothermal energy production directly or indirectly. Quantitative analysis was conducted to understand the economics of geothermal energy production in Indonesia from the company perspective. This part will includes calculation on costs and revenues and Net Present Value considering all related financial instruments and policies that the government has implemented. This analysis aims to provide a general idea about what will most probably happen if a company were to invest in geothermal energy production project in Indonesia. Finally, based on the qualitative and quantitative analysis, some suggestions for policy adjustments are made and conclusion is derived.

1.6. Target Audience

The main target audience of this thesis is the private industries that might be prospective investors and developers in the geothermal energy sector in Indonesia. The thesis to some extent provides practical information relevant for business investment in the case of Indonesia geothermal energy sector.

The thesis also relevant to governmental staffs and policy makers that are working on renewable energy policies in general and geothermal energy policies in particular. The thesis also provides analysis whether the current conditions and policies are providing enough incentives for prospective geothermal energy producer investment.

1.7. Thesis Outline

Chapter 1 – Introduction
This chapter provides a general overview of current and projected situation of energy sector in the world and in particular in Indonesia as well as renewable energy development in Indonesia.

Chapter 2 – Review of the energy sector in Indonesia
This chapter provides an in depth review and discussions of the energy sector in Indonesia. Features such as energy production and consumption, energy sources, energy prices, renewable energy market and electricity utility industry are discussed in this section.

Chapter 3 – Review of geothermal energy development in Indonesia
This chapter provides a review about the past and current geothermal energy development in Indonesia. This chapter also discusses geothermal energy development from a historical perspective to show how geothermal energy in Indonesia has developed overtime until today.

Chapter 4 – Review of energy policies for geothermal energy in Indonesia
This chapter provides a review of the existing policies and initiatives that relates to the geothermal energy sector in Indonesia. This section also provides short analysis of how each policy feature can affect geothermal energy sector.

Chapter 5 – Analysis and Discussion
This chapter provides a practical analysis from the business perspective of how private industry can fit in the surrounding policies. Both quantitative analysis and qualitative analysis are included in this section covering business risks and opportunities.

Chapter 6 – Conclusion
This chapter provides reflections based on the analysis from the earlier chapters.

2. Review of Indonesia Energy Sector

2.1. Energy Production and Consumption

Indonesia has been enjoying a steady economic growth of around 5% since the Asia economic crisis in 1998-2000. Economic growth has been directly impacting the demand for energy in the country. With the total energy consumption in 2000 and 2010 of around 109 Mtoe and 151 Mtoe respectively, the country shows a significant energy sector growth within a decade (MEMR, 2011). Currently, economic growth in Indonesia also increasing to around 6-7%, and with the current level of economic growth, energy demand in Indonesia is projected to increase up to around 400 Mtoe in 2025 (EIA, 2011b). According to Asian Development Bank, Indonesia currently has energy elasticity of around 2, which means every increase in 1% on GDP will give direct impact 2% increase on energy demand (ADB, 2012).

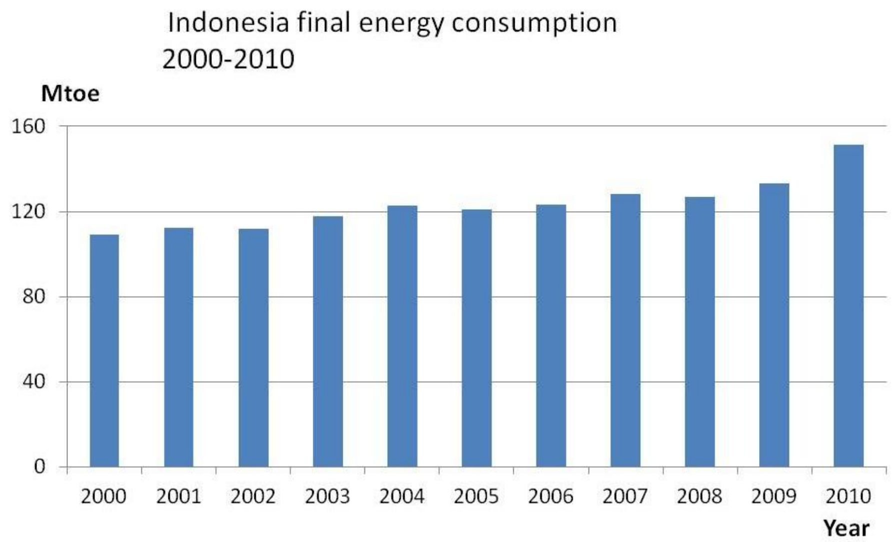

Figure 1. Indonesia Final Energy Consumption 2000-2010 (in Million tonnes of oil equivalent)

Source: MEMR

According to Indonesia MEMR (MEMR, 2011), industry and household sectors consume energy the most which are approximately 50 Mtoe and 45 Mtoe in 2010 respectively. Industrial sector accounts for around 33%, where households accounts for 30%, transportation sector accounts for 24%, commercial sector 3%, non-energy utilisation 8%, and other sector accounts for 2% of the final energy consumption in 2010. The growing industrial and transportation sectors show significant increase in energy consumption with the demand almost doubled in 10 years period since 2000. However, there is an interesting fact in the household energy consumption in the country. Most of the household sector energy demand were supplied by biomass source. The data above includes biomass source, as non-commercial energy source, into calculation. If the data were only estimating commercial energy consumption, which exclude non-commercial biomass usage, energy consumption in transportation sector would far exceed household sector energy consumption (MEMR, 2011). The low rural electrification rate in the country is believed to be one of the biggest reasons of huge biomass consumption in the country.

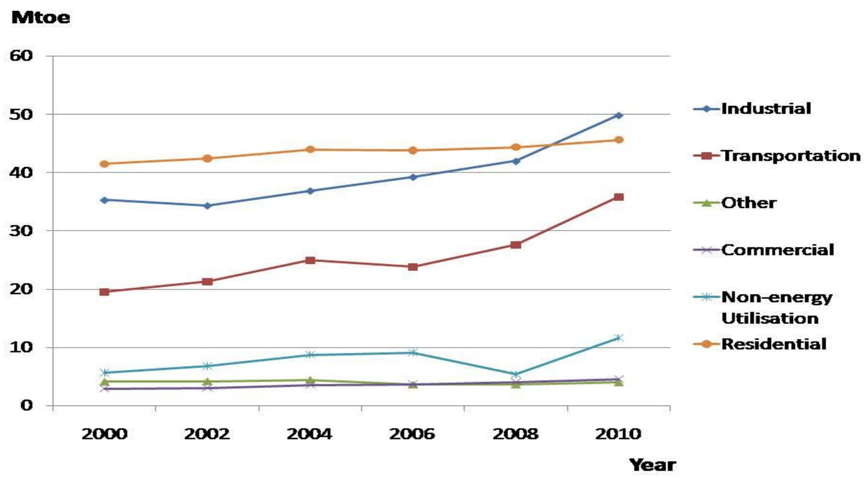

Figure 2. Indonesia Energy Consumption by Sectors 2000-2010 (in Million tonnes of oil equivalent)

Source: MEMR

Keeping up with the increasing energy demand in the country, Indonesia has been increasing its energy supply. In 2010, Its total energy supply reached 205.2 Mtoe exceeding the total demand in the same year (MEMR, 2011). As a rich country in resources as well as mineral resources, Indonesia highly depends on fossil fuel energy resources to meet its domestic energy demand. In 2010, around 76% of total energy supply comes from petroleum oil, coal, dan natural gas. The country's oil and oil product production reached 77.2 Million tonnes, while coal and natural gas production reached 39.4 Mtoe and 40 Mtoe (MEMR, 2011). Even though this share of fossil fuel resources has been decreasing compared to 2000 share which is 96%, the real amount of energy production has been increasing significantly in the past decade (see figure 3). It should be kept in my also, the figure includes non-commercial biomass as renewable energy source. If only commercial energy production calculated, the share of renewable energy sources in the total energy production would be decreased.

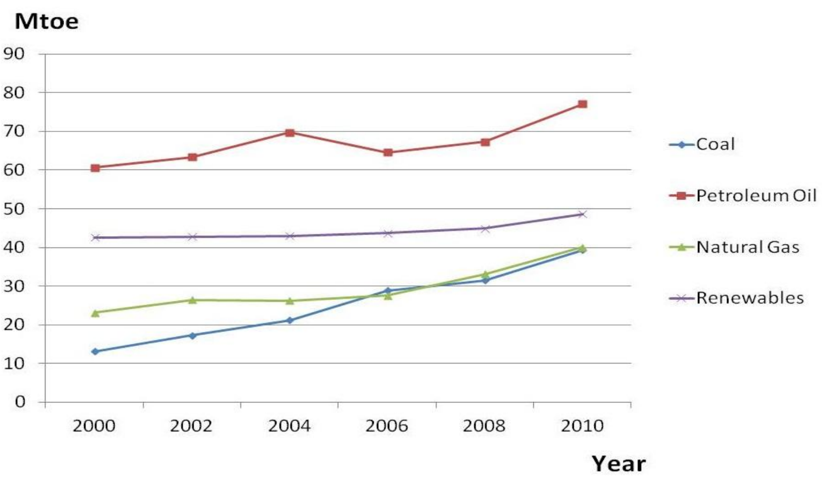

Figure 3. Indonesia Energy Consumption by Sources 2000-2010 (in Million tonnes of oil equivalent)

Source: MEMR

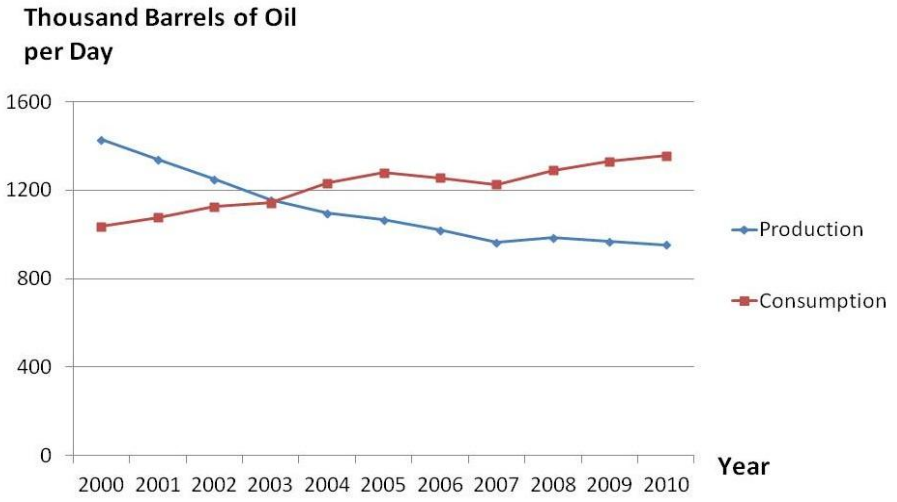

Figure 4. Indonesia Petroleum Oil Production and Consumption

Source: MEMR

Despite its high dependency on petroleum oil as energy source, Indonesia is facing a decreasing oil reserves in the country. The decreasing domestic oil production due to scarcity cannot keep up with the increasing demand of oil for power generation as well as fuel. In 2004, indonesia was forced to import oil from other countries because its demand which is 1233 barrels per day exceed domestic production at 1095 barrels per day (EIA, 2011b). Since then, the country suffers shortages in domestic production and in 2008 was forced to suspend its OPEC membership.

Indonesia is now importing petroleum oil to meet its domestic oil consumption. In 2010, Indonesia imported around 26 million barrels of refined petroleum products such as fuel oil and avtur (MEMR, 2011). Indonesia has to import refinery products not only because of its diminishing crude oil production, but also because of the small and limited capacity of refinery facility in the country. As a result, approximately 30% of its crude oil production has to be exported and refined in countries like Japan and USA (EIA, 2011b).

