Geothermal Handbook for Indonesia

Buku Pegangan Geothermal Indonesia

Directorate for Energy Resources, Mineral and Mining
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Volatility in the world oil market has encouraged us to address the need for a comprehensive approach to energy security. An increase in consumption in energy is inevitable to support our economic growth. National energy demand is growing at a rate that cannot be matched by the growth in domestic energy supply. Oil subsidies, which induce higher demand and further reliance on imports, have resulted in a sub-optimal energy mix. And, of course, this has hampered the development of the domestic market for other energy sources, such as natural gas, geothermal, etc. With a combination of depleting oil resources, other energy sources remaining underdeveloped, and rising domestic demand, we have recently become a net oil importer. This makes our economic and political independence increasingly strained. In addition, continuing and accelerating greenhouse gas emissions from the use of fossil fuels and the association with the average global temperature are likely to continue to significantly influence climate change.

Estimated to have nearly one third of the world’s geothermal resources, until recently Indonesia has only developed just over a thousand MW of geothermal power, far behind the current national target of realizing 6 to 9 GW. Geothermal is attractive for a number of reasons – it is a clean, renewable and environmentally friendly power source. Unlike oil and other fossil fuels, geothermal is also immune to external price fluctuation. Today, with the increase in the global oil price, geothermal is becoming more competitive. A major challenge for investors in the geothermal industry requires considerable spending on development and fuel storage costs upfront, including exploration costs. Revenues can only be expected to return when the power is sold to customers. This creates severe financial and commercial risks. With high upfront costs, incentives are needed to make the geothermal industry worthy of consideration.

This handbook provides very valuable references for investors who are interested in doing business in our geothermal industry. Starting with general information on geothermal resources and reserves, the handbook gives a construct of current practice of geothermal development, the increasing role of local governments, as well as supporting policy initiatives that have been endorsed to facilitate investment – reviving and scaling up geothermal power development.

We hope this handbook can enhance potential investors’ understanding on the investment climate in the renewable energy sector, and specifically how to do business in our geothermal industry – dealing with local entities. We believe that it will provide a sufficient basis and reference with which investors’ confidence to invest will be strengthened.

Minister for National Development Planning / Head of National Development Planning Agency

Prof. Armida Salsiah Alisjahbana
“Geothermal” literally means “Earth’s heat”, which is estimated to be 5,500 degrees centigrade at the Earth’s core – about as hot as the surface of the sun. Geothermal energy is a clean, sustainable resource. Electricity can be harnessed from subsurface geothermal reservoirs that contain heated rocks saturated with water or steam. Indonesia, which is blessed with the highest potential geothermal energy resources in the world, is in the enviable position of being able to replace significant amounts of fossil fuel to provide the increasing power demands of its growing economy and its burgeoning population; it may utilize its natural renewable resources such as geothermal.

Indonesia is actively promoting international financing and development of the geothermal resources in Indonesia; however, geothermal information and resource data have been scattered through multiple government agencies, universities, non-governmental organizations and private corporations. This fragmentation of geothermal information has created a barrier both for potential investors who wish to understand, learn about and keep current with the geothermal opportunities in Indonesia and for the national and provincial officials who are responsible for oversight of those resources.

Bappenas is charged with increasing the capacity, quality and professionalism of the human resources of Indonesia, especially institutional planners at central and local levels, and improving the dissemination of information to the public and the international community. The geothermal resources of Indonesia are in the hands of the local governments. It is our job to ensure that the leadership of those governments has access to the best available information. The development of those resources is dependent on investments at the national and international level. It is our job to ensure that the most up-to-date information about our natural resources is easily available to prospective investors.

Bappenas therefore has undertaken to facilitate the availability of this information with the goal of promoting geothermal investments and developments throughout Indonesia. Funded by the German international development bank KfW, Bappenas engaged Partnership International, Inc to develop two informational tools to support geothermal sector development: this Indonesia Geothermal Handbook and its accompanying interactive Geo Handbook, which may be found at our new website, the Bappenas Geo Portal located at http://geothermal.bappenas.go.id/.

I am delighted therefore to deliver this Handbook and its online companion Geo Handbook to provide an overview of the collective processes that bring the heat of the earth – the geothermal energy resources of Indonesia – to the people of Indonesia.

Deputy Minister for National Development Planning / Deputy of National Development Planning Agency

Dr. Endah Murtiningtias
TABLE OF CONTENTS

TABLE OF CONTENTS ........................................................................................................................... v
LIST OF TABLES ....................................................................................................................................... ix
LIST OF FIGURES ...................................................................................................................................... x
EXECUTIVE SUMMARY ......................................................................................................................... 1

CHAPTER 1
INTRODUCTION TO GEOTHERMAL DEVELOPMENT IN INDONESIA
1.1 OVERVIEW OF THE NATURE OF GEOTHERMAL RESOURCES .................................................. 7
1.2 POWER GENERATION ................................................................................................................... 14
1.3 GEOTHERMAL ENERGY : DIRECT-USE DEVELOPMENT ...................................................... 17
1.4 GEOTHERMAL RESOURCE DEVELOPMENT IN INDONESIA ............................................... 21
1.5 EXISTING NATIONAL RESOURCE POTENTIAL ...................................................................... 28
1.6 SUMMARY ...................................................................................................................................... 28

CHAPTER 2
NATIONAL GEOTHERMAL ENERGY STRATEGY
2.1 INDONESIA’S ENERGY PLAN ........................................................................................................ 32
2.2 INDONESIA’S REGULATORY ENVIRONMENT ......................................................................... 35
2.3 ENERGY POLICY INITIATIVES ................................................................................................... 38
2.4 THE 2010 GEOTHERMAL SECTOR POLICY INITIATIVES AND THEIR EVOLUTION .......... 44
2.5 SUMMARY ...................................................................................................................................... 50

CHAPTER 3
LOCAL GOVERNMENTS’ ROLE IN GEOTHERMAL DEVELOPMENT
3.1 OVERVIEW OF DECENTRALIZATION AND REGIONAL AUTONOMY ....................................... 52
3.2 LOCAL GOVERNMENT’S ROLE IN GEOTHERMAL DEVELOPMENT ........................................... 56
3.3 SUMMARY ...................................................................................................................................... 57

CHAPTER 4
GEOTHERMAL ENERGY LEGAL REGIME
4.1 EVOLUTION OF INDONESIA’S GEOTHERMAL LEGAL REGIME ............................................... 58
4.2 GEOTHERMAL LAW ...................................................................................................................... 60
4.3 STAGE 1 - PRELIMINARY SURVEY ............................................................................................. 65
4.4 STAGE 2 - TENDERING PROCESS ................................................................................................. 66
CHAPTER 8
FORESTRY, LAND USE, ENVIRONMENTAL ISSUES & SOCIAL RESPONSIBILITY
8.1 INTRODUCTION ........................................................................................................................... 144
8.2 LAND USE UNDER GEOTHERMAL LAW 27/2003 ................................................................. 144
8.3 LAND USE IN FOREST AREAS RELATED TO GEOTHERMAL ACTIVITIES ..................... 146
8.4 BORROW-USE PERMITS FOR FORESTRY AREAS ............................................................... 150
8.5 LAND USE & ACQUISITION ..................................................................................................... 152
8.6 LAW 32/2009 ON ENVIRONMENTAL PROTECTION & MANAGEMENT ........................... 154
8.7 WATER RESOURCES LAW ....................................................................................................... 158
8.9 SUMMARY ............................................................................................................................... 161

CHAPTER 9
GEOTHERMAL DEVELOPMENT PERSPECTIVES & SELECTED CASE HISTORIES
9.1 GEOTHERMAL PROJECTS IN INDONESIA ............................................................................. 162
9.2 SEULAWAH AGAM GEOTHERMAL FIELD ........................................................................... 162
9.3 SARULLA ................................................................................................................................. 166
9.4 KAMOJANG ............................................................................................................................ 170
9.5 SUMMARY ............................................................................................................................... 175

CHAPTER 10
GEOTHERMAL STAKEHOLDERS IN INDONESIA
10.1 NATIONAL GOVERNMENT (MINISTRIES AND THEIR SIGNIFICANT AGENCIES) ....... 180
10.2 UTILITY: PT PLN (PERSERO) ............................................................................................... 187
10.3 STATE-OWNED GEOTHERMAL DEVELOPERS ................................................................. 188
10.4 PRIVATE DEVELOPERS ........................................................................................................... 189
10.5 FINANCIAL INSTITUTIONS ................................................................................................. 194
10.6 OTHER RELEVANT GEOTHERMAL RELATED PARTIES .................................................. 199

APPENDICES
APPENDIX A: TERMS AND TERMINOLOGY ................................................................................ 203
APPENDIX B-1: 19 NEW GEOTHERMAL WORKING AREAS (TENDERED) ............................... 211
APPENDIX B-2: LIST OF 20 NEW GEOTHERMAL WORKING AREAS (TENDERING / TO BE TENDERED) ...................................................................................................................... 213
APPENDIX B-3: LIST OF 299 GEOTHERMAL LOCATIONS IN INDONESIA ............................... 215
LIST OF TABLES

Table 1.1 Nine Existing Operating Geothermal Projects as of October 2013 .........................................................29
Table 2.1 Policy Reforms to Enhance Investment Climate for Geothermal Development ........................................43
Table 4.1 Geothermal Project Transaction Cycle .................................................................................................75
Table 5.1 Chronology of Reform Phases in the Indonesian Power Sector .............................................................82
Table 5.2 Benchmark Purchase Price .................................................................................................................92
Table 5.3 Agreements in Geothermal Project ...................................................................................................94
Table 6.1 Risk Allocation Arrangements Over the Three Generations .................................................................108
Table 6.2 Summary of PPP Laws and Regulations .........................................................................................111
Table 6.3 Summary of Incentives & Guarantees for Geothermal Developers ....................................................124
Table 6.4 Differences between FTP II and PPP Scheme ..................................................................................124
Table 7.1 Simplified Financial Components of a Geothermal Project ...............................................................128
Table 7.2 Indicative Costs for Geothermal Development (50 MW ex generator capacity), in US$ Millions ..........130
Table 7.3 World Bank – Indonesian Equivalency of Geothermal Activities ......................................................131
Table 7.4 Screening Curve Levelized Cost (US$ per kWh) ..............................................................................136
Table 7.5 Assumptions Underlying Cost Supply Curve of Geothermal in Indonesia ......................................138
Table 8.1 Land Use Issues Between Forestry and Geothermal ........................................................................149
Table 8.2 AMDAL & UKL/UPL Laws, Regulations & Degrees .....................................................................157
Table 9.1 CDM IRR Effect ...............................................................................................................................173
Table 10.1 Flow Chart of Foreign Direct Investment in Indonesia ....................................................................179
Table E 1 For Geothermal Project in Indonesia ...............................................................................................269
LIST OF FIGURES

Figure 1.1 Schematic Depth-Temperature Plot for Geothermal Resources ........................................8
Figure 1.2 Global View of Geothermal Systems Associated with Magma Emplacement ...................9
Figure 1.3 Conceptual Model of an Indonesian Geothermal System .................................................10
Figure 1.4 Magnetotelluric (MT) Methods Measure the Earth's Impedance from Naturally Occurring Electromagnetic Waves in order to Attain Information for Geothermal Exploration. .......12
Figure 1.5 Location of Major Volcanic & Non-Volcanic Centers with Potential for Geothermal Development in Indonesia. ......................................................................................................14
Figure 1.6 Geothermal Dry Steam Plant .............................................................................................15
Figure 1.7 Geothermal Flash Plant ........................................................................................................16
Figure 1.8 Geothermal Binary Cycle Plant ..........................................................................................17
Figure 1.9 Geothermal Direct-Use Applications ..................................................................................18
Figure 1.10 Direct Geothermal Use Application ..............................................................................20
Figure 1.11 Steam Pipeline - Darajat Geothermal Project 1976..........................................................21
Figure 1.12 Geothermal Manifestation, Cisolok Cisukaram WKP.....................................................23
Figure 1.13 Muara Labuh Geothermal Field .......................................................................................24
Figure 1.14 Wayang Windu Geothermal Field ....................................................................................27
Figure 2.1 Electrification Ratios for Indonesia in 2013. ...........................................................................34
Figure 2.2 Projected Primary Energy Supply 2050 .............................................................................41
Figure 2.3 Capacity of Power Plants That Need to be Developed .....................................................42
Figure 4.1 Geothermal Development Flow Chart .............................................................................64
Figure 5.1 PLN Geothermal Development Plan 2012 to 2020 ..............................................................77
Figure 6.1 PGE and IPP Geothermal Developers in 2012 in Mega Watt (MW) .................................97
Figure 6.2 General Mechanism of Investment in Electricity ...........................................................98
Figure 6.3 Geothermal Development Phases .....................................................................................103
Figure 6.4 Guarante Mechanism: Contractual Arrangements and Payment Obligations ..................109
Figure 6.5 Geothermal Fund Scheme: Complete PPP Funding Process ........................................116
Figure 7.1 Project Cost Components .................................................................................................129
Figure 7.2 Cost Breakdown for Various Geothermal Project Activities ............................................131
Figure 7.3 Impact of Reservoir Temperature on Power Conversion Costs ........................................134
Figure 7.4 Impact of Resource Temperature on Specific Capital Cost (SKM 2007) .........................135
Figure 7.5 National Cost Supply Curve of Geothermal in Indonesia ..............................................137
Figure 7.6 Cost of Exploration Delays (10% inflation) .....................................................................142
Figure 8.1 Forestry View along WKP Steam Pipeline ........................................................................145
EXECUTIVE SUMMARY

Indonesia is the world’s fourth most populous country and it is undergoing an unprecedented degree of urbanization and industrialization. Indonesia’s 2013 estimated total electric generating capacity of 44.2 GWe is only just meeting the current demand for its 2013 population that is estimated to exceed 240 million persons. Indonesia’s National Energy Policy calls for energy producers to access the country’s abundant natural resources – specifically geothermal resources – with the goal of providing a significant portion of national electrical energy from renewable resource generation. Private sector investment, including international investment, is essential to fulfill this goal.

Indonesia is actively promoting international financing and development of Indonesia’s geothermal resources; however, geothermal information and other resource data are fragmented across government agencies, universities, non-governmental organizations, and private corporations. This fragmentation creates obstacles for potential investors and others, who wish to understand, learn about or remain knowledgeable of the geothermal opportunities in Indonesia. The National Development Planning Agency of the State Ministry of National Development Planning (Badan Perencanaan Pembangunan Nasional or Bappenas) has facilitated the availability of this information to promote geothermal investments and developments throughout Indonesia. Funded by the German international development bank KfW, Bappenas engaged Partnership International, Inc. (PI) in 2012 to develop geothermal information resources, remove data obstacles and enable sector development. The two major deliverables from this project are the Geo Portal, a web portal that is designed to find and access geothermal information about Indonesia, and this Geothermal Handbook for Indonesia (the “Handbook”), in both its printed and accompanying interactive forms. The interactive Geo Handbook may be found at: http://geothermal.bappenas.go.id/.

This Handbook and its online companion Geo Handbook provide an overview of the collective processes that bring the heat of the earth – the geothermal energy resources of Indonesia – to the people of Indonesia. In particular, this Handbook is intended to assist key stakeholders, such as private sector renewable energy developers investing in Indonesia, the central and regional government policy makers, and those national and international stakeholders who aim to promote geothermal developments in Indonesia. The Handbook covers the legal, policy, regulatory, financial and economic frameworks of the geothermal sector in the country and

Source: WWF Report June, 2012
describes how the government aims to foster geothermal economic growth in the energy sector.

The online interactive Geo Handbook will be available on the Bappenas Geo Portal, where it will be continually updated as the Indonesian geothermal regime continues to evolve and new guidance is issued by the Government of Indonesia (GoI). This Handbook is intended as a guide and is not intended to replace reference to governing laws and regulations. The chapters and appendices of the Handbook address significant aspects of the geothermal process and are aimed at helping decision makers gain a clearer understanding of this process.

Chapter 1 - Introduction to Geothermal Development

This chapter provides introduction geothermal in Indonesia and describes an overview of the scientific nature of geothermal resources, explaining power generation systems that convert the heat of the earth into commercial electricity. Depending on the chemistry and temperature of the fluids, geothermal resources can be converted to electrical power using any of three power conversion technologies: dry steam, flash, and binary. Flash steam plants are the most common in Indonesia. As of January 2013, 299 geothermal areas in Indonesia have been recorded, with an electricity generation potential estimated by the Center for Geological Resources as approximately 28.8 GWe. This chapter also provides the history of geothermal developments in Indonesia since the Dutch colonial period to present day in order to establish a context for the modern regulatory regime. Sound policy and law flows from the decision-makers’ understanding of the science underlying the natural resources that those decision-makers govern and regulate. The development of geothermal resources for electricity production requires significant front-end investment in technology and a sound regulatory structure that considers the geothermal developer’s risk at the onset of exploration and development. Indonesia is potentially the most geothermal-resource rich country in the world; however, as of 2013, with approximately 1346 MWs having been developed, Indonesia has developed only 4% of the identified potential.

Chapter 2 - National Geothermal Energy Strategy

This chapter notes that Indonesia’s population is undersupplied with electricity in comparison to the rest of South East Asia – particularly as Indonesia continues its rapid growth as an industrialized country. The country’s eastern provinces in particular are underserved. Therefore, the Government has established a series of ambitious goals. The First (2006) and The Second (2010) Fast Track Programs are implementing tools of these ambitious national goals. The First Fast Track Program aims to increase power plant generation to 10,000 MW by 2025, and the Second is designed to ensure that approximately 4,935 MW of this amount is in place by 2015 and comes from geothermal. The Government recognizes the importance of private investment in the development of additional power capacity in Indonesia. Investments of over US$25 billion are needed for the Second Fast-Track Program alone. This chapter also discusses the regulatory framework that governs the geothermal regime – in the context of national policy that has emphasized decentralization, transparent competition and ending monopolies. Within this context, national promotion of geothermal development culminated in the enactment of the 2003 Geothermal Law, which puts much of the control and development of the nation’s geothermal resources into the hands of the provinces, regencies and cities of Indonesia. Geothermal Law
27/2003 provides a developmental opportunity to the private sector and new mechanisms and incentive programs. Likewise, the Electricity Law of 2009 and PR No.4/2010 establish the legal framework between the government and private investors. Furthermore, the guarantee and facility initiatives under PR No. 4/2010 show the government's seriousness and commitment in attracting private investors.

Chapter 3 - Local Governmental Role in Geothermal Development

This chapter provides an overview of decentralization and regional autonomy and its impact on geothermal development during the 21st century – in particular, the impacts of decentralization on direct foreign investment and the tender process controlled by the regional governments. The provinces are subdivided into districts, which are further subdivided into sub-districts and then into village groupings. Depending on the location of the proposed geothermal working area and whether it crosses provincial or local boundaries, the jurisdiction for the tender may be allocated to the MEMR, the provincial Governor or local Regent or Mayor of the applicable area. The foregoing situation calls for an experienced third-party that can bring its resources to assist the relevant governmental authorities in situations that require knowledgeable experience. An interdisciplinary Tender Committee, comprising both government and INAGA, has been established for such a purpose.

Chapter 4 - Geothermal Energy Legal Regime

This chapter details the elements of the pivotal 2003 Geothermal Law and its implementing regulations, which collectively open up geothermal development in the context of competitive tendering administered by the appropriate authority. Such tendering authority is dependent upon the geographical location and coverage of the Geothermal Work Area (WKP). This chapter discusses the mechanisms by which resources are scientifically identified, thereby allowing the designation of a WKP to be tendered by the governmental authority in whose area the WKP is located. The chapter also explores the process by which the WKP is open for bidding on the development of the upstream exploration and feasibility phases that culminate in downstream production of electricity. The legislation provides that a successful business entity must possess a license (IUP) to conduct geothermal activities. It also examines the GoI’s responsibility for managing information on geology and for compiling information concerning resources.

Chapter 5 - Electricity Sector Regulatory Structure

This chapter introduces the electric power market in Indonesia. Electricity in Indonesia is governed by Article 33 of the Indonesian Constitution, which states that the government is a single provider of electricity for Indonesia – and that responsibility for the provision of electricity is shared by the central and regional governments. Indonesia does not have a monopoly utility, but the state-owned utility PLN controls around seventy-five percent (75%) of the national generation capacity. Although it has no generation monopoly PLN plays a dominant role in the country’s generation and transmission (with some regional carve-outs). Private sector investment is essential for the growth of Indonesia’s electricity sector. Under the previous Law 15/1985 on Electricity, the private sector was only allowed to sell electricity to PLN. The 2009 Electricity Law provided private sector opportunities for entering any electricity line of business (generation, transmission and distribution). Importantly, although PLN no longer enjoys a monopoly position, it is effectively the
only buyer of electricity in Indonesia because PLN, as the sole owner of transmission and distribution assets, remains the only business entity in charge of transmitting and distributing electric power for public use. This chapter also discusses the key policy issues of electricity law, including licensing, regional autonomy, tariffs, cross-border sales and direct sales. It also focuses on the financial incentives that have been encouraged by the Government of Indonesia, including proposed tariff prices which are currently being reviewed, the Government financial guarantees and the requirement that PLN purchase electricity from geothermal Independent Power Producers. The chapter concludes with a discussion of power purchase agreements, electricity sales contracts and proposed incentive programs.

Chapter 6 - Private Sector Geothermal Resource Development

This chapter explores governance of the private sector in the geothermal development context, particularly in view of the private sector investment critical to the success of the Government of Indonesia’s ambitious geothermal development program. This chapter discusses both the hurdles that the Indonesian geothermal developer may encounter and the actions that the government has taken to overcome these hurdles in order to encourage geothermal development. In particular, that PLN must buy electricity produced from geothermal resources is a positive attraction for international investment. However, the developer as well as its equity investors and debt lenders are both dependent on the creditworthiness of PLN in order to obtain the capital to fund projects. Since PLN’s creditworthiness was called into serious question during the Asian financial crisis and since PLN remains subsidized in this second decade of the 21st century, geothermal development must rely on sovereign guarantees. This chapter discusses the ramifications of those factors. Finally, Chapter 6 reviews greenhouse gas emission and carbon credit schemes that are interrelated with geothermal development, as well as United Nations financial mechanisms that could potentially benefit geothermal developers.

Chapter 7 - Cost Estimates of an Indonesian Geothermal Development

This chapter discusses the economics of geothermal projects that are generally similar in all parts of the world. High up-front capital requirements and the timing of the risk profile, particularly regarding resource risk, are two factors having a profound impact on investment opportunities. Based on the most recent data available, and that can be expected to be encountered in Indonesia, this chapter addresses costs associated with individual activities of a typical geothermal project in Indonesia, including exploration, drilling, power plant construction and transmission. Also addressed in this chapter is an analysis of data provided by the World Bank that compares the relative incremental levelized costs of geothermal energy under various environmental settings. The purpose of the analysis is to demonstrate that geothermal energy can be cost effective when compared to development of coal, which is generally considered as the least cost option for new Indonesian electricity generation. The chapter also discusses perspectives of present Geothermal Investors in Indonesia, and their key recommendations in improving private development in the sector, specifically a reasonable purchase price and a predictable permitting and regulatory process.
Chapter 8 - Forestry, Land Use, Environmental Issues, and Social Responsibility

This chapter discusses the complicated interrelationship between the developmental policy governing environmentally friendly geothermal resources and policies governing protection of forests, the ownership of land, and environmental considerations in Indonesia. Indonesia has the third-largest forested area in the world, and protecting that area from unwarranted intrusion is of international as well as domestic interest. It has been estimated that as much as 58% of the nation’s geothermal resource areas underlie forests areas. This chapter discusses the national efforts to resolve tensions that arise when carbon reduction policies conflict – policies that are on the one side designed to protect forests and on the other side to promote the development of environmentally friendly geothermal resources in the forest location. Since the holder of a geothermal license to develop a WKP has the responsibility to acquire the land for its geothermal business, this chapter also explores Indonesia’s land-lease laws in the geothermal context. The chapter also discusses Indonesian law and regulations for the protection and management of the environment and reviews potential environmental impacts of geothermal development, including the array of mitigation measures that are available. Finally, of particular interest to the potential investor or developer, the laws of Indonesia also impose both corporate social and environmental responsibilities on a geothermal operating business.

Chapter 9 - Geothermal Development Perspectives and Selected Case Histories

This chapter presents select geothermal projects and with the goal of comparing and contrasting various development approaches, past and present, that have been adopted for geothermal development in Indonesia. Three case studies are presented in this section: Seulawah Agam (expected power potential of 100-160 MWe, which is presently being developed under a Public-Private Partnership scheme), Sarulla (as a Joint-Operating Contract under state-owned utility PLN), and Kawah Kamojang (an operating geothermal field producing steam since 1926).

Chapter 10 - Geothermal Stakeholders in Indonesia

This chapter identifies stakeholders in both the upstream and downstream segments of the geothermal development process in Indonesia. The chapter identifies these stakeholders in brief and, when available, a citation to the URL of their homepages. The stakeholders include Government, Developers, Utility, and Financial Institutions. The Government consists of the Ministries and relevant agencies of the national government, provinces, regencies and cities are prime stakeholders. Information on these government authorities, the 542 autonomous regions (34 provinces, 410 regencies and 98 municipalities that comprise Indonesia as of 2013), are best accessed through Government of Indonesia Internet resources, including the Geo Portal of Bappenas providing up-to-date data (Data Bank) and resources information (Knowledge Bank). The Developers are those that are invested and are investing in Indonesia, with the hope that the list shall soon be expanded. The Utility is PLN that remains the pivotal downstream buyer for geothermal developers. The Financial Institutions are lending institutions and equity investors always have a major role to play in any private sector investment, and are significant stakeholders in this process. Other relevant participants in the geothermal industry such as: academia, industry organizations and newspapers and business journals are important elements in the Indonesian policy mix.
Appendices
Appendices include a compendium of terms and terminology, the geothermal development zones, the template of the PLN Power Purchase Agreement and the 2003 Geothermal Law, a flow-chart on the process for securing the government’s Geothermal Fund, an overview of environmental considerations for geothermal developers and concludes with a comprehensive bibliography.

Geo Portal
Additional resource data and information can be found in the Geo Portal’s Data and Knowledge Banks on the Bappenas website:

http://geothermal.bappenas.go.id
CHAPTER 1

INTRODUCTION TO GEOTHERMAL DEVELOPMENT IN INDONESIA

1.1 OVERVIEW OF THE NATURE OF GEOTHERMAL RESOURCES

Indonesia is a large, densely populated developing country with energy demands rapidly approaching those of the most developed countries. Richly endowed with extensive reserves of coal, oil and gas, its economy has historically relied on cheap and heavily subsidized fossil fuels. Indonesia’s reliance on fossil fuels, however, is becoming unsustainable because of financial and economic costs. Indonesia is also endowed with one of the world’s largest volcanic features – the Sunda-Banda volcanic island arc. This line of volcanoes, many of them active, extends 4,800 km through Indonesia’s most populated islands, Sumatra, Java and Bali. Two smaller volcanic arcs occur in northern Sulawesi and Halmahera. These widespread expressions of shallow crustal heat represent an environmentally-friendly, energy resource - provided that it can be exploited safely and cheaply.

In recognition of both the need to encourage geothermal development throughout the world’s largest archipelago and the concomitant need to facilitate private-sector investment in the development of geothermal resources, the Government of Indonesia has adopted a series of policies designed to bring electricity generated from geothermal energy onto the regional electrical grid system. These government policies are designed to be complementary to policies and operations of the local and regional governments controlling national geothermal resources. Since sound policy flows from decision-makers’ understanding of science underlying geothermal resources they regulate as well as the technology that converts those resources to electricity, this chapter summarizes the different natural occurrences of geothermal systems and explains the power generation systems that convert the heat of the earth into commercial electricity. In addition, since history is generally precedent to the future, this chapter will also review Indonesia’s history of geothermal power development.

1.1.1 Definition of Geothermal Energy

“Geothermal energy” is a general term that describes thermal energy available and stored in the Earth, and translates literally as “Earth’s heat energy”. Geothermal energy originates from the formation of the planet and the radioactive decay of its elements. The geothermal gradient - meaning the rate of change in temperature between the earth’s surface and its interior - drives continuous conduction of thermal energy in the form of heat from the earth’s interior to the surface. The majority of this heat is either too deep or spread too diffusely to be exploited economically. However, in some places the heat is concentrated as a result of certain geologic and hydrothermal processes. These geothermal regions allow the concentration of heat into geothermal systems that can be harnessed. The resources that occur in such geothermal regions vary in size, temperature, permeability and chemistry depending primarily on the specific geologic setting and the rocks that make up a geothermal reservoir. Based on these reservoir fluids, geothermal systems can occur as either liquid-dominated or steam-dominated resources. The steam and liquid geothermal system, as well as the power systems they require to generate electricity are described in the following Sections.
1.1.2 Geothermal Systems

There are various types of geothermal systems and different ways to utilize geothermal heat. Below, two separate categories are defined based on whether the geothermal system utilizes heated fluids naturally occurring in the subsurface (Conventional Hydrothermal Systems) or whether they simply use the heat of the rock formation (Earth Heat Systems).

**Conventional Hydrothermal (Geothermal) Systems**

- Higher temperature, liquid or vapor dominated systems are associated with magmatic (volcanic) activity, in deep regional structural settings or associated with deep sedimentary units; these systems are commonly applied for generating electrical power.

- Lower temperature systems are found in a variety of geologic settings; these can be used for direct heating such as space heating, industrial processes and heated pools and spas.

**Earth Heat Systems**

- Engineered Geothermal Systems (EGS) generate electricity without natural convective hydrothermal sources; permeability is created or enhanced artificially; fluid is introduced from the surface to the system in order to transfer the heat to the surface.

- Geothermal Heat Pump technology taps the energy near the earth's surface, driving a heating system for both residential and commercial use.

Figure 1.1 is a schematic representation of these two types of geothermal systems, overlain on a temperature-depth graph. Actual temperature gradients are shown at 20, 50, and 100°C/km.

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**Figure 1.1 Schematic Depth-Temperature Plot for Geothermal Resources**

*Source: EGS Inc.*
Conventional Hydrothermal Systems (colored red and pink) show overlap in the temperature range of 75-110°C, a range in which geothermal systems may be applied both for generating electricity and direct-use depending on specific site conditions. EGS potential exists in areas where minimum temperatures are likely >150°C and at depths generally below approximately 3,000 meters. In Figure 1.2, the relative position of deep sedimentary basins, sometimes associated with oil and gas production, is outlined with dashed lines. Finally, although it is currently possible to drill much deeper than 5,000 meters the costs would be restrictively high. For many geothermal systems that would be economically unattractive.

1.1.3 Setting of Geothermal Systems

As shown in Figure 1.1, conventional hydrothermal systems are primarily associated with regions of high heat flow, which can be encountered in a number of different geologic settings:

1. **Volcanic Systems**: Volcanic systems are intrusive or extrusive magmatic bodies within the Earth’s crust that are a source of heat. Generally, these systems are most often situated within volcanic complexes near plate boundaries or hot spots. The fluid flow in these systems is controlled by permeable fractures, fault zones, and rarely permeable sedimentary strata. Volcanic systems are the most common sources of heat for geothermal systems, and are found predominately around the “Ring of Fire”, so named because of its extensive network of volcanoes (See Figure 1.2). The Sunda-Banda volcanic island arc in Indonesia exemplifies the Ring of Fire volcanic system.

*Figure 1.2 Global View of Geothermal Systems Associated with Magma Emplacement*
2. **Convective Systems:** In convective systems with deep-water circulation in tectonically active areas, water circulates to greater depths through mostly vertical fractures to extract the heat from the rocks. The heat source is often heated crustal rocks at shallow depths resulting from elevated geothermal gradients due to present or past proximity to mantle material. This kind of system can be found in the Basin and Range region of the United States.

3. **Sedimentary Systems:** Sedimentary systems with permeable layers at great depths (2-5 km) are the most common worldwide, including geo-pressured systems often found in conjunction with oil resources. Sedimentary basins commonly consist of alternating layered sequences of permeable (limestone, sandstone) and impermeable strata (shale or mudstone). Water is interstitial water, commonly a brine of connate origin. An example of such system would be the Paris Basin in France.

1.1.4 **Geothermal Systems in Indonesia**

The position of the Indonesian archipelago, located at the intersection of three major tectonic plates (India-Australia/Eurasia/Pacific) creates a complex tectonic setting. It is between the subduction of continents and oceans that magma migrates upward into the shallow crust. Figure 1.3 is a conceptual model of a typical andesitic volcanic geothermal system that can be used to illustrate those found in Indonesia geothermal system.

![Figure 1.3 Conceptual Model of an Indonesian Geothermal System](source: Henley and Ellis, modified by Lawless et. al., 1995)

Geothermal systems can be found in geologic settings other than that illustrated in Figure 1.3 and can develop in areas where there is not a volcanic heat source that drives convection as described above.
1.1.5 Requirements for Technical Evaluation of Geothermal Systems

Geothermal systems generally have three primary requirements. First, a heat source that allows fluids in the subsurface to be heated. This heat source is commonly associated with a young, relatively shallow volcanic system or with an elevated regional geothermal gradient. Second, a fluid that allows the heat to be transferred from depth to the shallow subsurface where it can be accessed by drilling. The fluid is almost always a water or brine and under certain geothermal circumstances can be steam. And the third, pathways within the rock fabric that allow transport of the fluid to the shallow subsurface. The driving transport mechanism is a balance between the pore pressures within the rocks and the density differences between fluids of various compositions and temperatures. The pathways are almost always fractures and faults (fracture permeability); however, in some areas, connectivity of the pore space within the rock (rock permeability) can also provide suitable pathways for fluid flow.

In many geothermal systems, the presence of a naturally formed cap rock serves as a reservoir seal, preventing geothermal fluids from leaking out of the reservoir. It is generally composed of hydrothermal clay minerals resulting from fluid and rock interaction at elevated temperatures. The cap rock is impermeable or has a very low permeability. In order to complete an evaluation of a potential geothermal resource within a given area, certain basic data sets need to be available for review. These data sets include, but are not necessarily limited to:

1. **Geology and Tectonic Data:** Most geothermal systems around the world are primarily controlled by rock fractures. For this reason an understanding of the tectonic setting of the area is critical – in particular, the relationship between the prevailing stress field and local geology. At the initial stages of review regional structures can often be identified using remote sensing techniques such as satellite imagery and aerial photography.

2. **Surface Geothermal Data:** The occurrence of surface manifestations such as hot springs, mud pots, fumaroles and surface hydrothermal alteration are often indications that an active geothermal system is present in an area. Geochemical analyses, including those from cold springs and water wells, provides insight into the chemical characteristics of the system and in some cases allows estimation of the subsurface temperatures.

3. **Geophysical Data:** More advanced exploration programs usually include a variety of geophysical surveys. The most widely applied geophysical technique in geothermal exploration is magnetotellurics (MT) as shown in Figure 1.4, a geophysical method of imaging the Earth’s subsurface by measuring natural variations of electrical and magnetic fields at the Earth’s surface. MT measurements allow the detection of resistivity anomalies associated with productive geothermal structures, including faults and the presence of a cap rock, and allow for an estimation of geothermal reservoir temperatures at various depths. Gravity surveys that measure variations in rock densities are frequently completed in association with MT surveys to aid in their interpretation. In some areas, seismic reflection surveys can be used to identify the dimensions of specific fault zones that might be conduits for geothermal fluid flow.
4. Temperature Gradient and Exploration Well Data: It is common in geothermal exploration programs to drill shallow temperature gradients or exploration wells (sometimes referred to as “slim holes”), prior to the drilling of deeper and more expensive production/injection wells. From these shallower wells (usually 150 to 750 meters in depth), geothermal gradients and rock properties can be derived that allow for estimating deeper subsurface temperatures and identifying better locations for drilling targets.

Figure 1.4 Magnetotelluric (MT) Methods Measure the Earth’s Impedance from Naturally Occurring Electromagnetic Waves in order to Attain Information for Geothermal Exploration.

Source: Phoenix Geophysics (http://www.phoenix-geophysics.com/applications/geothermal/)

1.1.6 Geothermal Resources in Indonesia

Geologically, the Indonesian Archipelago lies at the intersection of the Eurasian, Indian-Australian and Pacific plates. This tectonic condition leads to magmatic and volcanic processes to form a volcanic belt along Sumatra, Java, Bali, Nusa Tenggara Barat, Nusa Tenggara Timur, Sulawesi, Maluku and North Maluku although potential geothermal resources have also been located in non-volcanic regions such as in the regions of Kalimantan, Bangka-Belitung Islands, Central Sulawesi and Papua.¹

As of January 2013, 299 geothermal areas in Indonesia have been recorded, with an electricity generation potential estimated by the Center for Geological Resources as approximately 28.8GWe. This estimated production capability is updated annually in line with the discovery of new geothermal areas or additional exploration activities. Based on the National Standard Classification of Geothermal Energy Resources Potential in Indonesia,² the identified sites include:

- 7,472 MWe of Speculative Resources;
- 4,881 MWe of Hypothetical Resources;
- 13,371 MWe of Possible Reserves;
- 823 MWe Probable Reserves and
- 2,288 MWe of Proven Reserve.³

³ Public data from the Center for Geological Resources January, 2013.
Five classifications are based on the stages of an investigation conducted at a geothermal area:

1. **Speculative Resource**: Characterized by active geothermal manifestations, the size distribution of the reservoir is calculated from surface manifestations and geology, while the temperature is calculated by a geothermometer. Power per unit area is determined by the assumptions. Estimation of potential energy is carried by the comparison method.

2. **Hypothetical Resource**: Indicated by active geothermal manifestations, this type of resource is identified by data produced by regional geological surveys, geochemistry and geophysics studies. A prospect area is determined using the results of these surveys with temperatures based on geothermometry (water, gas or isotope). Potential electrical output is estimated using the volumetric method. The thickness of the reservoir is assumed to be 1 to 2 km.

3. **Possible Reserves**: Size and thickness of reservoir and rock/fluid physical parameters are estimated based on geoscience data that is described in an integrated resource geothermal model. The formula estimates the potential energy using volumetric methods.

4. **Probable Reserves**: Evidenced by a successful exploration wells with flow of steam or hot water. Reservoir area and thickness data obtained from wells and the results of integrated geoscience. Rock and fluid parameters and reservoir temperature data are obtained from direct measurements in wells and/or laboratory analytical data. The formula estimates the potential energy used by volumetric methods.

5. **Proven Reserves**: Evidenced by more than one successful exploratory steam/hot water well. Reservoir area and thickness are based on well data and the results of a detailed investigation of integrated geoscience. Rock and fluid parameters and reservoir temperature data obtained from direct measurements in wells and/or laboratory analytical data and reservoir simulation. The formula estimates the potential energy use reservoir simulation combined with the volumetric method.

This nomenclature system has been used to establish potency for each of the 299 geothermal areas that have keep identified in Indonesia dependent on their specific level of available exploration data. Note that this methodology, although well established, can frequently overestimate the level of geothermal energy available to the country because it does not truly account for those geothermal areas that will prove not to be economically viable for development either through lack of resource, confirmation, transmission issues or other logistic barriers. The methodology is particularly suited to the role of allowing comparisons to be made between separate geothermal areas – an important function for investors when a large number of prospects are available for development.
1.2 POWER GENERATION

There are three general types of geothermal power conversion technologies: dry steam, flash, and binary. Dry steam is the oldest of the geothermal technologies. The first geothermal power plant, commissioned in 1904 at the Larderello dry steam field in Italy, takes steam out of fractures and uses it to drive a turbine directly.\(^4\) Flash plants use steam flashed from high-pressure hot water in the formation, well or surface equipment. The steam that results from this process is used to drive a turbine, which in turn drives electrical generation equipment. In binary plants, hot water from a well is used in a heat exchanger, where it heats and vaporizes a secondary fluid with a much lower boiling point than water. This vapor then drives a turbine.

1.2.1 Steam Power Plant

Dry steam (or direct steam) geothermal power plants are used for reservoirs that are vapor-dominated and can be viewed as a variant of the flash plant, but without the separator. The steam is fed directly to the turbine after being "cleaned" of any debris, rock fragments or non-condensable gases. These were the earliest types of plants developed in Italy and in the United States. Recent direct steam plants have been installed in the California Geysers of the United States, with capacities of 55 and 110 MWe.\(^5\) Indonesia’s Kamojang and Darajat projects are also dry steam fields. Globally, about 28 percent of all electricity produced in geothermal power plants is obtained through the use of the direct steam power cycle.\(^6\) In addition, dry steam power plants have very low potential impact on the environment. The

\(^4\) The first geothermal power was commissioned in 1904 at the Lorderello dry steam field in Italy.
fluid from the well is only steam, negating the need for disposal of mineral-rich brine. Non-condensable gases in the steam are usually removed by means of vacuum pumps or steam jet ejectors. Such reservoirs are the least common of all geothermal resources and exist in only a few places in the world. Systems dominated by steam in the reservoir, such as Kamojang and Darajat in West Java, are comparatively rare but have the advantage of being able to use steam directly from the wells to power the turbine. The steam can occur as either wet steam or dry steam. Wet steam is in contact with the primary fluid within the reservoir. Dry steam is generally separated from its fluid of origin, and is often superheated.

Figure 1.6 Geothermal Dry Steam Plant

1.2.2 Flash Steam Power Plants

Liquid-dominated systems such as those mostly found throughout Indonesia are more common and generally occur as high temperature fluids in the subsurface. These fluids flash to steam either in the well, or more commonly, at specific surface equipment (separators). Flash plants can incorporate single, double or rarely triple flash equipment. Flash steam plants are used in cases where the geothermal resource produces high-temperature hot water or a combination of steam and hot water. Plants using this power generation cycle comprise 29 percent of all geothermal plants, and produce 40 percent of total global geothermal power. Individual power plant units are usually in the 30 to 55 megawatt electrical (MWe) range although many geothermal fields include more than one unit. A power plant unit can be one or more single turbine generator sets, often housed in the same building. In Indonesia, the

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average well output is often in the 8-10 MWe/well range with an estimated additional 50% of the number of production wells needed for injection of the spent brine.

The fluid from the well is delivered to a flash tank or separator where a portion of the water flashes to steam, which in turn is directed to the turbine. The remaining water (referred to as “brine”) is directed to injection wells. Depending on the temperature of the resource, it may be possible to use two stages of separation. In the illustrated case, the brine separated at the first, higher-pressure separator is directed to a second separator where more (but lower pressure) steam is separated. Remaining brine from the second stage tank is then directed to disposal. These so-called double flash power plants (see figure 1.7) deliver steam at two different pressures to the turbine.

**Figure 1.7 Geothermal Flash Plant**

1.2.3 Binary Cycle Power Plants

Binary cycle geothermal power generation plants differ from Flash Steam systems in that the water or steam from the geothermal reservoir never comes in contact with the turbine/generator units. Low to moderately heated geothermal fluid (below 400°F, 204°C) and a secondary fluid (hence, "binary") with a much lower boiling point than water both pass through a heat exchanger. Heat from the geothermal fluid causes the secondary fluid to flash to vapor, which then drives the turbines and subsequently, the generators. See Figure 1.8.
Binary cycle power plants are closed-loop systems and virtually nothing (except water vapor) is emitted to the atmosphere. In most parts of the world resources below 400°F (204°C) are the most common geothermal resource, a circumstance that suggests that future geothermal power plants will be dominantly binary-cycle plants.\(^8\)

1.3 GEOTHERMAL ENERGY: DIRECT-USE DEVELOPMENT

Geothermal reservoirs of hot water, which are found a few miles or more beneath the Earth's surface, can be used to provide heat directly. This is called the direct-use of geothermal energy. Direct-use applications exist on a scale ranging from heating and cooling households and large industrial and institutional buildings to commercial uses for aquaculture, resorts/spas, and greenhouses. Geothermal direct-use is very compatible with Indonesia's needs in industrial use, agricultural lands, bathing and spa resorts, which all require heat. Figure 1.9 shows direct-use applications for residential, industrial, and commercial uses.

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\(^8\) Kutscher, C., 2004. Geothermal Electric Power. NREL, USA
**Figure 1.9  Geothermal Direct-Use Applications**

<table>
<thead>
<tr>
<th>T (°C)</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>Digestion in paper pulp (Kraft); Evaporation of highly concentrated solutions</td>
</tr>
<tr>
<td>180</td>
<td><strong>Refrigeration</strong> by ammonia absorption</td>
</tr>
<tr>
<td>170</td>
<td>Heavy water via hydrogen sulphide process; drying of diatomaceous earth</td>
</tr>
<tr>
<td>160</td>
<td><strong>Drying</strong> of fish meal and timber</td>
</tr>
<tr>
<td>150</td>
<td><strong>Alumina via Bayers process</strong></td>
</tr>
<tr>
<td>140</td>
<td>Drying farm products; food canning</td>
</tr>
<tr>
<td>130</td>
<td><strong>Fresh water by distillation</strong></td>
</tr>
<tr>
<td>120</td>
<td>Concentration of saline solution; <strong>Refrigeration medium temperature</strong></td>
</tr>
<tr>
<td>110</td>
<td><strong>Drying</strong> and curing of light aggregate <strong>cement</strong> slabs</td>
</tr>
<tr>
<td>100</td>
<td><strong>Drying</strong> of organic materials eg: seaweed, grass, vegetables etc;</td>
</tr>
<tr>
<td>90</td>
<td><strong>Washing and drying of wool</strong></td>
</tr>
<tr>
<td>80</td>
<td>Drying of stock fish; intense de-icing operations</td>
</tr>
<tr>
<td>70</td>
<td><strong>Space heating (buildings + greenhouses)</strong></td>
</tr>
<tr>
<td>60</td>
<td><strong>Refrigeration (lower temperature limit)</strong></td>
</tr>
<tr>
<td>50</td>
<td>Animal husbandry: greenhouses by combined space</td>
</tr>
<tr>
<td>40</td>
<td>Mushroom growing: <strong>balneology/therapeutic hot springs</strong></td>
</tr>
<tr>
<td>30</td>
<td>Soil warming: <strong>swimming pools</strong>; biodegradation; fermentation</td>
</tr>
<tr>
<td></td>
<td>Warm water for years-round mining in cold climates; de-icing; fish farming</td>
</tr>
</tbody>
</table>

*Source: After Lindal, 1973*
The direct-use of geothermal energy has significant economic, environmental and social benefits, chiefly because it reduces electricity demand as it replaces electric-driven heating and cooling applications. Although using direct geothermal energy does not generate electricity, it is a more efficient form of energy as the fuel undergoes only one energy conversion rather than the several that occur in electricity generation usage. Direct-use also does not emit carbon and thereby helps reduce Indonesia’s carbon footprint. In direct-use systems, a well is drilled into a geothermal reservoir to provide a steady flow of hot water. The water is normally pumped to the surface and flows through a mechanical piping system which uses a heat exchanger in order to deliver the heat directly for its intended use. A disposal system then either injects the cooled water back into the subsurface or disposes of it on the surface. No heat pump installations are used to date as they appear to be uneconomical at this time due to the availability and abundance of high enthalpy fluids. There is no accurate data on countrywide utilization; however, annual energy estimates are above 11.8 GWh/year.9

In Indonesia, geothermal direct-use is most commonly used in balneology, bathing, and heated swimming pools. Since 1999, direct-use of geothermal energy has been used in agriculture production in Indonesia, initiated by geothermal research group called the Agency for the Assessment and Application of Technology.10 Their first project examined the use of geothermal energy for mushroom cultivation. Researchers used a steam generator heat exchanger, an autoclave, a freshwater tank, an inoculation room, incubation rooms, and production rooms. The system works by directing dry steam from a small capacity well (temperature of 110-120°C) to a steam generator to heat up freshwater. The heated freshwater is used to sanitize the mushroom growing equipment and also for space heating to keep the incubation room warm and suitable for mushroom development. The geothermal steam substitutes for the use of fossil fuel (kerosene). This has become a model for the cultivation of other agricultural goods in Indonesia.11


10 Surana, Taufan “Development of Geothermal Energy Direct Use In Indonesia” for the Agency for the Assessment & Application of Technology (BPPT), Indonesia.

More recently, other uses of direct-use geothermal fluids include large-scale palm sugar processing, copra drying, tea drying, pasteurization, and fish farming. The process for drying goods is shown in Figure 1.10. Large food industries are beginning to utilize these methods in Indonesia for exported products. Direct geothermal is also used in the aquaculture industry, where it has enjoyed significant economic benefits. For example, freshwater fisheries in Lampung province use geothermal energy to heat their breeding waters to grow catfish.\(^{12}\)

As the third largest exporter of flowers in the world, Kenya has demonstrated the advantages of applying direct-use in commercial horticulture.\(^ {13}\) Because of this successful integration of direct-use, other industries are looking to take advantage of this renewable resource for commercial-scale production of staples crops such as coffee, tea, maize, onion, and cassava. Likewise in Indonesia, geothermal direct-use applications have the potential to contribute significantly to economic development in the country. To help improve the quality of life for local communities, the Government of Indonesia seeks to promote renewable resource use through its energy diversification and fossil fuel substitution programs. Many local governments have started to identify direct-use potential in their administrative territories. The Geothermal Law regulating geothermal energy direct-use is undergoing revisions, and MEMR is presently preparing an implementation regulation on the application of direct-use in Indonesia, facilitating the growth and development of direct-use businesses in the country. Promoting economic growth and cleaner environment, geothermal direct-use has the potential to improve the quality of life for the Indonesian people.

\(^{12}\) Surana, Taufan, op. cit.

1.4 GEOTHERMAL RESOURCE DEVELOPMENT IN INDONESIA

1.4.1 Early Development Activities

1920s: Serious exploration of Indonesia’s geothermal systems began at Kawah Kamojang, West Java, in the 1920s under the auspices of the colonial-era Geological Survey of Indonesia. Several shallow holes encountered flows of steam and hot water. At Dieng, on the two-kilometer-elevation volcanic plateau in Central Java, a shallow hole was drilled into a fumarolic area. There appears to have been no attempt at commercial development of either of these areas for electric power.

1971-1974: Nothing of further significance was done until the early 1970s. The first five-year development plan (REPELITA) of independent Indonesia included an inventory of geothermal areas in Sumatra and certain other islands by the Volcanological Survey of Indonesia (VSI). This was completed in 1974. A New Zealand assistance project, begun in 1971, evolved into a bilateral agreement between the Indonesian and New Zealand governments, under terms and conditions outlined in the Colombo Plan. New Zealand and Indonesian scientists, the latter from the VSI, jointly evaluated and ranked five geothermal prospects on Bali and Java. The prioritized list for further exploration placed Kamojang as the top-ranked prospect, followed by Darajat, Salak, and Cisolok, all in West Java, and Bedugul in Bali.

Figure 1.11 Steam Pipeline - Darajat Geothermal Project 1976

Source: Chevron

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14 This brief description of the history of geothermal development in Indonesia is taken from a World Bank report prepared by GeothermEx, Inc. of Richmond, California, U.S. in June 2010 and titled: An Assessment of Geothermal Resource Risks in Indonesia. This historical background is presented in full with editorial changes for clarity and consistency with this Handbook.
**1974-1977:** In 1974, under **Presidential Decree 16/1974**, responsibility for exploration and development of geothermal resources in Java and Bali was assigned to the national oil company, Pertamina. Pertamina thereupon became an active participant in exploration. A series of deep exploration wells were drilled at Kamojang beginning in 1974. A high-temperature (~240°C) vapor-dominated system was encountered, with strong flows of steam (averaging ~60 tons/hr per well) from a reservoir exhibiting a pressure of ~35 bars. At the time, the rare vapor-dominated or dry steam reservoirs, as distinguished from liquid-dominated systems, were limited to reservoirs at Larderello, Italy; the Geysers in the United States; and Matsukawa in Japan. Bilateral assistance projects had been granted a few years earlier by the Governments of France and the United States for the further exploration of Dieng. This Dieng project included drilling of a high-temperature well in 1977.