On the other hand, Indonesia is a leading coal and natural gas producer and exporter. The country has proven natural gas reserves of around 3 trillion cubic meters as of January 2011(EIA, 2011b). In 2010, Indonesia produced around 96.5 billion cubic meters of natural gas and around half of it were processed into LNG and exported to to other countries as the domestic demand was far below the production level (MEMR 2011). Coal also is an abundant energy resource in Indonesia. According to Pengkajian Energi Universitas Indonesia (PEUI), Indonesia has total coal reserves of around 38.8 billion tonnes of which 5.4 billion tonnes are exploitable. Like natural gas, coal production in Indonesia far exceed its domestic consumption, therefore Indonesia export its coal resources to other countries.

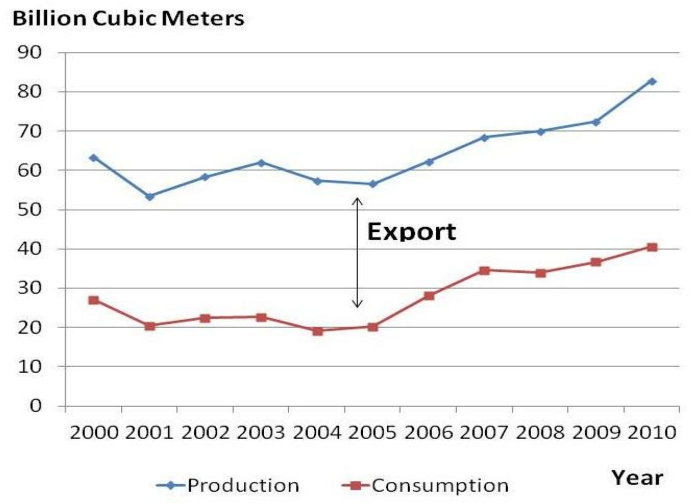

Figure 5. Indonesia Natural Gas Production and Consumption

Source: EIA

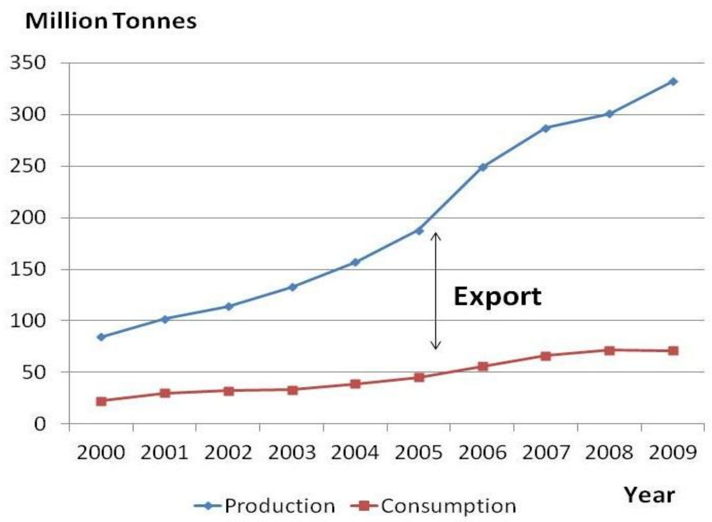

Figure 6. Indonesia Coal Production and Consumption

Source: EIA

Based on Presidential Regulation No. 5 /2006 on national energy policy, GOI issued the national energy blueprint 2005-2025 which defines the future plan for national energy mix. GOI set a target to increase the share of renewable energy in the final energy mix up to 15%, coal to more than 30%, and gas to more than 30%, while reduce the share of oil to less than 20% (MEMR, 2005)

2.2. Energy Producer

Energy industry in Indonesia was oncea monopolized by the government. Government owned energy company, Pertamina, was running the energy business from exploration until distribution. However, the country found the need to diversify and expand its energy sytem as the government's capacity to provide energy is limited compared to the growing demand of energy. In 2001, The Oil and Gas Law 22 about privatising energy industry in Indonesia was enacted and ended the government monopoly in energy production sector. Pertamina itself was converted to limited liability state owned enterprise, and will be privatised sometimes in the future.

The law states that private companies can explore and exploit energy sources in Indonesia with government issued license. Since the law enacted, there are more than 20 both domestic and foreign private companies such as Chevron, ExxonMobil, Sumitomo and Medco Energi got licenses from the the Government of Indonesia (GOI) to produce energy. However, the law states that companies that running upstream energy production business which include exploration and exploitation cannot run downstream energy production activities such as refinery and processing, transport, storage, and distribution, and the other way around (Oil and Gas Law no. 22/2001).

Chevron Pacific Indonesia Corporation, an American based multinational company for instance, is the largest crude oil and geothermal energy producer in Indonesia (Chevron, 2012). As for coal mining industry, domestic private companies such as PT. Bumi Resources are running the sector (Wellstead, J., 2011). Renewable energy industry such as hydro powerplant, geothermal energy and palm oil plantation are run by both private and public companies.

Pertamina, as the biggest energy company in the country, runs both upstream and downstream energy production activities. The company exploits oil, gas, and geothermal as energy sources together with its branches and partners in the country. Besides domestic production, Pertamina also operates in other countries such as Japan. Moreover in the gas sector, Distribution and other gas utility service are run by Perusahaan Gas Negara (PGN) or National Gas Company.

2.3. Energy Subsidy

Energy subsidy has been a feature of Indonesian energy policy since the Soeharto regime decades ago. Energy subsidy was implemented for several reasons. First, the government said that subsidy is the right of every citizen of Indonesia, as is written in 1945 Constitution. Moreover, the constitution also stated natural resources of high importance (including oil and natural gas) are managed by the government for the benefit of all Indonesian. Second, the government argues that oil subsidy is needed to support the livelihood of poor people and help to build and improve their economic wellbeing.

Under the energy subsidy, fossil fuel price are reduced greatly and not reflecting its true cost. For instance, national gasoline price is reduced by half from around USD 1/litre to 45 US cents/litre, and electricity price for household from average 9 US cents/kWh to 4.5 US cents/kWh.

Energy subsidy in Indonesia is divided into fossil fuel subsidy and electricity subsidy. Fossil fuel subsidy includes gasoline and diesel oil, kerosene, LPG, coal, and upstream and downstream oil and gas. In 2011, the GOI spent USD 20.5 billion for energy subsidy from the total overall subsidy of USD 25 billion (BPS, 2012). In 2012, energy subsidy also expected to exceed the original national budget. In 2012, the realisation of energy subsidy is expected to exceed its budget by USD 10.8 billion, from USD 21.4 billion to USD 32.3 billion.

Energy subsidy has been a big burden for the government considering the increasing oil price from time to time. Moreover, the high volatility of oil price also makes it very hard for the government to estimate the budget needed for the subsidy. Another problem arising from the practice of energy subsidy is that the subsidy that is originally target to support the poor people often ended up used by middle and upper class. For example, in case of subsidised gasoline, the middle and upper class that can effort having private cars are the ones that enjoy energy subsidy the most. In case of electricity subsidy, instead of limiting electricity subsidy for small voltage household category, the GOI also subsidising electricity for commercial and industrial categories as well.

Energy susbsidy for fossil fuel sources also believed to be one of the main barriers for renewable energy sector to develop because fossil fuel sector can effort a lower cost of production and thus throwing renewable energy sector out of the competition.

The GOI has been trying to cut the energy subsidy to save national budget several times. However, public resistance and demonstration towards the decision to cut subsidy have been giving the GOI a hard time to implement the decision.

2.4. Electricity

Like the developing energy sector, the electricity sector in Indonesia is also growing. The generation capacity in Indonesia in 2010 is 32,898 MW, increased by around 40% from generation capacity in 2000. Most of the installed power plants are run by the state owned electricity company, Perusahaan Listrik Nasional (PLN) or National Electricity Company. PLN generated around 131,000 GWh of electricity in 2010 (MEMR, 2011). This electricity generation is still heavily relying on coal as fuel source. Biomass and hydropower also contribute quite a siginificant amount of electricity generation compared to the other sources such as geothermal, solar power, and wind energy. However, PLN generated electricity is still not enough to meet the electricity demand that reached 150,000 GWh in 2010. Therefore indonesia also purchase electricity from other producers. (Perusahaan Listrik Negara, 2010).

Since the new electricity law no. 20 year 2002, electricity sector was restructured and privatised. The new regulation ends the monopoly of PLN as a single buyer and seller of electricity and start the new structure of multiple buyer and multiple seller (Nugroho, H., et al., 2005). Electricity sector activities used to be run fully by PLN, but now Independent Power Producers (IPPs) also taking part on electricity supply and distribution in the country even though PLN still dominating the sector (International Energy Agency, 2008). Those IPP, are only allowed to generate power and sell the electricity generated to PLN (International Energy Agency, 2008). The Indonesian government requires PLN to buy all electricity produced by IPPs that are generated using renewable energy sources using feed-in tariff mechanism as one policy to encourage renewable energy development (MEMR, Ministerial Decree 1122 K/30/MEM/2002).

Under the new electriciy law, IPPs are allowed to not only generate electricity and sell to PLN, but also all to deliver the electricity end-user directly. Just like PLN, IPPs can generate electricity to and choose between sell it to PLN to be mixed in national grid, or deliver it directly to end-user. The end-users are divided into five different tariff categories social, residential, commercial, industrial, and public facility, and each category has different electricity tariff (PLN, 2010). Currently IPPs only deliver electricity to commercial and industrial categories because the tariff for those two categories are more attractive from business point of view, while leaving the other three categories run by PLN (Nugroho, H., et al., 2005).

Furthermore, the electricity price does not reflect the true price since the Government of Indonesia is subsidising electricity. The electricity subsidy aims to make electricity affordable to all people in the country especially to poor lower class people (International Energy Agency, 2008). However, this subsidy eventually creates many problems both to the power sector and the government.

During the financial crisis in 1997/1998, the Indonesian currency, Rupiah (Rp), was depreciated fourfold against US Dollars from IDR 2400 to more than IDR 10,000 after recession and until now stays in the level of IDR 9,000 – IDR 10,000. This huge depreciation has been affecting the cost of generating power in the country that still rely on oil as a fuel to generate electricity. PLN's cost to generate electricity rose significantly. Although increasing of electricity price is a way to keep power sector stays in business, the Government of Indonesia forced PLN not to increase the electricity price. In return, the Government of Indonesia will make up the gap between PLN's cost and revenue. In short, electricity was subsidised from that moment. The increasing cost of electricity generation has been burdening the government with electricity subsidy (IEA, 2008).

In 2005, the electricity subsidy paid by the GOI was USD 1.6 billion and in 2008 the subsidy was increased to USD 3.2 billion. In 2012, the electricity subsidy was forecasted to reach USD 9.4 billion, exceed its quota by USD 2.4 billion (Agustiyanti, 2012). Electricity subsidy is clearly a burden for the GOI. Moreover, this situation earns PLN very little profit to make new investments in infrastructures needed. Electricity subsidy is believed to be the barrier for people who live in remote areas away from electricity access. On April 2012, The GOI asked PLN to raise the electricity price by 10% to ease the GOI's burden from electricity subsidy. Raising electricity price by 10% will reduce the government spend on subsidy by around USD 4 billion (Kusuma, R.R., 2012). Learning from this lesson, the GOI are encouraged to develop clean electricity generation using renewable energy.

Fulfilling the demand of electricity does not mean that all people in Indonesia have access to electricity. In 2011 electrification rate in Indonesia is 71% (Suprapto, H., Kurniawan, I., 2011). The electrifitation rate has been increasing compared to 2005 rate which is only 51% (International Energy Agency, 2008). However, due to the geographical difficulties, the majority of people in remote islands, especially in eastern Indonesia, still have no access to electricity. More investments on infrastructure are needed to give all people access to electricity.

In order to cope with the increasing demand and the target to increase electrification rate, the GOI introduce the Crash Program in 2006 aiming to add 10,000 MW power generation capacity. With the goal to add 10,000 MW new generation capacity, electricity sector in Indonesia entered the new phase of IPPs activities. The first phase of the program will be to add 10,000 MW new generation capacity using new coal fired power plants. The second phase is to add another 10,000 MW new generation capacity using alternative sources. Renewable energy resources were to contribute a significant amount of new capacity (MEMR, 2005).

2.5. Renewable Energy Sector

As explained in the earlier section, Indonesia is a country with an abundant renewable energy sources. This potential makes it possible for indonesia to reduce its dependency to fossil fuel resources and develop a clean energy system. Table 1 shows the potential of each existing energy sources in Indonesia and its current exploitation.

As an archipelago and having big amount of water resources, hydropower suits very well with Indonesia's energy system. Currently a total of around 4,000 MW capacity of hydro powerplants had been installed throughout the five major islands in Indonesia and 80% of them are operated by PLN. This number is still very low considering the huge potential that exist. An addition of 500 MW of mini or micro hydropower plant potentials has also proven and ready to be exploited in the country. In 2007, Indonesia received funding from UNDP for "Integrated Microhydro Development Program" to accelerate the development of hydropower in the country. Indonesia can yet still develop its hydropower potential to optimal utilization (Silviati, 2006).

Table 1. Indonesia Renewable Energy Potential and Installed Capacity

Renewable Energy	Proved Potentials	Installed Capacity
Hydro	75000 MW	4264 MW
Geothermal	28000 MW	1200 MW
Biomass	50000 MW	445 MW
Solar	1200000 MW	12.1 MW
Wind	9290	1.1 MW
Tidal	240000 MW	0

Source: MEMR

Having vast areas of forest and agricultural area, biomass is a promising source of energy in Indonesia. With the potential of around 50,000 MW, its commercial exploitation is still very low at around 445 MW. Power generation from biomass such as sugar, rice residues, and other agricultural wastes has been developed. However, currently production of biofuel, especially from palm oil, has been the main development focus in biomass sector. Indonesia set a target to develop its biomass sector to 810 MW capacities by 2025 (Silviati, 2006).

Located in the ring of fire with many volcanic activities, Indonesian territory holds about 40% of the total geothermal reserves in the world. The total potential is estimated at around 28,000 MW of capacities. The current exploitation of geothermal energy in Indonesia is still fairly low compared to its potential. However, the Indonesian government realised the importance of exploiting geothermal energy and encouraging its development through new policies and regulations. MEMR target to triple the current geothermal energy capacity by 2015 and make Indonesia the biggest geothermal energy producer in the world (Saptadji, 2010).

Being a tropical country, Indonesia also has a significant solar energy potential, estimated at around 4.8 kilowatt-hours per square kilometer per day. However, due to high initial investment cost, this sector has been developing very slowly. Until today the total installed capacity is only 12.1 MW. However, recently the government of Indonesia signed a contract with Sharp Corporation to cooperate building 100 MW capacity of solar panel in Indonesia. This news opens another opportunities for solar power sector to develop even more (Silviati, 2006).

Other renewable energy sources that also have a potential in Indonesia is wind power and tidal power generation. These two sources are the least developed renewable energy sector in Indonesia, but research and development in the country have been very keen on looking for the opportunities to develop these two sectors (Silviati, 2006).

To exploit and develop the potentials to their full capacities, the Ministry of Energy and Mineral Resources set new regulation about "Green Energy Policy" in 2003 that enhance renewable energy development and energy conservation. This regulation provides strategies and steps towards developing renewable energy industry in the country. Some policies implemented under this regulation includes: (1) investment and funding policy, (2) incentives policy, (3) energy price policy, (4) human resource policy, (5) information flow policy, (6) standarisation and certification policy, (7) research and development policy, and (8) institutional policy (MEMR, 2005). Some of these policies are proved very effective in supporting the enhancement of renewable energy projects, such as the policy that requires PLN to buy electricity generated from independent producers that utilise renewable energy sources. These policies were set to achieve the goal of increasing national energy security and encouraging the development of clean and sustainable energy system.

"Green Energy Policy" is also supported by Ministerial Decree 1122 K/30/MEM/2002, the previous policy set by the government in 2002 regarding small scale decentralised energy system. As one action to follow up the privatisation of energy industry in the country, this regulation allows private sector to generate power through small scale electricity generation using renewable energy and sell it to PLN. This regulation was also set to achieve the goal of increasing the electrification rate in the country, especially for rural and remote areas (MEMR, 2005). Moreover, the "Energy Blueprint 2005-2025" serves as a standard until what extent renewable energy in Indonesia should be developed by 2025. Having this target will help the government to keep the development on the right track.

3. Geothermal Energy Development in Indonesia

3.1. Potentials

As the biggest archipelago, Indonesia is blessed with vast amount of volcanic activity and is possesses a huge geothermal reserve. The geotectonic situation that places Indonesia between two tectonic plates and formed mountain ranges gives Indonesia high potential for geothermal energy (Carranza et al, 2008). Indonesia is known to have the biggest geothermal energy potential in the world. The are known 276 known geothermal energy fields or hotspots that made up a total potential capacity of approximately 28,000 MW (Saptadji, 2010). This number accounts for 40% of the worlds total geothermal energy reserves. The total 28000 MW geothermal energy potential is approximately equivalent to 9 billion barrels of oil. For comparison, the total approximate crude oil reserves in Indonesia in 2009 is 8 billion barrels. Geothermal energy has more potential than crude oil in Indonesia, thus geothermal energy is believed to be the way out for Indonesia to shift energy dependence on fossil fuel resources (Saptadji, 2010).

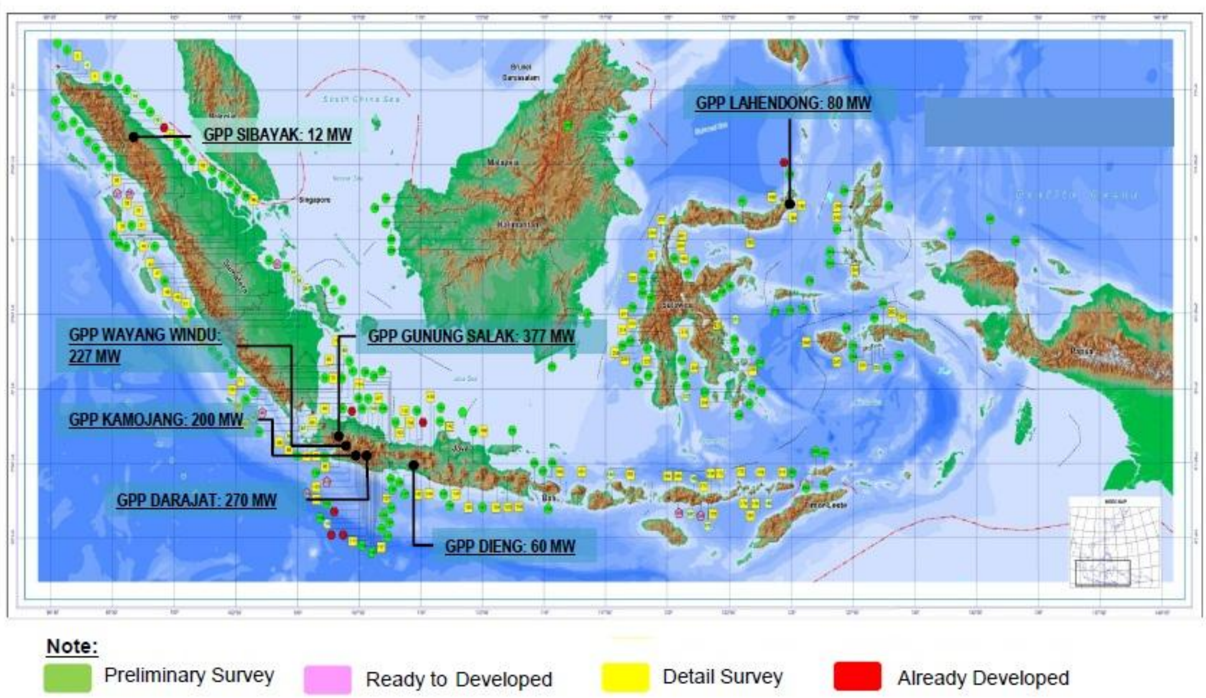

Figure 7. Map of Geothermal Hotspots in Indonesia and Installed Capacity

Source: MEMR

The Indonesian Ministry of Energy and Mineral Resources (MEMR) believes that the amount of geothermal energy reserve explored is not yet all the reserves available in Indonesia. There are potential more reserves unexplored, especially under the seafloor. As for the known potential geothermal hotspots, most of them are predicted to have temperature above 225 degree Celcius and the remaining have potential temperature of between 125-225 degree Celcius. This means geothermal energy reserves in Indonesia are very suitable for electricity generation purpose (Hochstein and Sudarman, 2008).

3.2. Earlier Development

The first development of geothermal energy in Indonesia was initiated during the Dutch colonial time in 1926. Geothermal hotspot in Kamojang, West Jawa, produced hot steam through its four wells, in which one of them is still in operation now. This was the first geothermal energy exploration and drilling activity in Indonesia. The operation in Kamojang was stopped in 1928 and geothermal energy operation in Indonesia practically stopped (MEMR, 2009).

The first commercial geothermal energy production was developed in 1972 by Pertamina and PLN. After ten years of exploration, drilling, and construction, 30 MW geothermal power plant in Kamojang was established in 1983. This project partialy was funded by the Government of New Zealand with total fund of USD 34 million. Besides geothermal power plant in Kamojang, Pertamina and PLN also established two monoblock with 2 MW total capacity in Kamojang and Dieng (MEMR, 2009).

In 1981, GOI enacted Presidential Decree No.22/1981 that pointed Pertamina to expand its exploration and exploitation in geothermal energy production in Indonesia. During 1980's Pertamina expand its research and exploration on geochemistry, geophysics, geology, and geothermal potential mapping. In 1982, Pertamina signed contract with Unocal Geothermal of Indonesia to develop GWF in Gunung Salak, and geothermal power plant in Gunung Salak was established in 1994 (MEMR, 2009).

In 1991, GOI enacted Presidential Decree No.45/1991, another regulation on geothermal business development that replace Presidential Decree No.22/1981. This regulation gives more space and authority for Pertamina to expand and exploit geothermal energy and to create joint venture with private companies to develop geothermal energy production, and to sell electricity produced to PLN. Moreover, in the same year GOI enacted Presidential Decree No.49/1991 to replace Presidential Decree No. 23/1981. This new regulation states that income tax for geothermal energy developer is reduced from 46% to 34% to give more incentives for development. During 1990's, three other geothermal power plant was commisioned in Wayang Windo, Lahendong, and Sibayak (MEMR, 2009).

In 2003 GOI enacted Law No. 27/2003, the new geothermal energy law that supplement Presidential Decree No.45/1991. This new law provides a comphrehensive guide for business sector to develop geothermal energy projects in Indonesia. The current existing geothermal energy projects are mainly divided into projects before Law No.27/2003 and after Law No. 27/2003 (MEMR, 2009).

3.3. Current Installed Capacity

Out of 276 known geothermal hotspots, 54 of them are already issued as Geothermal Working Area (GWA) by the GOI. Nineteen of which issued and developed before the issuance of new Law No.27/2003, while the remaining 35 GWAs issued and developed afterwards. From the total 54 GWA, 7 GWA are already in production with the total installed capacity of 1,226 MW. These GWAs are Sibayak, Gunung Salak, Wayang Windu, Kamojang, Darajat, Dieng, and Lahendong. Table 2 shows the current GWA in production and their installed capacity (Sukarna, D., 2012).

The GOI and developers plan to increase the capacity of existing GWA in production to 365 MW by 2014 with the detail plan as follow: 7.5 MW addition to GWA Sibayak, 125 MW to

GWA Wayang Windu, 110 MW to GWA Darajat, 55 MW to GWA Dieng, and 67.5 MW to GWA Lahendong. The remaining 47 GWA are still under tender process to developer, or under construction and development (MEMR, 2012a). Besides those seven GWA in production, there are 10 GWA with the total capacity of 665 MW, including GWA Sarulla and GWA Ulubelu with 220 MW and 110 MW capacity plan respectively, under construction by both PT Pertamina Geothermal Energy and private developers. However the GOI plan to increase the production capacity to 3,465 MW by 2014 using the exisiting GWA in production and new GWA (Sukarna, D., 2012).