After systematic exploration at Darajat, the first well was drilled in 1976. The second well encountered another vapor-dominated system. Pertamina, expanding the range of its activities, conducted surface exploration at Cisolok, Salak and Banten (also in West Java). The VSI, by itself and variously with Pertamina, and New Zealand and Japanese aid groups, explored the Bedugul prospect on Bali, and a number of prospects in Sumatra and Sulawesi. Shallow holes were drilled into several of these prospects. Many of the prospects explored during that period were later the sites of intense activity, drilling of deep wells, and in at least one case, Lahendong in northern Sulawesi, power plant installation.

The program thus far has successfully identified four fields that have geothermal power generation, Kamojang, Salak, Darajat and Lahendong. These four out of seven prospects were initially given high priority for exploration and assessment. A fifth prospect, Bedugul, has been drilled successfully, and is capable of being developed commercially in the next few years. Although production capacity was estimated at 175 MW in 2008, the project has been opposed by local residents and the regional government in Bali has made a decision not to approve this project at this time, primarily for cultural reasons. Risk for this program was borne by foreign donors, especially the Governments of New Zealand (GoNZ) and Japan (GoJ), and by the Government of Indonesia acting through Pertamina, VSI and PLN.

**1979:** The decision was made in 1978 to install a small (<1 MW) power plant at Kamojang and in 1979 a 30 MW power plant was constructed. Pertamina entered into a steam sales agreement (SSA) with the national electric utility, (Perusahaan Listrik Negara; Persero or PLN). PLN built and owned the plant (Kamojang Unit-1), which was in part funded by the New Zealand government.

**1981-1982:** Presidential Directive 20/1981 authorized Pertamina to enter Joint-Operating Contracts (JOCs) to develop geothermal fields. At this juncture, construction and ownership of power plants was still reserved to PLN. At a conference in Jakarta in 1981, the Government of Indonesia offered five areas for JOCs: Banten, Cisolok, Darajat, Dieng and Salak. Because of its prior expression of interest, Salak was awarded (1982) to Union Oil Company of California (subsequently renamed Unocal). Amoseas Indonesia Inc., a joint subsidiary of Chevron Oil Company and the Texas Company (Texaco), entered into a JOC for Darajat (1984). Limited interest was expressed about Dieng, although no JOC was requested. There was no expression of interest regarding Banten or Cisolok. SSAs were negotiated between Unocal Geothermal Indonesia (UGI) and Pertamina, and between...

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16 See discussion of JOC at Section 4.1.1 (The First Regime: the Pertamina Monopoly & a Constitutional Crisis).
Amoseas and Pertamina. Pertamina in turn agreed to sell steam to PLN, who would build and operate the power plants.

*Figure 1.12 Geothermal Manifestation, Cisolok Cisukarame WKP*

1981: In the 1981 tendering of prospects, no special consideration was given to Amoseas or UGI in return for their investment. Even the documents giving details of prior exploration at the areas being tendered had to be purchased (at an aggregate cost of approximately US$75,000). Bidders also were asked to provide training for Indonesian staff at the bidders’ cost, and to co-fund various local development projects. Although minor, these issues are considered to be part of the risk of doing business in Indonesia.

1982-1984: Prior to the beginning of the 1980s, all exploration risk had been borne by international aid agencies or by the Government of Indonesia, acting through Pertamina and VSI. However, beginning in 1982 at Salak and 1984 at Darajat, private developers began to share the resource risk. Salak, Darajat and Kamojang have proven to be highly productive fields. High production values have been characteristic of most of the fields explored initially by Pertamina and VSI, whether subsequently developed by Pertamina or by private entities under JOC with Pertamina.

Indonesia’s first commercial power plant (30 MW) went on-line at Kamojang early in 1983, partly financed by PLN and partly by New Zealand and other international lenders and donors. Drilling of additional wells continued. The decision was taken in 1984 to add two 55 MW units, and these (Kamojang Units 2 and 3) were constructed by PLN and commissioned by late 1987. Total installed generating capacity had reached 140 MW. Pertamina had
continued exploratory drilling at Dieng, but had encountered problems with non-condensable gases (NCG) and a phreatic (steam) eruption at one well, raising concerns about environmental hazards. Indeed, a CO\textsubscript{2} eruption at a nearby crater killed several people. An application in 1983 by PLN for a loan from the Asian Development Bank to construct a power plant at Dieng was withdrawn after these and other issues emerged regarding the project.

**Figure 1.13 Muara Labuh Geothermal Field**

1985-1994: Under terms of the JOC with Petamina, Unocal and Amoseas immediately began detailed exploration and exploratory drilling at their respective areas. By 1985, UGI had decided that the Salak field was suitable for commercial development. A 110 MW power plant was recommended to PLN. However, PLN delayed construction of the plant, and it was not completed until 1994. Delays in part reflected the need by PLN to keep the cost of electricity at or below 4 US cents/kWh. These delays in turn, pressured the JOC to accept a low price for steam.

At Darajat, Amoseas had also continued with exploration drilling. By 1988, together with Pertamina in the JOC, it was decided to recommend construction of a 55 MW power plant by PLN. Here, again, PLN deferred construction. Price, along with a continued preference for coal-fired generation, contributed to the delay. Darajat Unit 1, the 55 MW power plant, was finally commissioned in 1994. The delays and uncertainties were costly for all parties at Salak, Darajat and Dieng. Large sums had been spent in surface exploration, drilling wells and constructing associated surface facilities, which added to the economic risk of the project. Therefore, urged by private developers and by national entities, late in 1991 the Government of Indonesia issued PD 45/1991. It allowed the JOCs to build and operate power plants and to sell electricity to PLN, including electricity generated from geothermal resources. However, emphasis was given to coal-fired generation. PD 49/1991 subsequently provided implementation measures for PD 45/1991. Private IPPs were also allowed to construct power plants of 10 MW or lesser capacity, and to sell power directly to local purchasers at negotiated prices.
These decrees were intended to reduce uncertainty, and therefore to reduce risk. They also removed some of the financial stress facing an increasingly insolvent PLN by allowing the financially stronger Pertamina, Unocal and Chevron to arrange financing for power plants. Exploration of other prospects in Java, Sumatra, Bali and Sulawesi by Pertamina had continued throughout the decade of the 1980s, with mixed results. Highly attractive results were obtained from surface exploration, largely utilizing geothermometry based on chemical analysis of spring and well waters and fumarole gases, and electrical resistivity methods, and, occasionally, the drilling of shallow temperature gradient holes. Areas with significant results included: Wayang Windu; Patuha (including the small Cibuni area at the western side) and Karaha, all in West Java; Lahendong and Tompasos in Sulawesi; Bedugul in Bali; Sibayak and the broad Sarulla area in North Sumatra; and Ulubelu, Kunyiit-Lempur, Hululais, Sekincan-Suoh and Lumutbalai in southern Sumatra.

Deep exploration wells were drilled in many of these areas in the late 1980s and early 1990s. In addition to Dieng, one of the original five targets for development, there has been construction of a geothermal power plant at Wayang Windu, Sibayak and Lahendong. Projects are in advanced stages of activity at Sarulla, Patuha, Bedugul, Lumutbalai and Ulubelu. The advance of these projects demonstrates the effectiveness of state-supported programs of surface exploration and drilling of discovery wells.

During this period, the only private company conducting geothermal exploration in Indonesia to any significant degree was Unocal. Its efforts centered on the zone of intense fumarolic activity extending southward from Lake Toba in the greater Sarulla area, including Namora-i-Langit, Silangkitang and Sibualbuali. In 1992 Unocal negotiated a JOC for Sarulla with Pertamina. Negotiation for an Energy Sales Contract (ESC) was begun. Through its subsidiary, Unocal North Sumatra Geothermal Ltd. (UNGS), Unocal conducted further surface exploration and the drilling of several deep exploratory wells. A high-temperature hot-water system (to 310°C) was encountered, with attractive flow characteristics (averaging 130 tons/hour mass flow per well). However, acidic subsurface conditions and higher than desired non-condensable gases (NCG), 2 to 3 % by weight, also were found. Mitigation of acid and NCG content were expected to increase the cost of field development.

Mid-1990s: Under the terms of an aid project supported by the GoNZ, a mixed New Zealand-Indonesia team at Ulumbu on the island of Flores carried out exploration. Highly encouraging results were obtained by the drilling of three wells. Continuation of well field development and construction of a power plant was assigned to PLN. However, there has been no significant activity subsequent to the mid-1990s. Risk of surface exploration at these prospects, in several cases including exploratory drilling of shallow and even deep holes, had been borne by the Government via Pertamina, and to lesser extent VSI and PLN. Some of this risk was supported by international donor agencies, principally from Japan and New Zealand. Further exploration and drilling of development wells would be at the risk of the participants in the JOCs. The Government of Indonesia has offered very little incentive.

1.4.2 Expanded Private Participation from 1991-1997

1991-1997: During the years 1993-1996, ESCs were signed between PLN and Pertamina and its JOC partners for the construction of power plants at ten additional locations: Bedugul, Cibuni, Darajat, Dieng, Karaha, Salak, Sarulla, Sibayak, Patuha and Wayang Windu. By itself, Pertamina entered into ESCs for the further development of Kamojang and Lahendong. PLN, purchasing steam from well field operators, had by 1991 constructed only 140 MW of geothermal power plants (at Kamojang). Another 220 MW were under construction (110 each at Salak and Darajat). These came on-line in 1994. Thereafter, almost all-geothermal
power plant construction was financed and managed by the Independent Power Producers (IPPs) working under JOCs with Pertamina. The exceptions were Unit 3 (55 MW) at Salak in 1997, previously under contract for construction by PLN, and a 20 MW plant at Lahendong, begun by PLN in 1999 and commissioned in 2001.

By 1997, Pertamina had catalogued or assessed some 250 geothermal prospects, of which about 70 were considered to have potential for generation of geothermal electricity. An estimate by Pertamina made in 1999 shows only 19.658 MW potential. Fields and prospects listed in columns headed as “Installed” and “Reserves Proven,” are essentially those where Pertamina had made its greatest exploration efforts. Of these areas, Pertamina had entered into JOCs with a number of private geothermal developers (Unocal, Amoseas, Mandala Magma Nusantara, California Energy Co., Karaha Badas Company, PT YalaTeknosa (at Cibuni), PT Dizamatra Powerindo (at Ssibayak), and Bali Energi Limited (in a JOC with California Energy Co.) in ten separate prospects or fields. Actual construction and commissioning by 2002 included:

- Unit 2 (90 MW) at Darajat
- Unit 1 (60 MW) at Dieng
- Unit 1 (110 MW) at Wayang Windu
- Units 4 through 6 (3 x 55 MW) at Salak
- Unit 1 (2 MW) at Sibayak.

The installation of these power plants brought total installed generating capacity up to 807 MW, of which 317 MW were the result of ESCs between Pertamina and JOC partners with PLN.

1.4.3 International Financial Crisis and Resulting Industry Decline

1997-1998: The Asian financial crisis of 1997-1998 had a major impact on Indonesia's geothermal industry. The rupiah-US dollar exchange rate plummeted from about Rp 2.500 to nearly Rp 17.000, before it stabilized at Rp 10.000. PLN’s financial condition was greatly weakened and the pricing of geothermal electricity became an issue difficult to resolve. ESCs for privately operated geothermal projects typically are denominated in US Dollars. The initial selling price for electricity from these fields for the initial 14 years varied from about 6.9 US cents/kWh for Cibuni and Darajat, to over 9 US cents/kWh at Dieng, with an average of almost 8 US cent/kWh. This range was significantly higher than the approximately 4 US cents/kWh cost for coal-fired power. However, the price at several geothermal fields was “front-end loaded” and was to decline significantly beginning in the 15th year, presumably after capital investment had been recovered completely. However, given the financial crisis, this front-end loading electricity price had created concern with regard to country risk and the need to meet the high “hurdle rate” for investment. As an example, in 1993 Unocal signed an agreement with PLN to construct power plants at Sarulla (which later was cancelled by mutual agreement). Price was to be 7,6 US cents for the first 14 years, 5,75 US cents for years 15 to 22, and 5,21 US cents thereafter until year 30. The ESC also included a “take-or-pay” clause and various bonus and penalty clauses. PLN stated that they could not pay the agreed prices in dollars; this determination resulted in a near-fatal impasse. Several projects either went into default (Wayang Windu) or shut down at least temporarily.

17 GeothermEx, An Assessment of Geothermal Resource Risks in Indonesia, supra, pp 3-11.
Late in 1997, the Government of Indonesia issued **PD 39/1997**. It cancelled various energy projects, including geothermal projects “…that are not yet in progress and the implementation of which can be postponed at this time…. The cancellation excluded those projects in which construction is underway…according to the original schedule …. ” Seven geothermal projects were suspended indefinitely. Salak Unit 6 (55 MW) had come on-line that year, and Dieng Unit 1 was completed and ready for commissioning by mid-2001. Construction was underway at Darajat and Wayang Windu, and loan agreements and various contracts had been entered into at Patuha, Bedugul and Karaha. After initial negotiations, legal action began, leading ultimately to demands for arbitration under international rules.

Lawsuits were brought in Indonesian courts and arbitration was conducted in Geneva. Arbitration resulted in a ruling that Pertamina and PLN were to pay the Karaha Bodas developer Himpurna California Energy US$ 261.1 million, plus interest at 4% per annum starting from January 2001. This penalty represented the US$111 million expended by the Karaha Bodas developer plus US$150 million for lost profit. Pertamina filed an appeal and the issue apparently has been resolved. An international arbitration panel also awarded Mid-American Energy Holding Co., the successor-in-interest of Himpurna California Energy Ltd., US$575 million for expenditures and lost income.

**1999:** In November 1999, the U.S. Overseas Private Insurance Corporation (**OPIC**) paid Mid-American Energy Holding Co. US$290 million under the terms of policies covering Dieng and Patuha. Ultimately, OPIC negotiated an agreement with the Government of Indonesia under which the Dieng and Patuha well fields and the Dieng power plant were turned over to the Indonesian government.

![Figure 1.14 Wayang Windu Geothermal Field](Source: Star Energy, 2012)

### 1.4.4 Post-2000 Developments

Indonesia has made a strong economic recovery from the 1997 financial crisis. Its Gross Domestic Product grew at an average of 5.4% per year from 2000 to 2013 as reported by Badan Pusat Statsik Indonesia. As of 2013, Indonesia is the largest economy in Southeast Asia. As energy supply became a more critical issue and the awareness of the impacts of

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19 Ibid.
global climate change became more apparent to developing nations, the Government of Indonesia began again to look at how it could develop its significant geothermal resources.

In 2003, Parliament enacted **Geothermal Law 27/2003**, dramatically changing how geothermal development could occur within Indonesia. The Law, among other things, mandated that future geothermal fields must be transparently and competitively tendered for development and required that much of the responsibility for that tendering be managed by regional and local governments.

While the Geothermal Law has allowed IPPs to participate in development there have been a number of obstacles to overcome and implementation of the law has been slow. Subsequent development under Law 27/2003 and how these barriers, both individually and collectively, have impeded geothermal industry growth are discussed in more detail in Chapter 4 (Geothermal Energy Legal Regime) and subsequent chapters of this *Handbook*.

1.5 **EXISTING NATIONAL RESOURCE POTENTIAL**

Indonesia has the world’s largest geothermal power development potential, estimated to be 28.8 GWe; however, as of 2013 only nine geothermal fields out of 299 sites identified are generating electricity (Table 1.1), although several more are presently under development. Given its huge geothermal potential, the Government of Indonesia began to step up its efforts to expand geothermal power development in 2003 — the year the Geothermal Law was promulgated — to open up new opportunities for private and public investments in the sector. However, from 2003-2013, there have been only a few private sector geothermal developments initiated in the energy sector. Over the last decade, Indonesia has been overcoming barriers in attracting private investors as well as creating financial incentives for developing its geothermal resources. Chapter 2, (National Geothermal Energy Strategy) of this *Handbook* discusses these implementation plans and other incentive programs that have been put in place to further encourage investments in the geothermal sector.

During the last decade, much has been done to prepare for private sector investments in geothermal developments. Of the 299 geothermal areas within Indonesia, approximately one-third (or 92 areas) has already become Geothermal Working Areas (“WKPs”). Of this total of 299 areas, 44 geothermal areas are in 19 Legacy WKPs and 48 areas are in 39 new WKPs. Note that one WKP may consist of multiple geothermal areas. For example, the Legacy WKP Kamojang and Darajat in West Java include four separate working areas while Seulawah Agam WKP in Nangroe Aceh Darussalam contains only one geothermal area. As of November 2013, a total of 20 of the 39 New WKPs are currently tendering or in the process of being tendered. Table 1.1, outlines the nine generating fields that are sited in eight WKPs. A complete list of all the geothermal areas and WKPs with their individual status as of 2013 is presented in Appendix B1 thru B3 of this *Handbook* and an up-to-date list may also be found on the Geo Portal’s Data Bank (http://geothermal.bappenas.go.id/).

1.6 **SUMMARY**

Geothermal energy in Indonesia represents an underutilized form of commercial energy that is safe, inexpensive, and environmentally sustainable. In an effort to promote private sector investment in this fossil fuel alternative, the Indonesian government has established policies designed to realize the potential for this energy source. The science and history of geothermal energy in Indonesia are key components to understanding geothermal development and investment, and were reviewed in this chapter.

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20 Center for Geological Resources, 2013.
Table 1.1  Elevent Existing Operating Geothermal Projects as of October 2014

<table>
<thead>
<tr>
<th>No</th>
<th>Field Name</th>
<th>Owner of Geothermal Working Area (WKP)</th>
<th>Name of Company (Developer)</th>
<th>Power Plant Capacity (MWe)</th>
<th>Turbin Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kamojang (West Java)</td>
<td>PT Pertamina Geothermal Energy (PGE)</td>
<td>PGE</td>
<td>PT PLN /PT. Indonesia Power</td>
<td>140</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 x 30 MW</td>
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<td>2 x 55 MW</td>
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<td></td>
<td>1 x 60 MW</td>
</tr>
<tr>
<td>2</td>
<td>Darajat (West Java)</td>
<td>PGE</td>
<td>JOC PGE– Chevron Geothermal Indonesia (CGI) Ltd</td>
<td>Indonesia Power</td>
<td>275</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>1 x 94 MW</td>
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<td></td>
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<td></td>
<td>1 x 121 MW</td>
</tr>
<tr>
<td>3</td>
<td>Gn Salak (West Java)</td>
<td>PGE</td>
<td>JOC PGE– Chevron Geothermal Salak (CGS) Ltd</td>
<td>Indonesia Power</td>
<td>377</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>3 x 60 MW</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>3 x 65.6 MW</td>
</tr>
<tr>
<td>4</td>
<td>Wayang Windu (West Java)</td>
<td>PGE</td>
<td>JOC PGE – Magma Nusantara Ltd</td>
<td>Star Energy Geothermal (Wayang Windu) Ltd</td>
<td>227</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 x 110 MW</td>
</tr>
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<td></td>
<td>3 x 65.6 MW</td>
</tr>
<tr>
<td>5</td>
<td>Lahendong (North Sulawesi)</td>
<td>PGE</td>
<td>PGE</td>
<td>Indonesia Power</td>
<td>80</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4 x 20 MW</td>
</tr>
<tr>
<td>6</td>
<td>Sibayak (North Sumatera)</td>
<td>PGE</td>
<td>PGE</td>
<td>PT Dizamatran</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>1 x 10 MW</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 MW (Monoblok)</td>
</tr>
<tr>
<td>7</td>
<td>Dieng (Central Java)</td>
<td>PGE</td>
<td>PT Geo Dipa</td>
<td>Indonesia Power</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 x 60 MW</td>
</tr>
<tr>
<td>8</td>
<td>Ulubelu (Lampung)</td>
<td>PGE</td>
<td>PGE</td>
<td>PGE</td>
<td>110</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 x 55 MW</td>
</tr>
<tr>
<td>No</td>
<td>Field Name</td>
<td>Owner of Geothermal Working Area (WKP)</td>
<td>Name of Company (Developer)</td>
<td>Power Plant Capacity (MWe)</td>
<td>Turbin Capacity</td>
</tr>
<tr>
<td>----</td>
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<td>----------------------------</td>
<td>---------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Upstream (Steam Field)</td>
<td>Downstream (Power Plant)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Ulumbu (NTT)</td>
<td>PLN</td>
<td>PLN</td>
<td>5</td>
<td>4 x 2.5 MW</td>
</tr>
<tr>
<td>10</td>
<td>Mataloko (NTT)</td>
<td>PLN</td>
<td>PLN</td>
<td>2.5</td>
<td>1 x 2.5 MW</td>
</tr>
<tr>
<td>11</td>
<td>Area Patuha (West Java)</td>
<td>PT Geo Dipa</td>
<td>PT Geo Dipa</td>
<td>55</td>
<td>1 x 55 MW</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>1.403.5 MWe</strong></td>
</tr>
</tbody>
</table>

Sources: Various sources gathered by BAPPENAS, 2015
Geothermal energy results from heat conducted to the earth’s surface from its interior. This energy is exploitable under certain geologic and hydrologic conditions and is found in two common forms: conventional hydrothermal and earth heat systems. Conventional hydrothermal systems are those where there are existing fluids in the subsurface that can be used to transfer heat to the surface. Earth heat systems require fluids first to be injected from the surface and then recovered when the heat has been “mined”. Conventional hydrothermal systems are generally found in areas of recent volcanic activity or in sedimentary systems where deep circulation is available. Such systems require a heat source, fluid to transfer the heat, and pathways within the rock mass to produce exploitable resources. Exploration and data collection provide a good indication as to whether geothermal power is feasible at a specific site to justify the expense of drilling production wells. Indonesia’s ideal geographical location with respect to regional volcanic activity has resulted in an abundance of opportunities for exploitation of such conventional hydrothermal resources. Earth heat systems are mentioned only briefly in this *Handbook* but could become sources of additional geothermal electric power in the future.

Depending on the chemistry and temperature of the fluids, geothermal resources can be converted to electrical power using any of three power conversion technologies: dry steam, flash, and binary. Flash steam plants are the most common in Indonesia, although the rarer dry steam resources are also found. Lower enthalpy systems also occur but their development has not been a major priority to date. In summary, geothermal systems are a source of renewable energy that is becoming increasingly viable due to Fast Track government policies and incentives and are discussed in more detail in the following chapters.
CHAPTER 2

NATIONAL GEOTHERMAL ENERGY STRATEGY

2.1 INDONESIA’S ENERGY PLAN

Indonesia’s electric power environment is on the cusp of historical transformation and the nation’s geothermal resources are integral to this transformation. The scale of the current plans to increase the capacity of geothermal power in Indonesia has a long history. While most of the prior geothermal developments have been carried out by the state-owned company Pertamina through its subsidiary PGE a majority portion of that new capacity is intended to be developed by the private sector, including international developers. Development of geothermal energy reserves is projected to grow eight-fold in the near-term, representing a significant increase in geothermal percentage share of the country’s electricity generating capacity.

Indonesia is the world’s fourth most populous country and it is undergoing an unprecedented degree of urbanization and industrialization. Indonesia’s 2013 total electric generating capacity of approximately 44GWe is barely meeting the current demand for its 2013 population of more than 240 million people. Indonesia’s economy is growing rapidly, and a large portion of the population is entering the middle-class and affluent consumer socioeconomic category. Demographic trends show the size of the opportunity.

There are currently about 74 million middle class affluent customers (MAC) in Indonesia, and this number will double by 2020, to roughly 141 million people. During that period, some 8 to 9 million people will enter the middle class each year. The growth of the MAC population is occurring throughout the country. There are now 25 locations in Indonesia (both cities and regencies) with MAC populations in excess of 500,000, and there will be 54 by 2020. According to utility PLN, demand for electricity is expected to grow substantially during this decade at an estimated rate of 8.46% annually, through the year 2020. This undersupply, compounded by Indonesia's 17.508-island geographic complexity, means that Indonesia has one of the lowest electrification ratios in South East Asia. An estimated 20 million households, or 80 million people, currently have no access to public

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21 The last official census recording the population of Indonesia took place in 2010 and it showed that there were 237,424,363 people living on its 17,508 Islands. See: www.bps.go.id Indonesia’s population continues to grow. As of September 9, 2013, the population was estimated to be 246,986, 230. See World Population, 2012.Population of Indonesia, [http://worldpopulationreview.com/indonesia.](http://worldpopulationreview.com/indonesia).


electricity. In some eastern Indonesian provinces this ratio ranges from 35% to 58%, as shown in Figure 2.1, below.

In July 2012, PLN revealed that 13 geothermal power projects were stuck in various exploration stages, and were likely to miss development deadlines. Long-term forecasts for Indonesia’s power sector project growth will average 7.3% per annum between 2013 and 2021. Delays affecting geothermal projects could stretch over the long-term, with coal-based generation covering the predicted supply shortfall. The supply of electricity is therefore emerging as a potential constraint on Indonesia’s long-term growth and development ambitions, with the situation likely to become even more critical.

In order to meet the anticipated shortfall in the national generation of electricity, the Government implemented plans in 2006 and 2010 to add an additional 20,000 MW under two Fast Track Programs. In addition, in order to meet the forecast national peak load requirements, an additional 37,300 MW will be needed. According to the Electric Power Supply Business Plan (RUPTL 2012-2021 or Rencana Usaha Penyediaan Tenaga Listrik), in the next 10 years, PLN is planning to install a total of 57,300 MW of energy capacity (which includes both the Second Fast Track Program and the remainder of the First Fast Track Program).

Presidential Regulation 5/2006 sets the national targets for the optimal energy mix. This Regulation uses 2025 as the target date, and provides that 17 percent (17%) of the national energy mix will be from renewable energy, including at least five percent (5%) from geothermal. As a significant part of this Blueprint for National Energy Management program instituted under PR 5/2006, the Government has established an ambitious goal of increasing the capacity of geothermal power plants to 9,500 MW by 2025, almost eight times the current capacity. The Second Fast Track Program envisions 4,935 MW of this amount on schedule for 2015.

Policy coordination with the regions and strategic governance by the Government of Indonesia are the subject of Energy Law 30/2007. This 2007 Energy Law created a National Energy Council chaired by the President. It provided the Council with the authority to design and formulate national energy policy. The Council, which was put in place in 2009, is designed to formulate and manage energy policy and the energy outlook, to determine mitigation efforts in the event of energy emergencies, and to monitor policy between sectors. Policy initiatives initiated by the Council must be endorsed by Parliament. More details on the roles of this National Energy Council are discussed in Section 2.3.3, below.

26 Based on the National Power General Plan (RUKN) and Presidential Regulation 5/2006, the contribution of renewable energy is to increase from its current 5% to 17% of the country’s total energy consumption in 2025. Geothermal is expected to account for 5% of the contribution of renewable energy with a target of 9,500 MW by 2025. PWC, Oil and Gas in Indonesia - Investment and Taxation Guide 2011, p.154.
27 MEMR Regulation 21/2013 amended the FTP II project list, bringing the total planned capacity of geothermal up to 4,935 MW by 2015. The amount and due date of geothermal energy planned may continue to change.
Figure 2.1 Electrification Ratios for Indonesia in 2013

Source: BAPPENAS, 2013
2.2 INDONESIA’S REGULATORY ENVIRONMENT

The geothermal policy environment is best understood in the context of Indonesian laws and regulations. The Indonesian geothermal regime is described by a complex of laws, regulations and decrees. Therefore, it is essential for any stakeholder, especially potential investors, to have an appreciation of the Indonesian legal structure.

2.2.1 The Hierarchy of Laws and Regulations

Indonesia law is based on a civil law system, intermixed with customary law and Roman-Dutch law. In Indonesia, law is declared by Parliament; however, under Indonesia’s legislative system, law is usually general in nature, lacking both in definitions and implementation. Rather the laws work as normative declarations of will or brief guidelines. Hence, implementing regulations are needed in the form of government, presidential, ministerial and regional regulations or decrees. These regulations and decrees provide further details stipulating how exactly the laws will be implemented. Article 7 of Law 12/2011 on the Formulation of Laws and Regulations sets forth the following official hierarchy of Indonesia legislation (from highest to lowest):

1. **1945 Constitution** (Undang-Undang Dasar 1945 or UUD’45);
2. **Consultative Assembly Decisions** (Ketetapan Majelis Permusyawaratan Rakyat);
3. **Law** (Undang-Undang (UU)) and Government Regulation in Lieu of Law (Peraturan Pemerintah Pengganti Undang-Undang or Perpu);
4. **Government Regulation** (GR) (Peraturan Pemerintah or PP);
5. **Presidential Regulation** (PR) (Peraturan Presiden or Perpres);
6. **Regional - Province Regulation** (Peraturan Daerah Provinsi); and
7. **Regional - Regency/City Regulation** (Peraturan Daerah Kabupaten/Kota)

In addition to the above hierarchy, Article 8 of Law 12/2011 establishes the binding authority of regulations promulgated by executive, legislative and judicial bodies that are binding as long as they have been made under directive of higher law or regulations or made under its respective authorities.

Indonesia’s promulgating bodies include:
- The People's Consultative Assembly;
- The House of Representatives (Parliament);
- The House of Regional Representatives;
- The Supreme Court;
- The Constitutional Court;
- The State Audit Board.

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31 Also known as the Regional Representatives Council.
- The Judicial Commission;
- The Bank of Indonesia;
- Ministers, agencies, institutions or commissions established by law;
- Regional Parliaments;
- Governors, Regents or Mayors

In practice, there are also the following Decrees, Instructions and Letters;
- Presidential Decrees (Keputusan Presiden);
- Presidential Instructions (Instruksi Presiden or Inpres);
- Ministerial Decrees (Keputusan Menteri or Kepmen);
- Regional Government

  Province Decrees (Keputusan Gubernur);
- Regional Government

  Regency/City Decrees (Keputusan Bupati/Walikota); and
- Circulation Letters (Surat Edaran).

These Decrees, Instructions and Letters sometimes conflict with each other. Ministerial Decrees and the decrees issued at a level below the Ministerial level do not have the same binding power as regulations. They are, however, binding in their respective sectors as administrative decisions. Note that if there is an apparent conflict between one authority in the hierarchy and a lower one, the higher authority governs. For example, if there is a conflict between a Ministerial Decree and a higher authority such as a Government Regulation, the higher Government Regulation governs. Once legislative and regulatory products are promulgated, the State Gazette of the Republic of Indonesia (Lembaran Negara Republik Indonesia) is issued from the State Secretariat. Sometimes a clarification (Penjelasan) accompanies some legislation in a supplement of the State Gazette. The Government of Indonesia also produces State Reports (Berita Negara), which publish government and public notices.

2.2.2 Governance of Resources Pursuant to the Legal Regime

Article 33 of the Indonesian Constitution states that land and water, and whatever is contained therein, is the State’s property and shall be utilized to the maximum welfare of the people. 32

- Geothermal resources fall within the Constitutional definition of “land and water, and whatever is contained therein”.
- Geothermal development (as distinguished from the resource itself) is governed by two separate regulatory frameworks:

  **Legacy WKPs: Presidential Decree** (Keputusan Presiden, Keppres) 45/1991 is the principal legislation governing treatment of legacy working areas/field. **Presidential Decree 45/1991** governs all concessions awarded prior to enactment of Law 27/2003. WKPs governed by this Decree are termed “Legacy WKPs”(wilayah kuasa pengusahaan) and those that remain unexploited all belong to Pertamina and PLN.

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32 See discussion at Section 3.1 of the Handbook.
**New WKPs:** Geothermal Law 27/2003 governs any new WKPs awarded after its enactment. Chapter 4 of the *Handbook* (Geothermal Energy Legal Regime) will focus on progress under the 2003 law as it governs the development of all new WKPs.

### 2.2.3 Policy Trends Influencing Geothermal Laws and Regulations

Three fundamentally new policy trends emerged in Indonesia following the Asian financial crisis and Indonesian *reformasi* movement of the late 1990’s. These policy trends are reflected in the geothermal regimes discussed in Chapter 4 (Geothermal Energy Legal Regime). The three policy trends influencing geothermal laws and regulations are regionalization, transparent competition, and de-monopolization:

- **Regionalization:** Law 22/1999 opened the door to greater authority for provinces (*provinsi*), regencies (*kapubaten*) and cities (*kota*). 33

- **Transparent Competition:** Laws and regulations across sectors began to require award of contracts, licenses or other rights through transparent competitive processes.

- **De-monopolization:** State enterprises that held monopolies (and in some cases regulatory powers) in their respective sectors began to be stripped of those powers – for example, The Oil and Gas Law 22/2001, although the oil and gas law did not affect Pertamina’s status as a state-owned entity, it did change its operational status to just another “production-sharing contractor”. Furthermore Electricity Law 30/2009 removed PLN’s monopoly.

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33 Law 22/1999 was superseded by Law 32/2004. See the discussion at Section 1.3 (Indonesian Government Structure).
2.3 ENERGY POLICY INITIATIVES

2.3.1 Fast Track Programs (FTP)\textsuperscript{34}

In 2006, the Government announced stage one of two programs, each designed to accelerate the development of 10 GW of generating capacity (a total of 20 GW). The first initiative, known as the First Fast Track Program (FTP I), was followed by a Second Fast Track Program (FTP II) at the start of 2010.

The 2006 FTP I goal set to increase renewable energy generation (17%). The 2010 FTP II also increased the capacity of renewable energy, particularly geothermal energy. Ministry of Energy and Mineral Resources (MEMR) Regulation 15/2010 describes the programs that were designed to accelerate development of electricity from renewable energy resources and to encourage IPP investment in the sector. In this program, 60% of capacity was derived from renewable energy. Under the FTP II, geothermal-based power as of 2013 aimed to produce approximately half (4,935 MW) of the additional 10,000+ MW goal. The National Development Planning Agency (“Bappenas”)\textsuperscript{35} established a medium term (2010-2014) development plan (Rencana Pembangunan Jangka Menengah or RJPM). This RJPM development plan furthered the development of infrastructure as a top Presidential priority. The RJPM plan set forth 45 key-infrastructure programs with milestones and goals including the utilization of alternative energies and in particular geothermal as a main source of energy sector infrastructure development.\textsuperscript{36}

On January 8, 2010, Presidential Regulation 4/2010 came into force. It authorizes Indonesian state-owned electricity generation company PLN to accelerate the development of power plants utilizing renewable energy, coal and natural gas (and supporting transmission facilities), by itself and through cooperation with independent

\textsuperscript{35} P.D. 4/2002 and P.D.5/2002 on the organization and working procedures of BAPPENAS.
\textsuperscript{36} Presidential Regulation 13/2010 that sought to clarify "public-private partnership" regulations.
power producers (IPPs) from whom PLN will purchase electricity. The regulation also stipulates that:

- The Ministry of Energy and Mineral Resources shall regulate the capacity and location of power plants;

- The Government of Indonesia shall guarantee the business feasibility of PLN in accordance with prevailing laws and under provisions to be regulated by the Ministry of Finance (MoF); and

- The Ministry of Finance will provide import duty exemptions to power plants and other energy-sector facilities.

Pursuant to regulations issued by the Ministry of Finance the Government provided several fiscal incentives for geothermal development through Government Regulation 62/2008 and 1/2007, MoF Regulation 177/2007 and MoF Regulation 22/2011. These incentives may be summarized as follows: 30% of corporate income tax and 10% of added-value tax absorbed by Government of Indonesia, custom duties exemption for a geothermal developer, 25% per year depreciation for eight years with double declining balance method, and investment tax credit of 5% per year for six years.

In January 27, 2010, MEMR Regulation 2/2010 set out details of the location and capacity of each power plant to be implemented under Presidential Regulation 4/2010. Under the Second Fast Track Program promulgated by this regulation, 10,147 MW of new capacity was planned, of which geothermal generating capacity made up the largest share, i.e., 4,925 MW. Subsequently, under MEMR Regulation 21/2013 the project list continued to evolve, and 78 projects in 2013 with a target of 17,918 MW capacity, of which the geothermal generating capacity to be implemented by IPPs is targeted at 4,935. Since all projects designated under FTP II may have government guarantees, unlike non-designated IPP projects, this list is of special importance.

2.3.2 The Geothermal Fund

The Government has established a national policy to encourage private sector geothermal resources development. To that end, in order to hasten the exploration and development of geothermal resources, Indonesia needs to provide an environment that will attract investments. In this context, the Government is determined to participate in the initial exploratory survey in order to mitigate the geothermal resource development risk to potential private investors as well as to be able to tender geothermal work areas for the maximum possible potential price. Therefore, in 2011 the Government created a revolving fund known as the "Geothermal Fund". This Geothermal Fund is intended to provide potential developers and investors with sufficient resource data and credible information on greenfield geothermal sites. This information is offered during the tendering process of new areas. The Geothermal Fund is discussed in detail in Chapter 6 of this Handbook (Private Sector Geothermal Resource Development).

2.3.3 The National Energy Council and the National Energy Policy 2050

Renewable Energy development in Indonesia is supported through the National Energy Policy and Energy Law as well as through the Ministerial Decree No. 02/2004 on Renewable

The Green Energy Policy is basically an effort to develop an energy system characterized by optimum use of renewable energy, efficient use of energy and clean energy technology (such as clean coal technology, fuel cell and nuclear energy) and public awareness of energy efficiency.

In 2006, the Government of Indonesia launched a National Energy Policy under **Presidential Decree 5/2006**. One major initiative of the policy is the establishment of the national energy supply mix targets for 2025 and 2050. The target developed for the energy supply mix was based on domestic resource availability and national energy security objectives. The national energy security objectives for generation of energy are to move away from oil (due to declining domestic reserves and imports) and to maximize the utilization of abundantly available domestic energy resources.

Energy **Law No 30/2007** established the National Energy Council of Indonesia (NEC) or **Dewan Energi Nasional (DEN)**. The NEC was formed in June 2009 and began to deal with the five main tasks assigned to it under the Energy Law:

- To plan and formulate National Energy Policy (**NEP** or *Kebijakan Energi Nasional (KEN)*).
- To establish National Energy General Plan (**NEGP** or *Rencana Umum Energy Nasional (RUEN)*).
- To determine measures in response to conditions of energy crisis and emergency.
- To supervise the implementation of cross-sectorial energy policies.
- To regulate type, amount, time and location of energy buffer stock (strategic reserve).

A 2011 draft of the National Energy Policy from the National Energy Council revealed a target of electricity consumption of between 710 to 910 TWh in 2030 and around 2,100 to 2,710 TWh in 2050 (1 TWh = 1,000,000 MWh). The Council pointed out that in the 2011, the capacity of the available power plants was 38 GW, the Council concluded that PLN needs to boost its capacity to up to 450 GW by 2050, i.e., by 2050 that portion of the country’s capacity controlled by PLN will need to increase by a factor of 15. The National Energy Council summarized the Indonesian energy strategy and policy consensus of the National Energy Council as of 2012:

- **Paradigm Shift**: Indonesia is rapidly evolving and may achieve parity with the developed countries in the 2030 to 2050 time frame. Energy is, as of 2012, in a development modality as distinguished from being an export commodity.
- **Energy Strategy**: Maximize development and use of renewable energy, minimize petroleum, use coal and gas for supply backbone - nuclear being the last choice.

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- **Universal Electrification**: Prioritize the development of modern energy access for all people (~100% electrification by 2020).

- **Remove Subsidies**: Set the energy price at 2014 market value, and remove the energy subsidies (to oil and electricity) by 2014.

- **Cease Import Dependence**: Prioritize the use of indigenous energy sources (both renewable and nonrenewable energy) for domestic supply.

- **Conserve Export Energy**: For long-term energy security, be conservative with the export of coal and gas.

In addition, the portion of the National Energy Policy established by NEC that specifically applies to geothermal energy is threefold. As set forth in the latest 2013 draft of National Energy Policy 2050, the three governing factors are:

1. Diversifying energy mix, increasing the share of RE to around 23% in 2025 and 31% in 2050 and decreasing the combined share of gas and coal to around 60% in 2025;

2. Conserving energy utilization, reducing energy elasticity to less than one in 2025; and

3. Establishing energy strategic reserves through on-going programs to determine type and amount.

The projected energy supply, published by the National Energy Council, is shown in Figure 2.2, while the capacity of power plants that need to be developed is presented in Figure 2.3.

**Figure 2.2 Projected Primary Energy Supply 2050**

![Graph](Source: DEN, 2014)

2.3.4 World Bank Strategy for Geothermal Development in Indonesia

The World Bank Group (WBG) has concurred with the Government’s assessment that geothermal power is one of the best options to diversify Indonesia’s energy mix.\(^{42}\) This judgment is based on the fact that geothermal energy is a base load generation technology not subject to the intermittency and variability associated with other renewable electricity sources such as wind and solar. The World Bank also observed that geothermal resources in Indonesia are ideally located on islands with major population centers where electricity demand is high and continues to grow. Furthermore, as an indigenous and non-tradable energy source, it will also enhance the country’s energy security and serve as a natural hedge against the volatility of fossil-fuel prices. The Bank has also observed that, in general, Indonesia has had difficulty in mobilizing financing even for conventional power generation options such as coal, given the challenging investment climate both globally and within the country. Despite being regarded as a commercially viable renewable energy technology, geothermal power development in Indonesia faces a number of significant sector-specific issues that are deterring investments.

Table 2.1 Policy Reforms to Enhance Investment Climate for Geothermal Development

<table>
<thead>
<tr>
<th>Policy Reforms to Enhance Investment Climate for Geothermal Development</th>
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</thead>
<tbody>
<tr>
<td>- Create policies &amp; incentives to mobilize investments in geothermal development.</td>
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<tr>
<td>- Improve preparation &amp; management of process of offering (tendering) geothermal concessions to developers, in line with the Geothermal Law.</td>
</tr>
<tr>
<td>- Improve domestic capabilities to manage sector development &amp; to undertake investments.</td>
</tr>
<tr>
<td>- Extend long-term carbon funds towards geothermal development in order to enhance financial viability of investments.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Direct Support Immediately stimulate Investment &amp; Scale-Up Development in Conjunction with NGOs (WBG, IBRD IFC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Assist public &amp; private developers with existing concessions to expand development.</td>
</tr>
<tr>
<td>- Reduce the cost of geothermal development &amp; filling financing gaps by extending attractive financing terms as well as mobilizing grant support.</td>
</tr>
<tr>
<td>- Cost-share exploration risks associated with geothermal power development especially with undeveloped fields (greenfields).</td>
</tr>
<tr>
<td>- Improve the capabilities of developers to immediately undertake the development of their geothermal fields.</td>
</tr>
</tbody>
</table>

The World Bank Group and the Government’s are working together to overcome these barriers, such as:

- Need for momentous investments (over US$25 billion) for the Second Fast-Track Program alone,
- Insufficient policy and regulatory support for implementation of the Geothermal Law, lack of a strong policy framework and legal structure for scaling up geothermal,
- Inadequate incentives and pricing mechanisms that fail to both reflect the environmental benefits of the technology and enable investors to secure a return commensurate with the higher risks they face especially when developing unexplored (greenfield) geothermal fields, substantial investments required at the front end of geothermal projects,
- Limited institutional capability to properly plan geothermal development and sufficiently engage suitable developers, lack of experienced geothermal practitioners capable of providing technical oversight to various activities related to development,
- Uncertainties relating to a single off-taker, PPA pricing and availability of technical and financial incentives to encourage investment,
- Lack of appreciation for the environmental benefits of geothermal development in PPA pricing,

- Heavily dispersed load centers with multiple disconnected transmission grids associated with numerous small island loads,

- Inexperience of local and regional governments regarding geothermal practices which result in the tendering process being slow and sometimes not transparent,

- Weak domestic capacity in the areas of resource assessment, equipment manufacturing, construction, and operation and maintenance of geothermal energy facilities.

Consequently, only a handful of existing geothermal operations (brown fields) in Indonesia have expanded production over the past decade while no new greenfields projects that carry greater risks have been developed. Harmonizing these issues has been an objective of the GoI as examined in Section 2.4, below.

In order to move forward with sector reforms and mobilize investments, the Government of Indonesia has initiated ambitious risk-reduction programs such as the Geothermal Fund (discussed in more detail in Chapter 6 (Private Sector Geothermal) of this Handbook). As summarized in Table 2.1, the Government of Indonesia in conjunction with the International Bank for Reconstruction and Development (IBRD) and the International Finance Corporation (IFC) have initiated major reforms to progressively enhance the investment climate in the sector.

2.4 THE 2010 GEOTHERMAL SECTOR POLICY INITIATIVES AND THEIR EVOLUTION

The goal of electrifying the country through the development of geothermal energy is one of many national priorities. There are competing national goals that often intersect and compete with each other. As Chapter 8 (Forestry, Land Use, and Environmental Issued of Social Responsibility) of this Handbook details, geothermal energy resources often underlay Protected and Conservation Forests. Both the development of geothermal energy and the protection of the forests are means to the reduction of CO₂ emissions; however, although both national initiatives have the same goal, reconciliation of the mechanisms by which each of these two national objectives can be difficult. This example illustrates only one of many such competing goals. Bappenas, the National Development Planning Agency, has undertaken the rationalization and reconciliation of such competing national goals. In this context, the geothermal sector requires policies affecting not only the Ministry of Energy and Mineral Resources, but also others, such as the Ministry of State Owned Enterprises (MSOE), the Ministry of Finance (MoF), the Ministry of Environment (MEnv) and the Ministry of Forestry (MoFor).

In 2010, Bappenas issued a major policy statement entitled Geothermal Development and Investment Plan 2010-2014, a policy designed to attract private sector financing. Bappenas has estimated that in order to achieve a target of 4,733 MW (a 2010 target figure) of geothermal energy to be developed by 2014 under the Second Fast Track Program. At the outset, Bappenas projected that 70% of the development funding (or approximately US$9.9 billion in 2010 dollars) must be from private investments. To that end, Bappenas set out to tackle the core hurdles that impeded achievement of this national goal. Bappenas has determined that the following policies, listed here in order of priority, are required. As of

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2013, while some of these policy objectives have been achieved, some are still in the process of development. This *Handbook* will further address the status of these policy goals in the ensuing chapters.

### 2.4.1 Institute Uniform and Transparent Power Purchase Agreement (PPA) with MoF Guarantees for PLN

Power Purchase Agreements in use in Indonesia are discussed in depth in Chapter 5 of this *Handbook*. In brief, PPAs establish the amount of money that PLN will pay an Independent Power Producer (IPP) for electricity; IPPs will not be able to get financing without clarity on the income (i.e., tariff price) of the project. A Power Purchase Agreement also details the conditions between the buyer (i.e., the utility PLN) and the IPP. It indicates the conditions under which PLN pays for the delivered electricity; it specifies the penalties PLN will pay in the event that the IPP can deliver the electricity, but PLN is not ready to off-take it. The PPA also established the penalties the IPP has to pay PLN in case it cannot deliver the electricity and PLN has to buy electricity from elsewhere. The policy objective is the creation of a uniform and transparent PPA text for any agreement that is to be entered into by an IPP and PLN. Mechanisms have been established for thorough preliminary analysis of the available geothermal resource data prior to site tendering, i.e., before the subsurface resource confirmation (drilling) has taken place. Only after such preliminary analysis is conducted shall the Government (through MEMR, authorization) permit PLN to sign a PPA with an IPP.

Bappenas has also identified a number of focused policy issues that will surface in the context of any PPA negotiations. For example, PLN has historically been under pressure by IPPs to pay for electricity in foreign currency. Recognizing that IPPs have to import their equipment from abroad and (more significantly) repay their loans in foreign currency, the Government of Indonesia has recognized that in order to ensure private-sector investment in the geothermal sector, some concessions on foreign currency conversion would have to be forthcoming. The Government to date is still deliberating whether to provide a facility for IPPs to convert their Rupiahs to foreign currency, enabling IPPs to more easily pay their foreign debts.\(^{44}\) In addition, the Government through MoF will reassure banks/lender institutions, that in case PLN, the official off-taker and party to the contract, fails to live up to the contract due to liquidity or solvability problems, the Government of Indonesia will ensure payment to the IPP, which in turn will be able to pay its debts to the banks. As of 2013, it is PLN policy that the price for electricity generated by hydropower is set in Rupiahs, while solar PV and geothermal are set in US Dollars. In practice, prices are established during PPA negotiations between PLN and developers. Usually, the overseas component of a PPA (such as imported equipment) is set in US dollars, while local components are set in Rupiahs.

Bappenas has recommended that *Presidential Decree 67/2005* (Government and Private Business Entities Cooperation in the Provision of Infrastructure) under which MoF can give these guarantees, should be adjusted to improve the clarity required for the banks to disburse their funds to the IPPs. Bappenas has recommended that the Government shorten the required time to obtain the guarantee, as the budget in which the guarantee is given has to be approved by Parliament.\(^{45}\)

Subsequently, *Presidential Regulation 13/2010* amended PD 67/2005 by authorizing the MoF to provide sovereign guarantees for PLN in context of geothermal PPAs. Furthermore, *PD 56/2011* added a provision allowing foreign legal entities to apply to initiate

\(^{44}\) See PD 67/2005.  
Public-Private Partnership (PPP) projects, which are discussed in more depth in Chapter 6 (Private Sector Geothermal Resource Development) of the Handbook.

2.4.2 Create Financial Facility

In theory, the simplest solution to get the investments needed to develop geothermal energy would be for PLN to take the price risk for fossil fuels. In other words, PLN’s investment decisions would be based on cost of fuel plus a hedge for the price of fuel for 5 to 10 years, which would make it comparable with the benefits those investments in geothermal offer with no significant price increases for at least 25 years. However elegant (and efficient) this solution may be from an economic point of view, the reality is that PLN’s investments in geothermal energy are guided by the principle of “least cost option”, which economic principle does not look at future price developments but at today’s markets. In Indonesia’s market, coal is the cheapest option. It is thus argued that in order to facilitate the required investments, the Government should offer IPPs a price equal to the average weighted production cost of PLN plus a feed-in tariff.

Consequently as of 2011, in order to get the required investments in geothermal developments, the Government began exploring a scheme in which PLN pays from its regular budget a price equal to the average weighted cost paid for electricity produced with coal. The MoF would augment that price paid by PLN through a special facility, which would be responsible for paying a feed-in tariff equal to the difference of the price needed by an IPP to achieve an Internal Rate of Return (IRR) of 15%. The 15% IRR would be calculated on the basis of a universal and transparent financial model determined by the MoF and other stakeholders. This scheme would automatically phase out when the average weighted production cost of PLN, now heavily dominated by the cost of coal and oil, equals the price needed to keep the IPP at 15% IRR. However, the IRR is a sensitive issue for developers and they have often demanded to revise the IRR to 18%.

Geothermal Development and Investment Plan 2010-2014 envisioned that a special facility “Geothermal Fund” would be established and would be responsible for:

- Under a mandate of the Government, collecting the revenues from the mitigation of CO₂; and
- Under a mandate of the Government, collecting revenue from other sources for the payment of the feed-in tariff, such as multilateral Clean Technology Fund (CTF).

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47 For PPPs government support though the MOT as stipulated in Article 17 A (4) of PR 13/2010 is in the form of a tax. PR 13.2010 also allow MoF to issue government guarantees (article 17 B).
49 If bidders are able to invest in new and more efficient exploitation methods, reflected in lower costs, they will reap the benefit of their know-how and innovations. Once the performance of these newer or more efficient methods are known, this can be amended in the financial model, which will be used in the tendering of new Geothermal Working Areas (or WKPs).
2.4.3 Clarity on Greenfield Tendering Regulations

MEMR and Bappenas have been promoting the training of local government officials from areas where WKPs will be tendered. It has also been proposed that officers in local governments earn accreditation for qualification to tender a geothermal field. The concept is that tenders be held only after MEMR has released fields for tendering and, then only, after the local government has accredited those officers responsible for the process.

The GoI has sought regulation to clarify the weight to be given to the experience of the bidding firm, how much of that experience can be subcontracted, the financial strengths of the company, and how a company will be required to provide proof of its financial strengths. Bappenas has also advocated providing regulatory guidance on conflicts of interest in constituting the tender evaluation committee. Bappenas advocates that members of the technical review and evaluation committees should not have, nor been seen as having, connections with firms that have tendered. For example, currently members of the Geothermal Association are represented in the committee, yet many members have connections with firms that have tendered. Similarly, if PLN staff participates in the Tender Committee, then under the no conflict of interest principles, PLN Geothermal cannot participate in the tender, Such participation would be clearly perceived as a conflict of interest, even though PLN and and/or others parties have an internal firewall between the two functions.

In its 2010 policy note, Bappenas observed that there was no clear regulatory structure in place governing the payments of reimbursements to owners and users of land to be used as geothermal working areas. To add another layer of complexity, the authority to issue binding regulations regarding such reimbursements is also still a question of debate, with potential of long lasting court cases before final clarity and settlement payments are known.

2.4.4 Enhanced Role of Local Governments for Social Safeguard, AMDAL & Protecting Forest Areas

The time it takes to get an Environmental Impact Study (Analisa Mengenai Dampak Lingkungan or AMDAL for exploration and exploitation can take anywhere between six months to three years. The Bappenas’ policy statement postulated that this delay can be alleviated by enhancing the capacity in the Ministry of Environment and in local government offices. The Government has defined a service standard for processing AMDALs at a maximum of six months, while also providing the required training and human resources to units processing the applications.

At the time that JICA and MEMR developed the master plan for geothermal development (2006-2007), only five percent (5%) of potential Geothermal Working Areas were located in or near pristine forest areas. Since then, the definition of pristine forest areas has changed, and over twenty three percent (23%) of WKP are now located in or near pristine forest areas. The Ministry of Forestry has started to analyze the situation, and a number of staff of the Ministry have attended courses in geothermal energy to understand the impact of

geothermal activities. The MoFor has developed a comprehensive resources methodology, which describes in detail the conditions with which a geothermal operation in a forest area has to comply.

In general, the Government’s (represented by the Ministry of Forestry) has the authority to issue permits in the forestry areas under its jurisdiction, and the local governments have the authority to issue recommendations. Nevertheless, MoFor and local governments are not in total accord regarding who has the authority to license forestry area projects pursuant to conflicting provisions of Law 22/1999 that decentralized the Government and Law 19/2004 that clarified some overlapping jurisdictional issues. These issues are further explored in Sections 3.1 (Overview of Decentralization and Regional Autonomy), 8.2 (Land Use Under Geothermal Law 27/2003), 8.3 (Land Use in Forest Areas Related to Geothermal Activity), 8.4 (Borrow-use Permits for Forestry Areas), and 8.5 (Land Use and Acquisition). These issues are further explored in Sections 3.1 (Overview of Decentralization and Regional Autonomy), 8.2 (Land Use in Forest Areas Related to Geothermal Activity), 8.3 (Borrow-use Permits for Forestry Areas), and 8.4 (Land Use and acquisition).

2.4.5 Mitigating the Risk of Resource Confirmation

The 2010 Policy Note listed as its fifth priority “Mitigating the Risk of Resource Confirmation.” In the absence of the cost of fuel during operation, the major cost in geothermal development is upfront costs (and risks) associated with the confirmation of geothermal resources in a Geothermal Working Area. Since companies translate the cost of risks into the costs of operations, a number of countries with geothermal resources have provided guarantees for resource exploration to IPPs, in an effort to reduce the costs for ratepayers.

Due to the significant subsidy to ratepayers, support to IPPs has been provided through individually negotiated tariffs, which has allowed projects retains a 15%-18% IRR. Once there is no need for a feed-in tariff, rates will be determined through a standard tariff. Using a standard, transparent financial model for the determination of the IRR, the model takes into account the average cost of resource exploration. Thus, the initial risk that companies take will be compensated through feed-in tariff. To provide incentives for investments, the Government will invest funds in developing the available data through surface, seismological, GIS and other methods and make this data available in a uniform and transparent manner.53

In August 2012, MEMR issued Regulation 22/2012, designed to meet the policy objective of attracting more investment to the geothermal power industry in Indonesia. See the more detailed discussion at Sections 5.6.2 (Financial Guarantee) and 6.3.3 (Geothermal Feed-in Tariff), of this Handbook. In brief, this regulation requires PLN to purchase electricity from geothermal power producers, including both the winners of a competitive bid and legacy concession holders. The regulation raises the price that PLN is obligated to pay new entrants into geothermal power generation. Complexities with implementing the regulation are being resolved as of the publication of this Handbook.

2.4.6 Geothermal Financial Intermediation

Geothermal plants require very long term loans, often up to 25 years. The local banking market can only provide loans for 4-to-5 years. To facilitate the full participation of the local banking sector, Bappenas has proposed a financial intermediation project be launched.

Exploratory discussions have been held with IFC, to provide a “put”\textsuperscript{54} option for loans made by an Indonesia Banking Consortium. As proposed, the Government would finance this “put” either from the budget or through a facility under the Clean Technology Fund. This “loan put option” concept remains viable but has proven difficult to institute during the short term.

\textbf{2.4.7 Geothermal Research & Development Program}

Developing and maintaining geothermal fields comes with many technical issues, and requires adequate research to address those issues. The wider use of geothermal resources will require communication with the general public concerning the benefits and risks of geothermal resource development. Local governments, NGOs, and others need to know how to respond when development problems occur, from isolated incidents to major problems.

The Government has planned to establish a Geothermal Research and Development (R\&D) support program, entitled the “Indonesia Geothermal Centre of Excellence” (IGCE), to respond to such concerns, financed through a subsidiary trust fund within the Indonesia Climate Change Trust Fund (ICCTF) energy window. This R\&D support program was planned to be located in Kamojang, with initial support from Pertamina and to Bandung Institute of Technology (ITB). Focused studies and research programs in collaboration with international study and research centers will be undertaken with the objective to reduce poverty and stimulate growth in the context of a low-carbon economy. The strategy for achieving such growth is to provide support for R\&D programs, to request proposals for research, study programs and database development, and to provide support for selected programs after careful peer review by local and international experts. The signing of a Memorandum of Understanding between Indonesia and New Zealand in April 2012 has brought collaborative efforts to fruition; for example, in December 2012 the Pertamina Learning Centre in Jakarta launched the Pertamina Corporate University. One of the university’s significant courses will be a Geothermal Master’s Degree program for Pertamina’s employees run by Indonesia’s Bandung Institute of Technology and Auckland University.\textsuperscript{55}

\textbf{2.4.8 The National Geothermal Task Force}

To implement these policy decisions, Bappenas proposed the creation of a National Geothermal Task Force. Its task would be to work with several ministerial departments and state-owned companies, i.e., Bappenas, MoF, MEMR, MSOE, MEnv, PLN, PGE, Geo Dipa and others. The secretariat for the Task Force would be based in Bappenas. This team, drawn from various ministries, would lead the execution of policy initiatives, disbursing funds and providing resources required for successful execution. As envisioned, the Task Force would consist of four groups — Planning & Programming Group, Tendering & Technical Support Group, PPA & Financing Support Group, and Capacity Building and Governmental Approval Support Group. In addition, it would have a secretariat to support its administrative activities, and the various advisors and consultants required would be assigned to this team. Although the need for an interdisciplinary task force remains, the organization has not yet materialized.

\textsuperscript{54} A “Loan Put Option” is a contract that grants a Financial Intermediary the right to sell to Foreign Direct Investment (FDI) its claims upon a borrower’s assets and/or revenues (as the case may be), at a specific price and by a certain date, in return for payment of an option premium and the accomplishment of other mandatory formalities in regard to the underlying claims.

2.5 SUMMARY

Indonesia’s electric power environment is on the cusp of an historical transformation. As the Indonesia National Energy Council has characterized that “Indonesia is a developing country with a population of 240 million people spread over a large archipelago of more than 6,000 inhabited islands, and with energy consumption growing at the note of 7% annually, Indonesia is challenged in managing its energy security and sustainability”. In managing Indonesia’s energy security and sustainability, the Government’s energy challenges are fourfold:

- Government studies of national energy reserves confirm that Indonesia is no longer a rich fossil resources country;
- Many Indonesian people are not aware of the situation and few efforts have been made to explain the existing condition;
- In contrast, Indonesia’s population is about 3.4% of the world population, meanwhile the share of fossil fuel energy reserves in Indonesia are all less than 3.4% (coal 0.58%, gas 1.7%, oil 0.36%), meaning that Indonesia’s proven reserve is less than the world average; and,
- Indonesia has a huge potential for renewable energy resources, so for the future renewable energy will play a large role in its national energy mix.

The government’s acceleration of the development and use of new and renewable energy in its national energy mix is taking place in context of three fundamentally new policy trends that emerged in Indonesia following the Asian financial crisis and Indonesian reformasi movement of the late 1990’s: regionalization, transparent competition, and de-monopolization:

- Regionalization: Law 22/1999 opened the door to greater authority for provinces, regencies and cities. Consequently, control over geothermal resources passed to the regional level.
- Transparent Competition: Laws began to require award of contracts, licenses or other rights through transparent competitive processes.
- De-monopolization by the Oil and Gas Law 22/2001 changed Pertamina’s operational status to “production-sharing contractor”, and the Electricity Law 30/2009 furthermore removed PLN’s monopoly.

In order to meet the anticipated shortfall in the national generation of electricity, the Government implemented two Fast Track Programs, the first in 2006 and the second in 2010, to add an additional 20,000 MW of generation capacity. According to Presidential Degree 5/2006, the share of new and renewable energy consumption must reach 17% by 2025 (of which geothermal represents 5%). Serious discussion is underway to mandate the increased contribution of new and renewable energy. According to the last draft of National Energy Policy 2050, the increased contribution of new and renewable energy must reach 23% by 2025 and 31% in 2050.

The Government is mobilizing to provide electricity both for its current needs and its future. The National Energy Policy seeks to ensure further access to Indonesia’s abundant natural resources – specifically geothermal resources with the goal of providing a significant

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56 Dr. Tumiran, The Macro Policy to Reach Indonesia Energy Scenario to 2050 (2012).
57 Law 22/1999 was superseded by Law 32/2004. See the discussion at Section 1.3 (Indonesian Government Structure).
portion of national electrical energy from geothermal generation. Private sector investment, including international investment, is essential to fulfill this goal. The government recognizes the importance of private investors in the development of additional power capacity in Indonesia. Geothermal Law 27/2003 provides a developmental opportunity to the private sector and new mechanisms and incentive programs. Incentives such as the Second Fast Track Program and the Geothermal Fund (under the auspices of Indonesia Investment Agency (PIP)) have been geared to help realize the Government’s long-term energy sector efforts. Likewise, the Electricity Law of 2009 and PR No.4/2010 establish the legal framework between the government and private investors. The Electricity Law of 2009 provides some degree of certainty for foreign private investors investing in the power sector notwithstanding PLN's dominant role. The guarantee and facility initiatives under PR No. 4/2010 show the government's seriousness and commitment in attracting private investors.
CHAPTER 3

LOCAL GOVERNMENTS’ ROLE IN GEOTHERMAL DEVELOPMENT

3.1 OVERVIEW OF DECENTRALIZATION AND REGIONAL AUTONOMY

3.1.1 Decentralization

From the start of the 21st Century, Indonesia has been undergoing a reform process - the era of reform (era reformasi). In its 2008 Energy Policy Review of Indonesia, the International Energy Agency (IEA) described its actions as “a radical transition from a centrally planned economy to a democratic community with partial reliance on liberalized market principles”.

One of the main features of this reform process is decentralization, which is more commonly known as “regional autonomy”. Decentralization was mandated under Decentralization Law 22/1999, which established the role of the regional governments and Law 25/1999, which established fiscal balance between the central and regional governments. In 2004, Law 32/2004 on Regional Governments and Law 33/2004 on Fiscal Balance replaced these earlier laws. Indonesia has undergone a relatively rapid transition to a democratic and decentralized State.

The decentralization process, under way since 1999, has transferred control of large amounts of public expenditure and service delivery from the Government of Indonesia to its local governments. Since the introduction of regional autonomy more than a decade ago, Indonesia has seen formed 205 new autonomous regions including seven provinces, 164 regencies and 34 municipalities. This is a drastic departure from 32 years of centralized government. In total, the country as of 2013 has 542 autonomous regions: 34 provinces, 410 regencies and 98 municipalities. Five of the 34 provinces in Indonesia (Aceh, Jakarta, Yogyakarta, Papua, and West Papua) have greater legislative privileges and a higher degree of autonomy from the Government of Indonesia than the others. Each province has its own political legislature and governor. The provinces are subdivided into districts, which are further subdivided into sub-districts and then into village groupings. The districts or regencies have become the principal administrative units, responsible for providing most government services.

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60 Indonesia is divided into 30 propinsi (provinces), two daerah istimewa (special regions), and one daerah khusus ibukota (special district). There are indications that the official spelling of the Bahasa Indonesia word for province is changing to provinsi. http://www.statoids.com/uid.html.
services. The complex local structure is further discussed in Section 3.1.2 (Indonesia Geothermal Structure), of the Handbook.

The infrastructure sector in Indonesia has also benefited from significant statutory and regulatory reform. For example, Electricity Law 20/2002, Geothermal Law 27/2003, and Water Resources 7/2004 were all promulgated after the 1998 economic crisis. The new laws shared the policy themes of improving the quality of services, eliminating monopolistic power, introducing competition, defining the new role of the government, and improving Public-Private Partnerships in the provision of infrastructure.

Significantly, the decentralization policy ensured that people in the local and regional areas would be the owners and beneficiaries of the mineral resources in the area in which they lived. The legislation that mandated regional autonomy, Law 32/2004, retained the ownership of mineral rights for the State, but transferred permitting and oversight of mining activities from MEMR to provincial and district governments. Not only were Indonesian mineral laws and regulations changed, but the functions of environmental monitoring were also largely transferred. Payment of royalties was mandated for provincial and district governments. The 2003 Geothermal Law does not create a legal distinction between geothermal resources and mineral resources. Geothermal resources are legally considered to be the same as a mineral resource therefore, under the 2003 law geothermal resources are governed under the mineral laws. The 2003 Geothermal Law regulated how the ownership of geothermal resources would be transitioned from the national government to regional and local administrations. Although the Law called for a royalty fee sharing of 80% for the local governments and 20% for the national government, the development and management of geothermal resources were given to local governments completely. Law 25/1999 on Fiscal Balance between the Government of Indonesia and the regions also required a radical reallocation in the sharing of revenues between the central and local governments. Of the 80% geothermal revenue flowing to the regions, 32% will go to the regency of origin (where the WKP is located), 32% will be shared among the other regencies in the province, and 16% will go to the provincial government. The decentralization process has, however, been a challenge to the energy sector and for the execution of most of energy development plans. Various additional taxes and regulations imposed abruptly by some local governments have increased costs for the survey, exploration, exploitation, and transportation of energy products.

3.1.2 Indonesian Government Structure

Following the implementation of decentralization, regencies and municipalities have become the key administrative units responsible for providing most government services. Prior to the introduction of regional autonomy during the 1999 to 2004 timeframe, regional and local governments enjoyed little autonomy, and their role was largely administrative: implementing policies, rules, and regulations as an extension of the Jakarta bureaucracy.

Law 27/2003 gave the geothermal field tendering authority to the administrative unit at the lowest tier of the administrative hierarchy in which a geothermal resource was totally contained. Consequently, it is useful for any potential investor to understand the government

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63 This law has been reversed by the Constitutional Court and replaced with the 2009 Electricity Law.
structure of the administrative hierarchy throughout Indonesia. According to the Constitution, sovereignty in Indonesia is vested in the people, who exercise their will through the People’s Consultative Assembly (MPR). The MPR is one of the six Constitutional bodies of State. Full executive authority is vested in the President. The President’s legislative power is shared with the House of Representatives (DPR). The State Audit Board exercises financial oversight. At the apex of the judicial system is the Supreme Court and the Constitutional Court which has final power in reviewing the constitutionality of laws.

Government administration is processed through descending levels of administrative sub-units. As of 2012, Indonesia is made up of 33 major units below the level of the National Government – 30 provinces (singular - provinsi), two special regions* (daerah-daerah istimewa), and one special capital city district**. Each province is headed by a Governor. Regencies and cities are the same level, having their own local government and legislative bodies. The difference between regency and a city lies in their demographics, size and economics. Generally the regency has a larger area than city, and a city has non-agricultural economic activities. Regencies are headed by a Regent (Bupati), and a city is headed by a Mayor (Walikota).

As of 2013, 40 of 98 municipalities or city governments (Kota) are at the same administrative level as the 410 regencies (Kabupaten). A sub-district (Kecamatan) is an area within a regency or city. The head of a district is known as a “Camat.” Camats are civil servants, responsible to the Regent (for the regency) or to the Mayor (for the city). Each sub-district is divided into villages (desa or kelurahan) – the lowest tier of the administrative hierarchy. Since 2005, heads of local government (Governors, Regents, and Mayors) have been directly elected by local general election.

3.1.3 The Impacts of Decentralization on Foreign Direct Investment in Geothermal Projects

Decentralization has shifted the power concentration from central to local governments by giving vast authority to the municipal and regency governments to administer governmental tasks within their boundaries. Thus, the local governments now have preeminent roles to determine development in their own domain, including the local economy. The expectation has been that services provided by local governments will be better than the services provided by a distant central government. The removal of the hierarchical bureaucracy would remove bottlenecks and assist local officials and the private sector to cut through complex procedures. However, the reverse can happen from the perspective of the geothermal sector.

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66 Aceh*, Bali, Banten, Bengkulu, Gorontalo, Jakarta Raya**, Jambi, Jawa Barat (West Java), Jawa Tengah (Central Java), Jawa Timur (East Java), Kalimantan Barat (West Kalimantan), Kalimantan Selatan (South Kalimantan), Kalimantan Tengah (Central Kalimantan), Kalimantan Timur (East Kalimantan), Kepulauan Bangka Belitung (Bangka Belitung Islands), Kepulauan Riau (Riau Islands), Lampung, Maluku, Maluku Utara (North Maluku), Nusa Tenggara Barat (West Nusa Tenggara), Nusa Tenggara Timur (East Nusa Tenggara), Papua, Papua Barat (West Papua), Riau, Sulawesi Barat (West Sulawesi), Sulawesi Selatan (South Sulawesi), Sulawesi Tengah (Central Sulawesi), Sulawesi Tenggara (Southeast Sulawesi), Sulawesi Utara (North Sulawesi), Sumatera Barat (West Sumatra), Sumatera Selatan (South Sumatra), Sumatera Utara (North Sumatra), Yogyakarta*.

67 Both Papua Province and West Papua Province enjoy special autonomy. The administrative level is translated as "Distrik", and is headed by a "Head of District" (Kepala Distrik).

68 However in Aceh, Indonesia, a mukim is a subdivision of a district. A mukim contains some villages (gampong).

69 Rachmad Erland Danny Darmawan, 2008: The practices of decentralization in Indonesia and its implication on local competitiveness, Public Administration-Public Governance study School of Management and Government, University of Twente, Enschede, Netherlands, p.52.
In assessing the role of decentralized governance in the geothermal sector, it is important to look at the effects of decentralization on foreign investment, since foreign investments are considered to be more vulnerable than domestic investments against local business environment changes. For example, the business procedures for foreign companies to operate their businesses are more complicated than for domestic entities. Foreign companies are also dealing with a more multilayered bureaucracy than domestic companies. Therefore, decentralization has important effects on the potential to attract foreign capital.

3.1.4 The Impacts of Decentralization on the Upstream & Downstream Equation

When the ownership of the nation’s geothermal resources was decentralized, the responsibility of assuring that geothermal resources are available became split between the central and local governments. The state still owns the resource but they are given to the local government for use. Thus, the upstream resources, the geothermal fields, were mostly under control of the local governments and outside the domain and direct control of the National Government. In contrast, under Article 33 of the Constitution as interpreted by the Constitutional Court in 2004, electricity is a “social necessity” within the meaning of Article 33. Consequently, the responsibility for the provision of electricity to the nation from geothermal resources is the exclusive role and responsibility of the National Government.

Consistent with this constitutional mandate to provide national electricity, the Government of Indonesia has initiated a massive increase in the electric energy capacity in the country. This undertaking is consistent with a strategic reliance on domestic renewable energies. Consequently, the Government has given the development of geothermal energy high priority in the energy supply mix, since it will provide a sustainable form of energy and will eventually reduce the need for energy subsidies.

One of the anomalies that occurred as a consequence of decentralization of geothermal resource ownership and management is that the regional areas do not have the depth and breadth of geothermal technical, scientific and legal knowledge that were retained in the Government of Indonesia. The local governments do not as of yet have the capacity to manage and supervise geothermal activities professionally. Many of these natural resources are in the hands of local governments with jurisdiction over limited areas and in some cases these local governments will only have oversight of one geothermal resource. Therefore, if the Government of Indonesia is going to achieve its ambitious plans to bring new geothermal capacity online, it must participate in rapid and wide-spread capacity building with the local governments. In addition to local capacity, the local governments must have a sufficient capital base to be able to afford the process of geothermal development, including negotiations of capital when private sector investment capital is involved in developing a geothermal field. As the Government has recognized, training of local government officials is crucial in WKP areas which will be tendered. See discussion at Section 2.4.3 (Policy Objective 3) of this Handbook.

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70 Constitutional Court’s Decision Number 001-021-022/PUU-I/2003. See Diagnosing the Indonesian Economy: Toward Inclusive and Green Growth (edited by Hal Hill, Muhammad Ehsan Khan, Juzhong Zhuang) pp.49-50. See also Section 4.1.2 (The End of the Pertamina Monopoly) of the Handbook, in which the ruling of the Constitutional Court is discussed.
3.1.5 Decentralization in the Tax Sphere

Prior to the decentralization reforms in 1999, the Government had enacted Law 18/1997 on Local Taxes and Fees to regulate and reorganize the regional level revenue structure. This law provided a closed list of taxes available to provincial and local governments in order to stop the practice of local governments issuing a plethora of local taxes, most of which generated little revenue and imposed high administrative, compliance and efficiency costs on the economy. This Law successfully reduced regional taxes from 42 to 9 percent. As part of the decentralization reform, the Government replaced Law 18/1997 with Law 34/2000,71 which allowed local governments to introduce new, local tax regulations based on broad principles, such as revenue adequacy, efficiency, equity and administrative feasibility. Oversight responsibility for these local revenue regulations was shifted from the Ministry of Finance to the Ministry of Home Affairs. The Ministry of Home Affairs is (as of 2013), known as the Ministry of Internal Affairs (or the Ministry of Interior). Local governments have reintroduced revenue instruments previously eliminated under Law 18/1997, as well as developing new ones. The Ministry of Home Affairs seldom intervenes with local government’s enactment of such new local rules and regulations.72

3.2 LOCAL GOVERNMENT’S ROLE IN GEOTHERMAL DEVELOPMENT

The 2003 Geothermal Law and its associated implementing regulatory framework increased direct private participation through competitive tendering as well as increased the significance of active regional government in geothermal development. The Law provided for a greater role for provincial and local governments to conduct these tenders for geothermal resources and to issue licenses. Depending on the location of the proposed geothermal working area and whether it crosses provincial or local boundaries, the jurisdiction for the tender may be allocated to the MEMR, the provincial Governor or local Regent/Mayor of the applicable area. When a WKP overlaps the jurisdiction of multiple provinces, control of the geothermal area shifts to the higher level of government or to the Government of Indonesia, which is responsible for issuance of licenses required for such a WKP.

MEMR Regulation 11/2009 on the Guidance of Geothermal Business Activities provides the basic guidelines for carrying out geothermal business activities. It sets out the process for applying for a geothermal mining permit (or Izin Usaha Pertambangan Panas Bumi or IUP) and sets out specific documentary requirements in support of tender bids. However recent proposed legislation has removed the designation of geothermal as a mining activity. An IUP permit may be granted for a maximum period of 35 years, which includes an exploration period of three years (which can be extended twice for a period of one year each), a feasibility study valid for a maximum of two years and an exploitation period, valid for a maximum period of 30 years after exploration has ceased. MEMR Regulation 11/2009 also sets out terms and conditions to which applicants or holders of geothermal mining permits must adhere, including typical provisions relating to annual approval of work plans and budgets, relinquishment of working areas and decommissioning and environmental restoration of working areas. Against this backdrop, there is no consistency in the tendering process or the licenses issued by the variety of governmental entities empowered to issue licenses to perspective geothermal developers.73 Obviously, a license will have to span the tenures of elected leadership and, upfront, the license holder will have to be protected against

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71 Law 34/2000 on changes to the Law 18/1997 on Local Taxes and Local Fees.
changes in government or government policy. Authorities at every level are attempting to resolve these challenges. The foregoing situation calls for an experienced third-party that can bring its resources to assist the relevant governmental authorities in situations that require knowledgeable experience. The Tender Committee, comprised of interdisciplinary for government and INAGA, has been established for such a purpose. The Tender Committee serves as something akin to a company board of directors. Whether such a body will suffice, or whether a full time professional body is required will be tested and determined through experience.

3.3 SUMMARY

The regional autonomy granted under Law 22/1999 as amended by Laws 32/2004 and 33/2004 transferred control of the nation’s geothermal resources to the local governments. Local governments have control of preserving geothermal resources as well as the developing these resources through the tendering process. Since regional governments may have only one or two geothermal resource areas that can be converted to a WKP, the governing authorities and the bureaucracy have little accumulated experience, particularly in the tendering of a WKP. Consequently from the perspective of the geothermal developer, the tendering and negotiating process may be slowed by the tendering government, which is going through a learning curve. It is difficult to predict how any individual geothermal development may progress, since there is no uniformity in the processes set forth among the various provinces and regencies that are responsible for tendering the geothermal resource areas. Authorities at every level are addressing the challenges that decentralization has introduced to the renewable energy sector. One major development is the creation of an independent body – The Tender Committee – which can bring interdisciplinary knowledge to political entities at every level of the governmental hierarchy. As further illustrated in Chapter 8 (Forestry, Land Use, Environmental Issues & Social Responsibility), the exercise of regulatory authority by the local governments will have major effects on the development process. For example, an issue remains as to who is responsible for licensing in the protected forests that much of the geothermal resources underlie.

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74 See Section 4.4 (Tendering Process) of the Handbook.
CHAPTER 4

GEOTHERMAL ENERGY LEGAL REGIME

4.1 EVOLUTION OF INDONESIA’S GEOTHERMAL LEGAL REGIME

Geothermal activity in Indonesia has historical roots dating back to the Dutch colonial period as outlined in Section 1.4 of the Handbook (Geothermal Resource Development in Indonesia). The modern era of private sector development of geothermal energy in Indonesia may be divided into three separate regimes:

i. The first regime started in 1981 under Presidential Decree 22/1981 subsequently amended by Presidential Decree 45/1991 which still continues to apply as it is grandfathered by the later enacted Law 27/2003 on Geothermal Energy, and previously, under Presidential Decree 76/2000 which was issued at the time Indonesia was still in the midst of recovery from the Asian economic and monetary crisis in the 1997 to 1999 timeframe.

ii. The second regime started when Law 27/2003 was enacted and is the effective regime in existence as of the publication of this Handbook.

iii. The third regime is developing under a proposed revision to Law 27/2003, which is being deliberated by the Government of Indonesia.

4.1.1 The First Regime - Pertamina Monopoly & a Constitutional Crisis

Presidential Decree 16/1974 was the first regulation of the post-colonial period that addressed geothermal development. This 1974 Decree empowered Pertamina to explore and develop geothermal resources on behalf of the Government. However, realizing that Pertamina did not have the technological resources and know-how to fully develop these resources, the Government looked to the oil industry for a model that would facilitate foreign participation in geothermal projects. Presidential Decree 22/1981 authorized Pertamina to be the sole commercial entity for exploration and exploitation of geothermal energy and opened the door for the use of Joint-Operating Contracts. In addition, the Minister of Energy and Mineral Resources is the authority to designate Geothermal Working Areas (or wilayah kuasa pengusahaan, with the acronym of “WKP”). The underlying business concept of the first regime was that the Government granted to Pertamina monopoly status as the holder of the Kuasa Pengusahaan (Legacy WKP) and a number of geothermal resource work areas to be developed and exploited through either its own operation or as a joint operation.

The term “through its own operation” means that Pertamina was to develop and exploit geothermal energy using its own resources; “joint operations” means that Pertamina was to engage private companies as contractors to develop and exploit geothermal energy under a Joint-Operating Contract. In Chapter 5, Sections 5.8 (Energy Sales Contract) and 5.9 (Other Operating Contracts) of this Handbook, these contractual arrangements are covered in more detail.

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This section 4.1 takes a second industrial approach, focusing on the monological development of geothermal resource law and policy.
The subsequent enactment of the 1985 Electricity Law (Law 15/1985) permitted limited private participation in electricity generation. Essentially, this model involved allowing private investment in power generating assets by Independent Power Producers (IPPs). These IPPs were licensed to sell the electricity that they generated solely to the state-owned electricity company PLN pursuant to Power Purchase Agreements (PPAs). PLN, as the sole purchaser of electricity output, therefore became the key driver of the commerciality of the entire value chain.

Under the 1985 Electricity Law, several geothermal IPP projects made it through various stages of licensing and commercial approval; however, this IPP program was frozen in the late 1990s when the Asian financial crisis hit. Since the off-take prices of the PPAs entered into by PLN were denominated in U.S. dollars, the devaluation of the Rupiah, which represented the source of income for PLN, effectively bankrupted the geothermal IPP projects and they were simply abandoned. PLN was left in the position that a significant degree of investor confidence in the sector was lost, and PLN could not independently fund the investment for additional capacity.

4.1.2 The End of the Pertamina Monopoly

In 2000, Presidential Decree 76/2000 on the Exploitation of Geothermal Resources for Power Plants ended the Pertamina monopoly on the exploitation of geothermal resources. Under the scheme of this 2000 Presidential Decree, Pertamina began to function as a business entity rather than as a regulator – with the exception of contracts that were in effect as of the date of promulgation of this Presidential Decree.

Oil and Gas Law 22/2001, reconfirmed the removal of Pertamina as a monopoly and of geothermal as an area under Pertamina’s regulation. Significantly, this 2001 law mandated development of a new legislative basis for geothermal energy. Parliament subsequently enacted Geothermal Law 27/2003, to regulate the upstream side of electric power generation. The downstream business that engages in electric power generation is still subject to Electricity Law 15/1985 and Government Regulation 3/2005. See the detailed discussion on the Geothermal Law at Section 4.2 [(Geothermal Law (Law 27/2003)], of this Handbook. The 2001 Oil and Gas Law also provided that Pertamina be restructured into a Limited Liability Company, functioning like other similar companies (although still state-owned). As a follow-up to these legislative changes, MEMR Ministerial Decree 667/2002 further provided that:

- Regulation and management of the upstream exploration, exploitation and development of geothermal resources would be under the auspices of the

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76 Jurisdictions that attempt to treat geothermal resources as a hydrocarbon (oil or gas) or water rather than a unique energy source have consistently found it difficult to accommodate geothermal development policy. For example, as stated in Para 2, Chapter I General Provisions of the Oil and Gas Act, geothermal does not include a natural gas which is defined as the result of natural processes such as hydrocarbons in atmospheric pressure and temperature conditions of the gas phase obtained from the process oil and gas exploitation.

77 Direct appointment. Government Regulation (GR) 3/2005 and GR 26/2006 allow PLN to directly select IPP contractors for effectively almost all its needs. PLN has chosen to stick with competitive bidding for what are likely to be smaller, more local projects.

78 The Limited Liability Company is the most common form of business entity in Indonesia. See Company Law 40/2007.

79 Under MEMR No. 667 K/11/2002, the Director General of Electricity is responsible for regulating and supervising the development of geothermal power plants. “Directorate General of Electricity” is a new name for “Directorate General of Electricity and Energy Utilization”, which changed its name in the year 2010 pursuant to President Decree 24/2010, which decree also created Directorate General New and Renewable Energy and Energy Conservation (DG-NRE-EC)
Regulation and management of the downstream power generation activities of geothermal energy would be under the auspices of the Directorate General of Electricity and Energy Utilization (which since 2010 has been the Directorate General of Electricity within the Ministry of Energy and Mineral Resources).

In order to reinvigorate investor participation, the Government also introduced reforms through the enactment of the 2002 Electricity Law – a law designed to pave the way to privatization. Under this law, electricity business areas were divided into competitive and noncompetitive areas – the “competitive” business area allowed for private participation in the generation and retailing areas of the electricity value chain. In 2004, however, the Constitutional Court held that 2002 Electricity Law was unconstitutional, declaring electricity to be a “social necessity” within the meaning of the Constitution. The Court concluded that there is a constitutional requirement that the delivery of electricity remain exclusively within a state-owned agency. The Court thereby effectively reinstated the previous 1985 law. From 1999 to 2004 no significant work areas or business licenses were granted or any development activities undertaken and there was very little investment of any sort in any new power projects.

4.1.3 The Second Regime - The Geothermal Law 27/2003

The 2003 Geothermal Law opened geothermal development up to private participation through competitive tendering conducted by the government authority designated to be responsible for the various WKPs. The experience of the country under the governance of Geothermal Law 27/2003 is set forth in Sections 4.2 through 4.8, below. Section 4.9 introduces the Third Regime, the governance of geothermal resources in the near future.

4.2 GEOTHERMAL LAW

The present framework for greenfields geothermal projects is based around the 2003 Geothermal Law (Law 27/2003), read together with requirements and provisions that are distributed over various secondary regulatory decrees. The intention of this regulatory framework has been to enhance the scope for development of geothermal projects by encouraging wider developer interest involving competitive tendering, while establishing a principal role for regional governments by way of their administering Work Area tenders and issuing exploration/exploitation licenses.

This Law mandated that future geothermal fields must be transparently and competitively tendered for development. It opened geothermal development up to any qualified firm on the basis of a competitive tender conducted by a competent government authority. The term “any qualified firm” refers to a legal entity that has qualified as a “special purpose vehicle” – registered in accordance with the applicable laws (see the discussion on Private Sector Geothermal Resource Development in Chapter 6).

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81 Constitutional Court's Decision Number 001-021-022/PUU-I/2003. Also see Section 5.2.2 (Structure Two: 2002 Electricity Law) of the Handbook.
82 However, the tender process has not met with complete success and has been described as having a number of inherent shortcomings. See Fitchner, eds.; MEMR Directorate General of Minerals, Coal and Geothermal, Design and Preparation for Geothermal Investment Transaction, Characteristics and Proposed Improvements (07.03.2011), p 2-1 et seq.
The “competent government authority” is determined by identifying the political jurisdiction(s) in which the geographical coverage of the WKP is situated. The Law also permits operators of the fields previously allocated under PD 45/1991 to retain control of these fields – a so-called “Legacy List” or “Legacy Work Areas”. The “Legacy List” included the WKPs established prior to the enactment of the 2003 Geothermal Law. This Legacy List includes eight (8) developed fields referred to as "brownfields", as well as eleven (11) "greenfields" the resources of which had not been proven by flow-tested, productive wells.

The MEMR also compiled all WKPs issued after ratification of the 2003 Geothermal Law in a "New WKP List". As of February 2013, this list contained a total of 39 geothermal prospects of which approximately half have been licensed to private groups by tendering. Under the 2003 Law, a transitional provision provided that all existing geothermal contracts would remain in force until the end of the contract term, but supervision of these contracts would transfer from Pertamina to the MEMR. Extensions of these “old” contracts are also possible provided that the extension follows the provisions under the new regime. This list continues to change and evolve and may be obtained from the Geothermal Directorate of the Directorate General of New and Renewable Energy of MEMR or may be accessed via Data Bank of the Bappenas Geothermal website located at: http://geothermal.bappenas.go.id/.

4.2.1 Key Provisions of Geothermal Law

The current geothermal legislation leaves significant scope for interpretation of specific provisions, largely due to the generality and inconsistencies of the drafting. In the view of some consultants to the MEMR, such as the German consulting firm Fichtner, the legislation does not adequately determine procedures, rights and obligations of the parties during tendering for and execution of the Preliminary Survey, tendering for the IUP Work Area or concerning exploration or exploitation. The following discussion in addition to describing the details of the Law and its implementing regulations, will inquire as to whether the investment landscape described by the Law and its implementing regulations is appropriately attractive to potentially interested international investors. The key provisions of Law 27/2003 are summarized below:

Associated implementing regulations include Government Regulation (Peraturan Pemerintah, PP) 59/2007 and a series of Ministerial Regulation (Permen) including:

MEMR 20/2012.
MEMRRule 11/2008 on the designation of WKP.
MEMRRule 11/2009 on tendering, exploration, feasibility studies and exploitation.
MEMRRule 32/2009 on geothermal contracting with PLN and Government approval of price. This regulation also caps the purchase price for geothermal power at 9.7 US cents/kWh.
MEMR Regulation 10/2005 and 26/2008 on licensing and commissioning for electricity supply.
**Licenses:** Companies must have an IUP license to conduct geothermal activities (Article 11). An Indonesian entity with either foreign (up to 95%) or Indonesian ownership may hold an IUP geothermal license. With foreign ownership, the Indonesian company should be a foreign investment company (*PT Penamanan Modal Asing* or *PMA*), subject to limits prescribed on foreign investment under the Negative List Regulation 77/2007. Investment in Indonesia is regulated mainly by Investment Law 25/2007 (April 26, 2007).

**National Government Role:** The National Government is responsible for regulations, policy, licensing and supervising in areas that cross provincial borders, managing information on geology and potential and compiling information on resources and reserves (Article 5). The National Government also defines the WKP area that is to be tendered by any level of government (Article 9).

**Regional Government Role:** Regional governments are responsible for regional regulations, licensing and supervising in relevant areas, managing information for regional areas, and compiling information on regional resources and reserves (Articles 6 & 7).

**Tendering Authority:** The head of the respective level of government will publicly tender new WKPs (Article 9). However, the basis for the award (e.g., lowest price) is not specified.

**Phased Development/Resource production and Power Generation:** Geothermal power is characterized as a single undertaking, combining upstream exploration and production with downstream power generation and sales. Geothermal activities are described in five phases: Preliminary Survey, Exploration, Feasibility Study, Exploitation and Utilization (Article 10).

**Third Party Participation:** The National Government can assign other parties to conduct a Preliminary Survey (Article 10). The Preliminary Survey constitutes the first implementation stage of a so-called Fast Track program of geothermal development on an Open Area (an “open area” being a geothermal resource area not yet determined as a Work Area). The Preliminary Survey can be conducted by the national or regional government responsible for the area or it can be assigned to “Other Parties”. While the legislation determines at one point that appointment of the Other Party to conduct the Preliminary Survey shall be through “tender” conducted by the Director General, the legislation indicates elsewhere that “Other Parties” need only to submit an application enclosing administrative, technical, and financial document requirements as broadly listed under MEMR Regulation 02/2009. An award would then be made according to tender, but on the basis of a “first applications system” whereby those applicants which satisfy certain administrative, technical and financial requirements shall have “first priority” to obtain the commission. The

MEMR Regulation 15/2010, which lists geothermal projects targeted by the National Government as part of its accelerated power development program. This decree is discussed further below in Sections 4.6 (Lending Institutions) and 5.1.2 (Procedure for Purchase of Electricity (MEMR Regulation 04/2007)).

With respect to ratio the foreign to domestic ownership, the percentage of foreign ownership is subject to limits prescribed on foreign investment under the Negative List Regulation 77/2007. Although there is no limit prescribed specifically for geothermal business activities, there is presently a 95% foreign ownership limit on electricity business activities, including power generation. See http://www.ina.or.id/inaweb/files/establishment%20of%20foreign%20company%20in%20Indonesia.pdf.
legislation refers to the process of award according a “first-come, first-served” principle.

**Government Right to Exploration and Company Rights:** Companies conduct the Exploration, Feasibility Study and Exploitation Phases as a unit, unless the Government conducts Exploration, in which case the Phases may be conducted separately (Article 11).

**Reversion of Geothermal Areas to Government:** Companies have to return WKPs to the Government over time – a “use or lose” policy (Article 13). Article 22 defines time limits for the various stages of geothermal development.

**Legacy Licenses:** Contracts issued prior to Law 27/2003 are unaffected, hence the continued operation and development of legacy WKPs held by PGE and PLN under Presidential Decree 45/1991 (Article 41).

**Taxation and Fees for License Holders:** IUP Holders must pay taxes as well as other levies, such as fixed fees and production fees as stipulated by regulation, as well as bonuses. The distribution of these revenues is stipulated (Article 30).

**Pricing Not Addressed:** Pricing as such is not addressed by the Law, other than to say that geothermal electricity production will be governed by electricity regulations (Article 10).

**4.2.2 Phased Geothermal Development under Geothermal Law & the Second Fast Track Program**

The primary components of geothermal development in Indonesia have variably been described as being a four-phased, five-phased and six-phased process. The

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89 There are a number of ways to characterize the phases of geothermal development. For example, the U.S. Geothermal Energy Association describes a four-stage process (http://www.geoenergy.org/plants_dev.aspx). In Kenya, a nine-stage process description is utilized. Mwangi, Martin N. Phases of Geothermal Development in Kenya; Kenya Electricity Generating Company (http://www.os.is/gogn/unu-gtp-sc/UNU-GTP-SC-01-06.pdf).

**U.S. Geothermal Energy Association:**
- Phase I: Resource Procurement and Identification (i.e., identifying resource, secured rights to resource, pre-drilling exploration, internal transmission analysis complete).
- Phase II: Resource Exploration and Confirmation (i.e., exploration and/or drilling permits approved, exploration drilling conducted/in progress, transmission feasibility studies underway).
- Phase III: Permitting and Initial Development (i.e., securing PPA and final permits, full size wells drilled, financing secured for portion of project construction, interconnection feasibility study complete).
- Phase IV: Resource Production and Power Plant Construction (i.e., plant permit approved, facility in construction, production and injection drilling underway, interconnection agreement signed).

**Kenya Electricity Generating Company:**
- The various phases through which geothermal development undergoes in Kenya are the most commonly used worldwide with perhaps minor modifications. These are:
  - Review of existing information of a prospect;
  - Detailed surface exploration;
  - Exploration drilling and well testing;
  - Appraisal drilling and well testing;
  - Feasibility studies;
  - Production drilling, power plant design and environmental impact assessment;
law itself recognizes five principle stages, and suggests a sixth — the most robust six-phase process description has been adopted for the purposes of this Handbook.

**UPSTREAM:**
- Preliminary Survey;
- Tendering of WKPs and issuance of a geothermal IUP mining license to the winner;
- Exploration;
- Feasibility Study;

**DOWNSTREAM:**
- Exploitation (producing steam and water); and
- Utilization (producing electricity or direct usage).

The Exploration, Feasibility Study and Exploitation Phases are completed by the selected developer in a manner similar to other geothermal developments in other parts of the world. The Preliminary Survey and Tender Process (Steps 1 and 2), however, differ markedly from other international geothermal development processes and are discussed below in more detail. The Exploitation and Utilization Phases are similar, differentiated only by Exploitation meaning the production of steam and water and Utilization meaning the production of electricity or direct usage from that steam or water. In general, the flow of geothermal activities is shown in Figure 4.1, below.

**Figure 4.1 Geothermal Development Flow Chart**

![Geothermal Development Flow Chart](source: [Geothermal Activities in Indonesia (Harsoprakito, 2011)](source)

The following Sections 4.3 through 4.9, of this Handbook, will explore not only the process under the 2003 Geothermal Law, but also some of the difficulties that have been encountered in its implementation.

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Power station construction and commissioning;
Reservoir management and further development; and,
Shutdown and abandonment.
4.3 STAGE 1 - PRELIMINARY SURVEY

The first step is for the Geological Agency of the Ministry of Energy and Mineral Resources to conduct a Preliminary Survey of prospective geothermal areas, from which a Geothermal Working Area is designated. Surveyed geothermal areas in which geothermal commercial resource potential have been identified may be designated by the Ministry of Energy and Mineral Resources (MEMR or KESDM or Kementerian Energi dan Sumber Daya Mineral) under MEMR Regulation 11/2008 as Geothermal "Working Areas" or Wilayah Kerja Pertambangan (WKP).

The “Preliminary Survey” is an exploration program that surveys a geothermal area or open area (in the generic sense) and defines a Geothermal Working Area (in the legal sense) in which geothermal business activities may be conducted. MEMR Regulation 02/2009 establishes the guidelines for geothermal preliminary surveys. The MEMR has the authority to plan, prepare and determine a work area based on studies and assessments of data obtained from the Preliminary Surveys. The Government of Indonesia will generally conduct Preliminary Surveys, but the Government has the option of appointing a third party to do so. The MEMR may also designate regional governments to complete the Preliminary Survey. In this phase, the MEMR (representing the national Government), Governors (Provincial Authorities) or Regents/Mayors (Regencies/Cities), depending upon the areas to be covered, undertake the Preliminary Survey for available geothermal energy resources.

Regional governments can make a recommendation that this task be assigned to a private business entity with the expertise and ability to conduct the preliminary survey by first offering Preliminary Survey work in a public forum on a first-come-first-served basis. The expert party conducting the survey must first obtain a permit from MEMR. A Preliminary Survey assigned to a private entity must be completed in one year, but the term can be extended once. The appointment of third parties to complete the survey at their own risk and cost is allowed. A private business entity that is assigned to undertake the Preliminary Survey does not automatically obtain rights to further develop the WKP. Nevertheless, the expert party conducting the survey (presumably as recompense for taking payment and other such risks during performance of the Preliminary Survey) has, according to present legislation, certain material advantages compared to other potential Work Area tenderers, e.g., the possibility to prequalify automatically and bypass the first stage of the Work Area tender process as well as the right to match the lowest tendered price for electricity, and thus be awarded the IUP license. In practice, these potentials – have become a de facto right of first refusal. The prime policy goal of this portion of the legislative scheme is to increase the value of the information available from a WKP, thereby to maximize commercial value of a geothermal resource area. In other words, the Preliminary Survey is designed to reduce the risk for prospective private sector investors, thereby maximizing the commercial value of an area to those private sector investors, and consequently to increase the bid price that the tendering governmental entity may achieve. The conventional wisdom is that maximum value can be achieved by a two-fold approach:

1. Employing a firm (or firms) with national or international credibility in geothermal resource determination – preferably one with an established reputation with lending institutions; and
2. Ensuring that the information provided is unbiased and that the bidder/offeror is neutral.

If a tendering governmental authority awards the Preliminary Survey work on a first-come-first-served basis to an entity that does not have the confidence of the international
private sector development or financial community, the goal of achieving maximum value may not be achieved. Moreover, if the party conducting the Preliminary Survey is not precluded from bidding for the Work Area, the neutrality, fairness and transparency of the Preliminary Survey process may be put into question.\footnote{Fitchner, eds, 2011.\textit{Design and Preparation for Geothermal Investment Transaction, Characteristics and Proposed Improvements}, MEMR Directorate General of Minerals, Coal and Geothermal, (07.03.2011), p. 1.6. Fitcher suggests that the Preliminary survey be funded by Government of Indonesia on the basis that such funding would be temporary only. That is, the costs of the Preliminary Survey would be recompensed by the successful Work Area tenderer as a condition precedent to signing the IUP. This should ensure that a fair, well-structured and controlled process is enacted leading to an increasing the level of confidence by Work Area tenderers, not just in the Preliminary Survey process but in the integrity of Preliminary Survey data, a crucial aspect of the integrated geothermal transaction structure.}

The results of the studies and assessments are used as the basis for determining the Geothermal Working Area including the basic price for the data and/or the amount of compensation awarded to the private parties conducting the assignment. The Preliminary Survey also provides geologic and other technical data from which potential bidders develop an estimate for the power price. Following completion of the studies and assessments, the next step is undertaken by the Directorate General (DG) of the New Renewable Energy and Energy Conservation (NRE-EC) within the MEMR.\footnote{See "Directorate General of New Renewable Energy and Energy Conservation." \textit{Minister of Energy and Mineral Resources}. <http://www.esdm.go.id/direktorat-jenderal-energi-baru-terbarukan-dan-konservasi-energi.html>.} If the findings are justified, NRE-EC will propose a defined area to the MEMR to be determined as a work area and to be offered through a tender.

### 4.4 STAGE 2 - TENDERING PROCESS

Once the MEMR has defined the Geothermal Working Area, the relevant governmental authority may tender the WKP through a bidding mechanism. The \textit{relevant authority} is determined by the location of the WKP. If the Geothermal Working Area is located within one district/regency, the bidding will be conducted by the district/regency government. If the working area crosses district/regency boundaries but is within one province, the bidding will be conducted by the provincial government. If the working area is located in multiple provinces, the bidding will be conducted by the MEMR. The tender is administered by the MEMR, the provincial Governor or the Regent/Mayor by establishing a Tender Committee that will determine the winner of the work area offered in competitive bidding process.\footnote{The New and Renewable Energy Section in MEMR tracks 11 steps in the Tender Process for working area exploitation: 0=Geothermal Potential; 1=Preliminary Survey (3G); 2=Preliminary Survey (MT); 3=GWK Established; 4=GWK Tendered; 5=IUP/Mining License Issued; 6=PPA signed; 7=Exploration/Detailed Survey (3G); 8=Exploration Drilling; 9=Feasibility Study; 10=Production Drilling; 11=Production}
4.4.1 Tender Committee

A Tender Committee\(^{93}\) is appointed to manage the tendering process which includes evaluation of the bidders’ qualifications to complete the following two phases:

**Phase One:** This phase covers administration/formalities as the submission of well as technical and financial capabilities (due diligence qualification). As part of the financial evaluation, bidders are required to provide evidence of capital availability for a tender guarantee from a local bank including deposit cash guarantees of:

- 2.5% of the estimated first-year exploration costs; and

- A performance guarantee in the amount of US$10 million deposited in a State bank (US$10 million is approximately the amount that would fund drilling costs for two standard exploration and exploitation wells).\(^{94}\) The US$10 million performance guarantee has not, as of April 2013, been required in practice. Consider the situation in which, after an IUP Holder conducts verification exploration, site potential has been over-estimated. In that circumstance, the IUP Holder may be justified in making the commercial decision not to drill, in which case it should not forfeit the performance guarantee.

**Phase Two:** This phase covers an evaluation of the electricity prices (or steam prices if applicable) offered by bidders. The lowest offered price carries a preference to win the bid as outlined in GR 59/2007.