Table 2. Existing GWA in production in Indonesia

No	Geothermal Working Area	License Holder	Developer	Name of Power Plant	Installed Capacity (MW)
1	Sibayak – Sinabung	PT Pertamina Geothermal Energy	PT. Pertamina Geothermal Energy	Sibayakl	12
2	Cibeureum – Parabakti	PT Pertamina Geothermal Energy	Chevron Geothermal Indonesia, Ltd	Salak	337
3	Pangalengan	PT Pertamina Geothermal Energy	Star Energy	Wayang Windu	227
4	Kamojang – Darajat	PT Pertamina Geothermal Energy	PT Pertamina Geothermal Energy	Kamojang	200
5	Kamojang - Darajat	PT Pertamina Geothermal Energy	Chevron Geothermal Indonesia, Ltd	Darajat	270
6	Dataran Tinggi Dieng	PT Pertamina Geothermal Energy	PT. Geo Dipa Energi	Dieng	60
7	Lahendong - Tompaso	PT Pertamina Geothermal Energy	PT Pertamina Geothermal Energy	Lahendong	80
	TOTAL				1226

Source: MEMR

As a state owned company, PT Pertamina Geothermal Energy (subsidiary of PT Pertamina) is pointed by the GOI to be the license holder to most of GWA in Indonesia. Most of the existing GWA in production and GWA under development are either developed solely by PT Pertamina Geothermal Energy or developed by joint venture of PT Pertamina Geothermal Energy and private developers such as Star Energy, Supreme Energy, and Chevron Geothermal Indonesia. With the new regulations that allows private actors to take part, national plans and targets, and incentives given to private industry, the number of private investor and developers as well as IPP's in geothermal energy sector are increasing rapidly.

3.4. Development Plan and Second Crash Program

As a response to energy blueprint 2005-2025 that promote significant increase of renewable energy portion in final energy mix, the GOI and MEMR issued Indonesia geothermal roadmap 2006-2025. According to the geothermal roadmap, GOI set a target to increase the geothermal capacity to 9500 MW by 2025 from the 2006 capacity which was only 852 MW (PLN Geothermal, 2009). In 2008, Indonesia was supposed to increase its capacity to 2,000 MW, yet only 1189 MW were installed in 2008. Moreover, in 2012 Indonesia supposed to have another additional capacity and increase its geothermal capacity to 3,442 MW, again only 1,226 MW of geothermal capacity installed up to date.

To catch up with the schedule and keep the geothermal energy development on track according to geothermal roadmap, MEMR annouced yet another goal to increase geothermal capacity to 4,500 MW by 2015. MEMR rely on the expansion of existing GWAs in production as well as new GWAs that are under construction and development to achieve this shorter term goal.

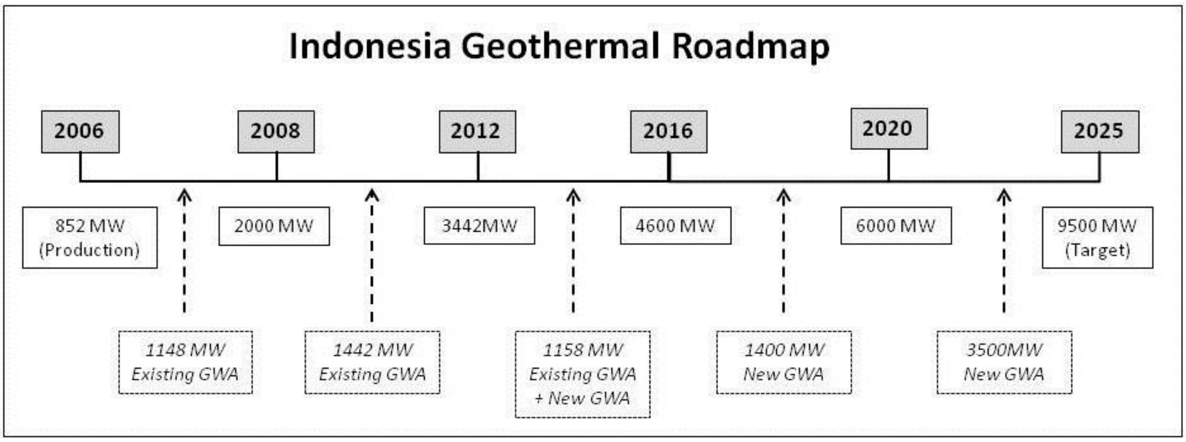

Figure 8. Indonesia Geothermal Roadmap

Source: MEMR

Since early 2006, GOI implemented the “Crash Program” to add 10,000 MW electricity generating capacity using new coal fired power plants to meet the increasing electricity demand. This program ended in 2011. To support rapid development of geothermal energy, as well as to keep up with the increasing energy demand in Indonesia, GOI announce “Crash Program Phase II” where another additional 10,000 MW electricity generating capacity will be added to the national grid. Unlike the first phase of the program that only focused on establishing new coal fired power plants, the second phase of the program prioritise renewable energy share, especially geothermal energy and hydro energy (Gipe, P., 2012).

Significant amount from the proposed 10,000 MW new capacity will be derived from geothermal energy which is 4,925 MW (Sukarna, D., 2012). This target will be made up from the expansion of existing GWAs in production which add 465 MW capacity, development of not yet in production of existing GWAs which add 1,535 MW capacity, and the development of new GWAs which add 2,925 MW capacity. Achieving the proposed target will lead Crash Program Phase II the single largest carbon mitigation project in the world. During Crash Program Phase II, an estimated 400 million tonnes of CO_2 will be mitigated (Sukarna, D., 2012).

4. Economic Intruments for Geothermal Energy in Indonesia

4.1. Feed-in Tariff

4.1.1. The rationale of Feed-in Tariff Policy

Feed-in Tariff (FIT) is an energy policy that support the development of renewable energy use and increase energy security supply by offering a long term purchase agreement for the generation and sale of electricity produced from renewable energy sources (Menanteau et al, 2003). The main principle of FIT policy is to offer a guaranteed prices for a certain period of times, usually ranging from 10-25 years, for electricity produced from renewable energy sources (Couture, T., Gagnon, Y., 2010). The price rate/tariff offered defined in every kilowatt hour (kWh) electricity produced and may differs according to the types of renewable energy sources, geographical location, technology, availability of other energy source, or even project specific variables (Mendonca, M., 2007; Fouquet, D., Johansson, T.B., 2008). FIT is not limited to large-scale power producers participation as it allows households, land-owners, municipalities, and small businesses to take part in the renewable energy investment and electricity generation (Klein et al, 2008).

The central provisions of FIT policy are (1) the guaranteed access to the grid, (2) long-term electricity purchase agreements, and (3) payment level based on the cost of generation (Mendonca, 2007). By addressing the key provisions, the risk of investment on renewable energy is greatly reduced and thus encouraging the rapid investment and growth of renewable energy industry. This investment security particularly important in the capital intensive projects like renewable energy projects that have high initial investment cost for the technology and infrastructure (Guillet, J., Midden, M., 2009).

The success of FIT policy is determined with the design of renumeration models of the policy. There are a number of different types of FIT design and each of them shows different level of success in the real implementation. This does not mean that one design is better than the others, but the choice of FIT design has to fit the situation in which the policy is implemented (European Commision, 2008). Different FIT designs generally fall into two categories: (1) Market independent FIT where the tariff level does not depends on the spot electricity price, and (2) Market dependent FIT where the tariff level depends on the spot electricity price (Kim, K.K., Lee, C.G., 2012). In the next section, different types of FIT designs together with their strength and weakness will be described.

4.1.2. Types of Feed-in Tariff Design

4.1.2.1. Market Independent Feed-in Tariff

Market independent FIT policy offers a fixed price or minimum price of payment for every kilowatt hour electricity sold. However, there are some adjustments made to the market independent FIT policy such as whether the tariff is adjusted with inflation overtime. In this section, different types of market independent FIT policy is examined.

The first one and the most basic market independent FIT is *fixed priced FIT policy*. Under this policy, renewable energy producer is offered a fixed and unchanged amount of money per kWh over a fixed period of time (Langniss, O et al., 2009). Other variables such as inflation, Consumer Price Index (CPI), oil price, etc are ignored in the implementation. This FIT policy model offers investors a security in investment and allow the investors to project the future revenues (Couture, T., Gagnon, Y., 2010). However, disregard the other variables mentioned above might lead to miscalculation of real revenues because the other variables such as inflation tends to reduce the real value of income (Fell, H.J., 2009).

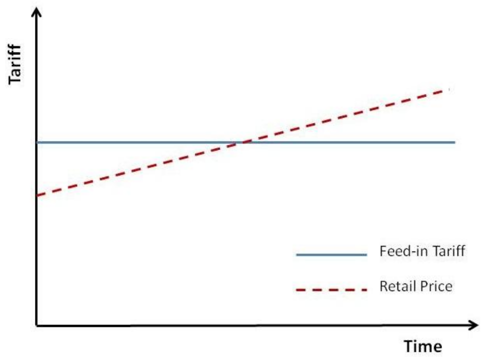

Figure 9. Fixed-price FIT Policy

Source: Langniss et al, 2009

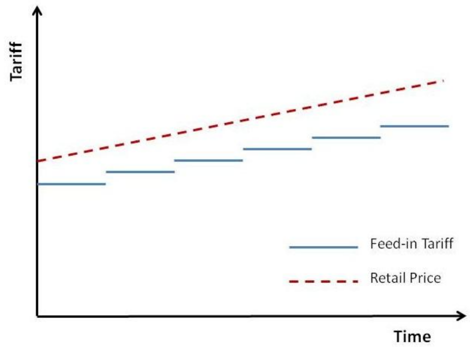

Figure 10. Fixed-price FIT Policy with Inflation Adjustment

Source: Langniss et al, 2009

The second one is *fixed price with inflation adjustment FIT policy*. Under this policy, the tariff set is increasing adjusted with the inflation rate overtime and provide a protection for renewable energy developers against the decline of real value of revenue. This policy provide a high degree of investment security for the investors, but under this policy, it is very difficult to project the future income as it is difficult to forecast the changes in inflation rate (Couture, T., Gagnon, Y., 2010).

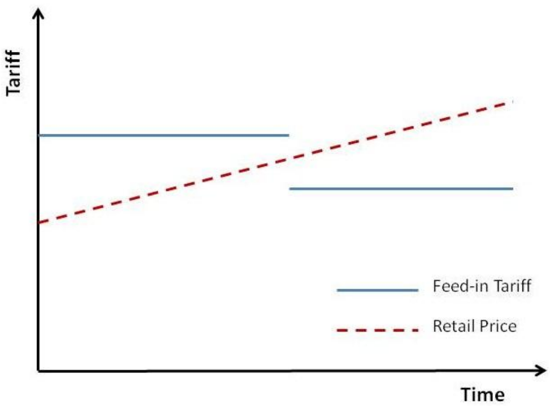

Figure 11. Front-end Loaded FIT Policy

Source: Langniss et al, 2009

The third one is *front-end loaded FIT policy*. Under this policy higher tariff is offered in the early years of the contract time period and decreased in the later years. The total amount of money received by the renewable energy producers under this policy will be the same as the total received under fixed price FIT policy, but the allocation of money is higher during the first years. This encourage innovation from renewable energy developers to reduce their production cost in the later years. This policy also allow the developers to benefit from receiving higher revenues in times when higher revenues are needed to pay off the loans for investment. This policy also allows the developer to forecast its revenues throughout the entire project life-time giving additional benefit for investment security (Couture, T., Gagnon, Y., 2010).

4.1.2.2. Market Dependent Feed-in Tariff

Market dependent FIT policy offers a changing tariff price based on the market price of electricity and its premium. Premium rewarded to renewable energy producers can be based on the value of environmental and social cost avoided (Cory, C.K et al, 2010). Market dependent FIT often implemented in the deregulated electricity market which has a fluctuating electricity price in relation to fuel cost and supply and demand (Couture, T., Gagnon, Y., 2010). There are also several types of market dependent FIT policy adjusting the circumstances.