4.4.2 Price for Power

In the tender process, pre-qualified bidders for each WKP tender a price for power being sold to PLN. See Section 5.3.3 (Tariff) of this *Handbook*.

4.4.3 Bidders

Present legislation provides that the Minister (MEMR), provincial Governor, Regent or Mayor will make available the Work Area to “Business Entities” via a tender procedure. The definition of “Business Entities” is any legal entity that, runs a “permanent and continuous business, works and is domiciled in the territories of Indonesia.” This process provides for a form of registration in which only Business Entities would be entitled to receive the Work Area tender documents. Thus, at a very early stage of the transaction process and depending upon the timescale, an international company could effectively be precluded from participating on the grounds of its needing to have established an Indonesian business presence/partner, which in practice takes time to establish. On the other hand, countries worldwide require foreign entities to be domiciled domestically.

4.4.4 Registration

It is general international practice for parties in a tender to prequalify on the basis of suitable company technical and financial credentials, including specific experience – and thus pre-qualified bidders would be entitled to receive the Work Area tender documentation. Importantly, note that the process of “registration” of bidders under the Geothermal Law 27/2003 does not require a pre-qualification procedure that is consistent with standard

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\(^{93}\) See Section 3.3 (Summary and Conclusions), of this *Handbook*, regarding the Tender Committee.

\(^{94}\) See Section 4.4.9 (Financial Obligations of Tenderers), below.
international practice and the requirements of many international funding agencies. However, regulations do require technical and financial requirements to be demonstrated.

### 4.4.5 Two-Stage Process

Current geothermal legislation stipulates that the WKP tender evaluation will take place in two stages. The first phase requires tender submission by the Business Entity on the basis of administrative, technical and financial requirements. The second phase requires the Business Entity (which has been declared by the Work Area’s Tender Committee as having passed the first-phase evaluation) to submit its offer price, the price at which it offers to sell electric power.95

Following the standard international norm for prequalification procedure, the WKP tender documents would set forth the Geothermal Work Area tenderer’s commercial, technical and financial proposals associated with the project itself, the company or consortium having already proven its credentials. Thus, the WKP tender documentation should be well-conceived and detailed and refer to explicit bid forms to be completed by the tenderers as a basis for accurate evaluation of important aspects of the tender in the interests of transparency and achieving a successful transaction at all stages.

The Geothermal Work Area tender documentation should set forth the known risk issues as well as the allocation of risks. (For example: How is the reservoir risk to be borne? Is one of the parties to carry resource insurance?) In general, the WKP tender documentation should be clear about the risk balance among: (1) the corporate bidder (the Special Purpose Company or **SPC**), (2) the Minister/Governor/Regent/Mayor (under the upstream activities), and (3) PLN as the off-taker of the electrical energy (downstream activities).

### 4.4.6 IUP License

The outcome of the bidding process is the grant of a Geothermal Working Area in which the winning entity may develop geothermal energy. This grant is in the form of a mining (geothermal) business license that allows, with some limitations, the winning bidder to develop the resource. IUPs are granted for Geothermal Working Areas under the Geothermal Law.

### 4.4.7 WKP Area

The largest work area to be granted an IUP is a maximum of 200,000 hectares, i.e., no individual WKP can exceed 200,000 hectares (~494,211 acres). The work area is subject to partial relinquishment during each relevant stage of the IUP. The largest Geothermal Working Area to be granted for the exploitation phase is 10,000 hectares (~24,710 acres), noting that a separate approval can be sought for more than 10,000 hectares.

### 4.4.8 IUP Term Limits

An IUP gives the holder a three-year exploration period, which is extendable twice (each time for a maximum of one year). Therefore, exploration permits have a maximum term of five years. The feasibility study permit period is for a maximum of two years. An

95 Fichtner, *supra*, p.1-7 recommends that the Work Area tender documents specifically focus on the tenderer’s commercial, technical and financial proposals associated with the project itself, since the tendering company or consortium will have already proven its general credentials prior to submitting the final tender. Thus, the Work Area tender documentation should be well-conceived and detailed and refer to explicit bid forms to be completed by the tenderers as a basis for accurate evaluation of important aspects of the tender. This approach will serve the interests of transparency and achieving a successful transaction at all stages.
Exploitation (or production) permit is for a maximum of 30 years (but extendable). The IUP Holder must commence exploitation activities within two years of the end of the exploration period.

4.4.9 Financial Obligations of Tenderers

According to MEMR Regulation 11/2009, Article 5, in respect of first stage evaluation, tenderers are required to enter into certain financial obligations and provide the following with their tenders:

1. A statement about commitment to pay the base price for WKP data.
2. A statement concerning commitment to pay data compensation (except for Other Parties which were assigned to do the Preliminary Survey).
3. Sources of funding for project development.
4. Evidence of placement of tender guarantee security (“Tender Bond”) of at least 2.5% of the first-year exploration cost from a local bank registered in the name of the WKP Tender Committee.
5. Evidence of placement of an Exploration and Exploitation Performance Security (“Performance Security”) of US$10 million in a State Bank for carrying out drilling of at least two standard exploration or exploitation wells in the form of (i) an Escrow account between business entity and the Minister of MEMR, Governor, Regent/Mayor or his authorized official in accordance with the laws, (ii) a standby loan, or (iii) a Certificate of underwritten credit facility from a financial institution. Note, again, that the US$10 million performance guarantee requirement raises the question of whether, after an IUP Holder conducts verification exploration there are circumstances under which it should not forfeit the performance guarantee.

4.4.10 Tender Evaluation

Article 23 (4) of Government Regulation 59/2007 concerning Geothermal Business Activity provides that the procedures for determining the winner of the WKP shall include:

Phase One:
- Prequalification announcement;
- Acquiring by the business entities of the prequalification documents;
- Completion and submittal of the prequalification documents;
- Prequalification evaluation;
- Any clarifications of the prequalification documents;
- Establishment of the prequalification results;
- Announcement of the prequalification results; and
- Time period to file any objection to the prequalification.

Phase Two:
- Invitation to the participants having passed the prequalification;

Also see 59/2007, Section 3.2 (Local Governmental Policy Geothermal Development).

- Acquiring by the business entities of the tender documents;
- Explanations;
- Formulation of the minutes on explanations of the tender documents and their amendments;
- Phase of submitting the offer of electricity price;
- Opening of the offer covers;
- Establishment of the ranking;
- Notification/announcement of the winner;
- Objection period;
- Explanations of objections; and
- Appointment of the winner.

MEMR Regulation 11/2009 elaborates further on principles for evaluation of the WKP tenders by the Work Area’s Tender Committee. Notably, technical evaluation is determined to cover evaluation of company experience, qualifications of experts, and project’s organizational structure, and work program. Evaluation of the work program is required at least to cover evaluation of:

- Project management systems, schedules and a plan concerning exploration, feasibility study, construction and development, and exploitation and utilization;
- Calculation of electricity cost;
- Notice of development intent;
- Plan of development of steam field that includes calculation of production wells, injection wells, makeup wells, and cost plan;
- Capacities to be developed;
- Stages of development of geothermal power plants; and
- Capacities of geothermal power plants to be developed.

The regulation does not make reference to the technical standard by which the bidder documents shall be evaluated.

4.4.11 Winning Bidder

A single legal entity can be granted only one IUP. In practice, a developer may form multiple legal entities in order to qualify for multiple IUPs. The winning bidder must comply with the terms of the geothermal mining permit or IUP. Initial obligations include payment for the working area data and payment of compensation for the data collected by the party carrying out any Preliminary Surveys (both within 30 days of the award). The holder of the geothermal mining permit must commence its activities within six months from the date of the award.

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98 Taken to be tender documents exclusively associated with providing the offer electricity price.
4.5 STAGE 3 - EXPLORATION PHASE

This Phase comprises geothermal characterization and resource confirmation including exploratory and development drilling. The Exploration Phase covers all geological investigations, geophysics, geochemistry, drill testing and the drilling of exploration wells. Exploration of geothermal resources can only be conducted by the holder of an IUP or if an IUP has not been issued, by the MEMR. This phase must be started within six months of an IUP being issued and must be completed within three years at the latest. Consistent with Geothermal Law 27/2003, Article 22, this three-year term can be extended twice, for two extension terms of one-year each upon application and approval by the Minister of MEMR, Governor or Regent/Mayor. Appointment of the successful bidder to becoming the IUP Holder would be formalized by and subject to completion of each of the following:

1. Signing by the successful party and Minister, Governor or Regent/Mayor of the (negotiated) IUP and Exploration Execution Agreement (as appropriate);
2. Signing by the successful party and PLN of the (negotiated) PPA;
3. Acceptable proof that the successful party has placed the Exploration Performance Security to the value of US$ 10 million, in accordance with the terms of the IUP/Exploration Execution Agreement;
4. Payment by the successful party of the base price of Geothermal Work Area data or bonus being non-taxable state revenue [reference – Regulation 11/2009, Article 8(1) a – such prices to be accurately determined in the IUP];
5. Payment of data compensation to the Other Party [reference – Regulation 11/2009, Article 8(1) a – such prices to be accurately determined in the IUP]; and
6. Other issues determined as conditions precedent under the IUP.

Should the successful party fail to complete the above relevant obligations, which are within its control, within a 30-day period, the Minister (MEMR) and the Governor or Regent/Mayor would be entitled to reject that party and invite the next ranked tenderer to enter into negotiations concerning the model PPA and IUP. Thereafter, having settled the above obligations, that successor party would become the winner of the WPK tender. In such circumstances, the tender bond of the first party would be retained by the State. The exploration performance bond (if already placed) may in such circumstance be closed by the first party in failing to meet the above obligations.100

4.6 STAGE 4 - FEASIBILITY STUDY

This Phase is composed of an evaluation of economics of developing the geothermal resource. Following completion of the exploration activities and submission of a detailed exploration report to the Minister of MEMR and the Governor or Regent/Mayor, the holder of an IUP may undertake the feasibility studies. If the exploration activities were conducted by the MEMR, the holder of the IUP may directly commence the feasibility studies phase.

99 After a bidder is successful, the IUP will be issued with conditions precedent that need to fulfilled, one of which would be a signed (negotiated) PPA. Arguably, since the off taker needs to sign, the PPA may not be totally within the successful party’s control within the 30-day period. Moreover there may not be a negotiated PPA, in which case the IUP might not have a PPA pre-condition.
100 It has been suggested that the IUP Holder should have rights to extend unless objected to by the Minister, Governor or Regent/Mayor Fichtner, supra p. 4-50.
This phase must be completed within two years’ expiration of the exploration phase, with no extension of the term available.

4.7 STAGE 5 - EXPLOITATION PHASE

This Phase allows geothermal operations for a 30-year period. Having completed the feasibility studies phase and obtained approval of the Environmental Impact Assessment (Analisa Mengenai Dampak Lingkungan or AMDAL), the holder of the IUP may enter into the exploitation phase in which it is allowed to produce steam. The term of the Exploitation Phase is 30 years, which is extendable, each time for a further 20-year period.

4.8 STAGE 6 - UTILIZATION

This phase is commonly referred to as the downstream geothermal business activity and is entered into simultaneously with the Exploitation Phase. The steam from the wells may be utilized as follows:

**Indirect utilization:** Indirect utilization means for power generation purposes under the Electricity Law and regulations. An IUP Holder wishing to generate geothermal power is required to obtain, under the Electricity Law, a power supply business license known as an *Ijin Usaha Penyediaan Tenaga Listrik* or "IUPTL" from the Directorate General of Electricity, prior to commencing its mining activities at the exploitation stage.

**Direct Utilization:** Direct utilization of geothermal water and/or steam is for non-electric power needs (e.g., food drying and hot spring facilities). To date no Government regulation on direct utilization has been issued. Direct utilization is feasible anywhere that geothermal power may be tapped, including in the nearby area around power plants. For example, the feasibility of using geothermal for tea drying in the area of the Wayang Windu geothermal power facility has been studied, but not employed. See Chapter 1, section 1.4 for more details on direct utilization of geothermal resources.

4.9 THIRD REGIME - TOWARDS A NEW GEOTHERMAL LAW

As stated in the introduction to Chapter 4, geothermal activity in Indonesia can be divided into three separate regimes. A third regime may be on the near-term horizon as the Government is considering replacing the 2003 Geothermal Law ("replacing" means that more than 50 percent of the law will be changed) and the Ministry of Energy and Mineral Resources is drafting a second amendment to *Government Regulation 59/2007* on the Geothermal Business Activities and vetting it within the Government.

The draft Geothermal Bill is included in the list of the National Legislation Program (*Prolegnas*) 2013. As of the publication of this *Handbook* it is too early in the legislative process to speculate as to what elements of the 2003 law will be changed. It is, however, clear from preliminary revelations that the MEMR is attempting to address many of the issues that have been identified as problematic with the 2003 Geothermal Law. The Bill reportedly covers such issues as the elimination of the terms of “mine” and “mining” for geothermal business activities. The elimination of mining terms is not merely a word choice issue, since the elimination of the mining terms would effectively begin the harmonization of the new law with other laws that cover conservation of natural resources, such as *Law 5/1990* on the Conservation of Biological Resources and their Ecosystems. One result is that the
Exploitation and Utilization of geothermal resources, which is now limited to Protected- or Production-Forests, may be extended to Conservation Forests.  

Furthermore, the draft law also covers geothermal energy prices, environmental permits for geothermal business activities, participating interest, and transfer of shares, and Government appointments to the General Service Agency (BLU) or to State Owned Companies (BUMN). It also provides authorizations for MEMR to suspend, revoke, or cancel Geothermal Licenses published by Governors and Regents/Mayors under certain conditions, as well as the limitation period of geothermal rights, contract, or licenses, and the mechanism of re-negotiating steam or electricity prices. The draft of a second amendment to Government Regulation 59/2007 would provide that in the tendering of a working area, the criteria for determining the winner would be based on the evaluation of purchasing price of steam or electricity. If this new draft is promulgated, the bidders will be evaluated based on the quality of their technical and financial submissions, the winner will be selected based on its work programs and exploration commitments as well as which offer is the lowest price amongst all other offers.

Recall that MEMR Regulation 2/2009 provides that the National Government can assign a third party to conduct a Preliminary Survey. The Preliminary Survey can be conducted by the national or regional governments or it can be assigned to an “Other Party” who to qualify to conduct the Survey. The Other Party needs only to submit an application enclosing documentations set forth in MEMR Regulation 02/2009 to qualify to conduct the survey. The Other Party would then have the right to reimbursement and “first priority” to obtain the concession. This pending second amendment to Government Regulation 59/2007 would revise the provision that if a geothermal resource is successfully found, compensation would be paid to the Other Party that conducts the Preliminary Survey for the work that the Other Party performed and financed. The Other Party would not receive compensation pursuant to the new amendment if such Other Party did not win the tender. The objective of this new rule is to ensure that any Other Party that undertakes a Preliminary Survey has a strong commitment in developing geothermal businesses from upstream to downstream. This new compensation rule will also serve to avoid a situation in which the tender winner, if not the Other Party, is required to purchase data from the Other Party. The rationale of MEMR is that the Other Party already has enormous rights, including a priority right to match; therefore, it should not be entitled to compensation for the expenses incurred during Preliminary Survey assignments.

4.10 OVERALL CYCLE

Under MEMR Regulation 11/2009, Article 9, an IUP is granted for a period of 35 years, i.e., five years for all Phases up to Exploitation and 30 years for Exploitation, for the IUP Holder to carry out:

- Exploration, valid for not later than 3 years but which may at the sole discretion of the Ministry be extended twice, each for 1 year;
- Feasibility study, valid for not later than 2 years; and

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101 Deputy Minister of Energy and Mineral Resources (MEMR), Susilo Siswoutomo opening remarks on the Public Hearing to the Geothermal Bill in Jakarta. The objectives of this event were to socialize and give a clear perspective to the Bill of Geothermal, which if it is enacted, will replace the Law 27/2003 on Geothermal. (April 14, 2012).
- Exploitation, valid for no later than 30 years, following completion of exploration activities.

A geothermal project transaction cycle may follow the proposed (principally sequential) time schedule set forth in Table 4.1 (Geothermal Project Transaction Cycle), below.\textsuperscript{102} This time schedule in some minor respects may differ from that contemplated by present legislation and recent practice with geothermal transactions in Indonesia, but appears consistent with policy measures designed to attract international tenderers as well as international tendering practice.\textsuperscript{103}

4.11 SUMMARY

The governance of geothermal energy in Indonesia has undergone a series of substantial changes since the 1970s when, as a monopoly, Pertamina first began to explore and develop geothermal energy. In the 1980s Pertamina began to partner with the private sector, engaging private sector technological know-how to develop and explore geothermal energy. Following the period of inactive development that resulted from the Asian Financial Crisis of 1997-1998, the Government began to initiate a series of reforms to reinvigorate development in the geothermal sector. In the 2000s, Pertamina began to function as a business entity and its monopoly over geothermal resources was ended. Simultaneously, decentralization, (discussed in Chapter 3), transferred the control of geothermal resources to local governments.

The Geothermal Law introduced in 2003 outlined the process for harvesting geothermal energy, as well the basic factors and considerations of the process. The Geothermal Law also provided a framework for competition in the development of this energy source from both foreign and domestic investors. The Law outlined important components of geothermal development including: issuing of licensing, governmental roles, and the tendering authority. It also detailed the six stages in the geothermal utilization process: preliminary survey, tendering process, exploration phase, feasibility study, exploration stage, and finally utilization. The Government of Indonesia continues to fine tune the geothermal legal regime. As of 2013 a new law and comprehensive regulations are under consideration. The regime continues to evolve toward commercialization and privatization of the geothermal sector, and utilization of foreign investment to create a sustainable power source. In the following chapter, we outline the electricity sector and its regulatory structure.

\textsuperscript{102} The times may vary in individual tenders.

\textsuperscript{103} Fitchner, \textit{supra}, p. 4.41 et seq.


<table>
<thead>
<tr>
<th>No</th>
<th>Activity</th>
<th>Estimated Duration</th>
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<tbody>
<tr>
<td>1.</td>
<td>Preliminary Survey</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.1 Announcement of area for commission of Preliminary Survey to selection of successful Other Party under MEMR Regulation 02/2009, including: public announcement, formal invitation to tender, evaluation, negotiation and signing of Preliminary Survey tender.</td>
<td>3-4 months</td>
</tr>
<tr>
<td></td>
<td>1.2 Term of Preliminary Survey (MEMR Regulation 02/2009).</td>
<td>12 months</td>
</tr>
<tr>
<td>2.</td>
<td>Work Area Tender Prequalification Phase (proposed)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.1 Issue of geothermal transaction Expression of Interest in the press with invitation for interested parties to pick up documentation constituting the Invitation to Prequalify.</td>
<td>3 weeks to business entities receiving documentation</td>
</tr>
<tr>
<td></td>
<td>2.2 Preparation by the business entities of Request to Prequalify.</td>
<td>3 weeks</td>
</tr>
<tr>
<td></td>
<td>2.3 Evaluation of requests to Prequalify, preparation of associated report, approval and notification to successful and unsuccessful applicants.</td>
<td>Approximately 2 weeks.</td>
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<td></td>
<td>2.4 Notice period.</td>
<td>Approximately 2 weeks</td>
</tr>
<tr>
<td>3.</td>
<td>IUP Holder Tender Phase</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.1 Issue Geothermal Work Area tender to prequalified parties including complete set of commercial documents (such as model PPA and model IUP/Exploitation Execution Agreement).</td>
<td>Approximately 2 weeks</td>
</tr>
<tr>
<td></td>
<td>3.2 Period for prequalified business entities to prepare respective Geothermal Work Area tenders.</td>
<td>Approximately 2 to 3 months</td>
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</tbody>
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<thead>
<tr>
<th>No</th>
<th>Activity</th>
<th>Estimated Duration</th>
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<tbody>
<tr>
<td>3.3</td>
<td>Evaluation of the Geothermal Work Area tenders, preparation of evaluation report with recommendation as to preferred bidder with whom to conduct negotiations concerning the IUP/Exploitation Execution Agreement and PPA.</td>
<td>Approximately 8 weeks.</td>
</tr>
<tr>
<td>3.4</td>
<td>Negotiation of IUP and PPA with “Preferred Bidder.”</td>
<td>Approximately 3 weeks</td>
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<tr>
<td>3.5</td>
<td>Governor or Regent/Mayor recommendation to award the IUP, Ministerial approval and IUP signing and PPA signing (subject to agree lender modifications following due diligence).</td>
<td>Approximately 1 to 2 weeks.</td>
</tr>
<tr>
<td>4.</td>
<td><strong>Exploration Phase</strong></td>
<td></td>
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<tr>
<td>4.1</td>
<td>Exploration activities.</td>
<td>Max. 3 years + 1 + 1</td>
</tr>
<tr>
<td>5.</td>
<td><strong>Feasibility Phase</strong></td>
<td></td>
</tr>
<tr>
<td>5.1</td>
<td>Feasibility Study activities.</td>
<td>Max. 2 years</td>
</tr>
<tr>
<td>6.</td>
<td><strong>PPA Finalization Phase</strong></td>
<td></td>
</tr>
<tr>
<td>6.1</td>
<td>Final negotiations to address (only) specific concerns of the project lenders and PPA signing will be done during Feasibility Phase.</td>
<td>2 months</td>
</tr>
<tr>
<td>6.2</td>
<td>Financial Close, which will trigger effectiveness of the PPA.</td>
<td>Following Item 6.1 above</td>
</tr>
<tr>
<td>7.</td>
<td><strong>Exploitation Phase (Construction)</strong></td>
<td></td>
</tr>
<tr>
<td>7.1</td>
<td>Implementation of contracts for the drilling of production wells and semi-parallel construction of the power plant and transmission lines.</td>
<td>2.5 to 3 years</td>
</tr>
<tr>
<td>8.</td>
<td><strong>Exploitation Phase (Operation)</strong></td>
<td></td>
</tr>
<tr>
<td>8.1</td>
<td>For a period from Commercial Operation up until natural termination of the IUP (unless agreed by both parties to extend).</td>
<td>Up to 30 or 33* years</td>
</tr>
</tbody>
</table>

*Source: BAPPENAS, 2013*

*If the exploration period is not extended, the IUP will be given for a period of not later than 33 years.*
CHAPTER 5

ELECTRICITY SECTOR REGULATORY STRUCTURE

5.1 INDONESIAN GEOTHERMAL ELECTRIC POWER MARKET

The sale of the electricity generated by a geothermal field is critical to the viability of a private sector geothermal resource developer who typically depends on the revenue stream of a PPA to finance its project. Therefore an understanding of the downstream electricity market in Indonesia is essential. This chapter addresses the electric power market in Indonesia historically and as governed by the 2009 Electricity Law. The legal basis for conducting electricity supply businesses and activities in Indonesia are the Electricity Law, Law 30/2009 (the “2009 Electricity Law”), Government Regulation 14/2012, various Presidential Decrees and Regulations, and MEMR Regulations including MEMR Regulation 04/2007. Private enterprises (IPPs), cooperatives, and regional government-owned utilities as well as state-owned companies are allowed to participate in electricity supply business. The power generation sector is dominated by PLN which reports generation of 32.182 MWe (March 2013), approximately three-fourths of the total national capacity. PLN’s generation assets in Indonesia include its subsidiaries such as PT Indonesia Power, PT Pembangkit Jawa Bali, and PT PLN Batam.\(^{105}\)

\(^{105}\) PLN generates 32,183 MWe, with the remainder coming from IPPs (10,287 MWe) and PPUs (1,729 MWe). Source: PLN Presentation – “Indonesia’s Electricity Policy and cooperation between Japan and Indonesia”, March 2013 by Jarman, Director General of Electricity on a occasion Visit of FEC Delegation.

*Figure 5.1 PLN Geothermal Development Plan 2012 to 2020*

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Source: PLN (2011) modified by BAPPENAS, 2013
It is important for the upstream investor to understand that although PLN is a state-owned liability company and is not a monopoly, it is effectively the only buyer of electricity in Indonesia because PLN, as the sole owner of transmission and distribution assets, remains the only business entity in charge of transmitting and distributing electric power for public use. The 2009 Electricity Law provides PLN with priority rights to conduct generation, transmission and distribution business throughout Indonesia.\(^{106}\) Dealing with a single buyer such as PLN has both advantages and disadvantages. On the one side, a developer has a known buyer but, on the other side, that buyer is government-owned and depends for its liquidity on a Public Service Obligation. Plus, the buyer has been insolvent from the perspective of lending institutions since the time of Asian Financial Crisis. The bottom line is that the developer and, its lender, and its equity investors are dependent on the Government for the recovery of invested monies.

The 2009 Electricity Law allows private participation in the generation, transmission and distribution of electricity; however, for public use, private sector participation is currently limited to the generation of power – although the geothermal developer is responsible to build transmission lines to the receiving substation or bus bar as set forth in a relevant PPA.

Such private sector participation is allowed through Independent Power Producer (IPP) arrangements sanctioned by the 2009 Electricity Law. The IPP is usually selected through competitive bidding except in certain circumstances (e.g., for renewable energy (including geothermal), crisis area, or expansion projects in which case appointment can be direct. In other words, the Government can select a geothermal developer through direct appointment. The process involves the IPP signing an Energy Sales Agreements or a Power Purchase Agreement with PLN to produce electric power and supply electricity at an agreed price for an agreed period.

As noted in Chapter 2, PLN has been under pressure by IPPs to pay for the electricity in foreign currency, as IPPs have to import their equipment from abroad and repay their loans in foreign currency. As will be seen in the discussion of the PLN model PPA in Section 5.5, below, PLN remains committed to a US$ payment schedule.\(^{107}\) Nevertheless, PLN is not equipped to deal in foreign exchange; however, the Government has not provided a facility in which IPPs can change their Rupiahs in foreign exchange to pay off their debts. The Government has been debating whether to put in place regulations stipulating that in the future PLN will only sign IPPs denominated in Rupiahs. The foreign currency exposure of PLN during the financial crisis of 1997-98 was the main reason why PLN was forced to close the existing PPAs at that time. Due to dramatically large exchange rate Rupiah/Dollar losses, PLN was unable to make PPA payments to IPPs. This eventually led to a series of court cases, where the Government of Indonesia received fines totaling over US$1.5 billion.

Because PLN is technically bankrupt as a result of having to sell electricity below the cost of production, PLN is regarded by the international banking sector as an unreliable partner. Consequently, in specified situations, the Government through the MoF, has been

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107 For example, MEMR Regulation 22/2012 on the Purchase of Electricity from Geothermal Power Plant and the Feed-in Tariff Preferences are priced in United States dollars.
granted the authority to issue a Business Viability Guarantee Letter (BVGL) to reassure banks and lender institutions that, if PLN as the official off-taker and party to the contract fails to live up to the PPA due to liquidity or solvability problems, then the IPP will be paid by the MoF. The Government is also seeking to shorten the time required to obtain the guarantee; presently, the official final analysis of the budget in which the guarantee is given has to be approved by Parliament prior to the execution of the PPA.

5.2 REGULATORY HISTORY OF ELECTRICITY

Early electricity arrangements were guided by the 1890 Dutch Ordinance entitled the "Installation and Utilization of the Conductors for Electrical Lighting and Transferring Power via Electricity in Indonesia." During the past quarter of a century, following the annulment of that law, the Government of Indonesia has made three distinct legislative efforts to structure a balance between and among the private sector investment in electricity infrastructure and the national and provincial governments’ responsibility to the people; namely, the 1985 Electricity Law, the 2002 Electricity Law, and the 2009 Electricity Law.

5.2.1 Centralized System - 1985 Electricity Law

The 1890 Dutch ordinance was annulled in 1985 with the introduction of Electricity Law 15/1985 (1985 Electricity Law). The 1985 Electricity Law essentially commenced the modern era of electricity regulation in Indonesia. The 1985 Electricity Law provided for a centralized system anchored by a state-owned electricity company PLN holding exclusive powers over the transmission, distribution and sale of electricity. Private companies were allowed to generate electricity, but the 1985 Electricity Law provided that PLN would be the single buyer of electricity and control both the transmission and distribution functions.

5.2.2 Liberalized System - 2002 Electricity Law

In 2002, the Government enacted Electricity Law 20/2002 (the "2002 Electricity Law"), which was aimed at liberalizing the electricity sector by allowing private investors to produce and sell power directly to customers in those areas designated as "competitive" areas. This 2002 electricity-sector reform law restructured PLN and set the foundation for an electricity market with open competition based on a multi-buyer, multi-seller mechanism opening the way for independent power production.

However, in December 2004, Indonesia’s Constitutional Court annulled the 2002 Electricity Law and effectively re-instated the 1985 Electricity Law (see Section 4.1.2, of this Handbook). The Court held that the 2002 Electricity Law contravened Article 33 of the Indonesian Constitution. The Constitutional Court determined that electricity is a strategic commodity and that consequently its generation and distribution should remain under the exclusive control of the Government. The Court ruled that privatizing and unbundling PLN, with the intention of opening up a national competitive electricity market, would strip the Government of its authority and mandate to provide electricity for the nation.

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108 MoF Reg 139/PMK.011/2011 sets forth the concept of a “Business Viability Guarantee Letter” to cover the risk of nonpayment by PLN for amounts stated in a payment invoice in respect of the purchase of electricity issued by an IPP in accordance with the applicable PPA.


The 1985 Electricity Law had been implemented through Government Regulation 10/1989 on the "Provision and Utilization of Electricity. After the 2004 Court ruling, the Government of Indonesia amended the unconstitutional Government Regulation 10/1989 by promulgating two Government Regulations 3/2005 and 26/2006. These two regulations amended the structure to permit IPPs to develop and supply power to ‘Electric Power Business License’ holders (PKUK111 and PIUK112), which business licenses were essentially limited to PLN. In other words, under the new structure IPPs could generate power as long as they sold power exclusively to the Government’s arm that provided electricity to the nation. This scheme was drafted so that it could withstand the same kind of constitutional challenge that annulled the 2002 Electricity Law. Electricity development by IPPs was also required to be in line with the prevailing Electric Power Supply Business Plan (RUPTL or Rencana Usaha Penyediaan Tenaga Listrik) and the National Electricity Master Plan (RUKN or Rencana Umum Ketenaqalistrikan Nasional); further shoring up the Government’s role in fulfilling its Constitutional mandate.

5.2.3 Decentralized System - 2009 Electricity Law

Subsequently, in September 2009, a new Electricity Law 30/2009 was passed. The 2009 Electricity Law, which had been under preparation since the annulment of the 2002 Law, reset the legal foundation for the restructuring of the electricity sector. The 2009 Law confirms the State as the controller of electricity supply and PLN as the supplier as per the Constitutional Court’s reading of the Constitution.113 Significantly, the new Law allows provincial governments to issue regulations on electricity and to issue permits to IPPs to generate and supply electricity. The 2009 Electricity Law also provides a greater role to regional authorities in terms of licensing and of determining electricity tariffs.114 The authority of the governments (central, provincial, and regent/city) includes:

- Determining regulations, policies and electrification master plans;
- Determining and issuing business, operation and supporting service permits;
- Determining the electricity business area;
- Determining and approving the selling price of electricity (but the governments need the approval of Parliament for establishing selling price to consumer); and
- Issuing guidance and oversight to business enterprises in the electricity sector

As indicated, the 2009 Electricity Law replaced the 1985 Electricity Law; however, unlike the intervening 2002 Electricity Law, the 2009 Electricity Law does not eliminate the main role of PLN in the electricity supply business (as PLN is given "priority" rights to conduct this business throughout Indonesia). To illustrate, under the 1985 Electricity Law, the electricity supply business in Indonesia was conducted by PLN as the holder of the Electricity Business Power License. Under the 2009 Electricity Law, electricity supply is still controlled by the State, but is conducted by the central and regional Governments through PLN and regionally owned entities. The 2009 Electricity Law also provides a greater role for

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111 PKUK means Electricity Business Power License under the 1985 Electricity Law (PemegangKuasa Usaha Ketenagalistrikan)
112 PIUK means “Electricity Power License Holder” (Pemegang Izin Usaha Ketenagalistrikan).
113 Articles III and IV, Electricity Law No. 30/2009.

80
regional governments and other entities to participate in this business consistent with the national move to decentralization.

In January 2012, the Government issued the Regulation on Electric Power Supply Business Activities Government Regulation 14/2012, which implements certain articles of the Electricity Law 30/2009. The Regulation divides the electrical power supply business into two categories: (i) supply for public needs and (ii) supply for private or own use. Both business categories require licenses – an electric power supply business license for the former and an operating license for the latter. To highlight the exercise of the State's Constitutional control in the sector, the 2009 Electricity Law also provides a right of first refusal to PLN to conduct an electricity supply business in an area before the central or regional government can offer the supply opportunity to regionally owned entities, private entities or cooperatives. The 2009 Electricity law is discussed in more detail in Section 5.3 of this Handbook. Table 5.1 shows the chronology of the reform phases in the Electricity Laws of Indonesia.

5.3 THE 2009 ELECTRICITY LAW

The 2009 Electricity Law divides the electricity business into the two broad categories of supply of electrical power and support of electrical power as follows:

Supply:
- Electrical power generation (both for self-use and for sale to an off-grid captive consumer);
- Electrical power transmission;
- Electrical power distribution; and,
- Sale of electrical power.

Support:
- Consulting activities;
- Construction and installation of electrical power equipment;
- Operations and maintenance of electrical power equipment; and,
- Development of electrical supporting equipment technology.

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115 See Section 6.1.3.2, below.
116 Other important regulations include:
- Presidential Decree 67/2005 (since amended by Presidential Decree13/2010) and MoF Regulation No. 38/2006 which set rules and procedures for "public/private participation" arrangements;
- Presidential Decree 42/2005 which outlined the inter-ministerial Committee for the Acceleration Program (KKPPi) responsible for coordinating policy related to the private provision of infrastructure;
- MEMR Regulation 44/2006 which allowed direct tender for the first fast track programs (of coal-fired plants); Presidential Decree 71/2006 which launched the first fast track program; Presidential Decree 4/2010 which launched the second fast track program; and
- MEMR Regulation 1/2006 (and its revisions via MEMR Regulation 4/2007) on "electric power purchasing or rental transmission lines" which covered the appointment of IPPs.

<table>
<thead>
<tr>
<th>Year</th>
<th>Measure</th>
<th>Status</th>
<th>Characteristics</th>
<th>Agencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1945</td>
<td>Indonesian Constitution Article 33</td>
<td>Implemented</td>
<td>As interpreted by the Constitutional Court, Article 33 requires the GoI to be the single provider of electricity for Indonesia</td>
<td>PLN</td>
</tr>
<tr>
<td>1985</td>
<td>Electricity Law 15/1985</td>
<td>Implemented</td>
<td>The GoI is responsible for regulating the electricity sector through the MEMR. Private Companies are allowed to participate in the electricity generation business. PLN is designated the single buyer of electricity and controls both transmission and distribution functions.</td>
<td>MEMR, PLN</td>
</tr>
<tr>
<td>1995</td>
<td>Sall Power Producers Scheme</td>
<td>Implemented</td>
<td>Scheme available to small producers up to 30MW per project for the Java-Bali region and up to 15MW per project for regions outside the Java-Bali system.</td>
<td>MEMR, PLN</td>
</tr>
<tr>
<td>2002</td>
<td>Electricity Law 20/2002</td>
<td>Annullled</td>
<td>The Law established a competitive electricity market by restructuring and unbundling the PLN, mechanism for adjusting electricity tariffs, rationalized mechanism for power purchase for the private sector and established a regulatory mechanism for the sector.</td>
<td>MEMR, PLN</td>
</tr>
<tr>
<td>2002</td>
<td>Ministerial Decree 1122/K30/MEM on Small Scale Power Purchase Agreement</td>
<td>Implemented</td>
<td>Requires PLN to purchase electricity generated from renewable energy sources by non-PLN producers for projects up to 1MW capacity. Institutions eligible to participate are cooperatives, private companies and government companies. Sets purchase tariffs at 80-percent for medium voltage and 60-percent for low voltage of PLN’s announced “Electricity Base Price”, which is intended to be its marginal production costs at the point of gridline interconnection of the renewable energy power plant.</td>
<td>MEMR</td>
</tr>
<tr>
<td>2006</td>
<td>MEMR Regulation 2/2006 on Medium Scale Power Generation from Renewable Energy Sources</td>
<td>Implemented</td>
<td>Extends the same price guidelines as MD 1122/K30/MEM for projects from 1MW to 10MW. Sets a minimum contract period of 10 years.</td>
<td>MEMR</td>
</tr>
<tr>
<td>2009</td>
<td>Electricity Law 30/2009</td>
<td>Implemented</td>
<td>Retains PLN monopoly on supplying and distributing to end customers. IPPs will be allowed to supply and distribute to the regions; however, subject to a “right of first priority” provided to State-owned company PLN.</td>
<td>MEMR, PLN</td>
</tr>
</tbody>
</table>

*Source: BAPPENAS, 2013*
In addition, the 2009 Electricity Law addresses five key policy issues, i.e., Licensing, Regional Autonomy, Tariffs, Cross-border Sales, and Direct Sales, which are further addressed below.

5.3.1 Electricity Supply Licensing
PLN is primary holder of an Electricity Supply Business Permit:

- PLN has the right of first refusal for un-serviced areas, which if not accepted by PLN, can be assumed by the private sector.
- If the private sector does not take up a business opportunity, the Government of Indonesia is mandated to instruct PLN to supply the area.

5.3.2 Role of Regional Autonomy
The Regional Authorities fulfill the following roles:

- The regional authorities are authorized/required to prepare a regional electricity plan – a National Electricity Regional Plan (RUKD), based on the National Electricity Master Plan (RUKN).
- The Regional Electricity Development Plan must comply with the Regional Electricity Plan.
- The regional authorities can provide licenses for power projects that are intra-agency and do not involve the sale of electricity to holders of a Government of Indonesia issued license.
- The Government of Indonesia provides licenses to PLN and to IPPs selling to PLN.

5.3.3 Tariffs
Tariffs are implemented as follows:

- The Government of Indonesia approves tariffs for Government issued license holders (e.g., PLN and IPPs selling to PLN).
- The regional authorities approve tariffs for IPPs selling to non-PLN utilities.
- Tariff variations, according to different business areas, are permitted.
- The regional authorities must consider the interests of the relevant business as well as the public.
- Tariffs must be approved by the Indonesian/Regional Houses of Representatives.

5.3.4 Cross-border sale and purchase
Cross-border sale and purchase is possible by the holder of a license for conducting electricity business for public use from the Government of Indonesia. Purchase conditions include that there be a shortage of electricity supply. Sale conditions include that domestic electricity needs have been fulfilled.

5.3.5 Direct sale of electricity to public
No link exists between electricity licensing and any requirement that electricity facilities be connected to the National Transmission Network. The 2009 Law suggests that the holders of
an IUPTL (which holds sale/integrated licenses) can sell directly to the public when the projects are not connected to the National Transmission Network or are not inter-province projects. In other words, an IUPTL holder under these circumstances could sell directly to a resort hotel or a large manufacturing company.

5.4 PROCEDURE FOR PURCHASE OF ELECTRICITY

5.4.1 Bidding Process for New Electric Power Capacity

As noted in Section 5.1 of this Handbook, the bidding process for new energy capacity is generally on a competitive basis in line with the private sector participation regulations set out in Presidential Regulation 67/2005 as amended by Presidential Regulation 13/2010. Since a geothermal developer would have already gone through the tender process outlined in Section 4.4 (Tendering Process) above and since the primary value of geothermal resource development is the production of electricity, it would not be an effective policy to have the geothermal developer rebid for an electricity license. Consequently, in practice MEMR will generally issue a license to a geothermal developer by direct appointment. Moreover, pursuant to MEMR Regulation 02/2011, PLN is obligated to buy electrical power resulting from geothermal energy. Direct appointment is permitted for geothermal project. Direct appointment, as distinguished from bidding, is significant to the upstream geothermal industry; however, when a geothermal project is bid or issued by direct appointment, the license award process is to follow a transparent process as set out in MEMR Regulation 01/2006 and its revisions under MEMR Regulation 04/2007 on Procedure for Purchase of Electricity and Rental of Grids in the Power Supply Business for the Public Interest. These regulations stipulate that:

- The purchase of electricity or grid rental shall be in accordance with the Electricity Supply Business Plan of the holder of an Electricity Business Power License under the 1985 Electricity Law, which is prepared in accordance with the National Electricity Master Plan.
- The purchase of electricity for public use shall be carried out through general tender, direct appointment or direct selection.
- The general tender, direct appointment or direct selection shall be carried out openly, in a non-discriminative manner, with transparent accountability, and in compliance with prevailing regulations.

5.4.2 Post Award Process

After the preferred tenderer is selected, the process from award of tender to operation will involve the following:

- The issuance of a letter of intent;
- The negotiation of an electricity tariff and other terms;
- The establishment of a special purpose company with a temporary business license applied for from the Directorate General of Electricity (Direktorat Jenderal Kelistrikan or DJK);
- MEMR approval of the tariff;

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- The negotiation and signing of a PPA;
- The application for the permanent business license from the Directorate General of Electricity submitted with a feasibility study and environmental impact planning document and PPA contract;
- The issue of a license for conducting electricity business for public use (i.e., an IUPTI), developers must obtain a power supply business license from the Directorate General of Electricity before commencing geothermal activities at the exploitation stage;
- The completion of financing;
- The awarding of engineering, procurement and construction (EPC) contracts; and
- The commencement of commercial operations.

### 5.5 POWER PURCHASE AGREEMENTS

The Power Purchase Agreement (PPA) is the cornerstone operational contract for IPP investors. A “bankable” PPA is essentially a long-term off-take agreement with a credit-worthy off-taker that provides for an adequate and predictable revenue stream.¹¹⁹

#### 5.5.1 The PPA under the Laws of Indonesia

As a written agreement for the procurement of infrastructure, a PPA can be construed as a "cooperation contract" as defined under Presidential Regulation 13/2010. As such its principle terms and conditions should include the items stipulated for cooperation contracts in Article 23 of Presidential Regulation 13/2010. These terms and conditions include:

- The scope of the contractual work or service;
- The period of operation (e.g., most PPAs are for a 15-30 years);
- The implementation guarantees (i.e., essentially the relevant IPP and PLN responsibilities);
- Start up and commissioning issues;
- Operations and maintenance arrangements;
- Sales and purchasing arrangements (with regulated price "ceilings" according to different types of fuel);
- Billing and payment arrangements;
- Rights and obligations on risk allocation;
- Service performance standards;
- Insurance arrangements;
- Force majeure scenarios;
- Dispute resolution arrangements;
- Sanctions; and,
- Purchase options (i.e., for PLN).

¹¹⁹ See also PPA discussion in Section 2.4.1.
Article 23 of Presidential Regulation 13/2010 also stipulates use of the Indonesian language in the cooperation agreement and, if the signed agreement is written in more than one language, that the Indonesian version prevails.

5.5.2 The “Bankable” PPA

A “bankable” power purchase agreement is essentially a long-term off-take agreement with a credit-worthy off-taker that provides for an adequate and predictable revenue stream. Private investors will have a different perspective than the utility on the contents of a PPA. Indeed, the private sector developer, its equity investors and its lenders will among themselves have differing perspectives on the contents of what constitutes a PPA that is “bankable”. Private investors would want not only government guarantees of the creditworthiness of PLN, but also terms that mitigate the risks of nonpayment in addition to off-taker creditworthiness guarantees. In many parts of the world PPAs are negotiated in several steps – the first step being between the developer and the utility and the second between the lender and the utility. Seldom is a utility-issued, take-it-or-leave-it PPA successful, virtually all PPAs are negotiated. Presidential Regulation 13/2010 itemizes standard clauses included in most international geothermal power purchases. The question of course is what content of those clauses constitute a bankable PPA in the view of international lenders.

5.5.3 The PLN Model PPA Compared with the “Bankable PPA”

The following discussion compares the standard approach taken in most international geothermal PPAs with the approach of the template PPA utilized by PLN, the creation of which was mandated under MEMR Regulation 02/2011. The template PPA is attached as Appendix C of this Handbook.

**Dispatch Risk:**

There are two ways generally accepted by banks for mitigating the risk to the geothermal power producer:

- **Take-or-Pay:** Under this model, the off-taker pays a fixed tariff comprising a capacity charge (a fixed amount that is paid regardless of whether the facility is dispatched) and an output charge (an amount paid in respect of energy actually delivered). This formula permits the power producer to cover certain fixed costs (including debt service and fixed operating costs) with the capacity charge.

- **Take-if-Delivered:** Under this model, the off-taker pays a fixed tariff for all energy delivered, regardless of whether the facility is dispatched. When using this model, off-takers will often use a higher “feed-in” tariff, intended to cover the capital costs of generating power at the site.

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121 The problem of reaching agreement on a bankable Power Purchase Agreement (PPA) with PLN, Montty Girianna, Director of the Energy, Mineral Resources and Mining Division of the National Development Planning Agency (BAPPENAS), wrote in an opinion column, was due to a number of factors. These factors included the “inability of geothermal power proponents to commit to a volume and price”, the rules and regulations on how PLN should set prices under a PPA, and the political problem of “getting more subsidies that may be required for geothermal PPAs” due to the “cost differential between coal-fired power plants and geothermal power plants.” *Why geothermal IPPs have yet to succeed in Indonesia*, Jakarta Post, April 12, 2011.
the geothermal power producer’s larger up-front financing and construction costs, which is later reduced at a date and to an amount agreed up front.

**PLN PPA:** In Section 1.1.20 (Take-or-Pay) of the template PPA (Appendix C), PLN adopts the “Take or Pay” model and establishes the minimum amount power that must be accepted and/or paid by PLN to the seller from each of the geothermal generator’s turbines or generators in the period of one calendar year.

**Fixed Tariff/Foreign Exchange:**

It is essential that the revenue of any PPA, whether “Take-or-Pay” or “Take-if-Delivered”, be fixed at an amount adequate to cover the cost of operating the facility in order to repay the debt and provide a reasonable return on equity. To avoid subjecting the power producer to currency risk, the power producer and its lenders will want pricing under the PPA to be linked to the exchange rate of the currency of the power producer’s debt.

**PLN PPA:** In Section 1.1.2 of the template PLN adopts the US dollar as the currency of the PPA. The Power Price is stated in US dollars. Section 11.2.1 (Payment and Late Payment) of the template provides that the buyer shall pay every bill in Euros with an option to pay the seller in US Dollars. The value of the transaction is set as the selling price of US Dollar against the Rupiah with great precision – for example: at 11:00 AM for foreign exchange transactions quoted by the Bank of Indonesia. This detailed transactional information provides the requisite link between the payments and the exchange rate of the currency of the power producer’s debt. There remains an open question as to the authorization of a facility, in which IPPs can change their Rupiahs into foreign currency in order to enable IPPs to make their foreign debt payments,

**Change in Law/Change in Tax:**

The agreement should explicitly state which party takes the risk of either the law or tax regime changing after the date of the agreement in such a way as to diminish the economic returns of the transaction for such party (e.g., increase in taxes on power producers reducing the producer’s returns). In order for PPAs to be “bankable,” most lenders require the off-taker to take this risk.

**PLN PPA:** The PPA does not directly address which party takes the risk of the law or tax regime changing after the date of the agreement. Section 18.1.1 of the PPA template defines the term “Force Majeure” as used in the PPA as a condition including, but not limited to “government action in terms of taxes and the Environment (related to licensing, approval, enactment of new legislation, new interpretations or amendments to existing legislation) that cause delays in implementation or part or all PARTY’s duty.” Whether this language is intended to treat all new legislation as well as new tax legislation as a force majeure would need to be clarified by the parties, and will, for legal enforceability, depend on the official Bahasa version of the PPA. In any event, the risk allocation in the event of a change of law or tax regime would merit clarification. Normally, when a seller proposes a tariff, that tariff is based on the law and tax regime in place at the effective date of the agreement. In the instant case, both parties are exclusively reliant on the feed-in tariff. Therefore the PPA would need to address the risk that is taken in the case of changed circumstances, including adjustment for inflation as well as well as a change of law (including a change to feed-in tariffs).
Note that the PPA does provide that “after the Force Majeure Period ends, the parties shall re-negotiate the continuation of the agreement”; however, when one has a fundamental change of circumstances, it is generally useful to agree in advance as to how such a “continuation of the agreement” is to proceed. In Section 15.2.3, the template PPA provides a mechanism for discussion regarding additional equipment for environmental handling that may be needed as a result of the enactment of new legislation.

**Force Majeure:**

The agreement should excuse the power producer from performing its obligations if a Force Majeure event (an event beyond the reasonable control of such party) prevents such performance.

**PLN PPA:** Section 18.1.1 (Force Majeure) of the template is a standard international, commercial Force Majeure clause.

**Off-shore Arbitration:**

The agreement should provide for offshore arbitration, in a neutral location, under rules generally acceptable to the international community (ICC, UNCITRAL, LCIA, and AAA).

**PLN PPA:** The PPA provides for neither offshore arbitration nor international arbitration rules. Article 17 (Conflict Settlement) provides that a conflict shall be submitted to the Indonesian National Arbitration Board (BANI) for resolution in Jakarta by arbitral council that consists of three arbitrators appointed according to BANI’s regulations, using Bahasa as the language both of the process and the arbitration. The agreement binds the parties to the provisions of Article 60 of Law 30/1999 on Arbitration and Alternative Dispute Resolution (Arbitration Law of Indonesia).

**Termination:**

The PPA should set out clearly the basis on which either party may terminate the PPA. Termination by the off-taker may leave the project with no access to the market and thus should be limited to significant events. The power producer and its lenders will require meaningful grace periods and cure rights, and the lenders will also require step-in and cure rights.

**PLN PPA:** The termination provisions of the PPA are limited to termination by the buyer – Section 11.2.3 of the template providing termination in the event that buyer has not paid seller. There is no provision in the PPA for termination for cause or breach of contract.

Note that in the PPA, the parties agree to waive Article 1266 of Act Book of the Civil Code regarding termination of the agreement without going through a court decision.

**Appropriate Termination Payment Regime:**

The agreement should provide that if the PPA is terminated for any reason, then the power producer (in practice, its lenders) will receive a termination payment at least equal to the full amount of the power producer’s outstanding senior debt. This provision is universally required by lenders.
**PLN PPA:** Section 11.2.4 of the PPA template states that the termination of the PPA by seller in the event that buyer does not pay seller the required monies will not eliminate all obligations regarding electricity supplied or distributed by the seller to PLN under the PPA, including payment and late payment penalties.

**Assignment:**

The PPA should allow “collateral assignment” of the agreement to the power producer’s lenders with the right to receive notice of any default and to cure such default. Additional step-in rights are generally set forth in a separate “direct” agreement between the lenders and the off-taker.

**PLN PPA:** The PPA is silent regarding “collateral assignment” of the PPA. This provision is usually required by international governmental lenders and banks, and is usually negotiated after the geothermal developer identifies the lender; however, a conditional clause usually appears in PPAs.

**Sovereign Support:**

Depending on the size of the project and the creditworthiness of the off-taker, it is often advisable for the off-taker’s payment obligation to be supported by a guarantee from the national government.

**PLN PPA:** The PPA is silent regarding a guarantee from the national government – i.e., the guarantee from the Ministry of Finance for PLN. The issuance of a Business Viability Guarantee Letter (BVGL) by the Ministry of Finance for a project would usually be recited as a condition of closing.

**Transmission/Interconnection Risk:**

The PPA should indicate which party bears the risk of connecting the facility with the grid and transmitting power to the nearest substation. The more that significant these risks may be (due to terrain, distance, populated areas); the more the lenders will require the off-taker to bear all or a significant portion thereof.

**PLN PPA:** The PPA, (Section 3.3), requires that seller deliver all power generated to the PLN network. Also provides seller’s commitment to construct transmission facilities from the sellers’ facilities to the point of connecting prior to the date of commercial operations.

The bottom line appears to be that although the PLN’s Power Purchase Agreement addresses many of the issues that are requisite to international PPAs from both the perspective of the developer and of its lender -- several points in the model PPA will require further clarification and negotiations by and between PLN, the developer and its lender.
5.6 POWER PURCHASE AGREEMENTS PRICING ISSUES

The Government has inserted itself in a significant way in the pricing process of PPAs. The Government of Indonesia, including the Ministries of Energy and Mineral Resources and of Finance have long been sensitive to the criticisms levied by various international agencies with respect to Power Purchase Agreement issues that in past years have had a chilling effect on private sector investment. Among these critical issues is the acceptability of the PPA in the Indonesian electrical sector. For example, in a 2011 International Energy Agency (IEA) case study published in the “Technology Roadmap: Geothermal Heat and Power”, the IEA concluded:

“Geothermal development in Indonesia can be hindered by the disconnection between those involved in electricity pricing for geothermal projects during the tender process and the power purchasing agreement (PPA) that will need to be agreed with PLN, the state-owned electric utility, later on. Geothermal producers can in general only sell power to PLN, although there are some emerging opportunities to sell directly to large industrial users. The price at which PLN sells power to its customers is set by the government, so PLN does not have economic incentives to buy geothermal power, as it will usually be more expensive than the electricity prices it is allowed to sell it for. Until 16 February 2011, geothermal projects were jeopardized financially by the risk that developers would not be able to agree on an acceptable PPA with PLN. From 16 February 2011, when MEMR Regulation No. 02/2011 was published, PLN is obliged 'to purchase electrical power resulting from geothermal power plants in accordance with the price of electrical energy resulting from the auction of working areas of geothermal mining.'”

5.6.1 Off-take Guarantee

In 2010, PLN was instructed to accelerate the development of renewable energy power plants pursuant to Presidential Regulation 04/2010. The Minister of Energy and Mineral Resources subsequently issued MEMR Regulation 02/2011, which specifically applies to geothermal power plants. As further discussed in Chapter 6 (Section 6.6.5) of the Handbook, MEMR Regulation 02/2011 requires PLN to purchase electricity from geothermal producers,


March 2, 2012 GDF SUEZ and International Power (70% owned by GDF SUEZ Asia, together with project partners PT Supreme Energy and Sumitomo Corporation, has signed 30-year Power Purchase Agreements (PPAs) for two 220MW geothermal projects with PLN, the state-owned utility of Indonesia. The Ministry of Finance of the Republic of Indonesia has issued a Business Viability Guarantee Letter for the two projects, covering the obligations of PLN under the PPA.

The two projects, called Muara Laboh and Rajabasa, are planned to be built on Sumatra Island to deliver power to the region, which continues to experience high demand growth. Both projects are included in the Indonesian Government's second fast-track program, of which around 4,500 MW should come from geothermal sources. Signing of the PPAs is a necessary pre-condition to commencing exploratory drilling for geothermal resource. Following confirmation of the resource, project financing and EPC (Engineering, Procurement and Construction) arrangements will be negotiated. Subject to the timing of these, both projects are expected to start operation in 2016. IPR-GDF SUEZ Asia has a 35% interest in the projects.

including both the winners of a competitive bid on a Geothermal Working Area as well as those producers granted geothermal rights or concessions before the enactment of the Geothermal Law 27/2003. In addition, the Ministry of Energy and Mineral Resources stated that the assignment also applies to power plant projects listed in MEMR Regulation 15/2010 – a regulation that lists certain accelerated power plants projects. While the MEMR assigns electricity purchases by letter to PLN, ongoing purchases of electricity prior to the issuance of MEMR Regulation 02/2011 are considered assigned and the electricity prices must be approved by the MEMR.

5.6.2 Financial Guarantee

When a state-owned utility is the off-taker, international bankers typically require the owner (in this case the Government of Indonesia) to provide a guarantee. In an effort to attract more private power investors, the Minister of Finance issued MoF Regulation 139/2011 in which the Government guarantees the financial obligations of PLN, the state-owned electricity provider, under Power Purchase Agreements. Based on this Regulation, the guarantee will be signed by the Ministry of Finance and issued to investors rather than PLN.

This guarantee would be provided based upon a proposal from PLN to the Ministry of Finance for part or the full period of the power plants operation (i.e., the commercial operation date through the expiration of the PPA). A full period guarantee will be valid until the PPA expires and a partial period guarantee will expire on a date certain as specified in the guarantee. For geothermal power plants, the guarantee would be cancelled if the investor fails to achieve financial closure (i.e., executing the requisite financing agreements and receiving funds therefore) within 48 months after the guarantee is issued.

As drafted, however, the guarantee does not include a termination guarantee. In other words, if PLN terminates a project for virtually any reason prior to the date at which the plant is operational – for example a problem with rupiah/dollar conversion as occurred during the Asian Financial Crisis – the sovereign guarantee would not apply. This termination guarantee was in the original language of MoF Regulation 139/2011; however, it was removed prior to promulgation of the regulation. A termination guarantee may be negotiable between a developer and PLN and the Ministry of Finance. Such a guarantee has been negotiated between Supreme Energy and the Ministry of Finance in context of the Supreme Energy geothermal project.

5.7 FEED-IN TARIFF

As of November 2013, a new MEMR Regulation is being drafted to replace MEMR Regulation 22/2012 Feed-in Tariff legislation. Nevertheless, the approach of MEMR Regulation 22/2012 is instructive. Under that Regulation, the new price for high voltage geothermal energy was raised to between 10 to 17 cents ($0.10 to $0.17) per kWh. The prices, which will vary from region to region where the power plants are located, are set forth in Table 5.2. (Benchmark Purchase Price).

124 While MoF Regulation No. 139/2011 seems to have improved the form and structure of the guarantee, some investors and lenders have opined that the guarantee is insufficient to ensure the realization and sustainability of power plant projects, as the guarantee does not cover risks beyond the possible non-payment by PLN.

125 This new MEMR regulation is expected to have the lowest price of $ cent 11.5/kWh to the highest of $ cent 30/kWh based on its capacity and temperature.
### Table 5.2 Benchmark Purchase Price

<table>
<thead>
<tr>
<th>Region (Wilayah)</th>
<th>High Voltage</th>
<th>Medium voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sumatera</td>
<td>10 cents</td>
<td>11.5 cents</td>
</tr>
<tr>
<td>Java, Madura and Bali</td>
<td>11 cents</td>
<td>12.5 cents</td>
</tr>
<tr>
<td>South Sulawesi, West Sulawesi and Southeast Sulawesi</td>
<td>12 cents</td>
<td>13.5 cents</td>
</tr>
<tr>
<td>North Sulawesi, Central Sulawesi and Gorontalo</td>
<td>13 cents</td>
<td>14.5 cents</td>
</tr>
<tr>
<td>Lombok and Nusa</td>
<td>15 cents</td>
<td>16.5 cents</td>
</tr>
<tr>
<td>Moluccas and Papua</td>
<td>17 cents</td>
<td>18.5 cents</td>
</tr>
</tbody>
</table>

*Source: MEMR, 2013*

MEMR Regulation 02/2011 established the maximum price for electricity purchased from a bid winner at 9.7 U.S. cents per kilowatt-hour (kWh). Until summer 2012, the maximum price allowed under this bidding process was set at 9.7 U.S. cents per kWh and was a bid price that PLN was mandated to accept. If the price bid was more than 9.7 then the price would have to be negotiated with PLN in context of the PPA and with the consent of MEMR and the Ministry of Finance. On August 30, 2012, MEMR promulgated MEMR Regulation 22/2012, which raised the price that PLN is obligated to accept. MEMR Reg. 22/2012 cannot be effectively enforced, because it is in conflict with Government Regulation 59/2007 on Geothermal Business Activities.

Under MEMR Regulation 22/2012 the feed-in tariff (FiT) scheme for geothermal electricity in Indonesia is divided into six geographical areas and is not dependent upon the resources in those areas. The proposed legislation asserts that all electricity generated from a geothermal power plant will be bought by PLN using this scheme. The Government has determined that it may accelerate geothermal development by establishing an economical/profitable price for developers. (Note that if a project cannot perform in regard to time and capacity, the feed-in tariff is replaced by the electricity price in effect at the time that geothermal is purchased by PLN.) This pending feed-in tariff is applicable for both existing and new geothermal resource areas:

- **Existing WKPs** for contract extension, unit expansion and already signed PPAs, provided that both PLN and the developer agree to renegotiate; and
- **New WKPs** for IUP Holders after the July 18, 2012 effective date of MEMR Regulation 22/2012.

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126 Could be more but PPA would then have to be negotiated with PLN – If <9.7 cents PLN had to accept bid price
127 As noted in Section 2.1 if there is an apparent conflict between a Ministerial Decree and a Government Regulation, the regulation, being a higher authority, governs.
There remain various non-financial issues that are not guaranteed such as difficulties in obtaining forestry licenses, the commercialization of the guarantee process, lack of ministerial coordination and costly land acquisition. Moreover, the guarantee also does not cover pre-commercial operation period, meaning that any issues that may cause delays to the commercial operation are not covered by the guarantee.

5.8 ENERGY SALES CONTRACTS

Although it is doubtful that Energy Sales Contracts (ESC) and Joint-Operating Contracts (JOC) will be required in future projects, Energy Sales Contracts have been executed in the past, and still have legacy validity and therefore remain of interest to a geothermal developer. The characteristics of an ESC can be described as follows:

- An ESC is executed on the same day that a Joint-Operating Contract is executed. Parties to the Agreement: PLN, PGE and Contractor.
- PLN is obligated to purchase electricity up to a maximum aggregate generating capacity or Contractor has the right to deliver electricity generated in the Contract Area to PLN on behalf of PGE.
- PLN is required to purchase the Net Electrical Output (and the Curtailed Delivery Output plus make a payment for the Unit Rated Capacity, for each Unit in the Contract Area from the Date of First Operation until the Date of Commercial Generation.

Electricity tariff is denominated in US currency (adjusted by the US Consumer Price Index) and in the original contract is made up of two components – Electricity Price and Capacity Charge, (except for the Darajt and Salak contracts). The tariff declines to 50% and 25% after 10-14 years and 22 years, respectively.

5.9 OTHER KEY AGREEMENTS

In addition to the PPA, key project contracts for a geothermal power plant development are illustrated in Table 5.3, which includes the following:

- The Shareholders’ Agreement;
- The Engineering, Procurement and Construction contracts;
- The Insurance Arrangements;
- The Operations and Maintenance Agreement; and
- Project Finance documents.

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129 PT PLN (PricewaterhouseCoopers International Limited), *supra,* p. 41.
<table>
<thead>
<tr>
<th>Project Contracts</th>
<th>Contracting Parties</th>
<th>Purpose of Contract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shareholder (SH) Agreement</td>
<td>Shareholders in the project’s special purpose vehicle (SPV).</td>
<td>Provides for the rights and obligations of shareholders.</td>
</tr>
<tr>
<td>SH Loan</td>
<td>Shareholders in the project SPV.</td>
<td>Allows for terms &amp; conditions for SH loans.</td>
</tr>
<tr>
<td>Power Purchase Agreement (PPA)</td>
<td>SPV and PLN</td>
<td>Key project document setting terms and conditions of power generation activity.</td>
</tr>
<tr>
<td>Engineering Procurement &amp; Construction (EPC) Agreement – with a party outside of Indonesia</td>
<td>SPV and third party contractor and/or affiliates</td>
<td>EPC arrangements typically involve entirely design and construction work with a party outside of Indonesia.</td>
</tr>
<tr>
<td>EPC Agreement – within Indonesia</td>
<td>SPV and third party contractor and/or affiliates</td>
<td>EPC construction, typically involving an Indonesian construction firm.</td>
</tr>
<tr>
<td>EPC Wrap Agreement (may also be referred to as Umbrella or Guarantee &amp; Coordination Agreement)</td>
<td>SPV and contractors</td>
<td>Provides for the guaranteed performance of either an non-Indonesian or an Indonesian contractor jointly.</td>
</tr>
<tr>
<td>Operations and Maintenance (O&amp;M) Agreement</td>
<td>SPV &amp; O&amp;M contractor</td>
<td>Governs O&amp;M fees and overheads charged to the project company.</td>
</tr>
<tr>
<td>Technical Services Agreement</td>
<td>SPV &amp; Affiliates/third parties</td>
<td>Provides the basis on which an affiliate or third party provides technical services to SPV</td>
</tr>
<tr>
<td>Project Finance Documents</td>
<td>Financiers and SPV</td>
<td>The PF documents may include contracts pertaining to:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Corporate Lending</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Export Credit Agencies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cash Waterfall Arrangements</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hedging Arrangements</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Political Risk Guarantees</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inter-creditor Agreements</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Security Documents</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sponsor Agreements</td>
</tr>
<tr>
<td>Developers/Sponsors Agreement</td>
<td>Sponsor &amp; SPV</td>
<td>Provides for a developer’s fee to be paid by SPV to the original sponsors.</td>
</tr>
</tbody>
</table>

*Source: BAPPENAS, 2013*
5.10 SUMMARY

From the perspective of private sector geothermal developers in Indonesia, the Indonesian electrical market is dominated by the state-owned PLN, which in 2013 supplies around 75% of the generation in the country. This percentage may decrease as and when regional governments and other entities begin to participate in the electricity market. In the near-term the participation of new entrants is expected to be evolutionary.

The Government has recognized that there is little economic incentive for PLN to buy geothermal power as long as it is more expensive than the electricity prices – set by the Government – which it is allowed to charge the consumer. Therefore, the Government has obligated PLN to purchase geothermal power in accordance with the price established in the geothermal WKP tender process. The Government has also allowed direct appointment of geothermal developers to produce electricity, as distinguished from requiring a separate bidding process, provided that the direct appointment is transparent. The geothermal developer is established as a special-purpose company and after being awarded an IUP geothermal license and prior to generating electricity, must obtain a temporary business license from the Directorate General of Electricity. After approval of its AMDAL environmental impact assessment, the developers may convert the temporary license into a permanent business license.

As of September 2013, the MEMR and the MoF continue to explore how to design a benchmark price for electricity purchased from a winner of a WKP tender so as to provide a proper price incentive for development. Importantly, the Ministry of Finance has undertaken to guarantee financial obligations of PLN, and to issue such a guarantee to the geothermal developer/investor. This guarantee will facilitate obtaining the loan portion of a financed geothermal project.
CHAPTER 6

PRIVATE SECTOR GEOTHERMAL RESOURCE DEVELOPMENT

6.1 OVERVIEW OF PRIVATE SECTOR FUNDING

6.1.1 Private Financing

With an infrastructure deficit, a population of more than 240 million, an economy that is growing by nearly seven percent a year despite global economic turbulence, and surging foreign direct investment, Indonesia would appear to be a promising destination for project financiers looking to seal geothermal development deals.

As discussed in Chapters 2 and 5 of this Handbook, the Asian Financial Crisis weakened the position of the state-owned power utility PLN. PLN’s economic position further deteriorated as a result of the dramatic increase in oil prices on the international market during the first decade of the 21st century. The national power company not only struggled to invest, but more fundamentally, in order to meet its day-to-day public-service obligation, required growing government subsidies to keep operating a system highly dependent on petroleum products. Private investment came to a halt under the combined effect of capital flight from emerging markets and the institutional turmoil that followed the repeal of the 2002 Electricity Law by the Constitutional Court in Indonesia.\textsuperscript{130}

Subsequent to the Asian Financial Crisis, Indonesia has had difficulty in mobilizing financing – even for conventional power generation options such as coal – given the challenging investment climate both globally and within the country. The Government of Indonesia has recognized this challenge, and has organized to overcome this challenge. Enhancing the government’s understanding of the private sector geothermal development process and the private sector developer financial prerequisites – at all levels of the decentralized governmental hierarchy – is a key element of the national efforts to engage suitable private sector geothermal development. As of 2012, there are five geothermal developers with generating geothermal assets in Indonesia – depicted in Figure 6.1. They are Chevron, Star Energy, Geo Dipa (an IPP that is state-owned by PLN and GoI), PGE (an IPP that is state-owned by GoI), and PLN (the state-owned utility).

\textsuperscript{130} Constitutional Court's Decision Number 001-021-022/PUU-I/2003.
Private sector investment in the electricity sector in Indonesia, particularly IPP investments, have been, and will continue to be, in the nature of the off-take arrangements known as the Power Purchase Agreements. 131 IPPs funded through the project financing mechanism of PPAs have existed in Indonesia since the early 1990s. As of 2013 geothermal developments controlled by IPPs account for approximately 3.2% of Indonesia's total generating capacity. Most IPPs in recent times have operated pursuant to a general set of Public Private Partnership arrangements; however the only geothermal PPP in Indonesia as of 2013 is the KfW-financed Seulawah Project, which is being tendered (for more details, see Case History, Chapter 10).

The key regulation governing Indonesian PPPs is Presidential Regulation 67/2005 as amended by Presidential Regulations 13/2010 and 56/2011. These regulations stipulate that PPPs can be formed for "... electricity infrastructure consisting of electricity generation, transmission or distribution...". The Electricity Act (2009) was enacted to encourage PPP schemes in the electricity sector, one among the sectors that were previously the domain of state monopolies. Figure 6.2 depicts the General Mechanism of Investment in Electricity. The following Sections discuss the private sector Independent Power Producer in context of PPP arrangements and the incentives that Indonesia has created to encourage private sector investments in geothermal resource development.

131 See the discussion of PPAs in Section 5.5 (Power Purchase Agreement).
Figure 6.2 General Mechanism of Investment in Electricity

6.1.2 Private-Sector Investments in Geothermal

For a geothermal investor to consider exploration and development of a geothermal project there are a number of criteria that need to be satisfied. These criteria result from the substantial capital investment needed in early stage project development even before the exact extent and viability of the resource is known. The primary consideration confronting the geothermal investor is the high cost of drilling exploration wells and production/injection wells, plus the risk that some of these wells will not produce sufficient geothermal fluids to warrant economic development. If this situation arises it is possible that developers could have spent significant amounts (upwards of five to fifteen million US dollars) and have failed to find developable resources. Consequently, risk mitigation for early phase development is a critical component of any geothermal development strategy.

There is a wide spectrum of potential geothermal developers and no simplistic description fits all; however, most private sector developers will share certain characteristics. Only a handful of potential private sector investors — such as large, cash-rich, natural resource companies — would be able to fund geothermal development without debt and third party equity financing. Funding a geothermal exploration program is the most difficult step in the development process. Funding agencies, such as banks or other financial institutions, are generally not prepared to take the financial risk that comes with early phase development. Obtaining such financing usually means either self-funding or giving up large portions of equity in the project. At the on-set of geothermal development in Indonesia, most of the early geothermal data was collected by oil companies because they had the resource knowledge and the funds available for drilling. Nevertheless, many of the present day geothermal developers are not oil companies and have to bring various funding sources to the table in order to fund early exploration - at least until they have proved the existence of an economically viable geothermal resource by having a certain amount of the geothermal resource flow tested at the well head. Only with reduced resource risk can funding be accessed through normal banks and loan institutions. In other words, the present-day developer must be able to self-fund development up to the drilling of production wells in order to qualify for financing.

6.1.2.1 Front-End-Loaded Expenditures

A private sector financial geothermal energy project, in order to be financeable, inherently includes both upstream and downstream investments (in Indonesia, linking the downstream and upstream investments is often referred to as the “Total Project” Investment). To realize maximum volume, geothermal energy has to be converted into electricity (either in the form of steam that is converted into electricity by the off-taker or directly into electricity by the producer). Unlike a hydrocarbon fuel production facility, one cannot export the geothermal “fuel” – the heat source – to a distant generating unit.

Geothermal energy must be used to produce electricity in the vicinity of the resource production. Consequently, the initial investment is the production of the fuel (geothermal energy) and the secondary investment is the generation. Therefore, geothermal energy is considered to be a "front-end-loaded" investment, meaning that high capital costs are spent at the outset of the investment to ensure that the “fuel” is available during the project's lifecycle. The high upfront cost of investing in technology means that the vast majority of geothermal development projects must be project financed. It is worth noting, however, that the electricity produced by a geothermal facility can be exported for some distances - a technical
feasibility that expands the potential market for geothermal energy and that provides economies of scale that enable investment.\textsuperscript{132}

6.1.2.2 Project Financing

"Project financing" is the financing of long-term infrastructure and public services (such as geothermal energy) based upon a non-recourse or limited recourse financial structure whereby the project debt and equity used to finance the project are paid back from the cash flow generated by the project. When a geothermal developer uses project financing, the developer is using a loan structure that relies primarily on the cash flow of the geothermal project for repayment, with the project’s resource rights held as collateral. In the case of a geothermal energy project, the collateral – the principal “project’s right” – is typically a Power Purchase Agreement or, in some cases, an agreement in which steam is sold to a generating entity.\textsuperscript{133} Project financing, however, does not come into play until the geothermal developer has a proven resource and a power purchase agreement in hand. In order to have a "proven resource", the developer has to have at least one, and usually more often times more than one, production well, which proves the quantity and quality of the resource to the utility that is purchasing the power as well as to any institution that is providing debt funding.

6.1.2.3 Equity Financing

Due to the high risk in the exploration stages of geothermal development, banks have not provided loan facilities to the private sector project developer until late in the process – meaning after production wells have shown a commercial-level flow. Consequently, the developer needs front-end equity. The significant up-front costs that must be spent prior to determining the viability of the resource are paid by equity and equity investors who require a reasonable return on their investment. The PPA must require the flow of sufficient monies to pay back the equity invested, as well as to pay back principal plus interest to the lender. Royalties to landowners and to government resource licensors are also often a factor. Sums of money generated will also cover operational expenses. Only after those requirements are met does the developer see a return on invested efforts. Moreover, considerable sums of money can be expended in dealing with the administrative tasks of obtaining licenses, permits and lands plus initiating the environmental and other studies that are prerequisites for bringing such a complex project online. The prudent investor therefore seeks a sufficiently large-scale project that can absorb these costs. Economies of scale are a crucial issue to most developers. Costs are approximately the same to mobilize for a small-scale project (drilling rigs for one example) as for a large-scale project. As a consequence the small-scale project often proves to be uneconomical. Therefore, it becomes quite difficult to incentivize a typical investor to invest in a small-scale (10 MW) geothermal project, as distinguished from a more sizable (50 MW) project that is more likely to generate a reasonable return on investment.

Most private sector developers will be attracted to geothermal resources that are located on islands in the Indonesian archipelago with major population centers where electricity demand is high enough to be able to absorb larger amounts of electricity.

\textsuperscript{132} The electricity produced by a geothermal facility can be exported – for example, electricity generated by geothermal facilities in Baja California are exported to Southern California, and St Kitts and Nevis is considering setting up undersea cables from the island of Nevis to more populous markets.

\textsuperscript{133} The Commonwealth of Dominica is looking to export to the French islands of Guadeloupe and Martinique. For example, in the Philippine, because of the Constitutional clause that requires the State to generate electricity, the generated steam that it sold to the State, and the State in turn outsourced the generation of electricity from that steam the same private sector operator, but in this altered outsource arrangement, as an agent of the State.
However, as noted in Section 6.1.2.1 (Front-End Loaded Expenditures) of this Handbook, in some market locations it may be feasible to export electricity, thereby creating an enhanced market sufficient to support an investment. Additionally, the new feed-in tariffs expected to be promulgated by the MEMR may give developers the incentive to invest in underserved small markets such as East Nusa Tenggara, Moluccas and Papua. In addition, Indonesia is competing with other geothermal-rich countries of the world for a limited amount of equity and debt dollars. The Government of Indonesia has recognized that national and regional incentives and pricing need to reflect the environmental benefits of the technology and enable investors to secure a return commensurate with the higher risks they face especially when developing unexplored (green) geothermal fields.

### 6.1.2.4 Geothermal Project Costs

Unlike other forms of renewable energy such as solar or wind, geothermal offers the advantage of power production, regardless of the time of day or weather conditions. It is a proven resource for meeting base-load demand. However, tapping into the thermal energy deep in the earth requires extensive and costly drilling. The huge cost involved from exploration to full-scale operation and its lengthy process is a dampener, even to well-monetized companies. The investment cost for a geothermal plant in large measure depends on the type of technology used and the number of wells drilled. Experts believe that advances in low-grade resources, improvements in drilling techniques and increases in deployment will significantly reduce the capital and lower the levelized cost of energy of geothermal plants. A more detailed discussion of cost associated with geothermal development is presented in Chapter 7 (Cost Estimates of an Indonesian Geothermal Development). The typical phases of a generic geothermal development for a 100 MWe project are illustrated in Figure 6.3, below. Development phases are not necessarily consistent with Indonesian terminology.

In Indonesia, the drilling of wells sufficient to support a 25 MW plant can take up to two years and cost upwards of US$30 million in 2013 dollars. This calculation includes both production and injection wells and allows for failed wells. Finalizing the design and construction of the gathering system to convey the steam/water to the plant and the waste fluids to injection wells must await the completion of the drilling program, but some of this effort can be done in parallel with the drilling. Power plant site selection, design and construction can be accomplished in 2-3 years for a geothermal steam plant and in about one to two years for a binary-type plant. Construction of the power plant is the most costly phase of the project and can run to US$50-75 million. Binary plants, particularly ones using air-cooled condensers, tend to be more expensive per installed kilowatt than a steam plant.

### 6.1.2.5 Special Purpose Vehicles Entity

The Geothermal developer will be required to organize discrete business entities for energy business that it undertakes in a project and from project-to-project. Business sectors in Indonesia can be classified either as:

- Business sectors banned for investment activity, or

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134 See discussion at Section 5.7 (Feed-in Tariff).
- Business sectors permitted for investment activity on the condition that a business permit is issued by the Government.\textsuperscript{137}

The geothermal power plant business is classified as one of the business sectors in Indonesia in which foreign investment is permitted with the conditions precedent that foreign investment equity participation must be limited to 95%. In other words, a geothermal developer must have a minimum of five percent Indonesian participation. Furthermore, according to \textbf{Government Regulation 59/2007}, there can be only one foreign controlled business entity in one business sector. In practice, this limitation means that one corporate entity can be granted the right to develop only one designated geothermal working area. Therefore, if a corporation is developing more than one WKP, it must re-organize as a new corporation to develop a second WKP, and so on; however, the same entity may participate in both the upstream and the downstream businesses.

6.1.3 \textbf{Licensing Requirements: General}

In virtually every country in which there is private-sector geothermal development, access to geothermal resources needs to be acquired before any substantial exploration can take place. Once a developer has secured geothermal rights to lands and the potential resource, a detailed exploration program can be completed. The program must have as its main goal the identification and drilling of a geothermal subsurface target from a given surface location – in other words the development of a production well.

In addition to an IUP geothermal mining permit, developers that are integrated geothermal businesses must also obtain a power supply business license (or \textit{Ijin Usaha Penyediaan Tenaga Listrik or IUPTL}) from the Directorate General of Electricity before commencing their geothermal activities at the exploitation stage. Notwithstanding the requirement for two licenses, the geothermal and the power operations can be carried out through a single Indonesian company. As Indonesia’s geothermal projects require a large number of permits and licenses from a variety of ministries, local authorities and other bodies it is important to involve Indonesian discussion at an early stage to identify the permits and licenses required and to advise on the timetable implications.\textsuperscript{138}

6.1.3.1 \textbf{Electricity Business Licenses}

A business license must be granted before an entity can supply electrical power or run an electrical power-supporting business. Business licenses for the supply of electrical power consist of:

A. \textit{Power Supply Business License (IUTPL)} to supply electricity for public use; and

B. \textit{Operations License} to supply electricity for own use (i.e., for captive power generation).\textsuperscript{139}

The 2009 Electricity Law automatically treats PLN as a holder of an IUPTL for the supply of electrical power.\textsuperscript{140}

\textsuperscript{139} Article 1 and Chapter VIII of Law 30/2009.
\textsuperscript{140} Article 56 paragraph (1) of Law 30/2009.
<table>
<thead>
<tr>
<th>1st 3-6 Months</th>
<th>1st 3-2nd Years</th>
<th>3rd &amp; 4th Years</th>
<th>From 5th to Up to 40 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assessment of Prospects &amp; Location</strong>&lt;br&gt;- Desktop Data Study&lt;br&gt;- Regional Reconnaissance&lt;br&gt;- Geology &amp; geochemistry resource studies&lt;br&gt;- Historical drilling data&lt;br&gt;- Infrastructure availability</td>
<td><strong>Regional Exploration</strong>&lt;br&gt;- Geochemical&lt;br&gt;- Geophysical</td>
<td><strong>Production Drilling</strong>&lt;br&gt;- Construction, roads &amp; pads&lt;br&gt;- Design characteristics&lt;br&gt;- Geological structure&lt;br&gt;- Drilling targets&lt;br&gt;- Engineering requirements&lt;br&gt;- Procurement of materials&lt;br&gt;- Obtain suitable ring &amp; crew&lt;br&gt;- Equity funding&lt;br&gt;- Well testing&lt;br&gt;- Reservoir management</td>
<td><strong>Operate Facilities</strong>&lt;br&gt;- Employ &amp; train staff&lt;br&gt;- Spare parts&lt;br&gt;- Routing maintenance&lt;br&gt;- Manage Resource&lt;br&gt;- Resource modeling&lt;br&gt;- Make up wells&lt;br&gt;- Well work-over&lt;br&gt;- Reservoir modeling</td>
</tr>
<tr>
<td><strong>Studying of Leasing &amp; Permit Issues</strong>&lt;br&gt;- Land Acquisition&lt;br&gt;- Land use laws&lt;br&gt;- Water rights &amp; availability</td>
<td><strong>Prospect Exploration</strong>&lt;br&gt;- Temperature corehole drilling&lt;br&gt;- Resource measurement&lt;br&gt;- Preliminary modeling</td>
<td><strong>Approval of Permits</strong>&lt;br&gt;- Environmental permits&lt;br&gt;- Exploration permits&lt;br&gt;- Geothermal resource permits&lt;br&gt;- Pre-drilling&lt;br&gt;- Road &amp; pad construction&lt;br&gt;- Rig procurement&lt;br&gt;- Target identification&lt;br&gt;- Exploration drilling&lt;br&gt;- Delineation drilling</td>
<td><strong>Ongoing</strong>&lt;br&gt;- Phases&lt;br&gt;- Repeat exploration &amp; development phases</td>
</tr>
<tr>
<td><strong>Preparing of Big &amp; Business Model</strong>&lt;br&gt;- Economic modeling&lt;br&gt;- Resource concept modeling&lt;br&gt;- Project concept modeling&lt;br&gt;- Market analysis&lt;br&gt;- Grid availability</td>
<td><strong>Approval of Permits</strong>&lt;br&gt;- Environmental permits&lt;br&gt;- Exploration permits&lt;br&gt;- Geothermal resource permits</td>
<td><strong>Approval of Permits</strong>&lt;br&gt;- Drilling permits&lt;br&gt;- Power purchase agreement&lt;br&gt;- Environmental permits&lt;br&gt;- Water permits&lt;br&gt;- Building permits</td>
<td><strong>Financing</strong>&lt;br&gt;- Bankable reservoir report&lt;br&gt;- EPC contract&lt;br&gt;- Viable financial model&lt;br&gt;- Lenders engineer&lt;br&gt;- 3rd party enviro review</td>
</tr>
</tbody>
</table>
An **IUPTL** can cover any of the following activities:

- Electricity generation;
- Electricity transmission;
- Electricity distribution; and/or
- The sale of electricity.\(^{141}\)

### 6.1.3.2 IUPTL Licenses

An IUPTL may be issued to the following entities:

- State-owned companies;
- Regional Government-owned companies;
- Private corporate bodies (IPPs); and
- Cooperatives.

The 2009 Electricity Law does not specify the procedures for applying for an IUPTL. These matters are expected to be dealt with in implementing regulations yet to be issued as of 2013. It remains to be seen if implementing regulations will require IUPTL applicants to meet specified administrative and technical requirements as previously required under the 1985 Electricity Law and [Government Regulation 03/2005](#).

### 6.1.3.3 Authority to issue IUPTLs

The central or regional governments (according to their respective authority) may issue licenses for the supply of electrical power. According to MEMR Regulation 05/2010, as a “one-stop shop” investment service, the Indonesia Investment Coordinating Board (Badan Koordinasi Penanaman Modal or BKPM) may issue operational licenses for power plants for captive use on behalf of the MEMR.\(^{143}\) For a business entity to sell power to the holder of an IUPTL, including PLN, a license must be granted by the Ministry of Energy and Mineral Resources. The holder of an operations license can sell surplus electrical power to the public with the approval of the central or regional governments.\(^{144}\)

### 6.1.3.4 Operations and Maintenance

Certain electrical support businesses also require a permit from the central or regional Government in order to conduct business. This permit extends to "Operations and Maintenance" activities for electrical power installations. O&M businesses are regulated as electrical or power support businesses and so require either an "electricity support services license" or an "electricity support industry license".\(^{145}\)

### 6.1.3.5 Rights and Obligations of License Holders

The rights and obligations of license holders for the supply of electrical power include:

- The right to cross public roads and railway tracks;

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\(^{141}\) PT PLN (PricewaterhouseCoopers International Limited), 2011, Electricity in Indonesia, Investment and Taxation Guide 2011; p43.

\(^{142}\) *Ibid*.

\(^{143}\) MEMR Reg 5/2010 Attachment B2c.

\(^{144}\) PT PLN (PricewaterhouseCoopers International Limited), *supra*, p.44.

\(^{145}\) *Ibid*. 
- The right to use land and areas above or beneath land (subject to the license holder compensating the holders of assumed lands);
- The obligation to provide electrical power which meets the specified quality and reliability;
- The obligation to provide the best services to consumers and to the public;
- The obligation to meet electricity safety conditions; and
- The obligation to prioritize the use of domestic products and services.
- The fulfillment of the quality of services provided by electrical power support businesses.

Note that the 2009 Electricity Law is silent on whether the license is transferable or a period for which the license is valid.146

6.2 IPP & PPP STRUCTURE IN INDONESIA

A PPP scheme, in a general sense, is a collaboration between the private and public sectors, which utilizes the efficiencies from the private sector to reap better value for the public. The primary tool to do this is by allocating "risk to the party with the best risk controlling capacity".147 PPPs have been slow to develop in Indonesia for a number of reasons, chiefly because of fears over security of return on investment, with both banks (particularly foreign banks) and project sponsors insisting on government guarantees that were not forthcoming.148 The second major problem has been land acquisition.149 Today, however, those key problems seem to have been addressed by the Government. Through a number of innovative laws and regulations that are set forth in this chapter, Indonesia appears to find itself on the cusp of a new dawn for project finance based on the PPP concept which aims at attracting additional investment and allows Indonesia to compete on a stronger footing with other countries.150

However, to date, only one WKP geothermal project is under the PPP umbrella scheme —the Seulawah Project, which is being financed by KfW. (See Section 9.3 case study on the Seulawah Agam Geothermal Field). There are several financial incentive facilities that are in the gambit of the PPP scheme, such as Indonesia Infrastructure Guarantee Fund; however, no geothermal developer has yet utilized this instrument as of October 2013. Nevertheless geothermal developers may very well find these facilities useful in the future. Indonesia’s Independent Power Producers administrative regime may be divided into three separate time frames.

**Generation 2** : 2005–2008
**Generation 3** : 2009-onwards

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146 Ibid.
148 The Ministry of Finance has been a strong advocate of fiscal prudence and rectitude ever since the Asian economic crisis of 1997/98.
149 The second major problem was land acquisition. This was the result of a number of interrelated factors, including the absence of a concept of eminent domain, an inadequate compulsory land acquisition mechanism, chaotic land title administration, speculation and insider dealing leading to land-price inflation, and a local culture of opposition to land procurement by the state dating back to forced land seizures under Indonesia's authoritarian former president, Suharto, who ruled for 31 years from 1967 until 1998.
6.2.1 First Generation (1992 until the Asian Financial Crisis)

Private participation in Indonesia's electricity sector started in approximately 1992. Relatively high forecast returns (Internal Returns on Investments often between 20-25%) together with the provision of a Government guarantee (via a support letter to cover PLN's obligations under the PPA) meant that there was initially a high investor uptake during IPP tendering during the last decade of the 20th Century.151 During the First Generation, Joint-Operation Contracts (JOCs) were the development vehicle through which the private sector participated. Although it is doubtful that JOCs will be required in future projects, they are technically a contractual vehicle for a geothermal developer in the future, potentially in brownfield developments.152 (See Section 9.3 on the Sarulla, case study of a JOC).

When the Asian financial crisis struck in late 1997, PLN became financially troubled particularly as a result of the fall in the value of the Rupiah. PLN had to put many of its IPP projects on hold. Ultimately six projects were terminated: six were acquired by the Government, one project ended up in a protracted legal dispute, and 14 projects continued under renegotiated terms. When renegotiations were completed in 2003, most continuing IPP investors agreed to new PPAs, which generally included lower tariffs than were initially agreed.153 In the interval between the First and Second Generation (1999–2004), no new power projects were tendered.154

6.2.2 Second Generation (post Asian Financial Crisis 2005 to 2008)

The second IPP generation is during the 2005–2008 period. This generation was not particularly attractive to investors for the following reasons:

- No Government guarantees were provided;
- The risk allocation was not viewed as favorable to investors; and
- The forecast returns were lower (with forecast IRRs often from 12% to 14%).

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151 PT PLN (PricewaterhouseCoopers International Limited), supra, p.34.
152 The characteristics of a JOC can be described as follows:
- Terms = 30 years for each generating unit.
- Existing field facilities and any new field facilities will be owned by Pertamina. The Power Stations will be the property of Contractor, and will be sold to Pertamina on an “as is” basis at the termination of the JOC (at an agreed price).
- Pertamina is responsible for managing the operation, although Contractor is solely responsible for the conduct of geothermal operations.
- Pertamina retains title over all the operating and geological data, as well as a right to observe operations or to inspect financial and technical records.
- Pertamina will receive a monthly production allowance from Contractor equal to 4% of Net Operating Income, which is tax deductible.
- Capping Contractor’s income tax rate at 34% and exemption from import duties, VAT and other levies for import. If the income tax rate is increased for any reason, the price payable under the ESC will be adjusted so that Contractor’s economics rate of return is not changed.
- A declining balance depreciation schedule for capital assets is authorized pursuant to Article 11 of the 1983 Tax Law and MoF Decision 457/1984.
153 PT PLN (PricewaterhouseCoopers International Limited), supra, p.34.
154 Nevertheless, this first generation saw generating capacity lifted to 4,262 MW. Landmark projects included the Salak Geothermal Power Plant, the Cikarang Combined Cycle Power Plant and the coal fired Paiton Power Plant (Paiton I). Paiton I was the largest IPP project in Indonesia with installed capacity of 2 x 615 MW. A second expansion occurred under the same first generation framework.
Of 126 project proposals only 18 infrastructure projects were awarded. The IPPs were selected through competitive tender (except such direct appointments as permitted by Government Regulation 03/2005 and Government Regulation 26/2006 for capacity expansion to existing projects or renewable energy sourced projects). These projects were forecast to bring on-line 440 MW of geothermal powered plants (PLTPs).

6.2.3 Third Generation (2009 to Date)

The third generation of IPPs operates under revisions to the PPP framework developed by the Policy Committee for the Acceleration of Infrastructure Provision (Komite Kebijakan Percepatan Penyediaan Infrastruktur or “KKPPI”). Third generation IPPs differ from second generation IPPs in that the PPP risk allocation mechanism is designed to be clearer and to provide more support from the Government to the investor. Presidential Regulation 13/2010 (issued January 2010), which amends Presidential Regulation 67/2005 on PPP infrastructure Projects, attempts to streamline the PPP process by offering:

- Revised bidding arrangements including extensive bidder/tender consultations;
- Better-defined risk allocations to help with the bankability of projects;
- Government support and guarantees (such as in relation to land acquisition); and
- Financial facilities (such as PT PII and the Infrastructure Financing Fund).

6.2.4 Summary of Risk Allocation Arrangements

A summary of the risk allocation arrangements over the three generations is in Table 6.1.

6.3 FINANCIAL FACILITIES AVAILABLE TO IPPs in a PPP

The Government has established two financial structures to support IPPs under the PPP framework: the Indonesian Infrastructure Guarantee Fund and the Infrastructure Financing Fund. These two structures are discussed below.

6.3.1 Indonesian Infrastructure Guarantee Fund (“PT PII” or "IIGF")

PT PII was established by the Government on 30 December 2009 and operates as an infrastructure guarantee fund to accelerate the development of infrastructure projects by reducing the risk of financing for infrastructure investors (including IPPs) by providing (essentially) sovereign guarantees or "letters of comfort" for a fee. It essentially functions as an insurer of any risk exposed to the private sector for a premium, but at a lower rate than those charged by traditional insurance firms.
### Table 6.1 Risk Allocation Arrangements Over the Three Generations

<table>
<thead>
<tr>
<th>Risk</th>
<th>Risk Sharing Mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel Supply</td>
<td>IPP bears the risk of availability of fuel</td>
</tr>
<tr>
<td>Fuel Cost</td>
<td>PLN bears risk on the fuel cost (through tariff, which is passed from IPP to PLN)</td>
</tr>
<tr>
<td>Site selection</td>
<td>IPP and PLN share the risk</td>
</tr>
<tr>
<td>Capacity and energy price risk</td>
<td>PLN bears the capacity and energy risk</td>
</tr>
<tr>
<td>Construction Risk</td>
<td>IPP bears the construction risk</td>
</tr>
<tr>
<td>Operational Risk</td>
<td>IPP bears the operational risk</td>
</tr>
<tr>
<td>Foreign exchange risk</td>
<td>PLN bears the foreign exchange risk</td>
</tr>
<tr>
<td>Country/regulatory risk</td>
<td>IPP bears the country/regulatory risk</td>
</tr>
</tbody>
</table>

Source: Indonesia Electricity Policy and Outlook, Seminar by Petromindo.com, 16 Dec 2009

It must be noted that although the Indonesian Government created PT PII to attract private sector investment, as of 2013 only one developer has utilized this instrument (see Seulawah Agam case study, Chapter 9). Also note that the Ministry of Finance as a result of its traumatic experiences at the end of the 1990s and early 2000s, when Indonesia found itself on the losing end of a number of multi-million dollar arbitration suits (the Karaha Bodas case, for example) the GoI is no longer willing to extend blanket guarantees. The Ministry also appears intent on restricting coverage to lenders, rather than sponsors, and to reducing the terms of guarantees from 20 years to 15 years. The PI PII will also provide a guarantee, backed by government or multilateral agencies, for a qualified project provided that a central or local government or a state-owned enterprise initiates it. PT PII’s main objectives are to:

- Reduce the cost of financing PPP infrastructure projects;
- Help the Government manage its fiscal risk by ring-fencing Government obligations against guarantees (“ring-fencing” means the economic strategy commonly used by regulated company, such as an electricity company, to separate itself legally from a parent or holding company that is not regulated); and
- Improve the quality of PPP projects by establishing a consistent framework.

PT PII will also function as a "single window" for all requests for Government guarantees on PPP projects. By acting as a single window, PT PII is designed to provide:

- Consistent policy on appraising guarantees;
- Single process for making claims; and

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- Enhance transparency and consistency to the process.

PT PII is also designed to boost competition in the tendering process, leading to better proposal quality and more competitive pricing. The issuer of the Guarantee Agreement will be PT PII with Multilateral Development Agency or Ministry of Finance support. The guarantee will cover the financial obligations of the contracting agency (generally PLN for electricity) and the addressee will be the project company (i.e., the IPP geothermal investor). To obtain this guarantee the contracting agency (e.g., PLN) must submit a guarantee support proposal to the PT PII for assessment. If agreed, the PT PII will issue a Letter of Intent at the proposal stage. The mechanism will work as shown in Figure 6.4.

**Figure 6.4 Guarante Mechanism: Contractual Arrangements and Payment Obligations**

![Guarantee Mechanism Diagram]

Source: Infrastructure Asia Conference (2010), modified by BAPPENAS, 2013

After the request is first screened by the relevant ministries, it is reviewed by the Policy Committee for the Acceleration of Infrastructure Provision (KKPPI) secretariat with the help of the central PPP unit. Before any Government support is granted, the Risk Management Unit (RMU) within the Ministry of Finance’s Fiscal Policy Office must provide its approval. The RMU aims to ensure that the risks of individual PPP projects are appropriately allocated between the public and private sectors. The RMU risk management assessment is based on:

- Political risk (e.g., loss as a result of amendments to legislation);
- Project performance risk (e.g., risks on completion of the project such as delays in acquiring land); and

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161 PT PLN (Price Waterhouse Coopers International Limited), supra, pp.36-38.
162 An Introduction to Indonesia Infrastructure Guarantee Fund (IIGF), as presented at the Infrastructure Asia Conference (15 April 2010).
163 The PPP Central Unit is also known as “Pusat KPS/P3CU”. It is managed by the Private Sector Cooperation Centre (PKPS) within Bappenas. PKPS was formed by Bappenas Decree No. 5/2007 to facilitate cooperation in infrastructure projects between the government and private investors.
- Demand risk.\textsuperscript{164}

PT PII may also cover risks in project development such as those in relation to construction, development and/or operations. PT PII only provides guarantees over risks for which the Contracting Agency is responsible. Project sponsors separately bear or seek cover for commercial or other risks beyond the Contracting Agency's commitment. Under \textit{Government Regulation 35/2009}, local Governments are also eligible to apply for guarantees for their PPP projects. This development is significant in that local Governments acting as a Government Contracting Agencies (GCA) are prevented by law from providing guarantees to private investors. PT PII was established by the Government with IDR one trillion (~US$100 million) of initial capital with plans to expand by IDR one trillion per year until 2014 (when it should reach IDR 6.5 trillion). As of 2013, PT PII can guarantee up to IDR 26 trillion (~US$2.6 billion) as it has also secured US$500 million of support from the World Bank.\textsuperscript{165}

6.3.2 PT Multi Infrastructure Facility (PT SMI) and the Infrastructure Financing Fund (PT IIF)

The Infrastructure Financing Fund operates through two agencies, PT SMI and PT IIF, and was established to help investors obtain domestic finance in terms of lending and equity for infrastructure development. PT SMI (\textit{PT Sarana Muli Infrastruktur}) was established on 26 February 2009 with IDR 1 trillion (~US$100 million) in capital. The capital will be increased by a further IDR 1 trillion in 2010. PT SMI is backed by multilateral agencies including the World Bank, which has pledged loans of IDR 1.5 trillion.

PT IIF (\textit{PT Penjaminan Infrastruktur Indonesia}) was established on 15 January 2010 as a subsidiary of PT SMI. PT IIF operates as a private company with its shareholders being the Government of Indonesia (via PT SMI), the IFC, the ADB and DEG (\textit{Deutsche Investitions - und Entwicklungsgesellschaft}). AusAID has also provided financial support for the drafting of a working plan and feasibility studies. PT IIF is a commercially oriented non-bank financial intermediary with an infrastructure focus. Modeled after the Indian IDFC, PT IIF's objectives are to facilitate the flow of private investment into infrastructure by bridging gaps in infrastructure financing and supporting the development of long-term domestic currency instruments in the Indonesian capital market.

PT IIF will raise loans in the domestic market and provide financial products. PT IIF will then extend long term financing (>10 years) and other financial support (e.g., guarantees, subordinated debt and minority equity stakes). PT IIF will provide advice on infrastructure policy issues and specific transactions as well as acting as a strategic advisor to the Government and lead coordinator for infrastructure projects.

6.3.3 Summary of Legal and Regulatory Framework Governing PPPs

A summary of the regulations governing Public Private Partnerships and other major laws and regulations is in Table 6.2.

\textsuperscript{164} MoF Regulation No. 38/PMK.01/2006.

\textsuperscript{165} The Rp30 trillion (US$3bn) Central Java Power Project is likely to be the first to receive an IIGF guarantee.
Table 6.2 Summary of PPP Laws and Regulations

<table>
<thead>
<tr>
<th>General Regulations on PPP</th>
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<tbody>
<tr>
<td><strong>Presidential Regulation 67/2005</strong></td>
<td>Cooperation between Government and Private Sector Business Entity (PPPs)</td>
</tr>
<tr>
<td><strong>Presidential Regulation 13/2010</strong></td>
<td>PPA as &quot;Cooperation Contract&quot; (Amendment to PR No. 67/2005)</td>
</tr>
<tr>
<td><strong>Presidential Regulation 56/2011</strong></td>
<td>Provision allowing foreign legal entities to apply to initiate Public-Private Partnership (Amendment to PR No. 67/2005 and PR 13/2010)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other Major Laws and Regulations</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Law 17/2003</strong></td>
<td>State Finance</td>
</tr>
<tr>
<td><strong>Law 02/2012</strong></td>
<td>Land Procurement for Public Interest</td>
</tr>
<tr>
<td><strong>Presidential Regulation 36/2005</strong></td>
<td>Land Acquisition for Public Projects</td>
</tr>
<tr>
<td><strong>Presidential Regulation 65/2006</strong></td>
<td>Land Acquisition for Public Projects (Amendment to the Presidential Regulation 36/2005)</td>
</tr>
<tr>
<td><strong>Presidential Regulation 42/2005</strong></td>
<td>Inter-Ministerial Committee for the Acceleration of Infrastructure Provision</td>
</tr>
<tr>
<td><strong>Presidential Regulation 12/2011</strong></td>
<td>Formulation of Laws and Regulations (Amendment to Presidential Regulation 42/2005)</td>
</tr>
<tr>
<td><strong>Presidential Regulation 78/2010</strong></td>
<td>Infrastructure Guarantee for Public-Private Partnership Infrastructure Guarantee Entity</td>
</tr>
<tr>
<td><strong>Ministry of Finance Regulation 38/2006</strong></td>
<td>Guidance for Controlling and Management of Risks</td>
</tr>
<tr>
<td><strong>Ministry of Finance Regulation 100/2009</strong></td>
<td>Infrastructure Financing Company</td>
</tr>
<tr>
<td><strong>Coordinating Ministry of Economic Affairs Regulation 4/2006</strong></td>
<td>Evaluation Methodology for PPP Infrastructure Projects that require Government Support.</td>
</tr>
</tbody>
</table>

*Source: BAPPENAS, 2013*

### 6.4 THE GEOTHERMAL FUND FACILITY

The Government of Indonesia has begun a significant funding initiative called the “Geothermal Fund Facility”, which is designed to help ensure that the geothermal component of the Second Fast-Track Program is brought on line. The following sections summarize the challenges that have been encountered since the enactment of the 2003 Geothermal Law and discusses the legal and regulatory structure that addresses them.

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6.4.1 Development Challenges under the 2003 Geothermal Law

The Government has instituted the Geothermal Fund in response to generally recognized barriers to development that emerged after the passage of the 2003 Geothermal Law. Implementation of geothermal activities under the 2003 Law has been challenged by several constraints. There has been a consensus that a number of post-2003 Geothermal Law issues need to be addressed, including:

First, the State Electricity Company, PLN, is the only buyer of geothermal power, and it has a dominant position in determining the electricity tariff. Note, however, that the tariffs that must be used when selling electricity to the public are regulated by the Government of Indonesia, which provides a subsidy. But how the rate and the subsidy affect the making of PPA between PLN and geothermal exploration companies is not well defined.