The first Market Dependent FIT policy is *Premium Price FIT Policy*. Under this policy, the tariff paid to the renewable energy producers is the market price of electricity and the fixed amount of premium on top of it. When the electricity price increase, the tariff paid to the renewable energy producers increase, and vice versa. Unlike the fixed price FIT policy, premium price FIT policy risks over-compensating or under-compensating the renewable energy due to fluctuating electricity price. To avoid over or under-compensating, "caps and floor" were introduced in the FIT mechanism.

Figure 12. Premium Price FIT Policy

Source: Langniss et al, 2009

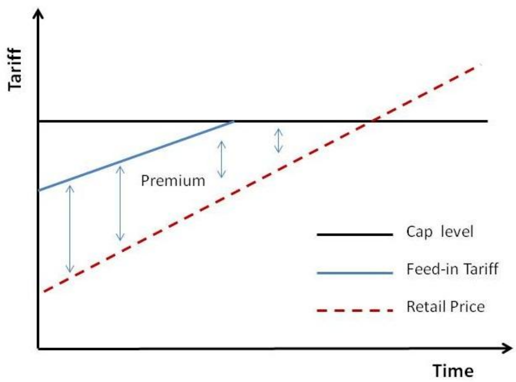

Figure 13. Caps and Floor FIT Policy

Source: Langniss et al, 2009

Under the *Caps and Floor FIT Policy,* the premium paid to renewable energy producers are not fixed. When the electricity price is low, the premium paid to the producers increase to guarantee minimum payment of FIT policy. On the other hand, as the electricity price increse, the premium paid decrease to avoid over-compensation until the premium reach zero and producers received FIT payment with the same level as electriciy market price. Caps and floor FIT policy give payment security to the producers by putting minimum and maximum payment, as well as protecting the electricity buyer and distributor from too high FIT payment.

Figure 14. Percentage of Retail price FIT Policy

Source: Langniss et al, 2009

The last type of FIT policy is percentage of retail price FIT policy. The principle of this policy is the same as Premium Price FIT Policy, however instead of adding a certain amount of premium on top of electricity price, the premium is determined by the percentage of electricity price. The higher electricity price, the higher premium paid and vice versa.

4.1.3. Feed-in Tariff Policy in Indonesia

Because electricity distribution is still dominated by PLN, FIT policy is currently the single source of income for renewable energy producers in Indonesia, including geothermal energy producers. Standarisation of FIT policy for geothermal energy was implemented in 2011 with the enactment of Ministerial Regulation No. 02/2011 on geothermal price structure. According to the regulation, FIT rate geothermal energy was set on the level of 9.7 cents/kWh. This level is very low compared to the electricity purchase from coal resource which are 35 cents/kWh. Other FIT rate for electricity produced from renewable energy such as hydro power and biomass were also very low compared to the rate for those produced from fossil fuel.

However, the serious commitment to develop its geothermal energy potential made the GOI set new policies regarding geothermal energy production, including FIT level. In July 2012, MEMR set up a new FIT for geothermal energy. Moreover, the government requires PLN to purchase all electricity from small scale renewable energy producer that secure the revenue stream. Table 3 below shows the new FIT level set by MEMR in July 2012.

The new FIT price in Indonesia was set as a Fixed Price FIT Policy with the differentiation of tariff in each region in the country. MEMR admit that in case of Indonesia, FIT policy can not be standardised on the same level for the whole region because of the different social, economic, and geographical condition. Assessment to determine the FIT price in each region also undergoes different criteria.

Table 3. New FIT price in Indonesia

Area	Price (Cent US$ / kWh)
Sumatera	10
Jawa, Madura, and Bali	11
Sulawesi Selatan	12
Sulawesi Utara	13
Nusa Tenggara Barat and Nusa Tenggara Timur	15
Maluku and Papua	17

Source: MEMR

The tariff in Sumatera is set the lowest at 10 cents/kWh with the justification that Sumatera has other alternative energy sources such as biofuel from palm oil plantation. Putting too high FIT price on geothermal energy might throw the other energy sources out of the competition and undeveloped.

In Jawa, Madura, and Bali, the region with highest density, FIT price is put on 11 cents/ kWh. Even though this region also has many other alternative energy source, the FIT price is put slightly higher from Sumatera's level because of environmental carrying capacity reason. By putting the level higher, more development on this region are expected to reduce the environmental problems created because of high density of population and economic activities.

FIT price in Sulawesi Selatan (South Sulawesi) and Sulawesi Utara (North Sulawesi) are set on 12 cents/kWh and 13 cents/kWh. The justification for these region is that both of them have an economy based on tourism and massive development of geothermal energy might disrupt the nature of tourism in the region. Moreover, the reason South Sulawesi has slightly lower FIT price is because it has more alternative energy sources available.

In Nusa Tenggara Barat (West Nusa Tenggara) and Nusa Tenggara Timur (East Nusa Tenggara) FIT price is set on 15 cents / kWh with the consideration of higher electricity generation cost and the unavailability of other source of energy in the region.

Lastly in Maluku and Papua region FIT price is set on 17 cents/kWH with the consideration of high electricity generation cost and the low electrification rate in the region. MEMR set high FIT price in this region expecting the development in Maluku and Papua will be massive and immediate to increase electrification rate.

However, the new FIT price is not eligible for all geothermal energy projects. Only new projects started after July 2012 are eligible for the new FIT price, while the ongoing projects will keep the previous 9.7 cents/kWh until the project contract ended and renewed.

4.2. Tax Incentives

4.2.1. The Rationale of Tax Incentive

Zee et al states that tax incentive is special tax provision granted to qualified investment projects that has the effect of lowering the effective tax burden on those projects, relative to the effective tax burden that would borne by the investors in the absence of special tax provision (Zee et al, 2002). Tax incentives are usually given in the form of tax credit, tax holiday, tax deduction, or even tax exemption. Tax incentives are very common tools used in many countries to encourage the rapid development of a particular industry and attract more investment. Attracting Foreign Direct Investment (FDI) in particular has been the main objectives of implementing tax incentives in a country. The United States, for example, have been using tax incentives for over 90 years to promote energy supply industry historically from the conventional fossil fuel energy sources to renewable energy sources (Hymel, M.L., 2006).

Tax incentives can target both individual or corporation. By providing tax incentives for corporations, corporations are expected to have higher investment Rate of Return over a period of time and thus makes the related industry more attractive for investment and development. From the macroeconomics perspective, tax incentives reduce the effective interest rate and thus increase the aggregate amount of money invested in the industry (Sawyer and Wirtshafter, 1984).

Tax incentives are not always the best solution since they will create a economic distortion between projects that receive incentives and projects that do not. This condition might encourage one particular industry and throw the other related industry out of the competition (Zee et al, 2002). However, the right justification of using tax incentives is to rectify market failures such as negative externalities. In this sense, some particular projects, such as renewable energy projects, are compatible with tax incentives implementation since they reduce negative externalities or promote positive externalities (Cansino, J.M., et al, 2010). Renewable energy projects will have higher investment cost due to the nature of including social and environmental cost, and thus introducing tax incentives to such industry will lift the competitive advantage and encourage more investment.

Aside from the objective of encouraging investment, tax incentive has some costs associated with its implementation namely distortion cost, revenue cost, administrative cost, and social cost. Distortion cost may arise because the amount of tax incentives provided does not exactly conform the amount of externalities associated. Such cost will arise even more when the projects have lower capability to internalize externalities. Revenue cost is the amount of tax income lost burdened by the government of the country when industries and projects are released from tax. Administrative cost associated with the cost required to administer, implement, and encourage the tax icentives. The amount of cost will increase as the tax provision scope increase and gets more complicated, and also when the provision involves more actors in its implementation. Rent seeking behavior and corruption also becomes very common social costs related to tax incentives and thus reducing the social wealth (Zee et al, 2002).

In this sense, designing tax incentives provision have to consider the cost-effectiveness of the provision. The tax provision has to be designed in a way that the cost really account for the externalities associated and effective enough to bring out the desired level of investment and development.

In general, tax incentives can be grouped into direct tax incentives and indirect tax incentives. Direct tax incentives commonly associated with Corporate Income Tax (CIT). Direct tax incentives can be as a reduction of income tax rate (or even CIT holiday) earned by the company or in the form of investment cost recovery. On the other hand, indirect tax is not related to the companies income tax and usually present to reduce operational barriers. Indirect tax can be in the form of exemption or reduction of import tariff, sales tax, and Value Added Tax (VAT) (Zee et al, 2002).

To promote rapid development of renewable energy industry, GOI also introduced tax incentives. Renewable energy developers get five different tax incentives which includes incentives for: (1) corporate income tax, (2) VAT, and (3) custom duties. The next section will discuss these five tax incentives implemented by GOI.

4.2.2. Corporate Income Tax

Corporate income tax incentives commonly presence in the form of corporate tax rate reduction, investment tax credit, tax holiday, or accelerated depreciation. Tax holiday is the most common form of tax incentives in the developing countries because of its ability to reduce cost of capital significantly for investor and thus increase the Net Present Value (NPV) of the project (Lin, K.Z., 2006). Corporate income tax reduction might also present in the form of direct rate reduction or in the form of investment tax credit. Investment tax credit is a tax provision that reduce a corporate income tax by deducting taxable income by a specified percentage of total money spent on capital investment. With the capital reimbursement, the cost of capital of a certain project will be reduced and thus increase the investment (Mankiw, N.G., 2007). In Indonesia, renewable energy producers get corporate income tax incentive in the form of investment tax credit and accelerated depreciation and amortization (Armadhana, R., private communication, July 22, 2012).

According to Government Regulation No.62/2008, renewable energy producer will have a income tax reduction of 30% from project's total investment allocated to 6 years period, or 5% anually. Under this provision, the corporate's taxable income is deducted by the amount of 30% of total investment (or 5% annualy). After deducted, the corporate's taxable income is a subject of 25% corporate income tax.

The normal corporate income tax rate in Indonesia for other industry is 25% from taxable income annualy, and 50% of income tax reduction might be granted for small to medium size business. However, geothermal energy production projects that requires a significant amount of investment are most most probably not eligible for such provision.

In addition to income tax rate reduction, the government provide compensation of loss carry forward for more than 5 years and less than 10 years period. Corporates also excluded from income tax article 22 on import for equipment and machinery, which is also a subject of VAT and custom duties (Anwar and Mulyadi, 2011) .

Accelerated depreciation and amortization also introduced by GOI as another form of corporate income tax incentive. In Indonesia, corporates can choose the method of depreciation calculation either straight line method or double declining method. Table 4 shows the difference between depreciation method with government incentive and without incentive.

Table 4. Depreciation Rate with Incentive in Indonesia

Type of Asset	Depreciation rate (Straight line) with incentive (%)	Depreciation rate (Straight line) without incentive (%)	Depreciation rate (Double declining) with incentive (%)	Depreciation rate (Double declining) without incentive (%)
Non Building – Group I	50	25	100	50
Non Building – Group II	25	12.5	50	25
Non Building – Group III	12.5	6.25	25	12.5
Non Building – Group IV	10	5	20	10
Permanent Building	10	5	-	-
Non Permanent Building	20	10	-	-

Source: MEMR

Under the incentive of accelerated depreciation and amortisation, assets will be fully depreciated twice faster. For non-building group 1 for instance, when using straight line depreciation method, the asset will fully depreciated in 4 years without incentive. However, with incentive, the asset will be fully depreciated in 2 years, and in the third year, it will not have an effect on net income (taxable income) anymore.

4.2.3. Value Added Tax (VAT)

Value Added Tax (VAT) is a form of consumption tax that is burdened to the consumers based on the added-value on the product of service they purchase. The amount of value added taxed is the amount of sale price deducted by production cost (Bhatia, K,B., 1982).

In case of producer, or specifically renewable energy developer, VAT reduction or exemption may be given as a form of tax incentives. VAT reduction or exemption is given to the imported equipment or other materials needed to conduct exploration or to build and establish the infrastructures for renewable energy project development.