Second, although PLN is the sole buyer of electricity, it is not represented in the Tender Committee for new geothermal areas in order to prevent conflicts of interest; however, PLN’s subsidiaries participate in the tender process.

Third, the information on the resources at hand that is available at the stage of tendering for geothermal working area has been quite limited, although Bappenas and the Ministry of Energy and Mineral Resources are aggressively attempting to remedy this shortfall. At best, the available information to date has been a guess on resources characteristics based on the observation of surface steam and heat manifestations. Under such conditions, the commercial feasibility of a project is likely to change as more information on the resources such as potential reserves and fluid properties become available upon the completion of exploration.\(^\text{167}\)

Consider the risks that both PLN and an IPP face when negotiating a PPA for a resource of which the characteristics are not well known. In such circumstances, the buyer (PLN) does not want to offer high prices before it knows the characteristics of the resource. PLN considers that the price to be a starting point for negotiations and that price can be changed when more information on the resources is available in conjunction with reevaluation of the commercial feasibility of the project. In contrast, the seller (the developer), does not want to base its project investment cost on unproven assumptions and thus it seeks high prices. The resultant situation involves risks that can be unacceptable for both buyer and developer. The Government has established a Geothermal Fund to ameliorate the inherent risks of negotiating a PPA for an undefined resource.

6.4.2 Program Legal and Regulatory Framework

Recognizing the hurdles to new development under the 2003 Geothermal Law, in mid-2010, the Government of Indonesia decided to propose that Parliament allocate a sizeable fund in the 2011 State Budget for financing initial geothermal exploration activities. Such initial exploration contemplates geological, geophysical and geochemistry surveys as well as drilling initial exploration wells. The purpose of the fund is to allow the geothermal authority with jurisdiction over a resources field (the regency, the province or the State) to have the ability to enhance the existing geological data in an area to commercial quality and in general

\(^{167}\) See also the discussion at Section 2.3 of this Handbook.
to improve the scientific and technical definition of the WKP before being offered for tendering.

The concept is that if the governmental authority tendering WKP provides enhanced data, geothermal risk will be more defined and predictably reliable for developers. Therefore, when the WKP is offered for tender, the tendering government and the purchasing utility would obtain a more affordable electricity price. Secondarily, the decreased risk would encourage bidding among a wider range of competitors. The fund will be made available to geothermal projects using the Public Private Partnership scheme described in Presidential Regulation 13/2010 and in Section 6.1 (Overview Private Sector Funding), of this Handbook. The costs of conducting the survey and initial exploration would be recovered in various forms, including data compensation to be paid by the participants in the tender process and reimbursement of the drilling costs by the winner. As designed, the fund is self-sustaining for future projects – assuming of course that it is properly managed. The funds expended for the field data acquisition is expected to be incrementally offset with the proceeds from the sale of data acquired.

6.4.3 General Scheme

The intent of the Geothermal Fund is to fund the initial exploration work in advance of the WKP tender process. This initial exploration work is intended to complement the data produced by Geological Agency of Indonesia; thereby it would assist the potential investor in evaluation of the geothermal prospect being offered. The Preliminary Surveys by the Geological Agency are funded by the State Budget and are designed to make an inventory of Indonesia’s geothermal resources. The Geological Agency surveys are conducted based on specifications as outlined in the Indonesian National Standard (SNI) 13/5012/1998 and MEMR Regulation 11/2008. As of 2012, the Geological Agency has identified 299 geothermal prospects throughout Indonesia. Preliminary surveys have been conducted in approximately one-third of the 299 geothermal prospects of which 58 have been defined as WKPs as of 2013.\(^{168}\)

The Geothermal Fund is intended to:

- Enhance data and information obtained during the Preliminary Surveys that have been conducted by the Geological Agency, including Magnetotelluric surveys and other geological and geophysical surveys to better locate the more promising sites of first deep well(s).

- Drill the first deep well(s). The information from deep wells provides better geological information, including but not limited to pressure and temperature gradient, fluid chemistry, steam quality, reservoir permeability, and exploratory proven reserves. The information and data obtained are used to improve the definition of the WKP and will be made available during the tendering process.

6.4.4 Distribution of Funds between Low vs. High Enthalpy Areas

During formation of the Geothermal Fund in Parliament, the prime target of the Fund was developing the geothermal resource in the eastern part of Indonesia, which is under-electrified.\(^{169}\) Although the push for renewable resources in eastern Indonesia is politically justifiable, much of the area is not associated with volcanic activity and has low temperature and low potential. For these reasons much of eastern Indonesia failed to attract developers’

\(^{168}\) NRECE continues to seek to define WKPs, and the list is expected to expand beyond 58.

\(^{169}\) See discussion at Section 2.1 (Introduction Indonesia’s Energy Plan).
interest when WKPs from the area were offered for development. Limiting the utilization of
the Fund to low enthalpy resources would put the Geothermal Fund at high risk with respect
to its sustainability. Accordingly, to ensure the Fund’s sustainability, considerations have
been given to include some high enthalpy resources prospects in Java and Sumatra both of
which have adequate markets to support a private sector funded development. Nevertheless,
based on the information gained from the Indonesia Investment Agency, the Geothermal
Fund can be used for all types of geothermal resources (high, medium, or low enthalpy) since
it has as its main objective to find in-site energy resources.

6.4.5 Fund Management

Based on MoF Decree 99/2008, the Fund is to be managed by a special agency, the Public
Service Agency or Badan Layanan Umum (BLU). The implementation of the Geothermal
Fund will be subject to the policy known as the “Principles of Fiscal Risk Management of
State Fund,” which requires that the Fund be result oriented with full accountability and
transparency. The Government of Indonesia determined that the Geothermal Fund for
geothermal exploration is the existing agency within the Ministry of Finance that is
responsible for infrastructure development, namely the Indonesia Investment Agency (Pusat
Investasi Pemerintah or PIP). The process and flow of the Geothermal Fund described in
MoF Regulation 03/2012. The Geothermal Fund Scheme is illustrated in Figure 6.5 below.
The flow of the fund and data of the Geothermal Fund under MoF Regulation 03/2012 is as
follows:

- **Nomination of WKP to PIP.** The Regional Government or IUP or PPP holder
  submits proposal to PIP for a nominated WKP to be financed by the Geothermal
  Fund.

- **PIP Screens Proposed WKPs.** PIP conducts rigorous screening of nominated
  WKPs to determine whether financing by the Fund will sufficiently mitigate
  resource development risk to attract private sector participation in a WKP
  tender.

- **PIP Retains Service Company to Conduct Exploration.** PIP assigns a Service
  Company to conduct initial geothermal exploration activities including drilling
  exploration well(s).

- **Service Company Provides Exploration Data.** Service Company submits the
  exploration data to PIP.

- **Data provided to data custodian and bidders.** PIP hands over the data to the
  regional government for tender:
  i. If the **regional government** is the recipient of funds, it will
tender the WKP and the Geothermal Tender Committee will also
make the data available to the bidders.
  ii. If an **IUP or PPP Holder** is the recipient of funds, the recipient
will execute the exploration activities.

- **Tender Process initiated if Regional Government is Initiator.** Tender
  Committee initiates tender process and receives bids. Tender Committee
  will evaluate the tender results for particular WKP and determine the
  winner together with the agreement.

- **Bidder Pays Compensation for Data.** In exchange for the exploration
data, all bidders will pay data compensation to the Tender Committee
(MEMR/Local Governments), who will pass it to the PIP. The funds expended for the field data acquisition is expected to be incrementally offset with the proceeds from the sale of data acquired, so that Fund will be self-sustaining.

- **Winning Bidder Pays Back Fund.** The costs of drilling exploration wells will be borne by the winning bidder who will reimburse the Fund.

  **IUP Holder** pays back loan to PIP in a maximum of 48 months or on the financial closing date (whichever is earlier).

  **PPP Holder** repays the loan to PIP in a maximum of five years after commercial operation date.

  **IUP Holder** pays back loan to PIP in a maximum of 48 months or the financial closing date (whichever is earlier).
Figure 6.5 Geothermal Fund Scheme: Complete PPP Funding Process

Source: BAPPENAS, 2013
6.4.6 Fund Risk Mitigation

The Geothermal Fund will be exposed to risk. In addition to the possibility of drilling a dry hole, there are a variety of technical risks and economic risks (e.g., the winning bidder fails to complete the development of WKP, because it failed to reach to financial closure or because the data that the developer receives does not represent actual subsurface conditions). Technical risks may be covered by conventional risks insurance (such coverage seems to be required if the managers are to conform to industry best practices). Financial risks, including failure to have financial closure and data errors in the foregoing example may be mitigated by performance bonds and securitized by professional indemnity insurance.

6.4.7 Potential for Expanding the Fund

As conceived, the Geothermal Fund was scheduled to receive money from the State Budget for five geothermal prospects each year over a period of five years from 2011 to 2016. The first half of that timeframe has been spent in establishing the criteria for awarding the funds. Distribution is expected to commence in 2013. Aside from the seed money from the State Budget, financing the Geothermal Fund can be expanded by co-financing from international multilateral and bilateral financing institutions. The Geothermal Fund facility theoretically should be able to operate continuously as long as geothermal projects are being prepared. Given additional funding, the data enhancement program for each prospect may be expanded to include drilling more than three deep wells in each prospect to better define the reserves potential of some of the geothermal prospects.

The success or failure of the program will be measured by the growth of a competitive market for developing and financing geothermal projects. An extended Geothermal Fund program becomes important to assist the Government of Indonesia in achieving its target as outlined in the New and Renewable Energy Development Blueprint. To enable Indonesia to meet its target of 12.400 MW of geothermal plants on line by 2025, which is the original target on Vision 25/25; or 9,500 MW which is the target of the Roadmap 2006, or 4,935 MW which is the target for the Second Fast-Track Program as of 2013 – a great deal of activity will be needed:

**Target Vision 25/25:** To achieve 12.400 MW an estimated more than 125 geothermal prospects will require initial exploration activities (with the total cost of US$2.725 million).

**Target Roadmap 2006:** To achieve 9,500 MW an estimated 52 geothermal prospects will require initial exploration activities (at a total cost of approximately US$1.477 million).

**Target Second Fast-Track:** The estimate also assumes the costs of US$25 million for each site to deliver 110 MW and a success rate of 60%. During that period, the maximum Geothermal Fund funds available from the Government of Indonesia are estimated to be US$1 billion (through 2016) – thus the 4,935 MW seems achievable under the Fund scheme.

The magnitude of fulfilling these objectives may be better appreciated if one understands that in order to bring 12.400 MW geothermal power plant capacity online, the

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Government of Indonesia has to expand the geothermal development program to more than ten prospects annually, either through increase of its own Fund or inviting participation of international financial institutions. The latter would require regulatory changes to allow and enable management and operation of the Geothermal Fund to conform to internationally acceptable best practices.

6.4.8 Hurdles with Respect to Utilizing the Fund

A threshold problem may exist with respect to utilization of the Fund by regional governments. The undeveloped geothermal resource areas are widely dispersed across the country. Consequently, there may be only one or two potential WKPs in any one single Regency. Therefore, that Regency will negotiate its way through the complicated Geothermal Fund process only once. The requisite human resources are unlikely to be available to the Regency prior to initiating the Geothermal Fund process. Therefore, at the outset of the process, when the Regency is required to commit to repayment of the fund to PIP within five years, the Regency is unlikely to have the technical capacity to evaluate the risk of the loan from PIP. Therefore, it becomes difficult for a Regency to make a repayment commitment to the Government of Indonesia. Such a commitment might jeopardize its resources for other purposes, such as education for example. This hurdle is not insurmountable, but is a hurdle that both the Government of Indonesia and the regional governments will have to deliberate in context of geothermal development pursuant to the Geothermal Fund.

6.5 CLIMATE FUNDS

Indonesia's greenhouse gas emissions are globally significant, with a substantial majority of such emissions the result of impacts from land use change and forestry. The energy sector, electricity generation in particular, is the next largest source of Greenhouse Gas (GHG) emissions and one of the fastest-growing aspects. Projections by the International Energy Agency indicate that if current trends continue, energy-related emissions in Indonesia will be the largest source of greenhouse gases by 2030. Due to this projection, Indonesia qualifies for a number of existing international GHG emission reduction mechanisms that provide financial and technical support for “green” projects - geothermal energy being the most relevant in Indonesia.

Article 4.3 of the United Nations’ Framework Convention on Climate Change (UNFCCC) states that developed countries have committed to provide funding for the “agreed full incremental costs” of climate change in developing countries. As a result, emerging economies such as Indonesia have been able to shift from fossil-fuel dependent economic growth towards low-emission, climate-resilient growth strategies. The Convention, the Kyoto Protocol and follow-up agreements and decisions by the Conference of the Parties have laid out some of the key principles relevant to the financial interaction between

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171 Also know as “Open Areas”.
174 The Kyoto Protocol is a protocol to the United Nations Framework Convention on Climate Change (UNFCCC or FCCC), aimed at fighting global warming, its first stage expired December 2012. The UNFCCC is an international environmental treaty with the goal of achieving the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.
developed and developing countries.\textsuperscript{175} The first commitment period of the Kyoto Protocol ended in 2012. The second commitment period is not in effect. The UN is continuing to work on the terms of a widely acceptable commitment protocol to come into effect and be implemented by 2020. Indonesia became a member of UNFCCC by signing the Kyoto Protocol in 1998 and the Peoples’ Representative Assembly ratified this membership in 2004. In this context, Indonesia recognized its status as an emitter of GHG, and its duty to mitigate climate change.

Multilateral Development Banks, led by the World Bank Group and the Asian Development Bank, acting mainly through the Climate Investment Funds (CIF) and the Global Environmental Facility (GEF), are major players in the delivery of climate finance to the region. Also, Japan, Australia, Germany and the United States are active through bilateral channels. The World Bank’s Carbon Finance Unit (CFU) uses money contributed by governments and companies in developed countries to purchase project-based greenhouse gas emission reductions in developing countries and countries with economies in transition. The emission reductions are purchased through one of the CFU’s carbon funds on behalf of the contributor, and within the framework of the Kyoto Protocol’s Clean Development Mechanism (CDM) or Joint Implementation (JI). The World Bank has been supporting these mechanisms since 1999 in a variety of carbon funds and facilities.

UNFCCC provides Indonesia’s geothermal sector the opportunity to capture the broader “green” value of geothermal power. Indonesia, due to its attractive geothermal potential and geothermal expansion opportunities, is well-situated to benefit from such investments. Indonesia’s Greenhouse Gas reductions initiatives have and can benefit in the development of the geothermal sector namely through the funds and successor funds outlined on the following pages.

6.5.1 The Climate Investment Funds (CIFs)

CIFs were designed by developed and developing countries and are implemented with the multilateral development banks to bridge the financing and learning gap between now and the next international climate change agreement. There are two distinct Climate Investment Funds: (1) Clean Technology Fund, and (2) Strategic Climate Fund.\textsuperscript{176}

1. **Clean Technology Fund (CTF).** The CTF promotes scaled-up financing for demonstration, deployment and transfer of low carbon technologies with a significant potential for long-term greenhouse gas emissions savings. Innovation and deployment of clean technologies at scales which will be central to their success. CTF provides loans to both public and private sectors for the development of geothermal projects.

2. **Strategic Climate Fund (SCF):** The SCF seeks to provide targeted programs with dedicated funding to provide financing to pilot new approaches with potential for scaling up. It will help more vulnerable countries adapt their development programs to confront the impacts of climate change ensuring climate resilience and a program to take action to prevent deforestation is under design. It will also enable discussions between donors and recipient countries


about climate related investment and encourage support from a wide range of bilateral donors, private sector and civil society stakeholders.

6.5.2 Carbon Credits

The UNFCCC has addressed the issue of increased greenhouse emissions by establishing an emissions redirection program that allows players to sell so-called Certified Emission Reductions. Since 2000, carbon funds and facilities under World Bank management have grown from US$145 million in 2000 to US$2.3 billion in 2013. They have demonstrated the role that market instruments can play in supporting cost-effective emission reductions and channeling mitigation finance to developing countries.

1. Clean Development Mechanism (CDM). CDM was designed with two objectives: to contribute to local sustainable development in the host country and to assist Annex-I countries (developing countries) to achieve their emission reduction targets in a cost-efficient manner. Under the CDM, emission-reduction projects in Indonesia could earn certified emission reduction credits. These saleable credits were used by industrialized countries to meet a part of their emission reduction targets under the Kyoto Protocol. Under these mechanism concepts, companies from developed countries invested or purchased "GHG emission reductions" from renewable energy or energy efficiency projects in developing countries as a way to offset their own GHG emissions.177

2. Certified Emission Reductions (CERs). CERs are a type of emissions unit (or carbon credits) issued by the CDM Executive Board for emission reductions achieved by CDM projects under the rules of the Kyoto Protocol. CERs can be used by Annex 1 countries in order to comply with their emission limitation targets or by operators of installations covered by the European Union Emission Trading Scheme (EU ETS) in order to comply with their obligations to surrender EU Allowances, CERs or Emission Reduction Units (ERUs) for the CO₂ emissions of their installations. CERs can be held by governmental and private entities on electronic accounts with the UN. CERs can be purchased from the primary market (purchased from original party that makes the reduction) or secondary market (resold from a marketplace). At present, most of the approved CERs are recorded in CDM Registry accounts only. It is only when the CER is actually sitting in an operator's trading account that its value can be monetized through being traded. The UNICCO’s International Transaction Log has already validated and transferred CERs into the accounts of some national climate registries, although European operators are waiting for the European Commission to facilitate the transfer of their units into the registries of their Member States. One Certified Emission Reduction equates to an emission reduction of one ton of CO₂ equivalent. Holders of CERs are entitled to use them to offset their own carbon emissions as one way of achieving their Kyoto or European Union emission reduction target.

3. Nationally Appropriate Mitigation Actions (NAMAs): CDM was hoped to become a powerful financial incentive for geothermal investment and to

As of September 2013, the CDM had an operating surplus of $82 million. Carr, Matthew uncarbon credit program.
increase geothermal competitiveness with traditionally cheaper fossil fuel-fired systems; however, the Kyoto Protocol first stage expired December 31, 2012. Indonesia has called on developed countries to sign and ratify the second stage of the Kyoto Protocol; however, the global community has not reached agreement on the continuation of the Kyoto Protocol. Some countries want the second stage to last until 2020, but others want to shorten it in order to accelerate the reduction of greenhouse gas emissions, several countries have said they would not bind themselves to the second Kyoto Protocol. Regarding funding provisions, some developed countries have committed to provide long-term funding, of up to US$100 million annually, until 2020. The funds will be managed by the Green Climate Fund. However, they have not been disbursed yet. In anticipation that no timely international agreement would be reached replacing the Kyoto Protocol, Indonesia has partaken in dialogues with a number of countries to explore Carbon Offset/Credit agreements for Geothermal Investments on a bilateral basis following the UNFCCC/CDM methodologies. Towards this end, the UNICCO’s Conferences of the Parties (COP) have established means for national mitigation of greenhouse emissions through Nationally Appropriate Mitigation Actions (NAMAs). NAMAs are a means through which individual countries can conjure their own methods for greenhouse emission reduction.

NAMAs are expected to be the main vehicle for mitigation actions in Indonesia and other emerging economies under a future climate agreement. NAMAs are thought to provide a new opportunity for developing countries to take action on their large and rapidly increasing emissions, while managing growth, social, and development needs. There are two categories of NAMAs, namely:

- **Domestically** supported mitigation actions as unilateral or voluntarily NAMAs
- **Internationally** supported mitigation actions as supported NAMAs

There are several questions still surrounding NAMAs, such as the financing of or the measurement and reporting of such actions, which are still unclear and have been in constant development. NAMAs, however, can be a potential source for financing geothermal projects in Indonesia. Expectations on (financial) support for implementation of mitigation actions are high. In Copenhagen, developed countries pledged to provide US$30 billion fast-start finance by 2012, and mobilizing US$100 billion in additional climate support annually by 2020 (from public and private sources, with a balance between mitigation and adaptation).
6.5.3 **Indonesia’s Climate Initiatives**

Blessed with an abundance of geothermal renewable resources, Indonesia has been actively trying to scale-up the development of these resources, which requires significant financial and institutional assistance. Indonesia has been able to benefit from the technical and financial assistance from international development banks and bilateral partners in order to help develop the countries geothermal targets without jeopardizing the Government’s overall development objectives. In doing so, the Government has utilized a number of the financing mechanisms available pursuant to the UNFCCC. Since 2004, PLN has sold carbon-offset credits as part of the UN backed Kyoto Protocol’s greenhouse gas reduction programs. This program has allowed players to sell and trade these so called Certified Emission Reductions in the international CER marketplace. Indonesia has demonstrated a strong commitment to redirect the emissions trajectory of the country. At the 2009 G20 Summit, President Yudhoyono pledged to unilaterally reduce Indonesia’s emissions by 26% and to further decrease emissions by an additional 15% with international assistance. This pledge demonstrates Indonesia’s voluntary commitment to addressing climate change. A number of policy documents have been prepared by the Government of Indonesia to further define its low carbon growth strategy including the *National Action Plan*. It proposes a range of mitigation measures in the energy sector that primarily focuses on improving efficiency and greater utilization of renewable resources. The government has also made it clear that efforts to mitigate climate change must be consistent with its development goals, that these efforts cannot be at the expense of the poor; and that any bilateral or multilateral climate change assistance should be in addition to development commitments made previously because the country cannot afford the incremental costs induced by renewable energy development without burdening electricity consumers.

Significantly, on March 15, 2010, the CTF Trust Fund Committee approved the allocation of US$400 million to co-finance World Bank Group and Asian Development Bank loans in support of select climate change and initiatives in Indonesia's energy sector. Three quarters of its allocation has been earmarked toward supporting key investment in Indonesia’s geothermal development program. The CTF funds are expected to leverage other financing sources, including multilateral loans, and support a progressive series of geothermal investments that are expected ultimately to lead to the development of the approximately 4,000MW of geothermal capacity that is currently targeted in the Second Fast-Track Program and eventually to reach the long-term goal of 9500 MW by 2025.

Indonesia has placed geothermal energy as one of the primary solutions for Indonesia’s desire to both increase energy supply as well as decrease greenhouse gas emissions. Although no NAMAs have been implemented, nor have these financial mechanisms have officially established as of yet, geothermal development has a very real potential role in the adoption of zero-carbon technologies and the increased efforts for renewable energy adoption, both goals that the UNFCCC strives for with NAMAs. Indonesia's UNFCC National Communication and recent UNICCO’s Conferences of the Parties (COP) related “position statements” have

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184 See Thamrin, S. *supra*. 

122
demonstrated that Indonesia is committed to actively promote geothermal energy as a means to reduce GHG emissions.

6.6 INCENTIVES FOR DEVELOPERS

6.6.1 Import Duty Facility

An import duty exemption on machinery and goods and materials is provided for a two-year period from the time approval of the application by a WKP holder. The two-year period can be extended in accordance with a construction timeframe that is stated in the approval of the investment. There is also an import duty exemption on capital goods utilized in developing power generation for the public use.

6.6.2 Income Tax Facility

The Government of Indonesia provides several fiscal incentives for geothermal development through Government Regulation 62/2008 regarding 1/2007, MoF Regulation 177/PMK.011/2007 and MoF 22/PMK.011/2011. The incentives may be summarized as follows: 30% of corporate income tax, 10% of added-value tax paid by the Government of Indonesia, custom duties exemption for geothermal developer, 25% per year depreciation for eight years with double declining balance method, and investment tax credit 5% per year six years. According to the Ministry of Finance, the income tax facility for the geothermal developer is fivefold:

- Reductions of net income by 30%;
- Acceleration of appreciation and amortization;
- Income tax on dividends paid to foreigners equals to 10%;
- Compensation for losses of more than five years, but less than 10 years; and
- Collection of income tax on goods in the form of machinery and equipment is exempted.

6.6.3 VAT Facility

There is exemption from the VAT on the importation of taxable goods that are strategic machinery and equipment.

Since under Because of the 2003 Geothermal Law, steam generated from geothermal activity is considered to be a product of mining. Under this prevailing VAT rule, the supply of steam is therefore VAT except. On this basis, any "input VAT" paid in relation to geothermal activities would not be creditable (but should be deductible). This means that, under the post-2003 arrangements, supplies of both steam and electricity are exempt, and so input VAT would not be creditable irrespective of whether connected to the steam or electricity generation activities.

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185 In general, See Ministry of Finance of Indonesia presentation, 2012. Geothermal The Right Time to Invest (Washington DC May 23, 2012), in which the incentives summarized are detailed.

186 Note, under the former Joint-Operating Contract framework, this VAT was reimbursable. PT PLN (PricewaterhouseCoopers International Limited), supra, p.75.
### Table 6.3 Summary of Incentives & Guarantees for Geothermal Developers

<table>
<thead>
<tr>
<th>Incentives &amp; Guarantees For Geothermal Development</th>
<th>Exploration</th>
<th>Construction</th>
<th>Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Import Duty Facility</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Income Tax Facility</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>VAT Facility</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Exploration Financing through the Geothermal Fund</td>
<td>YES</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Government Guarantee FTP II</td>
<td>--</td>
<td>--</td>
<td>YES</td>
</tr>
<tr>
<td>Off-take Guarantee (PLN Business Viability Guarantee)</td>
<td>--</td>
<td>--</td>
<td>YES</td>
</tr>
<tr>
<td>Government Guarantee PPP Projects (through IIGF)</td>
<td>--</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Viability Gap Fund</td>
<td>--</td>
<td>YES</td>
<td>--</td>
</tr>
</tbody>
</table>

Source: PLN 2012

### 6.6.4 Exploration Financing

The Geothermal Fund, discussed in detail in Section 6.4 (The Geothermal Fund Facility) of this Handbook, provides a mechanism for financing the high-risk exploration stage of development.

### 6.6.5 Guarantees (IIGF for PPP Projects)

See the detailed discussion at Section 6.3 (Financial Facilities Available to IPPs). The following chart summarizes the difference between FTP II and PPP Scheme treatment.

<table>
<thead>
<tr>
<th>Remark</th>
<th>FTP II</th>
<th>PPP Scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Coverage</td>
<td>Payment default regardless of the risk event</td>
<td>Risk event affecting private investment</td>
</tr>
<tr>
<td>Guarantor</td>
<td>Government</td>
<td>IIGF</td>
</tr>
<tr>
<td>Form of Guarantee</td>
<td>Business Viability Guarantee Letter (BV GL), sent to developers</td>
<td>Guarantee Agreement</td>
</tr>
</tbody>
</table>

Source: BAPPENAS, 2013

### 6.6.6 One-Stop Shop for PPP Projects

No single leading agency for PPP projects currently exists in Indonesia. BAPPENAS is one of the institutions that are closely related to PPP implementation. Presidential Decree 27/2009 sets BKPM (Investment Coordinating Agency) as a front office for Investor relation and BAPPENAS as a back office. P3CU (Public-Private Partnership Central Unit) is a working team that supports KKPPI (National Committee for Acceleration of Infrastructure
Development) to promote PPPs. KKPPI, chaired by the Minister of the CMEA and the head of BAPPENAS, is a steering committee to coordinate the infrastructure policy implementation at a ministerial level.

6.7 SUMMARY

Participation of a wide spectrum of international private sector bidders is crucial if the goal of 9,500 MW of new geothermal installed capacity is to be achieved by the target year 2025. To facilitate attracting qualified, international, private sector bidders, the Government authorities at all echelons need to have full understanding of both the capabilities and the limitations of the project financing vehicles utilized by bidders in the current world market. Developing geothermal energy, like developing any of the other renewable and sustainable energy resources that produce electricity, requires a high front-end expenditure of funds for the highly scientific technical processes that are marshaled to pinpoint the location of a geothermal resource and to extract it for commercial production. These technical resources reduce the risk to the developer. In addition, the developer also has a high front-end cost in protecting the community, as exemplified in the requirement to conduct environmental studies. Finally, front-end expenditures are also required to purchase equipment required to mitigate health, safety and environmental hazards over the long term of the project. For the private sector geothermal developer, time is money, and every bureaucratic hurdle costs time that in turn is ultimately charged against the PPA price.

The governmental entity organizing the WKP tendering process will need to be mindful of the realities of the market for electricity. In particular, bids should be so constructed that the target market will support the economies of scale requisite to a successful project. The tender process does not end with the successful bid. Negotiations are usually ongoing until the actual completion date of the project. The responsible government will be negotiating with the lender as well as with the private sector developer and the publicly owned utility. Lenders can be as diverse as private banks, banking consortiums and international institutions such as the Overseas Private Investment Corporation and KfW Bankengruppe. The lenders of debt usually demand a place at the table – usually successfully so – and their presence is usually ongoing for a considerable length of time as they work with the primary stakeholders to course-correct the project path.

In Indonesia, the geothermal developer will form a special-purpose vehicle that is at least 5% owned by Indonesian citizens. If the geothermal developer is working in more than one WKP, it is required to form a new corporation for each separate "business" in which it operates. The geothermal developer will be operating under the 2010 public private partnership framework that provides extensive bidder/tender consultations, at least with the Government of Indonesia and significant assistance both at the national and local levels. The newly created Geothermal Fund is specifically designed to encourage geothermal development by reducing the upfront risk of the private developer. The concept of the Fund is that the responsible governmental authority will retain expert assistance to identify and categorize the geothermal resource in a geothermal resource area, so that when a WKP is tendered, it can be tendered in a way that educated bidders will offer lower prices based on the risk-reduction provided by the scientific information made available by the offering government. The fund is intended to be self-sustaining as a consequence of the winning bidders’ reimbursing the fund for the information it obtains.

The essential element of a sound geothermal project is a "bankable" power purchase agreement. Essentially this is a multi-year off-take agreement with a credit worthy off-taker that provides for an adequate and predictable revenue stream. The development of a standard
PPA by PLN is indicative of increasing sophistication within the Indonesian geothermal community and a recognition that "time is money". Such a PPA will significantly shorten the time from bid to successful project completion. Nevertheless, there is seldom such a thing as a successful "take-it-or-leave-it" PPA, and the relevant parties will continue to negotiate and refine a PPA in context of local circumstances. Although the first phase of the Kyoto Treaty expired in December 2012, many of the emission-reduction incentive funds remain an active and viable source of project funding for Indonesia. The Government of Indonesia has been a proactive supporter of national and international NAMA initiatives. Indonesia is competing with many countries for investment capital, therefore it has initiated a number of incentives to attract qualified, international, private-sector investors in the geothermal market.
CHAPTER 7

COST ESTIMATES OF AN INDONESIAN GEOTHERMAL DEVELOPMENT

7.1 OVERVIEW OF GEOTHERMAL COSTS

This chapter evaluates the probable costs that would be incurred in developing a geothermal project in Indonesia. Geothermal development cost components are site specific. This inherent variability constrains establishing generic costs that apply to all projects. Unlike cost estimates for renewables such as solar and wind (in which construction costs are easily determined by resource characteristics), estimating the costs for geothermal projects is a more complex process.

Presented below are a series of geothermal cost estimates obtained from the public domain and private developers. Data are presented specifically for the Indonesian setting if available. If not available, data were obtained from similar settings in Asia, such as the Philippines. All development phases of a geothermal project are presented including cost elements such as transmission. The cost of capital is not reviewed because interest rates fluctuate yearly, and capital costs vary from project to project as well as from developer to developer.

The two major capital costs of a geothermal project are its power plant and its wells. The total well drilling cost, including the cost of exploration wells, production wells, injection wells, make-up wells and replacement wells, is significant and may become 30-40% of a project’s capital cost. Consequently, a substantial portion of project capital costs is required at the front-end of a project, prior to any project revenues being generated. The fact that geothermal projects require front-end capitalization strongly impacts development of many projects around the world. Obtaining front-end capital, especially when viewed in combination with associated early-stage resource risks, is the key hurdle that privately financed developers must overcome in order to be successful. As a result, development of geothermal projects is frequently staged in several phases in a way that allows revenues from the project to be generated as early as possible in order to assist in off-setting future project expenditures and protecting cash flows.

There are also valuable additional benefits to staging geothermal projects such as:

(i) Developing early stage reservoir simulation;

(ii) Better understanding of reservoir responses to development (reservoir degradation rates); and

(iii) Providing increased confidence (i.e. reduced financial risk) to both public and private funding sources that the project can meet its overall financial objectives.

Presented in Table 7.1 are the basic financial components of a geothermal project.
**Table 7.1  Simplified Financial Components of a Geothermal Project**

<table>
<thead>
<tr>
<th>Cost Component</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial selection of geothermal development area of interest</td>
<td>Developer</td>
</tr>
<tr>
<td>Early exploration costs such as remote sensing, geology, geochemistry and geophysics studies to identify the boundaries of the WKP prior to tendering. This may now also include up to three exploration wells using the Geothermal Fund</td>
<td>Regional Governments, Geological Agency, MoF for drilling funds and/or Private contractors</td>
</tr>
<tr>
<td>Tender submittals and selection of Tender winner</td>
<td>Developer, MEMR and Regional Governments</td>
</tr>
<tr>
<td>Negotiations for PPA</td>
<td>Developer and PLN</td>
</tr>
<tr>
<td>Negotiations for IUP</td>
<td>Regency/Province/National Government and Developer</td>
</tr>
<tr>
<td>Exploration, including development drilling and Feasibility Study</td>
<td>Developer</td>
</tr>
<tr>
<td>All Permitting and Licensing costs</td>
<td>Developer</td>
</tr>
<tr>
<td>Road and other access facilities</td>
<td>Developer</td>
</tr>
<tr>
<td>Environmental documentation</td>
<td>Developer</td>
</tr>
<tr>
<td>Power plant and steam gathering system and other surface facilities directly related to the power plant</td>
<td>Developer</td>
</tr>
<tr>
<td>Transmission</td>
<td>Developer or PLN</td>
</tr>
<tr>
<td>Social Responsibility</td>
<td>Developer</td>
</tr>
</tbody>
</table>

*Source: BAPPENAS, 2013*

The primary cost components of an Indonesian geothermal project being developed under the Geothermal Law 27/2003, along with the entity primarily responsible for incurring those costs are presented in Figure 7.1.

Table 7.2 presents estimated costs for various development activities associated with a 50 MWe geothermal project as outlined in the 2012 *World Bank Geothermal Handbook*[^187], presenting a range of geothermal costs from low, through medium to high. The extent of the range of three estimates can be substantial. Together the development drilling and power plant construction costs vary by a factor of two between high and low estimates, which serve to emphasize the strong dependence of geothermal costs on site-specific conditions.

Figure 7.1  Project Cost Components

Source: Based on Indonesia Handbook (2010), modified by BAPPENAS, 2013
Table 7.2  Indicative Costs for Geothermal Development (50 MW ex generator capacity), in US$ Millions

<table>
<thead>
<tr>
<th>No</th>
<th>Phase / Activity</th>
<th>Low Estimate</th>
<th>Medium Estimate</th>
<th>High Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Preliminary Survey, Permits, Market Analysis</td>
<td>1</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>Exploration</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>Test Drillings, Well Testing, Reservoir Evaluation</td>
<td>11</td>
<td>18</td>
<td>30</td>
</tr>
<tr>
<td>4</td>
<td>Feasibility Study, Project Planning, Funding, Contracts, Insurances, etc</td>
<td>5</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>Drillings (20 boreholes)</td>
<td>45</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>6</td>
<td>Construction (power plant, cooling, infrastructure, etc.)</td>
<td>65</td>
<td>75</td>
<td>95</td>
</tr>
<tr>
<td>7</td>
<td>Steam Gathering System and Substation, Connection to Grid (transmission)</td>
<td>10</td>
<td>16</td>
<td>22</td>
</tr>
<tr>
<td>8</td>
<td>Start-up and Commissioning</td>
<td>3</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td><strong>142</strong></td>
<td><strong>196</strong></td>
<td><strong>274</strong></td>
</tr>
<tr>
<td></td>
<td>In US$ Million per MW Installed</td>
<td><strong>2.8</strong></td>
<td><strong>3.9</strong></td>
<td><strong>5.5</strong></td>
</tr>
</tbody>
</table>


Individual activities conducted during the above outlined phases presented in Table 7.2 do not necessarily correlate to those outlined in the current Indonesian development scheme. Since the World Bank costs presented are not Indonesia-specific Table 7.3 shows how individual cost activities compare with the geothermal development schemes currently in place in Indonesia under the 2003 Geothermal Law.

Presented in Figure 7.2 is a cost breakdown of the various project activities required for a geothermal project. Drilling represents 35% of the total development cost even if the exploration drilling cost borne by the governmental entity tendering the WKP is removed to better equate to the Indonesian development schemes. With all drilling costs included, the total percentage would increase from 35% to 46%.
Table 7.3  World Bank – Indonesian Equivalency of Geothermal Activities

<table>
<thead>
<tr>
<th>World Bank Geothermal Handbook</th>
<th>Indonesian Scheme</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity 1: Preliminary Survey</td>
<td>Preliminary Survey</td>
<td></td>
</tr>
<tr>
<td>WKP Tendering</td>
<td></td>
<td>No World Bank Equivalent</td>
</tr>
<tr>
<td>Activity 2: Exploration</td>
<td>Exploration</td>
<td>Advanced Exploration</td>
</tr>
<tr>
<td>Activity 3: Test Drilling</td>
<td>Exploration</td>
<td>Test drilling could be funded by through Geothermal Fund</td>
</tr>
<tr>
<td>Activity 4: Feasibility Study &amp; Planning</td>
<td>Feasibility Study</td>
<td></td>
</tr>
<tr>
<td>Activity 5: Development Drilling</td>
<td>Exploration</td>
<td></td>
</tr>
<tr>
<td>Activity 6: Power Plant Construction</td>
<td>Exploitation</td>
<td></td>
</tr>
<tr>
<td>Activity 7: Start-Up</td>
<td>Utilization</td>
<td></td>
</tr>
</tbody>
</table>


Figure 7.2  Cost Breakdown for Various Geothermal Project Activities


Numerous other factors can have a substantial impact on overall geothermal project costs. Many of these factors are resource related or are controlled by the type of project being developed. They include:
Expansion of Existing Project: If the project is an expansion of an existing geothermal project, there will be less exploration cost and lower drilling and infrastructure costs.

Greenfield Project: If the project is a greenfields project, reservoir location and characteristics will almost certainly be unknown. Consequently the result is likely to be a lower success rate for exploration wells thus increasing overall drilling costs by requiring more wells to be drilled and lowering average well production rates.

Power Plant Size: The larger the power plant size (geothermal reservoir size) the less the cost per megawatt (economies of scale).

Fluid Temperature: Geothermal fluid temperature can have a significant impact on costs since resources with lower temperatures normally need to produce larger quantities of water for the same electrical power output and therefore require higher numbers of production and injection wells.

Fluid Characteristics: Other constituent characteristics of the geothermal fluid/steam, will impact costs. For example, scaling and corrosion affect equipment, and emissions from certain gasses have environmental impact, therefore the cost of mitigation of adverse fluid characteristics will impact project costs.

Reservoir Characteristics: Reservoir characteristics such as depth, nature of the fracture systems, well productivity, and subsurface geology and formation properties can all impact drilling costs.

Time Delays: Once funds have been committed to a geothermal development, any time delays can have a significant impact on overall costs. The most common delays are permitting and licensing time, equipment deliveries and equipment failures. Given that under ideal conditions geothermal projects can have a development period of up to seven years before cash flow is generated, time delays can be a major problem.

7.2 RESOURCE DEVELOPMENT COSTS

As discussed in Section 7.2 above, by far the greatest cost associated with resource characterization is well drilling. However before wells can be sited, sufficient data from the subsurface must be acquired and interpreted. In general the approach is to gather “surface data” and “subsurface data collected from the surface” until the continuation of surface data gathering no longer reduces exploration risk or until it is not possible to substantially improve the geothermal model of the system. As demonstrated in Sections 7.3.1 and 7.3.2 of this Handbook, when a developer weighs the disparity between the cost of exploration and the cost of drilling, it makes less sense for the developer to skimp on exploration activities particularly when the decision has been made to drill and only the exact target requires definition.

7.2.1 Exploration Costs

A normal surface exploration program (i.e., surface data gathering) on a greenfield project can cost between US$1 million to US$3 million depending on site access and surface conditions and substantially less in a brownfield project. Usually the highest single cost item is the geophysical survey (magnetotellurics with time domain electromagnetics – TEM/MT) the cost of which depends strongly on the number and size of the sites. This type of
geophysical survey can often take 30% to 40% of the exploration budget but is a critical part of the exploration program. In some special geothermal settings seismic reflection surveys may be used in place of TEM/MT. The costs are similar for such seismic surveys.

### 7.2.2 Drilling Costs

There are a number of different types of drilling that can be completed in any geothermal project. Each project will have different cost structures:

**Temperature Gradient Holes:**

Usually completed by water well drillers rather than geothermal drilling contractors, temperature gradient holes are significantly cheaper and do not constitute a large portion of the total drilling budget. The wells are usually drilled to depths of 150 to 400 meters and are designed to evaluate the increase in temperature with depth in a way that allows extrapolations to be made to the approximate depth of the reservoir. Their cost can be in the range of US$10,000 to US$50,000 per hole and is generally dependent on depth.

**Slim Holes:**

Slim hole definition varies substantially, ranging from (i) standard mining-type core holes which normally have a bottom hole diameter of less than 10 cm (~4 inches) and provides continuous rock samples, to (ii) rotary drilled wells with a bottom hole diameter up to 15 cm (~6 inches). The overall purpose of these wells is to measure directly the reservoir temperature.

Core holes can be drilled up to a depth of approximately 1500 meters but their size usually precludes any detailed reservoir information other than temperature. Occasionally a core hole will flow to the surface if its enthalpy is sufficiently high, in which case a fluid sample can be obtained and simple flow characteristics can be assessed. In general these types of core holes can be drilled for approximately US$1 million provided that drilling rigs are locally available and do not need to be imported.

The larger diameter slim holes are specifically designed to gain more detailed reservoir information such as temperature, pressure, non-condensable gasses, etc. In some cases these wells can be drilled with larger surface casing so that, if warranted after well testing, the lower portion of the well can be opened to a larger diameter for production or injection. Both types of these slim holes can also be used as monitoring wells during later production phases of geothermal development.

**Production Wells:**

The recent estimations of production well costs in Indonesia also vary considerably. A reasonable assumption is that under current 2013 conditions the cost for an average 8 MWe productions well in Indonesia is approximately US$7 million. In a 2010 study by Geothermex, site production well costs in Indonesia of US$4 million per well. Later estimates by the same Geothermex authors (Sanyal et al, 2012) use drilling costs of US$300,000 to US$400,000 per MWe. An existing Indonesian geothermal developer, which is currently an IUP Holder and planning drilling operations for 2013, provided more recent drilling cost estimates. Based on this source, cost estimates for a 2000+ meter production well are in the range of US$6 to US$8 million. These costs came from a multi-well program where mobilization and demobilization were shared between a numbers of

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188 This latter estimate may seem to be an anomaly that well capacities range from 3-40 MWe in Indonesia with a stated average of approximately 8MWe. Using a cost of $350,000 per MWe the average well capacity would have to be between 11 to 12 MWe range rather than the average of 8 MWe.
wells. This US$6-8 million per well was through bids from respected commercial drilling companies with geothermal experience; it is safe to assume that under 2013 conditions, the cost for a production well in Indonesia can be estimated at approximately US$7 million. This cost figure is considerably higher than the low and high estimates made by the World Bank of US$2.25 million and US$5 million (Table 7.2).

7.2.3 Infrastructure Costs

Infrastructure cost can be significant since many of the geothermal sites in Indonesia are located in remote areas, often in rugged topography. In most cases such infrastructure costs are associated with access into the area for drilling equipment and subsequently power plant construction. The mobilization of drilling equipment requires access roads of substantial size, which must also be capable of withstanding extreme weather conditions such as heavy rains. As a result, infrastructure costs are strongly dependant on site-specific conditions and so generic estimates will not be representative. However in cases where sites are in rugged terrain and remotely located, it would be reasonable to anticipate infrastructure costs in the range of US$1 million to US$10 million.

7.3 GENERATION, TRANSMISSION & DISTRIBUTION COSTS

7.3.1 Power Plant Costs

Investment costs per installed megawatt can vary widely as Table 7.2. (Indicative Costs) indicates, depending on the country, region, geology, infrastructure in place, and the difficulty in exploring and drilling the field. However, there is probably more consistency in power plant construction costs from country to country since much of the critical equipment (such as turbines, generators, condensers, etc.) come from the same limited number of suppliers. For example turbines for geothermal flash power plants are sourced almost exclusively from manufacturers in Japan – Mitsubishi, Fuji and Toshiba, so the only pricing difference would be in transportation. A range of possible costs for power generation is presented in Figure 7.3. The data and show the cost dependency on reservoir temperature for both flash and binary power plants. Given the data is from 2007, the actual cost for 2013 in accordance to inflation should be increased roughly by 10% to 11%. The increase in costs above 250ºC for conventional conversion is due to higher anticipated chemical treatment.

Figure 7.3 Impact of Reservoir Temperature on Power Conversion Costs

Source: U.S.DOE (2005), modified by BAPPENAS, 2013
Figure 7.4 shows the range of capital costs from Sinclair Knight Mertz (SKM) presented as an envelope for 20–50 MWe greenfield developments in New Zealand. Again the reservoir temperature is seen to play a major role on capital cost of development.

Figure 7.4 Impact of Resource Temperature on Specific Capital Cost (SKM 2007)


7.3.2 Transmission and Distribution

Distance to the customer is an important economic factor because geothermal generation has to occur at the location of the resource and cannot be conveniently sited near load centers. Transmission is a high-voltage (usually >230kV) component of the electricity system and distribution is the low-voltage component (< 230kV). The distinction between transmission and distribution is important to geothermal technologies, since this distinction identifies project interconnection issues. Among the cost-sensitive issues that can arise are:

- Impacts to the rest of the grid,
- Planning requirements,
- Sensitivities to economies of scale,
- Existing transmission constraints, and
- Time required for approval for interconnection.

Costs for new transmission can exceed US$200,000 per km (2008 estimate), which for a 50km line can be substantial. Developers are generally expected to pay for transmission to the nearest utility interconnection point that has available capacity.

7.3.3 Comparison of Generation Costs from other Renewables

The standard way to evaluate the economic viability of a specific geothermal project is to simply calculate the revenue generated by the selling of electricity at the amount stated in the
project’s PPA and compare that revenue with the cost of generation calculated using the total cost of the project, including capital costs together with operating fixed and variable costs plus taxes, and less any additional revenue from tax rebates, carbon credits, etc. An acceptable alternative is to use the levelized cost of electricity (LCOE) as a method to evaluate economic viability. Usually, LCOE is an approach used to compare different renewable technologies or different geothermal projects, rather than to calculate or evaluate the cost viability of an individual technology or project. An example of such a comparative use of LCOE is presented in Table 7.4. The table presents levelized costs (in US$/kWh) for various power conversion technologies at different capacity factors.

<table>
<thead>
<tr>
<th>Capacity Factor</th>
<th>0%</th>
<th>20%</th>
<th>40%</th>
<th>60%</th>
<th>80%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSD HFO</td>
<td>0.25</td>
<td>0.17</td>
<td>0.14</td>
<td>0.12</td>
<td>0.12</td>
<td></td>
</tr>
<tr>
<td>Steam Turbine HFO</td>
<td>0.31</td>
<td>0.21</td>
<td>0.17</td>
<td>0.15</td>
<td>0.14</td>
<td></td>
</tr>
<tr>
<td>Steam Turbine Coal</td>
<td>0.23</td>
<td>0.14</td>
<td>0.11</td>
<td>0.09</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>Combustion Turbine NG</td>
<td>0.13</td>
<td>0.09</td>
<td>0.08</td>
<td>0.08</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>Combined Cycle NG</td>
<td>0.16</td>
<td>0.10</td>
<td>0.07</td>
<td>0.06</td>
<td>0.06</td>
<td></td>
</tr>
<tr>
<td>Combined Cycle LNG</td>
<td>0.18</td>
<td>0.12</td>
<td>0.10</td>
<td>0.09</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>Combined Cycle FO#4</td>
<td>0.21</td>
<td>0.14</td>
<td>0.12</td>
<td>0.11</td>
<td>0.11</td>
<td></td>
</tr>
<tr>
<td>Combustion Turbine FO#4</td>
<td>0.23</td>
<td>0.19</td>
<td>0.18</td>
<td>0.17</td>
<td>0.17</td>
<td></td>
</tr>
<tr>
<td>Small Wind Turbine</td>
<td>0.20</td>
<td>0.10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large Wind Turbine</td>
<td>0.14</td>
<td>0.07</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small Hydropower</td>
<td>0.19</td>
<td>0.10</td>
<td>0.07</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Large Hydropower</td>
<td>0.20</td>
<td>0.10</td>
<td>0.07</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geothermal</td>
<td>0.24</td>
<td>0.12</td>
<td>0.08</td>
<td>0.06</td>
<td>0.05</td>
<td></td>
</tr>
</tbody>
</table>

HFO – heavy fuel oil; NG - natural gas; L – liquefied natural gas; FO4 – fuel oil no. 4

Source: Fernando Lecaros - World Bank, 2012

As can be seen the LCOE for geothermal at its normal capacity factor of approximately 90% to 95% (0.055-0.0525 US$/kWh, linearly averaged between 80 and 100%) are competitive with all the other technologies presented in the screening analysis completed in this World Bank 2012 Report.\(^\text{189}\) The levelized cost of geothermal compared to the levelized cost of competitive technologies is important because the critical element that will make geothermal energy the preferred source of future electricity supply in Indonesia is its ability to be cost competitive with coal. If externalities are accurately priced it can be

\(^{189}\) Although these numbers do seem to be low as compared to other published LCOE values for geothermal and there are no statements in the report as to how the numbers were calculated.
shown that under existing present economic conditions geothermal energy is competitive with coal.

A report prepared by Castalia Strategic Advisors in 2007 for the World Bank attempted to quantify the gap between the cost of geothermal development and the cost of coal-fired generation. Coal-fired generation, in general, has been regarded as the cheapest expansion option for Indonesia. Hence, it provides a useful benchmark for geothermal generation. The comparison of financial costs between the two options provides an indication of how much support is required for geothermal generation. As part of the report, cost curves for electrical generation were developed for the Java/Bali and Sumatera islands based on cost data generated from both coal and geothermal past projects. For the geothermal projects Castalia used data from 51 geothermal sites analyzed in the *JICA Master Plan Study for Geothermal Power Development in the Republic of Indonesia* (dated 2007).

An additional study completed by the World Bank in 2010 (*Winds of Change – East Asia’s Sustainable Energy Future*) evaluated how Indonesia and other East Asian countries could balance energy sustainability with national energy security. Using incremental levelized costs, rather than actual generation costs, the study showed that geothermal power is likely to be competitive with electricity produced from coal up to a capacity of 3.8 GW and up to a capacity of more than 11.4 GW if local environmental benefits and greenhouse gas emissions are incorporated into the pricing structure. The costs were updated using the spreadsheets developed by the World Bank staff and revised competitive costs indicated that the breakeven values were 2.4 GW and 10.5 GW respectively Figures 7.5.

![Figure 7.5 National Cost Supply Curve of Geothermal in Indonesia](image)

*Source: World Bank - Winds of Change, 2010*

Some of the data presented in the 2010 World Bank report were developed prior to 2010 and is not necessarily applicable under 2013 economic conditions. In an attempt to

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evaluate the premise of competitive pricing of geothermal with coal generation the cost supply curve was regenerated under three different scenarios using applicable 2013 values:

*Scenario 1.* The cost of drilling wells was doubled (x2)

*Scenario 2.* The price of coal was increased from US$40/ton to US$90/ton

*Scenario 3.* Scenarios 1 and 2 were both run simultaneously.

The results of these three scenarios are presented in Table 7.5, below. As Table 7.5 demonstrates, there is a stronger sensitivity to the price of coal than to increases in the cost of drilling. Drilling is by far the most difficult of the geothermal costs to estimate. As discussed earlier in this chapter, drilling costs are highly variable and frequently represent up to 40% of the total capital costs of a project. The cost curves for the three scenarios are presented in Appendix D.

| Table 7.5 Assumptions Underlying Cost Supply Curve of Geothermal in Indonesia |
|--------------------|----------------|----------------|----------------|----------------|
| Scenarios          | Q (bau) | Q (econ) | Q (env) | Q (global) |
| 1 World Bank Case (PAD) Base Case | 852 | 662 | 2,442 | 10,499 |
| 2 World Bank with drilling cost x2 | 852 | 300 | 300 | 5,939 |
| 3 World Bank with coal cost US$90/ton | 852 | 9,504 | 10,812 | 12,674 |
| 4 World Bank with Scenarios 2 and 3 | 852 | 8,140 | 8,420 | 11,729 |

*Source: BAPPENAS, 2013*

In summary, costs of geothermal energy have declined dramatically over the past two decades. Geothermal can be economically viable compared to the costs of coal-fired power plants plus local and global environmental external costs. With rising fossil-fuel prices, the cost gap is closing. Geothermal power has the additional advantage of providing base load power; while solar and winds are intermittent.

### 7.4 PERSPECTIVES FROM INVESTORS & DEVELOPERS

This section will address questions that would be asked by a prospective investor/developer prior to committing investment funds to geothermal projects in Indonesia.

For accelerated development it is important to recognize that in most cases there is a practical and financial limit to how many geothermal projects can be effectively explored and developed by any potential investor/developer. Only very large, asset-rich companies such as PGE and Chevron can undertake multiple projects and it is unlikely that any single investor/developer would be financially capable of developing more than five geothermal projects at a time – most investor/developers would probably be limited to between one to three projects. Only when projects move into the exploitation phase and revenues are being generated can most companies consider adding new greenfield projects. Given this premise and with the amount of power projected to come from geothermal development in the next 10 years, a significant number of new investor/developers must be actively engaged in geothermal development if the goals set by the Indonesian government are to be reached.

There are numerous types of potential geothermal investors with many different motivations and varying corporate financial objectives. Clearly there is no way that a national investment policy can satisfy the full range of potential investor developers. At some point in time, there
will need to be some prioritization of those types of investors/developers that would best suit the Indonesian market.

7.4.1 Types of Investors

1. Large-scale Developers/Investors:
   a) Large national/multi-national natural resource development companies with previous extensive experience in geothermal development (e.g., PGE Chevron).
   b) Large national/multi-national natural resource development companies without experience in geothermal development but which could easily acquire that expertise if so needed. (e.g., PT Bakrie, Origin).
   c) Large national/multi-national development companies without experience in natural resource development.

1. Small to Medium-scale Developers/Investors:
   a) Small to medium-sized companies with previous geothermal experience (PT Supreme Energy, PT Star Energy).
   b) Small to medium-sized companies with no previous geothermal experience.

2. Financial Investors:
   a) Private Equity Companies.
   b) Small to medium sized banks and other financial institutions.
   c) Multi-lateral donor agencies (World Bank).
   d) Governments and government agencies.

In order to understand the geothermal investment climate in Indonesia the authors of this *Handbook* met with a number of existing developers in Indonesia to gauge their perspectives on what, in general, a developer needs to feel confident about prior to investing in the geothermal industry in Indonesia. Among the developers that were interviewed were: Star Energy, OTP, Supreme Energy, Medco and Chevron. Also included in the discussion was a representative of Fichtner, a consulting firm active in geothermal development in Indonesia.

7.4.2 Corporate Perspectives

Perspectives from these companies were varied but can be grouped into four major areas:

1. Geothermal Resources and How They Can Best be Developed:
   Investors/developers from Category 1.a and 1.b have a sophisticated understanding of the nature of resource risk and are generally in the business of accepting resource risk as a part of their business strategy. They tend to be more focused on ensuring that the regulatory system which is in place will allow them to complete the exploration and development phases as rapidly as possible without costly time delays.

   Since the Indonesian tendering process lacks maturity – there are only a limited number of precedents for the developer/investor community. This system for selecting investors/developers that will be granted an IUP to develop a specific WKP is based on a tendering process. If Indonesia is to develop its resources it requires investors/developers that either have experience in such developments or who have
the financial capability to acquire that experience. Realistic tendering with financial commitments that are monitored and have penalties for non-performance is one of the ways to identify bidders that do not have the experience or financial capability to complete for a geothermal project.

It is also a widely held perception that some winning bidders have little or no intention of undertaking development but have acquired the WKP/IUP on a speculative basis, meaning that they would intend to “flip” (sell quickly) the IUP at a premium or to join a consortium team (for a percentage of the profits) with and experienced developer. The problem with speculative bidders is that they seldom have the capacity to perform and often default. Financial penalties for non-performance would help prevent that situation but a more effective tool would be to indentify such speculating entities during the tendering process and disqualify them at that stage.

To ensure that there is a transparent process for selecting the winning bid from a WKP, tender committees need to have experienced members that understand what it takes to complete a project successfully. Comments made by a number of the companies interviewed suggest that may not always be the case. Knowledge about resource potency of the geothermal resources in the smaller provinces is limited. Capacity building within the provincial and regency areas is crucial. Many of the local WKP tenderers have limited exposure to and understanding of upstream and downstream geothermal developments, and therefore lack the ability to let tenders that maximize the probability of success over the long run.

2. Political Issues

Developers need a clearly defined political structure in which to operate. This precondition means that there should be strong sectorial leadership on the part of both the national and the local governments and a high level of inter-government coordination. There should also be strong communication between the national and the local governments as well as between various ministries and agencies within government sectors. It was the strong opinion of many investor/developers that communications between national and regional entities needed strong improvement.

A problem for investors/developers is that there is a perception of politics having played a major role in the selection of WKP winners. This perception stems from local government officials sometimes not having access to knowledge of geothermal issues and making decisions on information not always geothermal-related. Some of those companies interviewed expressed the opinion that, for the sake of consistency, the tendering process should be in the hands of an independent, non-political, technically qualified task force or agency.  

3. Financial

One of the most critical requirements for a developer is that it has a safe and secure market for its product. That precondition means that the off taker must be a sound financial entity and that there be very little or no risk that PPAs would not be fully honored. The capability of PLN, even with the support of various government guarantees, to meet this precondition is still questionable. There has to be a predictable price for energy from the time that a WKP is first tendered until its fruition. With or without feed-in tariffs it is critical that the off taker recognizes that costs begin to inflate as soon as the PPA is signed and that escalation clauses need to

191 See discussion regarding Tender Committee at Section 4.4.1 (Tender Committee) of this Handbook.
be established at that time. Many developers commented that legislative changes that impact the price that the off taker pays for power result in inequities and inconsistencies between those investors/developers that negotiated their PPAs prior to such specific legislation and those that negotiated after that event. A mechanism that mitigates this result and levels field for all players is needed.

Recent establishment of two major legislative changes – the Geothermal Fund and proposed ceiling prices based on power plant capacity and resource temperature will have a major impact on development for most investors/developers. Those companies interviewed had differing perspectives on both of these changes:

- The Geothermal Fund has both supporters and critics. The majority suggests that the best use for the Fund would be either to support the development data from the Preliminary Survey or to assist in the development of remote sites where the electric load may not be sufficient for investors/developers to warrant the exploration risk.

- The feed-in tariff that had been set forth in MEMR Regulation 02/2011 which has since been revoked, placed a new ceiling price base on capacity and temperature. Investor/developers felt the proposed feed-in tariff removed the fundamental basis of the tender process. MEMR Regulation 20/2011 is discussed in Chapter 5 of this Handbook addresses.

For a level playing field to exist for all potential investors/developers, it is necessary that outside financial assistance or aid be available for all parties considering development in Indonesia. Government agencies and SOEs have a significantly greater chance of obtaining soft loans or other forms of financial support which puts private investors at a distinct disadvantage. Financial stability and predictability is crucial to development. Ironically, proposed legislation and regulatory reforms that are designed to improve the investment and regulatory environment can have a chilling effect to both investment and development. Both investors and developers are cautious about premature commitment in a fluid regulatory environment – many developers will not enter into a PPA today when it may be more advantageous to wait until circumstances improve tomorrow.

4. Environmental

Forestry issues related to geothermal development have long been a source of debate and tension in Indonesia. The debate stems from the fact that geothermal development has historically been classified as a mining business, and geothermal development is therefore burdened by the restrictions that apply to the mining industry, even when these restrictions have little applicability to the geothermal energy industry. A further problem has been the arbitrary way that forestry land designations have occurred over recent years with large areas being reclassified with little or no consideration as to how that would impact access to geothermal resources. Such uncertainty in access to the geothermal resources causes major concerns to investors/developers and generally would prevent them from bidding on any lands where future non-geothermal decisions could cause significant loss of either sunk costs or future revenue. The permitting process is of importance to all investors/developers – the primary concern is that delays cost a considerable amount of money and “time is money.”

As can be seen in Figure 7.6, below, for every eight years of delay a cost of US$150 increases to US$500. Given the high cost of exploration and development delays have a serious impact on the overall cost of development. The timing of those delays is also
critical because sunk capital during exploration and pre-revenue development phases can be substantial. Although also partly a financial issue, investors/developers need to have some criteria to be able to assess land values in geothermal areas. The issuance of an IUP does not give a right to enter onto land. A problem expressed by some companies was how to value the surface rights. This valuation issue is something that requires addressing by regulatory authorities so that long, drawn out negotiations do not delay the development process.

Figure 7.6 Cost of Exploration Delays (10% inflation)

7.4.3 Summary of Stakeholder Interviews

The following question was asked of each investor/developer interviewed as part of this process to evaluate the options available to the GoI for investment in Indonesian geothermal:

*If the Indonesian government could provide both:*

a. a reasonable and reliable electricity tariff that allowed the investor/developer to make a reasonable return on their financial investment (be it debt or equity) in a timely manner and;

b. a predictable permitting and regulatory process such that development of the geothermal resource could proceed within a reasonable time frame and not be subject to unpredictable time delays due to regulator or government actions…

*…then would you, as an investor/developer, be willing to take all of the resource risk associated with the development of such a geothermal resource?*

Without hesitation each of the investor/developers interviewed answered directly in the affirmative.

This response suggests that in order to encourage geothermal development in Indonesia the most effective tool that the Government has at its disposal is to (i) establish a reasonable and equitable tariff structure, and (ii) resolve issues associated with national and local Government jurisdiction and inter-agency and inter-ministry regulations and governance so that a streamlined regulatory process is in place.
7.5 SUMMARY

This chapter sets forth cost estimates of geothermal development in Indonesia. These estimates are based on inputs of both public and private developers, and where possible, draw on data relevant to the Indonesian setting. The two major capital costs of any geothermal project are its power plant and production/injection wells. Total well drilling costs can comprise up to 30-40% of the total capital cost of a project. The high cost of drilling, combined with the fact that it must be paid up front, presents a challenge to potential developers. Designing the project in a way that generates early revenue to the developer often effectively mitigates the drilling risk of this expenditure, and allows for protecting cash flows and off-setting future project expenditures.

The project financial information suggests that in order to encourage geothermal development in Indonesia the most effective tools that the Government has at its disposal are:

i. To establish a reasonable and equitable tariff structure, and

ii. To resolve issues associated with local and national Government of Indonesia jurisdiction and inter-agency and inter-ministry regulations and governance so that a streamlined regulatory process is in place.

Geothermal exploration was first begun in Indonesia in 1920, although power was not implemented in commercial power plants until 1983. Today, there exists a huge untapped potential of geothermal power in Indonesia. Given this large geothermal potential in Indonesia, why has there not been an even greater effort placed on development of geothermal resources? One reason has been Indonesia’s substantial reserve of inexpensive and readily available fossil fuels, particularly low cost coal. Until recently, focus has been placed on coal as the primary source of fuel for future electricity generation. However, a number of studies have indicated that when environmental externalities are factored into generation costs, it can be clearly demonstrated that renewables, and geothermal energy in particular, can compete economically with coal. This chapter discusses the commercial viability of the deployment of geothermal energy vis-à-vis competitive energy sources such as coal. In summary, if local environmental benefits and greenhouse gas emissions are incorporated into the pricing structure using incremental levelized costs, rather than actual generation costs, geothermal power in Indonesia is competitive with electricity produced from coal. Furthermore, the exploration risk in Indonesia is lower than in many other countries, however exploration costs are high and until the institution of the recent government incentives, there have been few government incentives in place.
CHAPTER 8

FORESTRY, LAND USE, ENVIRONMENTAL ISSUES & SOCIAL RESPONSIBILITY

8.1 INTRODUCTION

This chapter discusses the resolution of conflicts that have arisen because of tensions between policies that on the one hand are designed to protect forests and on the other hand are designed to promote geothermal development – both advocating policies in the name of carbon reduction. The chapter also explains the efforts to reconcile both the forest conservation and the renewable energy development sectors by classifying certain activities such as geothermal development to be a "strategically important" activity that allows the issuance of lease-use permits for geothermal development. Since the award of an IUP to a developer to work in a WKP does not automatically include the right to work on the land on which the WKP is located, the IUP Holder has the responsibility to acquire the land for its geothermal business in accordance with prevailing laws and regulations. Therefore it is important for the geothermal developer to understand the process by which land is obtained under Indonesian law.

This chapter also introduces the environmental protection regulatory structure in Indonesia that is governed by both the environmental law and the company law of Indonesia. Considering the importance of environmental considerations in Indonesian policy planning, this chapter also highlights environmental impacts that geothermal development may have in Indonesia and Appendix E (Geothermal Environmental Impacts & Mitigation Practices) details a number of the mitigation issues that have been introduced internationally as well as in Indonesia. Finally, since Indonesia is home to the world's third largest tropical forest, and considerable portions of Indonesia’s geothermal resource areas underlay forest lands that the national government is committed to protecting from development, forestry regulation is significant to the geothermal developer. The international efforts to mitigate greenhouse gas and carbon emissions in Indonesia, particularly with respect to potential funding mechanisms for geothermal development, also impact geothermal development in Indonesia.

8.2 LAND USE UNDER GEOTHERMAL LAW 27/2003

Under Geothermal Law 27/2003, the licensed right to conduct geothermal business in a WKP area does not include title to land rights. The IUP Holder is required to acquire the land for its geothermal business in accordance with the prevailing laws and regulations. The Law, however, mandates that the holder of the land title on which a WKP area is sited, will allow the IUP Holder to commence geothermal business on that land provided that the IUP Holder’s purposes, location of its proposed activities and any resettlement plans have been agreed between the IUP Holder and land title holder. According to the 2003 Geothermal Law, the maximum size of a Work Area is 200,000 hectares.

Lands that are dedicated for geothermal businesses, and for security purposes, are granted with a “right to use” (hak pakai). The National Land Affairs Agency of Indonesia, Badan Pertanahan Nasional or “BPN” and/or the regional government, in consultation, may grant the IUP Holder the title to land that has not been previously granted to other parties; however, such a potential grant is more of a theoretical than actual possibility – and one fraught with political hurdles. In addition, nearly all IUP Holders will need to manage forestry land issues since almost a majority of Geothermal Work Areas are located in forested mountainous regions, which contain Conservation Forests. Indonesia is home to the world’s third largest tropical forest; consequently, a great majority of the geothermal sites are located in Ring-of-Fire mountains that are usually forested. The Government classifies forests as Production, Protected or Conservation Forests. Problems occur, however, because geothermal development is completed under a mining license. Under the present legal structure, geothermal development is defined as a mining activity and is not allowed in Conservation Forests. Geothermal Development can, however, be completed under a permit in Protected Forests. The use of forests is governed by the Forestry Law 41/1999 and its amendments (Law 1/2004 and Law 19/2004), except where Government of Indonesia may designate a forest area special status providing that the principal function of the area is respected and that the area is not unduly impacted. To this end, a permit from the Minister of Forestry is

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195 As used in this Chapter, the term “1999 Forestry Law” includes its amendments.
required (right to use permit). MoFor Regulation 43/2008 lays out the process for lease use permits.

8.3 LAND USE IN FOREST AREAS RELATED TO GEOThermal ACTIVITIES

Virtually every geothermal developer in Indonesia will need to manage forestry land issues since many of the geothermal working sites in the country are located in forests that are in the status of “Protected Forest” (e.g., Wayang Windu, Lumut Balai) or “Conservation Forest” (e.g., Kamojang). Consequently, land use rights in the areas under the Ministry of Forestry are of special significance to the geothermal industry. For example, see Figure 8.1 that shows the overlay of forests on geothermal resource areas on Sumatra. The 1999 Forestry Law operates to prevent specified activities from being carried out in Protected Forest areas except where a Government permit is obtained. Because geothermal upstream and downstream developments are deemed to be "strategically important," these developments may take place in Protected Forests. It is useful to understand the management scheme set forth in the 1999 Forestry Law. The forest areas of Indonesia are divided into “State Forest” and “Rights Forest.” Functionally the State Forest is further divided into three types as follows:

- **Conservation Forest** is a forest that is governed so as to conserve the natural plants and animals within its ecosystem.

- **Protected Forest** is a forest that is governed so as to protect life support systems, manage watersheds, prevent floods, manage erosion, prevent sea intrusion and protect the fertility of the land.

- **Production Forest** is a forest that is governed so as to facilitate the production of forest products.

Forestry Law, Article 38, paragraph 1 provides that the use of forest areas for non-forest activities may only be conducted in “Production Forest” and Protected Forest areas and the results again must not change the main function of the forest area. In practice, geothermal resource areas located in Protected Forests have been licensed for development by negotiations in which an area in a Protected Forest has been swapped for a replacement area double in size and thereby the Protected Forest area has been re-designated by the Ministry of Forest with the approval of Parliament.

**Geothermal Law 27/2003.** Article 16, includes the provision that a right to work in a geothermal area does not include any rights to the land surface of the earth. In the event that the geothermal work area encompasses parcels of land in forest areas, the geothermal

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196 The term is translated as “borrow-and-use, rent-and-use or lease-and-use”.


198 “State Forest” (including the traditional Adat forest) is defined as a forest located on lands bearing no ownership rights. “Right Forest” is defined as a forest located on lands bearing ownership rights “Adat Forest” is defined as State Forest that is located within the territory of an Adat community. Article 5 of the Forestry Law further clarifies that the inclusion of Adat Forest into the State Forest does not undermine the rights of Adat community over their forest so long such Adat community still exists and is acknowledged... See discussion at 8.5 (Land Use and Acquisition) in this Chapter.

199 Note that in Java and Banten a “Protected Forest” is essentially equivalent to a “Production Forest” in other provinces of Indonesia. Asian Development Bank, Karaha Initial Environmental Examination, Geothermal Power Development Project 43249, pp.29-30 (Oct. 2011).

200 De Wilde, Antonie, Bappenas, Discussion (09/30/2010).
developer that is the IUP Holder must also obtain the rights to use the forest lands from the Ministry of Forestry.

*Figure 8.2  Geothermal Potential in Sumatra Overlaying with Protected Forest and Conservation Forest Areas*

*Sources: GIS-Spatial Planning of WWF-Indonesia, MEMR, 2012*
Funded by the Japan International Cooperation Agency (JICA), the Master Plan for Geothermal Development in Indonesia was first published in September of 2007. At that time, only 5% of the 256 then-identified geothermal fields were located in forest areas. In 2007, however, Indonesia re-drew its maps to implement international definitions for Protected Forests and Conservation Forests. The re-drawn map of the Indonesian forest layer placed 72% of all known geothermal fields into Protected Forest areas that limit or prevent mining activity. The national government is attempting to reconcile legitimate goals of geothermal development and forestry conservation. The Memorandum of Understanding between the Ministry of Energy and Mineral Resources and the Ministry of Forestry, MOU 7662/2011 addresses accelerated issuance of geothermal energy development permits in Forest Production and Forest Protection areas. Nevertheless, several fields such as the expansion of Kamojang, the exploration of Lumut Balai and Sungai Penuh in Sumatra, exploration of Blawan Ijen, to mention a few, have been or are still being delayed as of the spring of 2013 due to the forestry permitting process.

Since at least one-third (and some commentators estimate as high as three-fourths) of Indonesia’s geothermal lands underlay what is known as Protected and Conservation Forests, the issue is significant to the geothermal developer (See Figure 8.3.b below). Clearly one of the fundamental issues of the MOU between the MEMR and the MoFor is that geothermal energy has been allowed to develop in forest areas; however, higher legal authority, the existing laws, have not been revised or amended to support geothermal development in forests. The 2003 Geothermal Law, for instance, categorizes geothermal activities as "mining activities". With this classification, geothermal energy development cannot take place in Conservation Forests as is stipulated in Forestry Law 41/1999. Until there is a fundamental revision to the laws themselves, the development of geothermal energy and the mitigation of the impact and risk of geothermal energy in the national forests will continue to be a developmental hurdle.

By way of background, institutional arrangements in the forestry sector involve a complex interrelationship among various government agencies. In general, the management of the forests remains under control of the Government of Indonesia (through the Minister of Forestry). Since the era of decentralization, however, the management of forestry sector at the operational level has been under the control of the regional governments. The Government of Indonesia has the role of determining national plans, revenue collection and resource expenditure allocation through the budgeting process. These roles are shared among Bappenas (for development planning), the Minister of Finance (for budget control), and the Minister of Forestry (for forestry-sector planning). Provincial and District government activity is focused on monitoring and implementation of plans, standards and processes.


202 Ibid.

203 Government Regulation 38/2007 (concerning the Division of Government Affairs between the Governments, Provincial Governments and Local Government of Regency/Municipality) covers the division of authority for the forestry sector.

204 Commentators observe that in many cases, there is weak enforcement of supervision by regional government, which leads to violation of the forestry laws. Anullah & Partners Law Firm (2011). Legal Memorandum on Forestry Law and Land Use Related to Geothermal Activities.
There is also a division of authority between the Ministry of Forestry and the National Land Affairs Agency (Badan Pertanahan Nasional or BPN), whereby the Minister of Forestry has the authority to determine the designation of land that is covered by forest, while the agency head of BPN has the authority to determine the designation of land that is not covered by a forest. In other words, if a geothermal developer holds a permit for utilization of a forest area it does not also have to file application for title to land right as long as the developer’s activity remains in compliance with the forestry permits. Title to lands in the non-forested area must be determined by BPN. Accordingly, a geothermal developer may hold an IUP to work in a WKP, a “Lease-Use Permit” (izin pinjam pakai or IPKH) from the Ministry of Forests to work on a WKP geothermal land area in a State Forest, and a right to use permit (Hak Guna Usaha or HGU) issued by the BPN office for WKP land areas adjacent to the State Forests.

205 The IPKH is variously translated as “borrow-use permit”, “lease-use permit”, and “rent-use permit”. In English, “to lease” means to grant the temporary possession or use of (lands, tenements, etc.) to another, usually for compensation at a fixed rate.

206 One issue that should be highlighted is the vagueness of forest boundaries. There are certain areas registered in the map as forest area while in reality the area no longer forest areas; 6 Artedi (2008), p 61.

207 Under Government Regulation 24/2010 on the Use of Forest Areas, the utilization of Forestry Areas for non-forestry activities is permitted in both Production Forest areas and Protected Forest areas subject to obtaining a Forestry Lease-Use Permit from the Ministry of Forestry. The Lease-Use Permit holder will be required to pay various non-tax State Revenues pursuant to these activities and will need to undertake reforestation activities upon ceasing its use of the land. The issuance and validity of the Lease-Use Permit depends entirely on the spatial zoning of the relevant forest area. The spatial zoning plan requires another permit for the use of space (izin permanfaatan ruang). Power plants are only allowed to be built in the National Energy Network and the National Strategic Area. Permits for the use of space are valid for 20 years but are reviewed every five years. The local

208 The “National Energy Network” is a network that consists of oil and gas pipes, electricity power plants, and electricity transmission lines and facilities. The “National Strategic Area” is an area which has been prioritized for spatial zoning in recognition of its significant contribution to State sovereignty, national defense and security, national economy, social, cultures and/or environment (including areas declared as World Heritage Sites). National Strategic Areas are set forth in Government Regulation 26/2008 on the National Spatial Zoning Plan.
governments (Regents and Mayors) have the authority to issue these permits for the use of space.

Geothermal power facilities do not commonly need large tracts of land – an entire geothermal field spans 0.4-3.2 hectares per MW versus (for comparison) 2.02-4.04 hectares per MW for nuclear plants and 7.67 hectares per MW for coal plants. The authors of a Strategic Review study calculated that the projected total land area required to develop geothermal energy results in “only” 26,570 hectares to build 9,500 MW by 2025. This geothermal land usage figure is small compared to other development activities in Indonesia. Nonetheless, if not explored and exploited using the best available technologies and taking into account sustainability principles, geothermal may lead to degradation of forests. But if done responsibly, geothermal energy development can provide an incentive for the proper management of forests and support the livelihoods of forest-dependent communities. The geothermal energy development in Gunung Salak, West Java is a good example of balancing geothermal development with forest conservation.

Use of a forestry area (particularly in a Rights Forest) will often also require the making of land compensation transfers or compensation payments to local landowners. The Director General of Forest Protection and Nature Conservation (within the Ministry of Forestry) has announced that geothermal businesses no longer need to obtain land permits in order to operate in Protected Forest areas. Instead they must enter into a profit sharing arrangement with specified conservation funds to be paid to the Ministry of Forestry. This approach is similar to ones in place in other countries, for example Kenya. The Ministry of Energy and Mineral Resources has a different view. The MEMR, with its focus on low cost electricity, wants no additional monetary burden placed on geothermal energy resource development. As of October 2013, this issue is still under interagency review.

8.4 BORROW-USE PERMITS FOR FORESTRY AREAS

Government Regulation 24/2010 allows mining, power plants and other projects that are deemed strategically important (such as toll roads, telecommunication network and broadcasting facilities) to take place within Protected Forest areas. The definition of "strategically important activities" is broadly defined in Government Regulation 24/2010 as those activities that have a significant impact on state sovereignty, defense, economic, social and cultural growth, and environmental preservation. The Ministry of Forestry (MoFor) clarified the definition of "strategically important" activities in MoFor Regulation 18/2011, which regulation provides that Lease-Use Permits for Production Forest areas and Protected Forest areas may only be granted where the activity has a clear strategic purpose. Geothermal is designated as one of the activities with a “clear strategic purpose”. The Regulation also clarifies the process for obtaining a Lease-Use Permit. The key provisions of MoFor Regulation 18/2011 are as follows:

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211 Prior to the promulgation of MoFor Regulation 18/2011, obtaining a "Lease-Use" Permit for using Production Forest areas and Protected Forest areas for non-forestry use (including mining related activities) historically has been covered under Ministry of Forestry Regulation P43/Menhut-III2008 dated 10 July (MoFor Regulation 43/2008) and associated authorities.
Types: The regulation divides Lease-Use Permits into two types, namely (i) survey or exploration Lease-Use Permit that is valid for two years and extendable for a single one year term; and (ii) An exploitation Lease-Use Permit that is valid for the same period as the underlying WKP business license (e.g., an IUP).

Applications: Applications are to be made to the Ministry of Forestry (subject to a couple of exceptions). The Ministry of Forestry, if it accepts the application, will issue an Approval in Principle License (ijin prinsip) which is valid for two years. The final Lease-Use Permit is to be issued following a further application once the conditions of the Approval in Principle License have been satisfied. The time frames for issuance set out in MoFor Regulation 18/2011 is within four months for an exploration Lease-Use Permit and within two months for exploitation Lease-Use Permit.

Environmental Impact Assessment: The regulation sets forth a number of Environmental Impact Assessment (AMDAL) requirements; however, an AMDAL is expressly not required for exploration Lease-Use Permit applications.

Compensation: These Lease-Use Permits carry with them a compensation requirement that when geothermal developer utilizes a forest area for commercial purposes under a condition in which the total forest area in the relevant province where the target forest areas is situated comprises less than 30% of the total prevention land area; then the developer must provide compensation land in the ratio of 1:2. In other words, the geothermal developer must provide two acres of compensation land for each acre it develops.

Assignments: Permits granted by the Minister of Forestry may be assigned to any third party after obtaining written approval from the Minister of Forestry. In a geothermal development context, the effective time frame of Lease-Use Permits may be extended to match the time frame of the validity of the IUP permit held by the geothermal developer, or be terminated by the Minister of Forestry if there has been a violation.

The permitting process (Lease-Use Permits for survey, exploration and other activities and the Approval in Principle Licenses) is shown in Figure 8.3. Government Regulation 24/2010 and MoFor Regulation 18/2011 should have positive long-term implications for geothermal power plants and production sites since such a large percentage of the identified geothermal fields are located in State Forest areas. Prior to the issuance of Government Regulation 24/2010, many geothermal operations were unable to operate within Protected Forest areas due to strict restrictions on their activities. With an explicit policy to support

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213 Lease-Use Permits for mining activities (i) with crucial impact, (ii) covering large Forest Areas and (iii) having strategic value, which are conducted in Special Mining Business Areas (Wilayah Usaha Pertambangan Khusus or “WUPK”), may only be granted upon approval by the House of Representatives (Dewan Perwakilan Rakyat or “DPR”). It is difficult to tell how effective Government Regulation 24 and MoFor Regulation 18/2011 will be in practice. While “Approval in Principle Licenses” (ijin prinsip) can be granted by the Ministry of Forestry for an initial period of up to two years extendable, the full forestry Lease-Use Permit (ijin pinjam pakai) requires the approval of the House of Representatives (“DPR”). Approvals from DPR have historically been difficult to obtain and subject to political considerations. There is, of course, no guarantee that such an approval will be granted at all.
accelerating geothermal energy development, the Government continues to balance policies
that ensure that lands acquired for geothermal energy use are not in high value Conservation
Forests with sensitive ecosystems, and that impacts and risks on the forests are mitigated. The
2011 Memorandum of Understanding No. 7662 (MEMR/MoFor MOU 7662/2011) between
MEMR and MoFor helps fast-track permits for geothermal energy development in
Production Forest and Protected Forest areas and also ensures conservation of forest areas
where geothermal energy development takes place.

Figure 8.3 The Lease-Use Permitting Process

8.5 LAND USE & ACQUISITION

8.5.1 State Land

In general, land in Indonesia is either State land or private land. Private land is land with
private (non-State) ownership rights on it, either registered or meeting the qualifications to be
registered. There are two subcategories of State land:

State land: Land which the Government has granted certain use rights to
designated persons or legal entities; and

Free State land: State land on which the Government has granted no use rights.

Buildings are not legally part of the land and because land ownership is individual,
not commercial.214 There must be a separate title for commercial buildings. Civil law permits
a separate tenure whereby one person’s building can exist on another’s land.215

214 The distinction between “individual” and “commercial” may be an important one in some
circumstances; however, a legal entity can own land if that legal entity is Indonesian –owned. International
geothermal development companies are unlikely to qualify, and multi-year 50-year leases are the norm.
8.5.2 Tenures in the Geothermal Context

Indonesia’s 1945 Constitution states that all natural resources are owned by the State for the benefit of the people. The Basic Agrarian Law 5/1960 (BAL, Undang-undang Pokok-pokok Agraria), which was aimed at reconciling national and adat legal codes governing land rights, is the predominant body of law governing land rights, and it recognizes the right of private ownership. This Law was augmented by the passage of a land acquisition bill in December 2011 that enshrined the concept of eminent domain and established mechanisms for fair market value compensation and appeals. The National Land Agency registers property under Government Regulation 24/1997, although the Ministry of Forestry administers all forestland. Registration is sometimes complicated by local government requirements and claims as a result of decentralization. Registration is also not conclusive evidence of ownership, but rather strong evidence of such. Foreigners are not allowed to own land in Indonesia, but can acquire the rights to use, sell, lease, and mortgage land through an Indonesian entity. Foreign investors’ land holdings are usually obtained through long-term lease agreements (normally for 30 years) with the Government or with private parties. These lease holdings can be used as collateral. Government regulations allow mortgages to be registered against real property.

There are presently five types of basic land tenure, with Hak Milik the highest and nearest to freehold tenure. These land ownership tenures are:

- Hak Milik – ownership (freehold)
- Hak Guna Usaha – cultivation only
- Hak Guna Bangunan (HGB) – building only
- Hak Pakai – use only
- Hak Pengeolaan – land management only

The current regulations on land acquisition (principally Presidential Decree 36/2005 as amended by Presidential Decrees 65/2006 and Regulation of Head of BPN 03/2007) are aimed at accelerating land acquisition for public purposes. In many countries geothermal developers are accustomed to governments, exercising the right of eminent domain when the developer requires private land for a public purpose. In Indonesia, limitations exist in applying for land expropriation (which requires the involvement of the President) and negotiating compensation (which requires the involvement of an independent land acquisition committee, a land appraiser, and representatives of the Government).

Government Regulation 11/2010 regarding the Enforcement and Empowerment of Abandoned Land stipulates that State land that originated from abandoned land will be allocated to society through agrarian reform, strategic programs and national reserves. The

218 This hierarchy of rights, uniquely linked to the use of land, has blurred the boundary between land administration and land management. Under such a structure the land registration system is a de facto planning control mechanism.
The Law on Land Acquisition Procedures for Public Interest Development, **Law 02/2012** specifies time limits on the land acquisition process and supports a more legally certain process. The law seeks to facilitate land acquisition in the public interest for electrical transmission lines, and other public infrastructure projects (such as geothermal projects) and significantly increases the feasibility of land acquisition projects. The law seeks to clarify roles, impose time limits on each phase of the land acquisition process, deter land speculation, and curtail obstructionist litigation, while still ensuring safeguards for land-right holders. However, the geothermal developer should be mindful that the crucial power of revoking land rights will rest with provincial governors; therefore, the long-term effectiveness of 2/2012 – or potential misuse as a tool of expropriation – will depend in part on the inclination of respective governors.

The IUP Holder has the responsibility to acquire the land for its geothermal business in accordance with prevailing laws and regulations. The land holder shall allow IUP Holder to commence geothermal business in that land if (i) prior to the commencement of activities, the business presents its IUP license and duly inform the land holder of the purposes and location of activities; and (ii) the settlement of the land acquisition has been completed or, in the alternative, guarantees for resettlement have been agreed between the IUP Holder and the holder of land title (or land users).

Lands dedicated for geothermal businesses are generally granted with right to use (hak pakai). Note, however, that if there are spaces within WKP areas that have not been granted to other persons, the BPN may grant higher titles of land rights.

### 8.6 LAW 32/2009 ON ENVIRONMENTAL PROTECTION & MANAGEMENT

In October 2009, the Indonesian Parliament passed **Environment Law 32/2009** (the “2009 Environment Law”). The Law requires investors to comply with specific environmental practices and secure environmental permits before they begin operations. An environmental impact analysis (**Analisis Mengenai Dampak Lingkungan** – **AMDAL**) is required for projects greater than 10 MW and an environmental management effort and environment efforts monitoring report (**Upaya Pengelolaan Lingkungan Hidup dan Upaya Pemantauan Lingkungan Hidup** – **UKL-UPL**) are required for projects less than 10 MW. The AMDAL and the UKL-UPL is a prerequisite to obtaining a business license. In addition, investors are exposed to special environmental taxes.

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219 Land acquisition in government projects under construction process are sometimes delayed because the presidential regulation as derivative regulation from the Law on Land Procurement for Development for Public Interest has not yet been issued as of September 2013, see, e.g., Dinisari. Mia Chitra and Paripurna, Arsyad, 2012. *Land Acquisition for Toll Road May Halted, Bisnis Indonesia, http://en.bisnis.com/articles/land-acquisition-for-toll-road-may-halted*


221 US State Department, Bureau of Economic and Business Affairs, 2012. *Investment Climate Statement (June 2012).*


223 PT PLN (PricewaterhouseCoopers International Limited), *supra*, p 25.

224 EIA was officially introduced under the Basic Environmental Law. 4/ 1982. Government Regulation 29 /1986 provided the implementing regulation, and established the EIA system in Indonesia. Since then, the EIA regulation has been regularly revised to reflect institutional changes, and increased understanding of EIA. In the nineties, reforms of the regulation shifted responsibilities for EIA review, and provided more inclusive provisions for public involvement. After adoption of regional autonomy laws, the Ministry for Environment issue decrees to clarify regional mandates for EIA. In 2006, the Ministry of Environment issues two decrees (No. 8 and No 11) to further detail EIA procedures and revise the list of projects subject to EIA. In 2009, the
Government Regulation 27/1999, concerning Environmental Impact Assessment (EIA) describes the procedures for the preparation, review, approval and public disclosure of environmental assessments. Article 3 of the Regulation obliges the Minister of Environment (Kementerian Negara Lingkungan Hidup or KNLH or MEnv) to specify the types of businesses that are likely to give rise to significant impacts. The Minister promulgates these licenses types through issuance of a Ministerial Decree, the most recent of which is MEnv Regulation 11/2006. Annex I of that regulation specifies that projects involving exploitation or development of geothermal energy of 55 MW or greater require an EIA particularly in reference to potential impacts on water, air, flora and fauna, social and economic activities, and local culture. Annex II of MEnv Regulation 11/2006 also lists the types of conservation areas within which areas any proposed project, regardless of type or size, must have an EIA: i.e., Conservation Forests, peat swamps, aquifer recharge areas, beaches and riverbanks, areas surrounding lakes and springs, national parks and reserves, marine parks and reserves, and national parks, tourism parks and forest reserves. The content of an EIA is specified in MEnv Regulation 08/2006.

- Geothermal power projects smaller than 55 MW and not located in any of the conservation areas would require an environmental management plan and monitoring plan, the contents of which are specified in MEnv Decree 86/2002 regarding Guidance on the Preparation of UKL/UPL.225

According to the Global Environment Facility, in 2008 the AMDAL requirements were generally adequate to address environmental and social safeguards, but their implementation in various sectors, including energy, often falls short of the standards desired by the Ministry of Environment. Typical problems in the standards of an EIA included lack of shared understanding among developers, EIA preparers, and the governments on the scope of:

- An environmental assessment;
- Failure to collect sufficient data and apply analytical techniques so that impacts can be predicted in quantitative terms;
- Disconnects between EIA and project planning and licensing, so that permits are issued without regard to EIA approval; and
- Weak implementation of mitigation and monitoring plans.

On 23 February 2012, Government Regulation 27/2012 on Environmental Licenses was issued to regulate the environmental impact documents (AMDAL, UKL-UPL), and the protection of the environment226. Government Regulation 27/2012 is the implementing

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226 GR 27/2012 is an implementing regulation of the 2009 Environmental Law 32/2009 and revokes Government Regulation 27/1999, which previously regulated two types of environmental reporting and
regulation for Articles 33, 41, and 56 of **Law 32/2009** on Environmental Protection and Management, which replaced **Government Regulation 27/1999** on Environmental Impact Analysis. An environmental license is now defined as a license issued to a party engaged in any business activity that requires an AMDAL or an UKL-UPL assessment. In principle, the AMDAL is a study of the potential significant impact of the proposed business activity on the environment, while the UKL-UPL covers monitoring and management efforts undertaken for business activities that are not likely to have significant impact on the environment. The required AMDAL and UKL-UPL assessments must be completed before an environmental license can be issued. In other words, any geothermal business activities that require an AMDAL or UKL-UPL also require an Environmental License.\(^{227}\) The UKL-UPL is also prepared at the planning stage of a business activity by completing the prescribed forms and submitting them to the “relevant authority” set forth in regulations. An UKL-UPL is required for every business activity located in the same ecosystem. The application for an Environmental License must be submitted along with its supporting documents, such as the AMDAL or UKL-UPL, to the Minister of Environment, Governor, or Regent/Mayor as applicable. The application will be published in the media and posted on a notice board at the site within five working days of receipt of the complete application. The AMDAL Evaluation Commission reviews all AMDAL applications once they have been completed. The Commission has 75 working days to provide a recommendation and on receipt of an AMDAL application. Upon receipt of the recommendation, the Minister, Governor, or Regent/Mayor has 10 working days to approve or reject the AMDAL application.

In obtaining an Environmental License, the holder must:

- Comply with the terms and conditions of the environmental license;
- Submit a report in compliance with the terms and conditions of the environmental license to the Minister, Governor, or Regent/Mayor every six months; and
- Provide guarantee funds for environmental recovery.

Sanctions for failure to comply with Government Regulation 27/2012 may include written warnings or the suspension and eventual revocation of the Environmental License and operating permits. Sanctions for non-compliance can also include fines, revocation of operating permits and/or imprisonment. The Environmental License will be issued by Ministry of Environment Governor or Regent/Mayor, as relevant, in the form of an Environmental Feasibility Decision (**Keputusan Kelayakan Lingkungan Hidup**) a decision stating the acceptability of the environmental feasibility of the business plan and/or activities obliged to be completed, plus AMDAL or UKL-UPL recommendations. The Ministry of Environment is responsible for regulating and monitoring environmental aspects related to the geothermal sector. Commentators have noted that Indonesia has had a history of weak environmental monitoring, but the 2009 Environment Law and a wider process of judicial reform, is beginning to change this situation. In addition, decentralization encourages regions to implement various environmental monitoring instruments such as AMDAL evaluations.\(^{228}\) The Government of Indonesia’s current framework and process for decentralization provides the opportunity for provincial and district (kabupaten) governments to plan and manage their own programs. The legal framework also provides widespread opportunities for provinces for companies operating in Indonesia: (i) an Environmental Impact Analysis Report (“AMDAL”) and (ii) an Environmental Management/Monitoring Efforts Report (“UKL – UPL”).

\(^{227}\) Certain stated business activities are exempt from the AMDAL requirement.

\(^{228}\) See, e.g., http://baseswiki.org/en/Ministry_of_Environment_(MEnv)/Ministry_of_Forestry_(MoFor);
http://www.greenassembly.net/indonesia/indonesia-ministry-of-environment/
and regencies to determine their own priorities and be directly involved in environmental management and monitoring. Preparation of environmental assessment reports of geothermal energy projects is the responsibility of the project proponent. The Environmental Agency at various levels is responsible for evaluation and approval of EIA reports as follows:

- Where the project site is located in one Regency/City and the regency and/or city has an EIA team, the environmental management institution responsible for evaluation and approval of the document is the concerned Regency/City.

- Where the project site is located in one regency or city and the regency and/or city does not have an EIA Team, the environmental management institution responsible for evaluation and approval of the document is the concerned Province.

- Where the project area extends over more than one regency or city and the regency and/or city has an EIA Team, the environmental management institution responsible for evaluation and approval of the document is the concerned Province.

- Where the project area extends over more than one province and the province has an EIA Team, the environmental management institution responsible for evaluation and approval of the document is the State Ministry for Environment or the Ministry of Environment.

The following Table 8.2 is the established legal and regulatory regulation for the implementation of AMDAL or UKL/UPL:

<table>
<thead>
<tr>
<th>Law 32/2009</th>
<th>Environmental Protection and Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government Regulation 27/2012</td>
<td>Environmental Licenses</td>
</tr>
<tr>
<td>Head of BAPEDAL Decree 08/2000</td>
<td>Guidelines for Public Disclosure and Public Consultation in AMDAL</td>
</tr>
<tr>
<td>Head of BAPEDAL Decree 09/2000</td>
<td>Minimum Standard of AMDAL Terms of Reference</td>
</tr>
<tr>
<td>MEnv Decree 86/2002</td>
<td>Guidance on the Preparation of UKL/UPL</td>
</tr>
<tr>
<td>MEnv Decree 11/2006</td>
<td>Activities Requiring AMDAL</td>
</tr>
<tr>
<td>MEnv Decree 05/2008</td>
<td>AMDAL Evaluator Working Guidelines</td>
</tr>
<tr>
<td>MEnv Decree 24/2009</td>
<td>Guidelines in Evaluating AMDAL Document</td>
</tr>
<tr>
<td>MEnv Decree 07/2010</td>
<td>Competence Certification in developing AMDAL document and requirements for Institution Providing Training for AMDAL Researcher</td>
</tr>
</tbody>
</table>

Source: BAPPENAS, 2013

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Additionally, an overview of environmental mitigation measures and a hypothetical Environmental Impacts Mitigation Matrix for a typical geothermal project is provided in Appendix E (Geothermal Environmental Impacts & Mitigation Practices). It identifies potential environmental impacts that could occur during each stage of the project and proposed mitigation measures to address each impact. A developer would also identify its institutional responsibilities for implementing the Plan including an environmental monitoring plan to ensure its effectiveness.  

8.7 WATER RESOURCES LAW

Responsibility for water supply development rests on the State as part of a policy “to ensure universal access to water for minimum daily basic needs to support a healthy, clean and productive life. The State policy is primarily articulated in Law 7/2004 on Water Resources and Government Regulation 16/2005 on Water Supply System Development. Water supply development includes many aspects: planning, construction, operations and maintenance, and monitoring and control of services. The authority to develop water supply within their jurisdiction primarily rests on local governments, who must act consistently with national and provincial policies and strategies. Under the law, this authority is executed through nationally or regionally owned enterprises Badan Usaha Milik Negara (BUMN) or Badan Usaha Milik Daerah (BUMD). Respectively, the Joint Decrees of the Ministries of Public Works and Energy and Mineral Resources 04/1991 and 76/1991 address the utilization of water resources for geothermal resources businesses.

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230 Asian Development Bank, Karaha Initial Environmental Examination, Geothermal Power Development Project 43249, pp. 63-71 (Oct. 2011). Figure 8.4, relies on the Karaha environmental Impact and Mitigation Study.
Figure 8.4 AMDAL Process Overview

Indonesia's Company Law, Law 40/2007\textsuperscript{231} imposes environmental obligations on companies undertaking business activities in the natural resources sector, i.e., geothermal development companies. The cost of these obligations is to be borne by the company. While the obligations apply to geothermal producers, ironically they may exclude IPPs using non-renewable feed stocks. This 2007 Company Law also requires that a company that engages in a natural resources business conduct to corporate social and environmental responsibility (CSR) activities. Article 74 of the Company Law is intended to continue creating corporate culture relations that are in harmony with the environment as well as the values, norms and cultures of local society. In this regard, on April 4, 2012, the Government issued Government Regulation 47/2012 on Corporate Social and Environmental Responsibility.

Under Article 74 paragraph (1) of the Company Law, there are two types of companies that are required to undertake Corporate Social and environmental responsibilities (CSR), namely:

- Companies that perform business activities in management and utilization of natural resources (including geothermal).
- Companies that do not manage and utilize natural resources, but whose business activities have impact on natural resources capability functions.

Government Regulation 47/2012 on Corporate Social and Environmental Responsibility specifically covers companies that engage in businesses in the field of geothermal resources and electricity. A geothermal developer, be it private or public, is therefore subject to Regulation 47, and as such, can discharge its mandatory CSR obligations by conducting CSR activities itself or through third parties, provided that the implementation cost is included in its annual business plan and the activities are conducted by its Board of Directors, approved by its board of commissioners or in a general meeting of its shareholders, in accordance with its Articles of Association. The budget for CSR activities is required to be calculated as a part of the company’s operational cost and must be included in the annual report provided to shareholders at the company's meeting. Failure to implement mandatory CSR regulations as required under Regulation 47 will subject the company to penalties in accordance with prevailing laws and regulations. Corporate social and environmental responsibility is also the subject of Article 15 of Law 25/2007 on Capital Investment (the “Investment Law”). In the Investment Law, the legal risks for Companies that do not undertake CSR are regulated in Article 34 of the Investment Law, which imposes administrative sanctions such as:

- Written warning;
- Restrictions on business activities;
- Suspension of business activity and/or investment facilities; or
- Revocation of business activities and/or investment facilities.

As of September 2012 there are no implementing regulations in effect that implements the imposition of such sanctions under either Law 40/2007 or Law 25/2007.

8.9 SUMMARY
Decentralization and regional autonomy have been in existence only since 1999 – a relatively recent political event of major proportions. Consequently, the sorting out of the respective authority between the national and regional governments is still being tested. From a governance perspective, unresolved interrelationships between the bureaucracies of the Government of Indonesia and the local governments have the potential of being a source of confusion if not frustration to the geothermal developer. Provincial governments and regencies have primary responsibility for geothermal resources. The Government of Indonesia clearly has a governance role (for example the Ministry of Forestry with respect to forest areas and the National Land Affairs Agency with respect to land areas and the Ministry of Environment with respect to pollution mitigation). The local governments also have some degree of authority and responsibility for (i) the forest areas, (ii) the land both inside and outside of the forests, and (iii) environmental regulation, of which the exact dimensions are still in development.

Forestry land issues are a major concern to the geothermal developer, since a large portion of geothermal resource areas in the country underlie Protected Forests. Although there may be an inherent conflict between the policies governing the protection of forest and the operation of geothermal wells and power plants in those forests, the protection of the forest and development of geothermal energy can be co-existent and complementary. Both of these policy activities enhance carbon reduction, and geothermal development is not only environmentally benign, but can enhance forest areas as has been proven in various geothermal locations throughout the world – Kenya for a notable example. Environmental protection in Indonesia is becoming of increasing importance from the national perspective, and is evolving on the regional level. The geothermal developer should expect to file AMDAL (environmental impact) documents in most developmental stages. However, there is a consensus that the environmental requirements in Indonesia are not as stringent as they are in many other countries that develop geothermal energy. Nevertheless the geothermal developer will require an environmental license from the Minister of the Environment or the responsible Governor, Regent or Mayor.

Like all forms of electric generation, both renewable and nonrenewable, geothermal power generation has environmental impacts as well as benefits. The environmental impacts of geothermal installations, however, are limited compared to all forms of nonrenewable energy and most forms of renewable energy. A litany of mitigation techniques that are worldwide available indicate that the mitigated environmental impact will have a little (if any) negative effect in the areas in which geothermal energy is developed. The Company Law and the Investment Law regarding Corporate Social Responsibility will govern the operations of companies that are developing geothermal energy and merit the attention of the developer. CSR activities are required to be calculated as a part of the company's operational cost and must be included in the company’s annual report. The bottom line is that with respect to forest, land and CSP issues the geothermal developer may be dealing with coexistent, concurrent or competing jurisdictional issues as between the national and the regional governments. Additionally, the authority of each of the regional governments also differs between and among the jurisdictions; therefore, it is difficult to generalize about regional governance other than to comment that for the geothermal developer, the rules of the game will be different and diverse.
CHAPTER 9

GEOTHERMAL DEVELOPMENT PERSPECTIVES & SELECTED CASE HISTORIES

9.1 GEOTHERMAL PROJECTS IN INDONESIA

This chapter presents three case histories of geothermal projects in Indonesia – two in Sumatera (Seulawah Agam and Sarulla), and one in Java, Kawah Kamojang. These three geothermal projects were selected to present a range of various development schemes – namely, a Public-Private Partnership (PPP), an Independent Power Producer (IPP) and a Public Project – and to show how each has been forwarded in developing geothermal energy in Indonesia. The case studies review the history and hurdles encountered in each project development and the lessons learned on how those difficulties where addressed and overcome. The three Geothermal Working Areas (WPKs) case studies reviewed are:

1. **Seulawah Agam:** Seulawah Agam is a “New WKP” geothermal project. This project will be the first geothermal project developed under the Public-Private Partnership scheme with a regional government entity. Under the jurisdiction the Province of Aceh, this PPP will also be the first geothermal project in Indonesia to be granted a government guarantee.