In Indonesia, in general, imported goods are a subject of 10% VAT. However, according to Ministry of Finance Regulation No. 21/PMK.011/2010, geothermal energy developers receive VAT exemption for importing equipments for exploration and building infrastructure. The equipments exempted from VAT must fall under some criterias: (1) The equipments are not produced in Indonesia, (2) the equipment are currently being produced in Indonesia, but have not yet fulfill the necessary specification, and (3) the equipments are produced in Indonesia, but the number of produced unit is not enough for industrial purpose (Anwar and Mulyadi, 2011).

4.2.4. Custom Duties

Custom duty is a tariff collected to a goods imported or exported. According to Ministry of Finance Regulation No.177/PMK.011/2007, Indonesia provide incentives for geothermal energy developers through custom duty exemptions for all imported equipment and machinery necessary for exploration and building geothermal energy development. Custom duties exemption is rewarded to developers that already signed contract for Geothermal Working Area

(GWA) with GOI, PT. Pertamina, and to PT. Geo Dipropa Energi as state owned geothermal energy developers. The equipment and machinery that are exempted from custom duties must fall under the same criteria as the ones in VAT exemption (Sukarna, D., 2012).

4.3. Government Fund and Guarantee

To fasten the exploration of geothermal energy resources, in 2011 the GOI establish Geothermal Fund Facility, or Revolving Fund which was established as a response of the Finance Miniester Decree Number 286/2011. With the total budget of USD 145 million, Geothermal Fund Facility is operated by Indonesia Investment Agency (IIA) under Ministry of Finance with the main objectives to: (1) to help potential developers and investor getting sufficient data on pre-leminary survey on to reduce the risk of geothermal exploration activities, and (2) to support financing of exploration activities by developers (Wahjosoedibjo and Hasan, 2012., IIA, 2012). Based on the objectives, Geothermal Fund provides two facilities which are (1) provision of exploring data/information and (2) loans for exploration activities.

The IIA indicates that Geothermal Fund is eligible for (1) Local/provincial government that issue geothermal business permits to developers, (2) developers that already received geothermal energy business permit, and (3) holders of geothermal concession before Law 23/2007 (Wahjosoedibjo and Hasan, 2012., IIA, 2012).

Moreover, to ensure the smooth geothermal projects development, GOI provides guarantees for exploration and development activities for geothermal developers and IPPs. Previously, GOI provides guarantee payment of electricity sold to PLN by IPPs even if PLN was not able to fulfill its obligation to buy electricity from renewable energy IPPs. However, developers argued that such guarantee alone is not enough and they demand guarantee on exploration and facility establishment phase also (Fadillah, R.D., 2011c). As a response, in 2011 GOI announced another guarantee for any failures in exploration activities in order to develop geothermal energy projects. The GOI provides around USD 39 millions in 2011 to compensate any failure in 2011 (Fadillah, R.D., 2011b).

4.5. Banking Policies

Environmental and sustainability issues vary to problems that are more tangible such as deforestation, carbon emission and climate change to problems that are intangible such as how to finance projects and activities that reducing those tangible problems. Reducing environmental degradation and enhancing sustainable development without a doubt requires a big amount of money for capital investment. Renewable energy industry for instance requires a advance technology which is expensive to install.

Banking industry, even though it is not directly contributing to environmental degradation, provides most of the money needed for capital investment to make sure renewable energy projects develop. Even though it has no specific definition, green banking is following the principle of including environmental and sustainability criteria for project loans and funds. Under this principle, projects that are proved that could enhance environmental protection while boosting an economy is given a priority for loan. On the other hand, projects that might reduce or destroying environmental quality will be given less priority or no priority to receive loans.

Bank Indonesia (BI), the central bank of Indonesia, announced its readiness to support sustainable development program, including renewable energy projects development, through

Green Banking policies in Indonesia (Setijawan, E., 2012). BI is currently working towards the completion of Green Banking policies and regulations, and BI targets that it will be issued in 2012. The policies and regulations mainly focus on financing activities for businesses and projects that meet environmental and social standard requirements and projects that enhance environmental protection. On the other hand, banks that provide financing to businesses and projects that do not meet those standard requirements will be sanctioned (Hans, G.N, 2012). The figure below shows the Green Banking framework by BI.

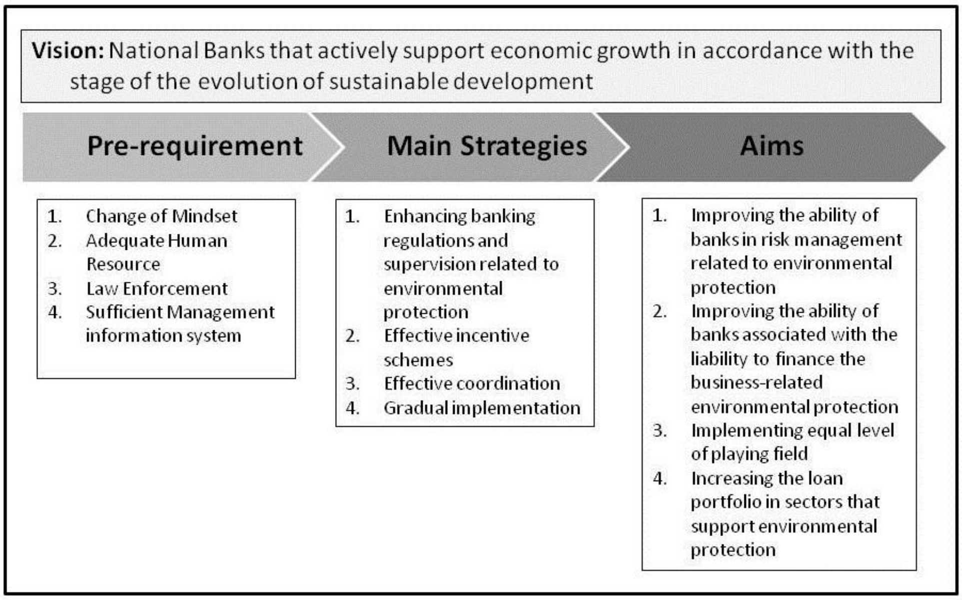

Figure 15. Indonesia Green Banking Framework

Source: Bank Indonesia

BI also provides incentives for banking sector, to enhance the widespread implementation of Green Banking principles. Incentives given are including (1) incentives for Human Resource Development such as top management, risk management, and credit management training with sustainable principle and provide "Environment and Social Risk Analyst Certification" for those who already finished the training, (2) recognition incentives by giving Green Banking award for banks that successfully implement Green Banking principles, and (3) information incentives by giving easy access to a clear Green Banking scheme, government regulations, and other necessary information (Banjarnahor, D., 2012).

5. Analysis and Discussion

5.1.Evaluation of the Economic Policies and Incentives

The FIT is probably the most important policy that support the development of geothermal energy in Indonesia. Unlike some European countries that reward renewable energy producer with "Green Certificate[2]" or the opportunity to sell emission quota using Emission Trading Scheme (ETS)[3], FIT is the single source of income for geothermal energy producer in Indonesia. Consequently, the design of FIT remuneration model is important to attract more investment in this sector (Couture and Gagnon, 2010).

Indonesia is currently using the most basic design of FIT policy model, the fixed-price model with the rate differentiated among regions. Fixed-price model is believed to better fit the Indonesia electricity sector situation which is market independent and highly subsidized. Because of the fixed electricity price, using market-dependent FIT design that depends on electricity price and premium added will not bring significant difference to FIT rate. Moreover, calculating the FIT remuneration based on the subsidized electricity price means the FIT price paid hardly reflect the true cost of electricity production from geothermal energy and thus may reduce the attractiveness of geothermal energy sector for potential investors.

The MEMR decision on differentiating the FIT rate for each region will also better fit the situation in Indonesia which is very dynamic in terms of geographical, social, and economic. The rate set for each region is believed already reflecting the true production cost of geothermal energy in each region. In Papua for example, the lower availability of human resource, the cost of electricity distribution, and higher administration cost will result in higher production cost. If the FIT rate in Papua was set at the same level as Java which has a complete opposite condition, developers might have difficulties to earn enough profit to keep the project GOI for long term. Thus setting higher rate for this region is very reasonable, and the final profit for developers will not differ significantly between projects in Papua and those in Java. On the other hand, if FIT rate in Java is as high as the one in Papua, there will be over-allocation of FIT budget occur.

The FIT price set (see table 3) by MEMR is also believed to bring enough incentive for investors considering the high internal rate of return[4] (IRR). The previous FIT price, which was 9.7 cents / kWh, is argued can only bring IRR of lower than 9%, where the reasonable IRR for renewable energy projects are 11-14%. However, the current FIT price can increase IRR of investors up to 19-20% (Astria, R., 2012). The current FIT price surely will attract more investors to develop geothermal energy in Indonesia. However, PLN argues that raising the FIT price to these level is not necessary and will add more burden to the government for subsidising electricity. This critique was countered by Indonesia Renewable Energy Society (METI) that in order to balance the electricity subsidy, instead of decreasing the price for renewable energy, the government should have decrease the price put on electricity from fossil fuel sources (Isu energi, 2012).

However, Surya Dharma argued that differentiation of FIT price based on regions is not reflecting the true economics of geothermal energy production. This differentiation is mainly

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[2] A certificate that woth economic value that is given for electricity producer that use renewable energy source for generation

[3] Market-based approach used to control pollution by providing economic incentives for achieving reductions in the emissions of pollutants.

[4] Rate of return used in capital budgeting to measure and compare the profitability of investment.

based on the factors that are not directly affecting the geothermal energy project investment and operation cost such as availability of other energy sources and economic and social situation in the respected region. Meanwhile, investment and production cost of geothermal energy fully depends on the nature of geothermal system in the respective GWA, the infrastructure, and the capacity of the geothermal energy plant. The capacity of the geothermal energy plant is one example, the larger the capacity means the less investment and production cost per MW. If we take Java for example, in Java there are many kinds of GWAs. There are GWAs that can support large scale geothermal energy plant and there are GWAs that cannot. For the large scale geothermal energy plants, 11 US Cents/kWh for FIT price seems more economically feasible than for small scale geothermal energy plants. Forcing small scale geothermal energy plants using lower FIT price might encourage developers to economise their plants and thus reducing the standard requirement of the plants. In this sense, case by case differentiation for FIT price is more suitable for the nature of geothermal energy production in Indonesia compared to regional differentiation FIT price (personal communication, August 28, 2012).

Furthermore, it is necessary that the government be aware of the presence of inflation target[5] in Indonesia. From 2012 Bank Indonesia (BI) set inflation target of 4.5% and the interest rate is hold at 5.75%. The current Indonesia inflation rate is at 4.6% (Bank Indonesia, 2012). Considering Indonesia is still a developing economy, naturally inflation is necessary to support economic growth in the country (Mankiw, N.G., 2007). The presence of inflation means there will be a reduction of real value of money. Inflation target policy will certainly affect the real income of geothermal energy developers because FIT policy design in Indonesia is not adjusted with inflation rate.

Even though there is not yet any future plan to re-evaluate the current FIT policy for geothermal energy, it is important for MEMR to evaluate the current policy after a couple of years of implementation to see if the FIT policy achieved what was targeted and to make further adjustment for the future situation that might change.

In addition to FIT, tax incentives are also important to make geothermal energy industry in Indonesia more attractive by reducing the cost of capital and operation. First, GOI provides 30% tax reduction of total capital investment to taxable income. Given this incentives, geothermal energy producer certainly will pay less tax compared to other businesses. Moreover, the fact that tax reduction rate is based on the total amount of investment, the incentive reduce capital cost. This way, the higher the amount of investment will result to more corporate income tax reduction (Sukarna, D., 2012). In addition, compensation of loss for 5-10 years will give more safety and trust in geothermal energy investment in Indonesia.

Accelerated depreciation and amortisation provides income tax incentives for geothermal energy developer in another way. Under the accelerated depreciation provision, corporate will have more depreciation cost in the early years of the project that reduce taxable income. More depreciation cost thus reduce the corporate's income tax and increase the cash flow of the project. Although in the end the amount of income tax paid is the same, such allocation of tax will benefit geothermal energy developers which need more cash in the early years of the project for loan payoff for instance (Ross, S et al, 2007).

[5] An economic policy in which a central bank estimates and make target for inflation rate and attempts to steer the actual inflation towards the target through the use of interest rate changes and other monetary tools

In Indonesia, most of equipment for geothermal energy exploration, establishment, and operation is still imported from other countries. Moreover, the economic value of these equipment is not small. Equipments may become a subject of high VAT and Custom Duties charge. However, VAT and Custom Duties exemptions provide another incentive to reduce the capital investment cost and operational cost. Importing goods and equipments is a subject of 10% of VAT and 2.5% of Custom Duties in Indonesia. Therefore including these two charges, the normal investment cost will be at least 112.5% of the original initial capital investment cost. However, the exemption of VAT and Custom Duties will reduce the cost of capital of geothermal energy project.

Tax incentives for geothermal energy industry in Indonesia are provided within a certain time framework, for example income tax reduction only applies for the first 6 years of operation and VAT and custom duties exemptions applies for the first two years. This timeframe encourages technological innovation and operational process improvement for the developers to bring down their cost, compete, and expand more even after incentives are not given.

Governmental fund and guarantee had been proved to provide more incentives through creating safer investment environment in geothermal energy (private communication, July 17, 2012). The presence of governmental fund and guarantee makes developers are willing to take risk of failure while conducting exploration as the government will compensate them.

Finally, even though green banking policy has not yet officially implemented, developers and potential investors are showing interest in investing in geothermal energy projects in Indonesia because of the priority they will benefit by the presence of green banking policy once it is implemented (Dharma, S., private communication, August 27, 2012).

5.2. Economic Assessment of Geothermal Energy Project

In this section, a hypothetical financial feasibility assessment of geothermal energy project in Indonesia will be shown. The purpose of this assessment is to provide a general idea of how developers can benefit from geothermal energy project in Indonesia with the given economic instruments and financial incentives that explained in the earlier section, and see whether the current economic instruments and incentives are providing enough incentives for geothermal energy developer.

The financial feasibility assessment method used is the calculation of Net Present Value (NPV) of a hypothetical geothermal energy project in Indonesia. NPV is a calculation and comparison of the amount of money invested today and the amount of cash received in the future with the presence of time value of money[6] (Ross, S et al, 2007). NPV is a very common method used to assess whether a project financially worth invested or not.

To calculate NPV, first the projected cash flow throughout the project lifetime has to be calculated. Cashflow of the project divided into cash inflow and outflow from operating activities and investing activities. After projecting the future cash flow from the project, cash flow then adjusted with time value of money (discounted cash flow) to know the real value of cash received

[6] The value of money figuring in the given amount of interest earned over a given amount of time

in respect to inflation. To make this adjustment, discount rate[7] is used. The formula for NPV calculation is:

$$NPV(i) = \sum_{t=1}^{N} \frac{R_t}{(1+i)^t}$$

Where,

i = discount rate;

t = the time (period) of cash flow;

Rt= the net cash flow in the given time

To calculate NPV of the hypothetical project in this thesis, the following assumptions are used:

1. Company X plans to develop geothermal energy project A. Project A aims to establish a geothermal energy power plant with a capacity of 50 MW in Java. The project lifetime is 30 years, as stated in Indonesia geothermal law for a GWA contract.

2. Capital investment/MW for Project A is USD 2.5 million/MW capacity and thus USD 125 million for the 50 MW geothermal powerplant, USD 70 million is allocated in the first year and USD 55 million is allocated in the second year. From the total USD 125 million capital investment, USD 70 million is allocated for building and USD 55 million is allocated for non-building asset. This assumption based on the new geothermal energy project in GWA Dieng in Central Java. Geothermal energy project in GWA Dieng used for comparison because it is currently the most recent project under development which is located in Java (MEMR, 2012a). Geographical condition and other factors assumed to be similar to Project A.

3. Financing of Project A comes from bank loans USD 75 million, with the interest rate of 10% per year, and the maturity date of the loan is in 20 years, and USD 70 million of capital injection in the first year and 2 million from the second year to the fisth year for operational purpose from company X.

4. Project A is located in Java, thus the FIT for Java region, which is 11 US cents/kWh (USD 110/MWh) is used. The powerplant is assumed to produce geothermal energy and generate electricity 8300 hours per year. Under these assumptions, yearly revenues of the project will be USD 45,650,000 / year (USD110 x 50 MW x 8300 hours). Geothermal powerplant assumed to produce energy at 8300 hours / year.

5. Project A use the first 5 years for establishment thus there is no revenues in the first 5 years. Production starts from the sixth year. Throughout its project lifetime, there is no expansion on powerplant and thus there is no anual business development and increasing revenues of the project

6. Production and operating cost for Project A is 3.5 US cents/kWh, which means USD 14,525,000/year. During the period when production has not started, production and

[7] Discount rate is the rate to discount future cash flow to determine the present value invested money

operating cost is assumed to be 20% of the total anual production and operating cost. This assumption also based on the geothermal energy project in GWF Dieng.

7. Depreciation of this asset is using straight-line method[8] with incentive, which means building asset will be fully depreciated in 10 years (Permanent building asset) and 4 years for non-building asset (Non-building asset group II[9]). Thus the depreciation cost for building assets is USD 7 million/year for 10 years and depreciation for non-building assets is USD 13.75 million/year for 4 years.

8. Income Tax incentives are given for the first 6 years at rate of 5%/year from the total amount of capital investment.

9. VAT and Custom Duties are assumed to be zero, therefore there is no additional tax charge on assets for capital investment.

10. For NPV calculation, Bank Indonesia rate which is 5.75% is used for discount rate. This rate is used by GOI to steer the inflation towards Indonesia inflation target. Therefore, using BI rate for NPVcalculation is expected to reflect the time value of money in the current Indonesian economy. Inflation rate is assumed to be the same during the project lifetime.

11. Based on the above assumptions, calculation of Project A future cashflow and discounted cashflow is developed. Table 5 shows the calculation of future cashflow and discounted cashflow of Project A.

[8] the simplest and most-often-used technique, in which the company estimates the salvage value of the asset at the end of the period during which it will be used to generate revenues (useful life) and will expense a portion of original cost in equal increments over that period.

[9] In Indonesia regulation this group includes equipments and other assets in energy and mining industry

Table 5. Cashflow and Discounted Cashflow Simulation for ProjectA

(In thousand US Dollar)

YEAR	1	2	3	4	5	6	7	8	9	10
CASH FLOW										
Operating Activities										
Revenues	0	0	0	0	0	45650	45650	45650	45650	45650
Operating Cost	2905	2905	2905	2905	14525	14525	14525	14525	14525	14525
Gross profit	-2905	-2905	-2905	-2905	-14525	31125	31125	31125	31125	31125
Depreciation Cost	20750	20750	20750	20750	7000	7000	7000	7000	7000	7000
Tax incentive	5000	5000	5000	5000	5000	5000				
Taxable income	0	0	0	0	-26525	19125	24125	24125	24125	24125
Income Tax (25%)	0	0	0	0	-6631.25	4781.25	6031.25	6031.25	6031.25	6031.25
Cash flow	-2905	-2905	-2905	-2905	-7893.75	26343.75	25093.75	25093.75	25093.75	25093.75
Investing Activities										
Capital Injection	70000	2000	2000	2000	2000					
Loan	75000									
Capital Investment	70000	55000								
Loan repayment		5000	5000	5000	5000	5000	5000	5000	5000	5000
Interest payment		5250	5118.75	4856.25	4593.75	4331.25	4068.75	3806.25	3543.75	3281.25
Cash Flow	75000	-63250	-8118.75	-7856.25	-7593.75	-9331.25	-9068.75	-8806.25	-8543.75	-8281.25
Total Cash Flow	72095	-66155	-11023.75	-10761.25	-15487.5	17012.5	16025	16287.5	16550	16812.5
Previous Cash Balance		72095	5940	-5083.75	-15845	-31332.5	-14320	1705	17992.5	34542.5
Ending Cash Balance	**72095**	**5940**	**-5083.75**	**-15845**	**-31332.5**	**-14320**	**1705**	**17992.5**	**34542.5**	**51355**
Ending Discounted Cash Balance	**68174.94**	**5311.60**	**-4298.76**	**-12669.83**	**-23691.53**	**-10239.08**	**1152.82**	**11503.99**	**20884.80**	**29361.55**
Discounted Cash Flow Generated	**68174.94**	**-59156.43**	**-9321.55**	**-8604.81**	**-11710.61**	**12164.27**	**10835.16**	**10413.85**	**10006.33**	**9612.33**

(In thousand US Dollar)

11	12	13	14	15	16	17	18	19	20
45650	45650	45650	45650	45650	45650	45650	45650	45650	45650
14525	14525	14525	14525	14525	14525	14525	14525	14525	14525
31125	31125	31125	31125	31125	31125	31125	31125	31125	31125
31125	31125	31125	31125	31125	31125	31125	31125	31125	31125
7781.25	7781.25	7781.25	7781.25	7781.25	7781.25	7781.25	7781.25	7781.25	7781.25
23343.75	23343.75	23343.75	23343.75	23343.75	23343.75	23343.75	23343.75	23343.75	23343.75
5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
3018.75	2756.25	2493.75	2231.25	1968.75	1706.25	1443.75	1181.25	918.75	656.25
-8018.75	-7756.25	-7493.75	-7231.25	-6968.75	-6706.25	-6443.75	-6181.25	-5918.75	-5656.25
15325	15587.5	15850	16112.5	16375	16637.5	16900	17162.5	17425	17687.5
51355	66680	82267.5	98117.5	114230	130605	147242.5	164142.5	181305	198730
66680	82267.5	98117.5	114230	130605	147242.5	164142.5	181305	198730	216417.5
36050.51	42059.47	47435.29	52222.17	56461.73	60193.16	63453.36	66277.03	68696.77	70743.23
8285.45	7969.15	7662.75	7366.10	7079.06	6801.46	6533.12	6273.84	6023.45	5781.74

(In thousand US Dollar)

21	22	23	24	25	26	27	28	29	30
45650	45650	45650	45650	45650	45650	45650	45650	45650	45650
14525	14525	14525	14525	14525	14525	14525	14525	14525	14525
31125	31125	31125	31125	31125	31125	31125	31125	31125	31125
31125	31125	31125	31125	31125	31125	31125	31125	31125	31125
7781.25	7781.25	7781.25	7781.25	7781.25	7781.25	7781.25	7781.25	7781.25	7781.25
23343.75	23343.75	23343.75	23343.75	23343.75	23343.75	23343.75	23343.75	23343.75	23343.75
5000	5000								
393.75	131.25								
-5393.75	-5131.25								
17950	18212.5	23343.75	23343.75	23343.75	23343.75	23343.75	23343.75	23343.75	23343.75
216417.5	234367.5	252580	275923.75	299267.5	322611.25	345955	369298.75	392642.5	415986.25
234367.5	252580	275923.75	299267.5	322611.25	345955	369298.75	392642.5	415986.25	439330
72445.18	73829.63	76267.66	78222.29	79738.88	80859.27	81622.08	82062.88	82214.43	82106.89
5548.51	5323.55	6452.41	6101.57	5769.81	5456.08	5159.42	4878.88	4613.60	4362.74

In this scenario, the total discounted cash generated for 30 years is USD 155,856,170 where the intial capital investment is USD 125,000,000. Therefore, the NPV of money invested in Project A throughout its project lifetime is USD 155,856,170 deducted by USD 125,000,000 which is USD 30,856,170. Project A have a positive NPV which means Project A is worth for investment. It can be concluded that in this case GOI had provided at least enough financial incentives for geothermal energy developers.

However, as shown in the calculation, the early years where Project A has not yet generating revenues, suffers a hard time in accumulating cash. From the second year to sixth year, Project A suffers negative cash balance which is crucial for the project operations and therefore additional capital injections from company X or from bank loan is needed during these years. Loan repayment and interest payment is the main expenditure during the early years. To make geothermal energy industry more attractive, adjustment in banking policies might necessary to make geothermal energy investment more feasible.

In Project A scenario, accelerated depreciation for assets and income tax break for the first 6 years should help Project A to reducing the amount of taxable income. In this scenario, depreciation cost in particular contribute a significant amount in reducing taxable income of the company to in the first 4 years. In addition, as explained earlier, there are no additional tax charges on assets for capital investment as geothermal energy developer gets VAT and Custom Duties exemption that even give more opportunity to the project to generate cash in the earlier years. However, those income tax incentives for the early years barely have effect on Project A's financial performance. This is because most of geothermal projects will not yield revenues at least in the first 5 years. Infrastructure and powerplant needs at least 5 years to be established. During those 5 years, there will be no production and no income. Therefore, even without income tax incentives, income tax during the first 5 years will be zero. Income tax incentives will have much more impact on financial performance if they are applied after the project starts production and generates revenues.

In conclusion, even though Project A is financially feasible and profitable, there are still many things to adjust in Project A scenario and geothermal energy investment can be more attractive than its current state.

The scenario above is a very rough scenario based on assumptions and ignoring other factors that may affect the financial performance of the project such as revenue growth, additional cash injection, etc. This is due to the lack of information gathered during the research process. However, even though the numbers are not precisely reflecting the real implementation of geothermal energy project, the simulation can provide a general idea how current economic policies affect geothermal energy project development throughout the project lifetime. The outcome of the simulation may vary based on the assumptions made. For example, if the project were located in Papua instead of Java, there will be a significant difference in revenues because of different FIT price. Other factors that may have impact are project lifetime, technology used, inflation rate, interest rate, etc.

5.3. Key Implementation Barriers

There are several other barriers that are not directly related to economic policy for geothermal energy, but still affecting the development of geothermal projects in Indonesia. One of them is the inefficient bureaucracy system that provides licenses and permits for geothermal energy project development in Indonesia. In Indonesia, to get the right to develop geothermal energy projects, developers have to acquire many kinds of permits, namely permit for land use, permit from Ministry of Forestry, permit from tax office, permit from local government, etc. Places to get these permits are scattered in many governmental bodies and offices and each permit takes a long time to be granted from the first proposed time. With the complexity of bureaucracy, corruption, and inefficient working system, usually developers have to wait for more than 2 years to get the whole permits and start working on the project development. This situation will certainly reduce incentives to develop geothermal energy from operational perspective.

Other barriers are the lack of national level commitment in developing geothermal energy and also the lack of consumer awareness on the imporatance of renewable energy. Currently only several actors are actively promoting geothermal energy development such as the Ministry of Energy and Mineral Resources and Ministry of Finance. However, to develop geothermal energy to its full capacity, commitment from other actors at the national level that are related to geothermal energy industry is also necessary. Raising consumer awareness of the importance of renewable energy sources can support the development of geothermal energy development as the demand for clean energy production from the public is increasing.

5.4. Suggestions for Adjustment

Some adjustments for a better policy framework to enhance geothermal energy development might include simplification of administration in bureaucracy, standardization for a project's FIT price assessment, adjustment on income tax incentives, government guarantee to developers toward changing regulation and policy, clear framework for green certificates and carbon credit, and economic incentives for geothermal energy consumers.

As explained in the earlier section, administration matters to get licenses and permits for geothermal energy project development have been very inefficient. Simplification of this process will certainly provide more incentives and boost the development of geothermal energy projects. Establishing a governmental body or independent body that is dedicated to ensure administration matters that are directly connected to other necessary governmental bodies for permits might also be helpful.

Regarding FIT policy, FIT prices are suggested to be differentiated based on project's production cost situation instead of differentiated based on regions. A standard to assess and decide FIT price case by case can be developed easily by assessing the production cost of each project scenario. For example, for 100 MW capacity geothermal power plant, 11 US cents/kWh of FIT price used while for 20 MW capacity geothermal power plant, 14 US cents / kWh of FIT price used. Several different scenarios for geothermal energy projects might be developed and FIT price for each project can be assessed based on these scenarios.

Adjustment is also needed to be made on income tax incentive received by developers. Currently geothermal energy developers get 30% of income tax reduction from the total investment allocated for the first six years. However, geothermal energy project takes at least four years from the initial project investment to production state. Therefore, there will be no revenues and taxable income for the first four years. This scenario means, developers will effectively receive income tax incentives only in the fifth and sixth year. In this sense, the current framework for income tax incentive is not largely affecting the project's financial performance. For a better financial performance of geothermal energy projects, government should provide income tax incentive start from the period when the geothermal energy plants start producing steam and electricity, and generating revenues.

Regulations and policy frameworks in Indonesia often changes. Regulations and policies on geothermal in Indonesia have been changing several times and those changes were not necessarily become a better one. Uncertainty on regulations and policies might affect the investment environment and becomes another barrier to develop geothermal energy sector. To tackle this issue, a guarantee for the on-going projects whenever changes in regulations occurred might be introduced. This guarantee can provide choices to developers to choose whether the projects were to follow new regulations or keep their operation under the existing ones until contract finished. In this sense, developers will be able to have safer investment and to make future projections more precise (Dharma, S., private communication, August 27, 2012).

Unlike in some countries in Europe, Indonesia does not have a clear framework on carbon credit and green certificate whereas they can give more incentive in the form of additional income to geothermal energy developers. Currently developers can get green certificate when they propose to GOI. In case of carbon credit, GOI claims that carbon credit produced by renewable energy projects in Indonesia belongs to the GOI even though logically carbon credit is the right of renewable energy developers. Establishing a clear framework on carbon credit system and green certificate in Indonesia will certainly provide additional incentives for potential geothermal energy developers.

Energy consumers are among the most important factors to develop renewable energy industry. Besides incentives for producers, incentives for consumers such as tax break for using geothermal energy source is also necessary to develop the industry. However, with the current electricity system in Indonesia where all electricity generated from different sources are mixed to be distributed to final users. For future plan, it is suggested that electricity system changed so that consumers can choose their electricity sources and thus geothermal energy electricity can gain competitive advantage.

Finally, energy subsidy will have an impact on geothermal energy industry to some extent. Energy subsidy for fossil fuel resources currently putting geothermal energy in less competitive position. Eliminating energy subsidy and letting the market decide the true cost of energy will certainly give geothermal energy projects more competitive advantage. However, eliminating subsidy is not an easy task for GOI since it will result in economic shock in the market. That's why decreasing the subsidy overtime is better to make the transition phase go well. Some argue that even if GOI is not going to eliminate energy subsidy for fossil fuel, than renewable energy sources have to get those subsidy either to make the whole energy industry fair (Ananda Setiyo Invananto, private communication, July 30, 2012).

6. Conclusion

With the approximate geothermal energy potential capacity of 28,000 MW, Indonesia still have so much geothermal energy potential that can be developed to add renewable energy share in the final energy mix. Geothermal energy resource also very important to meet the rapid growing energy demand in Indonesia and to avoid other issues such as uncertainty in oil price and the decreasing of current oil reserve in Indonesia. To develop such potential, more investments are needed especially investments from foreign countries that possess the economic and technical feasibility.

The current development of geothermal energy capacity is also behind the targeted schedule, so acceleration program is necessary. GOI is trying to catch up the geothermal energy development with the geothermal roadmap schedule through acceleration program Crash Program phase II. Crash Program phase II plans to add a 10,000 MW new generation capacity to the national electricity grid and a significant amount will come from renewable energy sources particularly geothermal energy.

Judging from the economic policies, both the existing and the new ones, implemented in relation to geothermal energy projects in Indonesia, GOI has been proactively supporting the development of geothermal energy especially through the creation of good investment environment for potential investors. GOI has been reducing the cost of capital through economic policies such as investment tax credit and VAT and Custom Duties Exemption, and reducing investment risks through banking system, funds, and guarantees.

In general, these policies allowed geothermal energy projects to be economically feasible and profitable for developers, even though different project will have different situation. However, there are still some policies need to be adjusted such as FIT remuneration model and income tax incentives period. Besides economic policies, there are other conditions need to be improved to make geothermal energy project development more promising. These conditions includes the complex bereaucracy system in Indonesia that makes administration matters difficult and delayed, lack of national level commitment. Subsidies also important to determine the competitive advantage of geothermal energy industry. GOI is expected to be able to eliminate energy subsidies for fossil fuel sources and make fossil fuel sources reflect their true cost. By doing this, geothermal energy industry will have a better competitive advantage in the energy market.

Besides policies to encourage production, policies regarding clean energy consumption are also important to develop geothermal industry. Consumers have to be aware about the importance of clean energy sources and consumers should be given incentives for using clean energy sources, such as consumer's tax cut, etc. However, this will require other changes in the electricity industry structure.

Through these economic policies, initiatives, changes in the bereaucracy system, raising people's awareness on the importance of renewable energy, the target to achieve 9500 MW geothermal capacity by 2025 is feasible.

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Appendix A

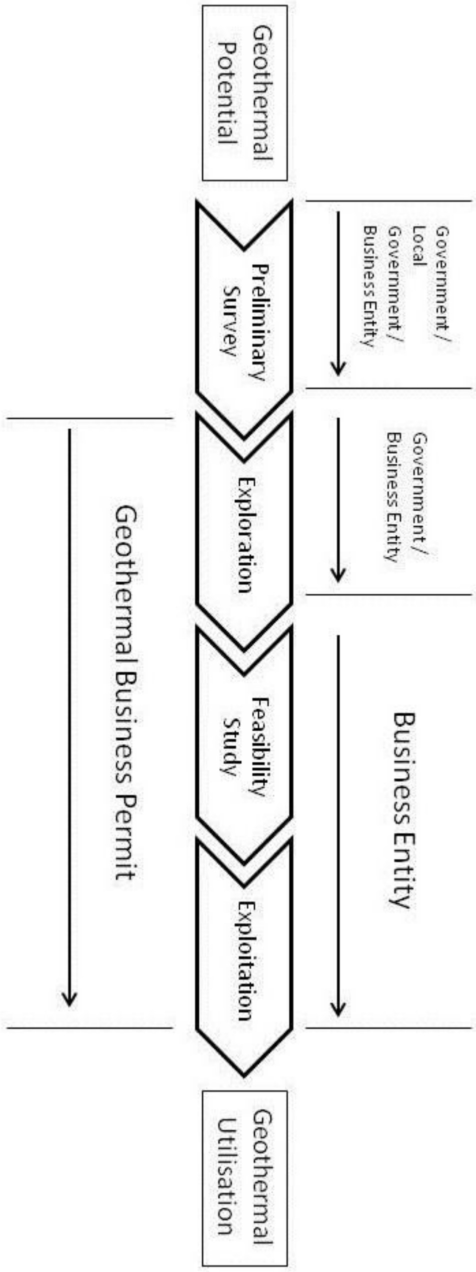
Existing GWA Status

GWA Status		Amount	Location
Production		7	North Sumatera: 1, West Java: 4, Central Java: 1, North Sulawesi: 1
Development	Tender Finished	32	Aceh: 1, North Sumatera: 2, West Sumatera: 1, Bengkulu: 1, Jambi: 1, South Sumatera: 2, Lampung: 3, Banten: 1, West Java: 6, Central Java: 3, East Java: 3, Bali: 1, North Sulawesi: 1, Maluku: 1, North Maluku: 1, NTB: 1, NTT: 3
	Tender in Process	3	Aceh: 1, West Java: 1, West Sumatera: 1
	Tender Preparation	9	North Sumatera: 1, West Sumatera: 1, Lampung: 1, South Sumatera: 1, Central Java: 1, Central Sulawesi: 1, North Maluku: 1, Banten: 1, NTT: 1
	Tender Failed	3	North Sumatera: 1, West Sumatera: 1, Central Sulawesi: 1
Total		**54**	

Source: MEMR

Appendix B

Geothermal Activities Scheme in Indonesia



Source: MEMR