2. **Sarulla:** An undeveloped “Legacy WKP”, Sarulla will be completed under private development as an IPP through a Power Purchase Agreement (PPA) with PLN. As of 1993, thirteen existing geothermal production wells were drilled by Unocal under Joint-Operating Contract (JOC) with PGE and Energy Sales Contract (ESC) with PLN – prior to the 1997 financial crisis and the Geothermal Law 27/2003. After overcoming numerous bureaucratic and financial obstacles, the project has reestablished operation under a private-sector IPP consortium.

3. **Kawah Kamojang:** In operation since 1984, Kawah Kamojang is also a “Legacy WKP” and the first major geothermal system developed in Indonesia. It is located in forest areas and as such was the first geothermal field to address the conflicting environmental issues related to development in Protected and Conservation Forest areas.

These three models present different aspects of geothermal developments in Indonesia. In the following pages are more details regarding these three WKP project histories, barriers overcome, and lessons learned.

9.2 SEULAWAH AGAM GEOTHERMAL FIELD

9.2.1 Seulawah Agam Project History

The government of the Aceh Province has decided to develop the geothermal resource of Seulawah Agam on island of Sumatera, located in Mount Seulawah area and its surroundings, see Figure 9.1 The Seulawah Agam Geothermal Work Area (Seulawah Agam WKP) was
The Seulawah Agam WKP was initiated in 2007 with a preliminary survey conducted by the MEMR’s Geological Agency. The following year, Aceh Province organized the project as a Public-Private Partnership. While several PPPs in Indonesia have been in operation, the Seulawah project is the first geothermal project to which a PPP scheme has been applied. Importantly, a PPP is entitled by law to receive a government guarantee, which further enables the project to receive “soft loan” funding at the relatively low rates offered by major international lenders. The German development bank KfW indicated its interest in funding the exploration phase of the project (notably, the most costly and risky phase of geothermal project finance).

The organization of this project as a PPP with a government guarantee afforded an international development bank the level of security required for loans of this magnitude. However, an international institution lending directly to a provincial or regency-level government (who are the owners of WKP in their jurisdiction under decentralization) raised legal issues since such grants would normally go to the government at the national level. Consequently, the Government issued Government Regulation 02/2012, a regulation designed specifically to enable a local government (in this case Aceh Province), to receive grant funds from an overseas donor (in this case KfW). This new regulation will likewise apply to future grant funding opportunities for projects throughout Indonesia. Success of the Aceh Seulawah project will establish a pattern for organizing future geothermal developments as PPPs. The Government of Indonesia is very supportive of this PPP initiative.

From the perspective of the provinces and/or regencies, the local government may participate in the PPP as a Badan Usaha Milik Daerah (BUMD), meaning a locally-owned
company. The organization of a BUMD has inherent advantages. With 100% local government ownership, the local government participates in the profits of the geothermal development. Moreover, the permitting process of the government enables expedited issuance of requisite permits and licenses. In the case of the Aceh Province, the enterprise is named Perusahaan Daerah Pembangunan Aceh (PDPA). The advantage of this organization to a local government is that it enables them to participate in the ownership and profits of the development. Furthermore, the exploration grant and the subsequent soft loan from KfW, places the Aceh Province in a position to partner with a commercial firm. The commercial partner in a PPP is selected through a competitive tender process. Local and regional governments have traditionally three sources of revenue from a geothermal project: the land tax, the fees from the licenses associated with the exploration and the royalty payments from the sales of steam and electricity from the concession. In the case of the Aceh PPP model, the local government (the Province) also participates in the distribution of profits as a shareholder.

9.2.2 Seulawah Agam Current Project Status

The commercial organization of the Seulawah Agam geothermal power project entails a somewhat complicated three-company arrangement, involving three corporate entities:

(1) A company owned by the Province of Aceh named Perusahaan Daerah Pembangunan Aceh or PDPA;

(2) A special projects company to be established as a private entity that will be selected in a competitive tender process for the Seulawah Agam WKP; this selection will be in accordance with both Indonesian geothermal regulations (under Geothermal Law 27/2003) and KfW’s tender requirements. This entity will be identified as winning “Bidder Company” for the purposes of this discussion; and

(3) A joint operating company Geothermal Energy Seulawah Agam Company or GESAC. GESAC will be established as a partnership with PDPA (the company owned by the Province of Aceh) and a private company (the winning Bidder Company).

GESAC will be owned by both the private entity winning the bid and by PDPA. The relative ownership of the private entity winning the bid and PDPA will be established in a Shareholders Agreement. The winning bidder will further be granted the IUP license including the IUP supplement, which it will then transfer to the Joint-Operating Company, namely GESAC. GESAC will have the task to explore the WKP and to design, construct and operate the future geothermal power plant of Seulawah Agam. PDPA will contribute a grant (~7 million US$), which will be used as initial equity contribution of PDPA to GESAC, and a loan (~72.8 million US$) from KfW for the exploitation stage. The KfW loan will be channeled to GESAC via the Government of Indonesia to the government of the Province of Aceh and then to the province-owned corporate entity PDPA. Sub-loan agreements will be undertaken as per the legal procedures established by Government Regulation 2/2012 regarding regional grants. The commercial set-up of the Seulawah Agam geothermal power project is shown in Figure 9.2, below.

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232 SAGPP Baseline and Transaction Strategy Report7585P01/FICHT-8360002-v1 3
Figure 9.2 Indicative Contractual and Permitting Scheme

Source: Request for Proposal Seulawah Agam Geothermal Power Project, 2012
Once GESAC is established, it will enter into PPA with PLN. As noted above, a model PPA will be included in the tender documents for the Seulawah Agam WKP. During project implementation, other project agreements and permits may need to be concluded by GESAC as shown in Figure 9.1 (for example: sales/lease agreements, exploration contracts, EPC and O&M agreements). With the participation of KfW in the process, the transaction has been established as a model of transparency. KfW has retained a consulting firm Fichtner to prepare and manage the project. All grant monies go to the consultant (rather than to the province) and the consultant arranges the delivery of all goods and services that are involved in the exploration phase.

9.2.3 Seulawah Agam Problems Encountered and Lessons Learned

In summarizing the key features of the Seulawah Agam development, unlike earlier WKP tenders in Indonesia, this WKP incorporates several sophisticated elements. First, the province established a Public-Private Partnership company (i.e. GESAC) with a PPP shareholders agreement. Second, for the PPP to receive grant/loan money from the Government of Germany, a multi-stage sub-lending procedure was established via the Government of Indonesia, to the Aceh Province, to the provincial company incorporated as Perusahaan Daerah Pembangunan Aceh and a further transfer step to the PPP Company GESAC (such procedure is without precedent in Indonesia so far). Lastly, the tender IUP license is complement with an IUP supplement and Model-PPA, both which aimed at clarifying vague clauses in the present geothermal regulations.

In summary, the Seulawah Agam geothermal power project is a model for future geothermal PPP projects, as follows:

- Organizing as a PPP facilitates NGO funding, since a government guarantee is associated with PPP organizations;
- Regencies and provinces can now directly receive grant and soft-loan funding from Non Governmental Organizations (NGOs) for the exploration phase;
- Organizing as a BUMD facilitates government participation in geothermal field revenue;
- Utilizing an independent consulting firm brings needed expertise to the local and regional government (as noted elsewhere in this Handbook, a province or region may only have one WKP, and therefore, local expertise may be lacking);
- Third-party management through an independent consulting firm ensures transparency of the development process.

As the first-type PPP model, these procedures help pave the way for other local governments responsible for the development of WKPs to partner with private sector investors.

9.3 SARULLA

9.3.1 Sarulla Project History

The Sarulla area is located 300 km south of Medan in North Sumatra (see Figure 9.3). In 1993, the total project was governed by a Joint Operating Contract (JOC) agreement with PT Pertamina with an Energy Sales Contract (ESC) with PLN. Unocal Geothermal Indonesia agreed to explore and exploit geothermal resources in a +/-980 square kilometer area including Sarulla and Sibualbuali. During the first seven years of the exploration, Unocal invested over US$45 million in resource exploration and drilled a total of 13 wells. (Pursuant to the terms of the JOC, Unocal agreed to spend at least US$28 million on exploration).
Unocal submitted resource feasibility studies to Pertamina in support of the early program of 330 MW developments at Silangkitang and Namora I Langit – the proven reserves of Sibual Buali is 20 MW (total potential 90 MW), Silangkitang is 100 MW (total potential 395 MW) and Namora I Langit is 210 MW (total potential 965 MW). In 1997, Unocal submitted a notice of intention to develop these resources.

PLN and Unocal agreed to the development of a power facility with a total capacity of 330 MW, with 55 MW to be completed by 1999. The power price for the contract was to be US\$0.07597/kWh for the first 14 years, US\$0.05750/kWh for the following 8 years, and US\$0.05208/kWh for the remaining 8 years. During the initial stage, Unocal planned to construct a 2x55 MW power plant. Unocal would operate and maintain the field facilities and electricity generation facilities, under a Build-Operate-Transfer scheme for the first 15 years. Following the contract agreement, the company invested an additional US\$100 million for the development of infrastructure and the plant site (making their total investment $145 million).

In 1997, under Government Regulation 39/1997, later followed by Presidential Decree 5/1998, PLN could no longer honor this ESC. After contracted negotiations, Unocal requested PLN to buy out the contract and reimburse Unocal for its investments in the Sarulla project. In 2005, PLN agreed to buy out the ESC for US\$70 million (less than half the amount invested by Unocal). The Government of Indonesia transferred the responsibility for the management of its concession from PT Pertamina to PT Pertamina Geothermal Energy which was established in 2006 as mandated by the Government to develop 15 Geothermal Working Areas in Indonesia. In 2007, PLN tendered the concession and the operating contract for 330 MW (estimated to require an investment of approximately US\$1.2 billion).
However, PGE informed PLN that it did not have the authority to tender the concession. They argued that under Article 33 of the Constitution, the Government of Indonesia has the right and responsibility to exploit its mineral resources, including geothermal, for the people of Indonesia. PLN acknowledged (in writing) PGE’s assertion. The open tender was won by the lowest bidder, Geo Dipa Energi (a joint subsidiary of PT Pertamina and PT PLN), for a price of US$0.043 kWh. A contract between PLN and Geo Dipa for the concession and the operation of the field was drawn up, but not signed. The winning bidder Geo Dipa due to financial burden from other fields, was not in a position to develop Sarulla, and therefore the second bidder was offered the concession. The contract was then awarded to the consortium Sarulla Operations Limited (SOL – referred to as MEDCO/SOL) consisting of Medco Power, Itochu, ORMAT, and Kyushu Electric. The MEDCO/SOL consortium requested changes to the contract including changes to the price of electricity.

9.3.2 Sarulla Current Project Status

The ESC was renegotiated with PLN and in April 2010 a new ESC with PLN was signed for an average weighted price over 30 years of US$0.0697. The ESC was signed on the condition that Finance and Development Supervisory Agency (BPKP) confirm to PLN that the price is acceptable. BPKP confirmed in early November 2010 that the price was acceptable. On April 4, 2013, Sarulla Operations Ltd signed a 30-year Power Purchase Agreement (PPA) with Indonesia’s state-owned electricity company PLN. The PPA includes development of a geothermal resource concession owned by PGE in Indonesia’s Sarulla region in North Sumatra, construction of a geothermal plant with a total capacity of approximately 330 MW and an ESC for power generation to PLN. The expected annual sale of electricity (once the site is in full operation) is estimated to be in the order of US$170 million.

Figure 9.4 Sarulla Geothermal Working Area

Source: http://setkab.go.id

The main lesson learned from Sarulla is that the Government of Indonesia took great efforts to bring the project to completion. Senior officials of Government addressed bureaucratic barriers that blocked the site’s development. This IPP geothermal project began
in 1993, but stalled for more than a decade until major intercessions by the Central Government were undertaken.

Since December 2010, this project began to be monitored by the most senior levels of government in order to address and overcome implementation hurdles one by one. The Vice President for Coordination became directly involved as well as numerous ministries, including the Ministry of SOE, Ministry of EMR, and the Ministry of Finance, President’s Delivery Unit for Development Monitoring and Oversight, Finance and Development Supervisory Agency and the Supreme Court.233

Now twenty years after initial exploration, the consortium has started preliminary testing and development activities at the site. The project will be implemented in three phases of 110 MW each, utilizing both steam and brine extracted from the geothermal field to increase the power plant’s efficiency. Construction is expected to begin after the consortium obtains financing, which is expected to take approximately one year. The first phase is scheduled to commence operation in 2016. The remaining two phases are scheduled to start within 18 months of the first phase. The project is expected to obtain construction and term loans under a limited recourse financing package of direct loans from the Japan Bank for International Cooperation (JBIC) and the Asian Development Bank, as well as loans provided by five commercial banks that are expected to be backed by political risk guarantees from JBIC.

9.3.3 Sarulla Problems Encountered and Lessons Learned

In summary – in 1993, Pertamina signed a JOC with Unocal for the operation of the field. In 1997, in the wake of the Asian economic crisis, PLN could no longer honor this ESC to pay the JOC for the electricity delivered. After protracted negotiations, Unocal requested PLN to buy out the ESC contract and reimburse Unocal (partially) for its investments in the Sarulla project. In 2005, PLN agreed to buy out the ESC for US$70 million. In 2006, the Japan Bank for International Cooperation (JBIC) reached an agreement with the Ministry of Finance to encourage the development of Independent Power Producer projects in the country, opening the way for an IPP to start the project afresh through JBIC funding. Then in 2007, PLN tendered the concession and the operating contract for 330 MW (although Unocal had a JOC with PGE). PGE informed PLN, that it did not have the authority to tender the concession and that only the GoI had that right. PLN acknowledged Pertamina’s assertion. The Joint-Operating Contract was proposed to the winning bidder Geo Dipa, but due to financial burden from other fields, Geo Dipa was not in a position to develop Sarulla, and the second bidder was offered the contract. In 2013, after addressing deficient payment and unenforceable terms under the original JOC, the second bidder SOL/MESCO signed the JOC contract for the concession with PLN.

The seemingly insurmountable obstacles were overcome by the will of senior members of the Central Government. The Government strongly supports the development of IPP geothermal projects because of both financial and nonfinancial benefits.

- **Financial Benefits.** If the Sarulla cost of geothermal electricity production will be 6.79 U.S. cents per kWh; per kWh, thereby providing the Government electricity subsidy savings of an estimated Rp 4 trillion per year.

- **Nonfinancial Benefits.** The operation of the Sarulla project can reduce CO2 emissions up to 1 million tons per year.

233 Bappenas, Coordinating Meeting PLTP Sarulla and Downstream Mineral and Coal (presentation made January 16, 2013)
The lesson learned from this IPP project is that involvement of senior government officials enabled the first IPP projects to move forward. When the will of the government is exercised at senior level, projects can progress. This project may have paved the way for future private-sector geothermal IPP project development to move forward in Indonesia.

9.4 KAMOJANG

9.4.1 Kamojang Project History

Kamojang District in the Regency of Garut, West Java, is the first geothermal field developed in Indonesia and one of the first developed in the world. Conducted by the Dutch colonial government, the explorations at Kamojang were a milestone in the historical development of geothermal resources -- with a well named “KMJ-3” successfully producing steam at a shallow drilling depth of only 66 meters. From 1926-28, the Dutch conducted a total of five geothermal exploration drillings but only KMJ-3 produced steam. More than three quarters of a century later (2013), KMJ-3 continues to produce natural dry steam with a temperature of 1400°C and a discharging pressure of 2.5 atmospheres (see Figure, below).

Figure 9.5 Kamojang KMJ-3 Garut West Java, Exploration Well (PGE)

After the success at Kamojang, however, Indonesia’s geothermal development stopped until 1964, at which point, with foreign aid and technical assistance from New Zealand, investigations of geothermal resources resumed. The Volcanological Survey of

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Indonesia and PT Pertamina began conducting geology, geophysics and geochemistry surveys. In 1974, the Government of Indonesia granted to its state-owned oil company PT Pertamina the right to develop geothermal energy in Indonesia. In 1974, again with assistance from the Government of New Zealand, Pertamina drilled the first exploration well at Kamojang and by 1979 had drilled a total of five exploration wells and ten production wells. In 1978, the Ministry of Mines and Energy inaugurated a 250 kW Monoblok (a small unit comprising all components necessary for power production, purchased from Geothermal Energy Corporation) as the first geothermal power plant installed in Indonesia. The Pertamina Geothermal Power Plant (PLTP) at Kamojang was inaugurated in 1983 with PLTP Unit-1 total generating capable of 30 MW. In 1987, Pertamina successfully began operating of PLTP Unit-2 & 3 each with 55 MW generating capacity.

![Figure 9.6 Kamojang KMJ-5 Garut West Java, Production Well (PGE)](image_url)

Source: BAPPENAS, 2011

To increase the capacity of the 140 MW Kamojang Geothermal Field to 200 MW, during the 1990s Pertamina drilled 11 additional wells and two more during the 2001–2002 time frame, thereby securing an additional steam potential of 60 MW. In 2006, Pertamina Geothermal Energy (PGE -- a newly formed subsidiary of PT Pertamina) developed a new geothermal power plant known as Kamojang Unit-4, which commenced commercial operation in 2008. The Kamojang Unit-4 geothermal power plant is the first large scale geothermal power plant built, owned and operated by PGE. A proposed 60 MW Kamojang Unit-5 geothermal field that was to be developed by PGE and funded by Japan

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235 Presidential Decree No. 06/1979.
237 Ibid.
Bank for International Cooperation was cancelled in 2005. When complications arose in developing the resource in a Conservation Forest, the Bank cancelled the loan and development halted. 238

9.4.2 Problems Encountered and Lessons Learned

Geothermal resources Kamojang Units-1, 2 and 3 were completed between 1982 and 1987, before the Asian Financial Crisis of 1997-1998 and before major changes were made by the government to Indonesian geothermal laws. All three power plant units were built and owned by PLN and operated by PT Pertamina.

![Figure 9.7 Kamojang Geothermal Field Garut West Java](image)

Under the Geothermal Law 27/2003 and the 2006 newly formed subsidiary PGE, Kamojang Unit-4 along with the existing Units-1, 2, and 3 took on a new business structure. The new PT Pertamina’s subsidiary PGE conducted both the development and production of geothermal electricity. Construction started in February 2006 and was successfully completed by 2008. The Kamojang Unit-4 geothermal power plant is the first power plant built, owned and operated by PGE with an Energy Sales Contract with PLN. As a result, PGE became: i) the steam supplier for all Kamojang field operations and ii) the power plant owner and generator of 60MWe (Unit-4) and of the total Kamojang field with capacity of 200MWe (Units-1, 2, 3 and 4).

The planning for Kamojang Unit-4 began in 2002 and continued in 2003 as the first United Nation’s Clean Development Mechanism (CDM) project in Indonesia. CDM was designed to contribute to local sustainable development in the host country of United Nations (UN) designated Annex-I countries (developing countries) to achieve their emission

reduction targets in a cost-efficient manner. Geothermal Energy allowed Indonesia to earn certified emission reduction credits through the agreements established under the Kyoto Protocol.

Initially, PLN offered an Energy Sales Contract of US cents 4.2/kWh to PGE; however this low tariff was not economically feasible for construction to begin. The Energy Sales Contract was subsequently renegotiated in 2004 with PLN. Under this new CDM backed ESC amendment agreement, CDM revenues from the United Nations were allocated to PLN (as co-developer of the project) who was able in return to give a more favorable electricity tariff; PLN passed on this CDM revenues to PGE thus enabling PGE to develop this geothermal resource. The tariff was increased from 4.2 cents to 4.42 cents which made the project economics viable. As a result, the CDM value increased the project Internal Rate of Return (IRR) by over 3.83%. Table 9.1 below shows the project’s World Bank estimated benchmark IRR needed to cover project costs is 18.15%; the projects IRR with CDM tariff revenues goes above the established benchmark IRR needed to cover costs, while the tariff price without the CDM fails to reach the World Bank benchmark rate.\textsuperscript{239}

\textbf{Table 9.1 \ CDM IRR Effect}

<table>
<thead>
<tr>
<th></th>
<th>With CDM</th>
<th>Without CDM</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRR</td>
<td>19.87%</td>
<td>16.04%</td>
</tr>
<tr>
<td>Benchmark</td>
<td></td>
<td>18.15%</td>
</tr>
</tbody>
</table>

In the efforts to develop Kamojang Unit-5, the Japan Bank for International Cooperation (JBIC) offered a 995 Million Yen loan to PGE. Soon after the loan agreement was signed in 2005, complications arose in developing the resource. The forestry regulation zoning changed the status of this land from “Protected Forest” to “Conservation Forest”. For Protected Forest user permits must be granted by the Forest Department, and must be renewed every five years, whereas for Conservation Forests prohibits the Forestry Department to release permits extension of use of the area for developing geothermal energy. The Ministry of Forestry can only provide forest utilization licenses in Production and Protection Forests; the law mandates that any development should not be done in Conservation Forest areas of nature reserves. The re-designation of a Conservation Forest is a long process requiring approval from Parliament. As a result, the 2005 loan agreement with JBIC was cancelled. It took an act of Parliament to re-designate the area from Conservation to Protected Forest, and thereby allow the geothermal development of Kamojang Unit-5 to move forward.\textsuperscript{240}

In 1991, the Government issued Presidential Decree No. 45/1991 as improvements on former Presidential Decrees by allowing Pertamina to conduct exploration and exploitation of geothermal resources with a private contractor. Also in 1991, the Government issued Presidential Decree No. 49/1991 (replacing PD No. 23/1981), which decreased the regulated geothermal business tax from 46% to 34%. These policies aimed to help stimulate an increase in the private-sector assistance in the development and production of geothermal energy. Although these decrees and policies were used to contract private sector development of other New WKP fields, they have only recently been utilized at Legacy WKPs, such as Kamojang.

\textsuperscript{239} Ibid.\textsuperscript{240}
As the Government effectively re-designated of land to Protected Forest land, PGE has since begun to independently invest in developing Kamojang Unit-5. As of October 2013, Tokyo-based Sumitomo Corporation has been awarded an Engineering, Procurement, and Construction (EPC) contract with PGE for the construction of a 35 MW capacity Unit-5 geothermal power station in Kamojang, West Java. The project will be part of Kamojang geothermal power plant complex.

Sumitomo Corporation will execute the contract in a consortium with PT Rekayasa Industri and Fuji Electric. Sumitomo will conduct the EPC parts of the projects with Rekayasa Industry, a state engineering firm. Fuji Electric (another Japanese firm), will be responsible for manufacturing and supplying equipment for the project. Rekayasa will carry out the civil work and installation of the plant and the steam collection system. Presently, construction is scheduled to take 23 months and be completed in July 2015. PGE has estimated the investment value of Kamojang power plant expansion to be roughly $58 million.\(^{241}\)

**Figure 9.8 Kamojang Power Plant, Garut West Java (PGE)**

PGE’s Kamojang geothermal field in West Java will generate electricity of 235 MW from proven reserves – with Unit-1 capacity 1x30 MW (completed 1983), Unit-2 & 3 capacity of 2x55 MW (completed 1988), Unit-4 with a total installed capacity of 60 MW (complete 2008) and Unit-5 to add an additional 35MW generating capacity potential (to be completed by 2015).

\(^{241}\) “Sumitomo Corp: Sumitomo Corporation Signs Deal with PT. Pertamina Geothermal Energy for Construction of the Fifth Unit of the Kamojang Geothermal Plant,” by 4-Traders, October 6, 2013.
The Kamojang power plants Unit-4 and Unit-5 were developed under new laws, policies and financial structures in Indonesia that both created and removed barriers in the development of its resources. In summary these issues were:

1. Under Geothermal Laws 27/2003 - PGE was authorized to build, own, operate power plants, thereby making state-owned PGE the first business entity to do so in the country.
2. Due to the clean nature of geothermal energy, Indonesia was able to utilize the United Nations’ CDMs financial credits to help make the Kamojang Unit-4 project development economically viable;
3. Conflicting environmental concerns with regard to the rezoning of Conservation Forest restricted the development of Kamojang Unit-5; this necessitated an act of Parliament to re-label the land from Conservation to Protected Forest, thereby allowing land-use permit be issued in order to develop this clean geothermal resource.
4. Presidential Decrees established in 1991 allowed PGE to utilize the expertise of private sector developers. In 2013 PGE hired an international consortium to expedite development of Kamojang Unit-5.

The overall lessons learned from this Legacy WKP site is that the Government of Indonesia granted PT Pertamina and the subsequent PT Pertamina Geothermal Energy company more flexibility in conducting business operation in order to explore and develop its geothermal resources.

9.5 SUMMARY

Three WKP case studies are presented in this section – Seulawah Agam, Sarulla, and Kawah Kamojang. The first, case study, Seulawah Agam is a New WKP developing under a PPP agreement with the local provincial government. The second, Sarulla is a Legacy WKP explored in the 90s but remained dormant until 2013, but is now being developed by a private-sector consortium under an IPP agreement with the public-utility PLN. The third study, Kawah Kamojang is Legacy WKP operated by the state-owned PGE with 200 MW in capacity and expanding to 35 MW under an EPC agreement.

1. **Seulawah Agam WKP:** This New WKP was established in 2007, with 45,000 hectares and an expected power potential of 100-160 MWe. It will be the first to be developed under a PPP scheme, so the success of this development will establish a pattern for future geothermal developments as Public-Private Partnerships. Local government participation in the PPP is facilitated by expedited issuance of necessary permits and licenses. This PPP scheme allows the local government to participate as a locally-owned company, which will mean they will participate in the distribution of profits as a shareholder.

The project also establishes a model for future potential geothermal PPP projects, where regencies and provinces can receive direct funding from Non-Governmental Organizations for the exploration phase. Additionally, the PPP government guarantee provides investors more security in providing funds to cover high initial costs of exploration and drilling. The KfW funding mechanism brings needed expertise to the local and regional government; in which third-party management ensures transparency of the development process. KfW hired a professional third-party consultant to prepare and manage the project. All grant monies will go through an appointed consulting firm (rather than the province) and this independent consulting
firm will arrange the delivery of all goods and services that are involved in the exploration phase.

2. Sarulla WKP: This project was plagued by seemingly insurmountable obstacles at the onset. In 1993, Pertamina signed a Joint-Operation Contract with Unocal for operation of the field. In 1997, in the wake of the Asian economic crisis, PLN could no longer honor its ESC, and therefore could no longer make payments to Unocal. After protracted negotiations, Unocal requested PLN to buy out the contract and reimburse Unocal (partially) for its investments in the Sarulla project. PLN agreed to buy out the ESC for US$70 million. In September 2006, Japan Bank for International Cooperation reached an agreement with the Ministry of Finance to encourage the development of Independent Power Producer projects in the country, opening the way for an IPP to start the project anew through JBIC funding. In 2007, PLN tendered the concession and the operating contract for 330 MW (although Unocal still has this JOC right with Pertamina). Pertamina informed PLN, that it did not have the authority to tender the concession and that only the GoI had that right. PLN acknowledged Pertamina’s assertion. The winning bidder Geo Dipa was ultimately not able to financially develop the resources, and the second bidder SOL/MEDCO (Sarulla Operation, Ltd) was offered to develop the project. SOL/MEDCO amended the contract terms and entered into the JOC as an IPP concession with an ESC with PLN.

Bureaucratic obstacles were overcome by senior levels of the central government. The Vice President for Coordination became directly involved as well as numerous ministries, including the Ministry of SOE, Ministry of EMR, and the Ministry of Finance. President's Delivery Unit for Development Monitoring and Oversight, Finance and Development Supervisory Agency and the Supreme Court. Government officials realized the benefits of geothermal development, both financial and nonfinancial, in the development of this energy resource. These high-level actions have paved the way to facilitate future IPP projects to move forward.

3. Kamojang WKP: Kamojang has produced steam since 1926. Since the early 1970’s PT Pertamina followed by its subsidiary PT Pertamina Geothermal Energy became the leading business entity owned by the government of Indonesia to develop the countries geothermal resources. The formation of Geothermal Law 27/2003, opened the door for PGE to build, own and operate the countries geothermal as a business entity.

WKP Kamojang Darajat is a Legacy WKP based on MEMR Decree No. 466/Kpts/M/Pertamb/74, 1974 and has an area of 154.318 Ha (36.67 Km x 42.08 Km). This WKP was established before the Conservation Law issued in 1990. This statute helped PGE to develop Kamojang field even after Conservation Law had been issued. However no mechanism had been provided by government to develop geothermal resources in legacy WKPs established before Conservation Law issued. This caused significant time delays to Kamojang development.

New financial resources from the UN’s Clean Development Mechanisms allowed for the development of the geothermal resources to be economically viable, and thus, the successful completion of Kamojang Unit-4. However, Unit-5 was burdened by the Ministry of Forestry’s new zoning of land, which classified the Unit-5 field as Conservation Forest. It took an act of Parliament to re-designate the land to allow for development of this clean energy resources. This opened the way for development of this resources, in which PGE will utilize the expertise of an international consortium to carry out this development. The lesson learned from this Legacy WKP site is PGE
gained more flexibility in conducting business operation in order to develop the countries geothermal resources at Kamojang.

The Kamojang geothermal field has made a huge contribution to Indonesia and the international geothermal industry. For Indonesia, the Kamojang geothermal field became a place of study for other geothermal field developers and university researchers, producing many geothermal experts for the national and international geothermal industry. In its development, Kamojang paid attention to both the environment and the communities in the immediate vicinity. Pertamina implemented many community programs - the CSR fund from Pertamina was used to build a green school, waste Bank, and there was a continuing commitment to keep the environment green and healthy. The community in the Kamojang field also protected the environment by planting trees - in 2012 90,000 trees were planted and by mid 2013 there are more than 75,000 trees planted. Pertamina has attempted to minimize the global warming impact by doing many similar community development projects.

The challenge for PGE at Kamojang is the steam price that is still at 50 rupiah (0.05 cent)/Kwh, even though the development has been going well. The Kamojang geothermal field was operated long before the conservation law was issued in 1990. There was no regulation for development in the conservation forest which caused problems for the geothermal industry. From the 7.805 Ha forest, PGE only used 48Ha being or only 0.07%. Meanwhile, if the forestry and environmental regulations are not issued then the Environmental Impact Analysis required to begin the project would not been issued.

After revisions to the geothermal law that allows geothermal development in a conservation forest area there should be better acceptance by the Ministry of Forestry of geothermal development requirements. This will lead to further geothermal development and maximizing the full potential of the Kamojang and other geothermal fields in Indonesia.
CHAPTER 10

GEOTHERMAL STAKEHOLDERS IN INDONESIA

This chapter introduces the stakeholders in the Indonesian geothermal process. The major players are:

**The Government**: i.e., the Ministries and relevant agencies of the national government. The provinces, regencies and cities are prime stakeholders. Government authorities are represented by 542 autonomous regions (34 provinces, 410 regencies and 98 municipalities as of September 2013). 242

**The Developers**: the Handbook focuses on the geothermal-related developers that are invested in Indonesia, with the hope that the list shall soon be expanded.

**The Utility**: PLN remains the pivotal downstream buyer of electricity for geothermal developers.

**Financial Institutions**: the lending institutions and equity investors always have a major role to play in any private sector investment, and are significant stakeholders in the process.

**Relevant Geothermal Related Parties**: academia, industry organizations and influential newspapers and business journals are important elements in the Indonesian policy mix.

Figure 10.1 is a flow-chart depiction of foreign direct Investment and roles of these key stakeholders in the geothermal sector. On the following pages are brief summaries of the key stakeholders in Indonesia and, when available, we have provided a link to further contact information. *Up-to-date information is available on these stakeholders through the Bappenas Geo Portal located at:*

http://www.geothermal.bappenas.go.id/

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242 See www.kemendagri.go.id.
Table 10.1  Flow Chart of Foreign Direct Investment in Indonesia

[Flow Chart Image]
10.1 NATIONAL GOVERNMENT (MINISTRIES AND THEIR SIGNIFICANT AGENCIES)

10.1.1 Ministry of Energy and Mineral Resources (MEMR)

The MEMR is charged with creating and implementing Indonesia's energy policy, issuing certain business licenses for facilities and licenses in the electricity sector and regulating the electricity sector.

The MEMR is also responsible for the National Electricity Plan (RUKN), for preparing laws and regulations related to electricity, and for the national tariff and subsidy policies.

The MEMR consist of 5 Directorates, 1 Agency, 1 Center of Research & Development and 1 Center of Education & Training. The Directorates relevant to geothermal within the MEMR include the Directorate of Electricity and the Directorate of New and Renewable Energy and Energy Conservation, under which is the Directorate of Geothermal and the Geological Agency.

Jl. Medan Merdeka Selatan No.18, Jakarta, 10110 Indonesia

Phone: +62 (021) 3519881
Fax: +62 (021) 3519881

The homepage of the Ministry of Energy and Mineral Resources is: http://www.esdm.go.id/.

10.1.1.1 Geological Agency (GA)

The Geological Agency is an agency under the MEMR, under the Directorate of New and Renewable Energy and Energy Conservation. The GA promotes geology for the planning, structuring and assessment of the potential of geothermal resources; among its functions are:

- Formulation of policies in the field of geology;
- Development and implementation of research and service;
- Geological survey service, and research and resource services in the field of geology, volcanology and geology disaster mitigation, and environmental geology;
- Provision of advice and information presenting the results of the survey, research and service; and
- Evaluation of geologic research and service areas.

The Geological Agency is responsible for carrying out pre-surveys of geothermal fields, collecting geothermal data and preparing Geothermal Working Areas.

Geological Agency

Ministry of Energy and Mineral Resources

Jl. Diponegoro 57; Duo 40122; West Java. Indonesia

Phone: +62-22-721-5297; +62-21-522-8371
Fax: +62-22-721-6444; +62-21-522-8372
Email: geologi@bgl.esdm.go.id

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243 Government Regulation No. 5/2010 delegated this authority to BKPM for facility and operational permits for captive power plants.
The homepage of the Geological Agency is: http://www.esdm.go.id/geology-agency.html and www.bgl.esdm.go.id

10.1.1.2 Center for Geological Survey (CGS)

The Center for Geological Survey (Pusat Survei Geologi), Indonesia, located at Bandung, conducts studies of earth science related disciplines. The CGS functions under the Geological Agency, with its role to collect and promote geo-scientific data for the sustainable development of Indonesia’s resources. The major activities of the CGS of Geological Agency of Indonesia can be summarized as follows:

- Proper use and maintenance of natural resources such as geothermal energy and mineral resources;
- Prediction, investigation and mitigation of the impacts of natural hazards, like earthquakes, landslides phreatic explosions and subsidence;
- Promoting environmental management and attainment of sustainable development;
- Studies related to natural hazards, environment and land use;
- Conducting research concerned with geological structures and formation and evolution of the earth's crust;
- Studies related to environmental geology and engineering geology;
- Land use planning and waste management; and
- Study of geological phenomena due to hazards.

CGS of Geological Agency
Jl Diponegoro 57, Bandung 40122 Indonesia
Phone : +62-22-7272601/7203205
Fax : +62-22-720-2669.

The homepage of CGS is: www.psg.bgl.esdm.go.id

10.1.1.3 Director General of Electricity (DG-E)

Under MEMR Regulation 667 K/11/2002, the Directorate General of Electricity is responsible for regulating and supervising the development of geothermal power plants.

The duties and functions of Directorate General of Electricity are:

- Formulation of policies in the electricity sector;
- Implementation of policies in the electricity sector;
- Preparation of norms, standards, procedures;
- Criteria in the electricity sector;
- Providing technical guidance;
- Evaluation in the fields of electricity; and
- Administration of the DG-E.

The name “Directorate General of Electricity” replaced the name for Directorate General of Electricity and Energy Utilization, in 2010. Geothermal Developers deal with the Directorate
General of Electricity during PPA negotiations regarding the construction and operation of power plants.

Directorate General of Electricity
Jl. H.R. Rasuna Said Blok X 2
Kav. 07, 08; Kuningan, Jakarta 12950 Indonesia
Telephone : (021) 5225180
Fax : (021) 5256044
The homepage of Director General of Electricity is: www.djlpe.esdm.go.id

10.1.1.4 Directorate General of New Renewable Energy and Energy Conservation (NRE-EC)


The duties and functions of Directorate General of New Renewable Energy & Conservation Energy are:

- Formulation of policies in the NRE-EC sector;
- Implementation of policies in the NRE-EC sector;;
- Preparation of norms, standards, procedures, and criteria in the NRE-EC sector;
- Providing technical guidance and evaluation in the fields of NRE-EC; and
- Administration of the Directorate of NRE-EC.

In geothermal business DG-NRE-EC is responsible for the management of Pre-Survey Activities conducted by the private sector, for Tendering of Geothermal Areas.

GE-NRE-EC
Wisma Budi Building Kav C-6, Jakarta, 12940 Indonesia
Fax: +62 21 5268950
The homepages of DG-NRE-CE are:

10.1.2 Ministry of State Owned Enterprises (MSOE)

The MSOE supervises PLN’s management, sets PLN’s corporate performance targets and approves its annual budget. According to Law 19/2003 on State-Owned Enterprises, a State-Owned Enterprise (SOE), is a business entity in which all or most of the capital is owned by the state through direct investments.

The approximate 120 SOEs in Indonesia, PT PLN, and PT Pertamina (Persero) are the largest.

Jl. Medan Merdeka Selatan No. 13, Jakarta, 10110

182
The homepage of the Ministry of State Owned Enterprises (MSOE) is:
http://www.bumn.go.id/ (http://www.bumn.go.id/daftar-bumn/).

10.1.3 Ministry of Finance (MoF)
The Ministry of Finance approves tax incentives that may be offered by the Government of
Indonesia for an electricity project as well as any Government guarantees. The directorates
and agencies relevant to geothermal within the MoF include the Directorate of Tax,
The Risk Management Unit (RMU) within the MoF is responsible for reviewing requests.
Any approved guarantees are administered by PT PII (which operates the Indonesia
Infrastructure Guarantee Facility – see below).
The Ministry of Finance also determines the electricity subsidy to PLN and loan
arrangements for PLN.

Ministry of Finance
Djuanda Building Lt. 12 Jl., Jakarta, 10710
Phone : +62 21-3849605
Fax : +62 21-3500847
The homepage of MoF is: www.depkeu.go.id

10.1.4 Ministry of the Environment (MEnv)
In general, the Ministry aims to improve the environment and management of natural
resources through sustainable development principles. Specific targets to be achieved are:
- The controlled pollution and environmental degradation of rivers, lakes, coastal and
  marine, as well as ground water;
- Protection of land preservation, biodiversity and forest ecosystems;
- The improvement in air quality and waste management, and hazardous and toxic
  waste; and
- Management of natural resources where the environment is integrated.
The MEnv is responsible for regulating and monitoring environmental aspects related to the
geothermal sector. MEnv has authority over AMDALs and Environment licenses for
geothermal lands that overlap multiple provinces.

Ministry of Environment
Jalan DI Panjaitan Kav. 24, East Jakarta, 13410 Indonesia
Phone : +62 021-8580067-68
The homepage of the Ministry of Environment is: www.menlh.go.id

10.1.5 The National Development Planning Agency (BAPPENAS)
Bappenas is responsible for carrying-out governmental duties in the field of national
development planning in accordance with prevailing laws and regulations.
Within Bappenas is the Project Development Facility that funds designated PPP transactions. Bappenas also includes the Private Sector Cooperation Centre (PKPS) which facilitates cooperation on infrastructure projects between the Government and private investors and which houses the PPP Central Unit (P3CU). P3CU has a number of functions including:

- Providing support to National Committee for the Acceleration of Infrastructure Provision “KKPPI” for policy formulation and assessment of requests for contingent Government support;
- The preparation of the Government's PPP "blue book" which lists project opportunities for private investors;
- Support to Government Contracting Agencies for the preparation of projects; and
- The development of capacity within government agencies for PPP implementation.

Bappenas
Jalan Taman Suropati No.2, Jakarta, 10310 Indonesia
Phone : +62 21 319 6207
Phone : +62 21 3145374
Fax : +62 21 3145374
The homepage of Bappenas is: www.bappenas.go.id

10.1.6 Agencies Dealing with Land Use

10.1.6.1 Ministry of Forestry (MoFor)

The Ministry of Forestry has the responsibility over the nation’s forest area, including establishing the national policy on forestry, establishment of KPH and providing permits for forest function conversion and issuing permits for Lease-Use of forest areas.

The Directorate General of Forest Protection and Nature Conservation (Direktorat Jenderal Perlindungan Hutan dan Konservasi Alam (PHKA)) is a Directorate General under the Ministry of Forestry. Its tasks and functions include planning and implementation of policy in the field of forest protection and nature conservation, including forest protection, forest fire, protected area conservation, wild plants and animals conservation, and natural recreation and environment.

Ministry of Forestry
Building Block I Mangala Wanabakti Lt. 3, Senayan Jakarta, 10270 Indonesia
Phone : +62-21-5704501-04
Fax : +62-21-5730191
The homepage of Ministry of Forestry is: www.dephut.go.id

10.1.6.2 National Spatial Layout Coordination Agency (BKPRN)

BKPRN, a national coordinating body undertakes the national coordination on the establishment of spatial planning, including supporting the establishment of spatial planning in provincial and district regency levels and addressing the strategic issues regarding the spatial plan.
National Spatial Layout Coordination Agency
Gedung Penataan Ruang dan SDA,
Jl. Patimura 20, Kebayoran Baru, Jakarta 12110 Indonesia
Email : timpelaksanabkprn@yahoo.com
The homepage of BKPRN is: www.bkprn.org

10.1.6.3 National Land Affairs Agency (BPN)
National Land Agency is a non-departmental government institution which is under and responsible to the President. In accordance with Presidential Decree 10/2006 the National Land Agency has the task of carrying out governance in the land sector nationally, regionally and sectorally.
National Land Affairs Agency
Gedung Badan Pertanahan Nasional Lantai V
Jalan Sisingamangaraja Nomor 2, Kebayoran Baru, Jakarta 12110 Indonesia
Email : pusdatin@bpn.go.id
The homepage of BPN is: www.bpn.go.id

10.1.6.4 Geospatial Information Agency (BIG)
Geospatial Information Agency (BIG) was born to replace the Coordinating Agency for Surveys and Mapping (BAKOSURTANAL) as a mandate of Article 22 of Law 04/2011 on Geospatial Information (GI), and Regulation 94/2011 regarding the Geospatial Information Agency. Geospatial Information Agency has the task of carrying out government duties in the field of Geospatial Information. Among the functions of BIG are:
Formulation and control of technical policy in the field of geospatial information provide Basic geospatial information services that includes data collection, processing, storage of data and information, and Use of basic geospatial information
Building the National Land Agency Floor V, Jakarta, Kebayoran Baru 12110 Indonesia
Phone : +62 21 7393939
The homepage of BIG is: www.bpn.go.id

10.1.7 Coordinating Institutions

10.1.7.1 National Energy Counsel (DEN)
DEN was formed in 2009 pursuant to Energy Law 30/2007 on the formulation of a National Energy Policy and the determination of the National Energy General Plan (RUEN), and the Planning of Steps to Provide for Any Future Energy Crisis. The President and Vice-President with the Minister of Energy & Mineral Resources as Executive Chairman, chair the DEN. DEN has 15 members, which include the Minister and Government officials responsible for the transportation, distribution and utilization of energy, and other stakeholders. The members of the Council are seven representatives from the ministries directly responsible for supplying, transporting, distributing and utilizing energy; and eight representatives from stakeholders. Ministerial members are appointed by the President and the others are selected by the House of Representatives.
The duties of the National Energy Council are to design and formulate national energy policy, to decide measures to manage energy crises and emergencies, and to monitor the implementation of energy policy that is cross-sectoral in nature.

Address: Jalan Jenderal Gatot Subroto Kav. 49 Jakarta Selatan
Email: sekretariat@den.go.id
Mlist: milis_den@yahoogroups.com

The homepage of National Energy Counsel (DEN) is: www.den.go.id.

10.1.7.2 The Investment Coordinating Board (BKPM)

BKPM acts as a "one-stop" integrated service for the licensing of all electricity projects. Its role includes centralizing the processing of projects that require private participation. As of 2013, some processing is done by the National Development Planning Agency (Bappenas). Indonesia's PPP programs are initially discussed at Bappenas and related ministries and institutions before being forwarded to the "back office" role of BKPM.

The Investment Coordinating Board is responsible for issuing investment licenses to foreign entities and has taken steps to simplify the application process through better coordination between various government institutions. BKPM launched a National Single Window for Investment, which will eventually allow foreign investors to apply for licenses and other services online. Although BKPM is meant to act as a one-stop service institution, investments in the mining, oil and gas, plantation, and other sectors require further licenses from related ministries and authorities. Likewise, certain tax and land permits, among others, typically must be obtained from local government authorities. Though Indonesian companies only require one approval at the local level, businesses report that foreign companies must obtain both administrative and legislative approval in order to establish a business.\textsuperscript{244}

The Coordinating Ministry of Home Affairs, Ministry of Administrative Reform and Bureaucracy Reform, and BKPM issued a circulating letter on September 15, 2010, to clarify investment that crosses provincial and regional boundaries. Investment in one regency is managed by the regency government; investment that lies in two or more regencies is managed by the provincial government; and investment that lies in two or more provinces is managed by Government of Indonesia, or central BKPM.

Capital Investment Coordinating Board (BKPM)
Jl. Jendral Gatot Subroto 44
Jakarta 12190, Indonesia
Email: info@bkpm.go.id

The homepage of BKPM is: http://www3.bkpm.go.id/

10.1.7.3 The National Committee for the Acceleration of Infrastructure Provision (KKPPI)

KKPPI has been established in order to speed up the undertaking of several rural infrastructure development projects. KKPPI is an inter-ministerial committee chaired by the

\textsuperscript{244} 2012 Investment Climate Statement US State Department Bureau of Economic and Business Affairs, June 2012 Report.
Coordinating Minister of Economic Affairs. KKPPI is responsible for policy coordination related to the private provision of infrastructure; KKPPI is also required to endorse requests for contingent government support (i.e., guarantees) for Risk Management Unit (RMU) consideration and approval.

Additionally, KKPPI acts as a clearinghouse to prepare feasibility studies, as well as pre-feasibility studies for some projects. KKPPI also serves as the committee that organizes the financing scheme, whether it should be done by a state-owned enterprise (BUMN) or the private sector.

KKPPI
Jl. Pattimura No. 20 Kebayoran Baru Jakarta, Selatan Indonesia
021-7248932, 739558 ext. 421, 298
Fax: 021-7248932
perpustakaan-pu@pu.go.id
http://pustaka.pu.go.id

10.1.7.4 The National Standardization Agency (BSN)
BSN promulgates the standards that are commonly used in most Indonesian industries; The Geologic Agency and INAGA are currently working in conjunction with BSN to establish National Standards for Geothermal.

The National Standardization Agency
Badan Standardisasi Nasional (BSN)
Manggala Wanabakti Blok IV, 4th Floor; Jl. Jendral GatotSubroto, Senayan, Jakarta 10270 Indonesia

The homepage of BSN is: www.bsn.or.id

10.2 UTILITY: PT PLN (PERSERO)

10.2.1 PT Perusahaan Listrik Negara (Persero) (PLN)
PLN is responsible for the majority of Indonesia's electricity generation and has exclusive powers in relation to the transmission, distribution and supply of electricity to the public. PLN is regulated and supervised by the Ministry of Energy and Mineral Resources, the Ministry of State Owned Enterprises and the Ministry of Finance.

In 2004, PLN was transformed from a public utility into a state-owned limited liability company (or Persero). The 2009 Electricity Law removed PLN's role as the PKUK or Authorized Holder of Electricity Business License. PLN is now simply the holder of an Electricity Business Supply License for Public Use (IUTPL)245.

The 2009 Electricity Law also provides a right of first refusal to PLN for conducting electricity supply in an area before the national or regional Governments can offer the opportunity to regional-owned entities, private entities or cooperatives.

PLN Head Office
Main Building 7th Floor; Jl. Trunojoyo Blok M I/135, Jakarta 12160 Indonesia

245 Article 56 of the 2009 Electricity Law.
10.3 STATE-OWNED GEOTHERMAL DEVELOPERS

10.3.1 PT Pertamina Geothermal Energy

PT Pertamina Geothermal Energy is one of the largest geothermal energy resources companies in Indonesia. The Company was established in 2006 and is operated as a subsidiary of PT Pertamina (Persero), Pertamina's scope of business incorporates the upstream and downstream sectors. Opportunities within Pertamina are a diverse set of businesses: such as exploration, production, refining, distribution to marketing of products, and geothermal.

When established in 2006, PGE was mandated by the government to develop 15 Geothermal Business Working Areas in Indonesia.

In the course of time, the Government through Presidential Decree 76/2000 revoked the previous Presidential Decree and put into effect Law 27/2003 regarding Geothermal Energy, wherein PT Pertamina no longer has monopolistic rights to geothermal energy business, but has the same rights as other geothermal business players in Indonesia.

In implementing the aforementioned law, Pertamina has returned 18 Geothermal Business Working Areas (WKPs) to the Government out of 33 WKPs granted to manage.

PT Pertamina has management rights to 15 Geothermal Working Areas (WKPs) with a total potential of 8,480 MW equivalent to 4,392 MMBOE. Out of the 15 WKPs, 10 WKPs are managed by PT PGE alone, namely (1) Kamojang: 200 MW, (2) Lahendong: 80 MW, (3) Sibayak: 12 MW, (4) Ulubelu, 110 MW (5) Lumutbalai, (6) Hululais, (7) Kotamubagu, (8) Sungai Penuh and (9) Iyang Argopuro and (10) Karahabodas. Three of these areas have been in production with a total capacity of 402 MW

Pertamina Geothermal in its business has always focused on activities to increase production in the three operation areas (Kamojang, Lahendong and Sibayak). Total products generated from the 3 existing operation areas are 9.5 million tons of steam with a generation of 1.3 million MWh. In addition, the contribution of Joint-Operating Contract is 30.37 million tons of steam and 4.1 million MWh. Total annual geothermal steam products are 39.89 million tons with a power generation of 5.36 million MWh.

Kabupaten Bandung, Bandung, Garut 44101
Phone: +62 22-7806882
Fax: +62 22-7806379


10.3.2 PT Geo Dipa Energy

Founded on July 5, 2002, Geo Dipa Energi has since dedicated itself to capitalizing the economical and environmental value of geothermal energy. Leveraging the vast capacity of their power generator projects in Dieng and Patuha – with potential energy being 400 MW of each – Geo Dipa Energi strives to meet national electrical power demand by capitalizing on the cost-efficient and environmental qualities of geothermal energy.

Geo Dipa Energi was a joint subsidiary of PT Pertamina (Persero) and PT PLN (Persero), a leading state-owned enterprise in energy exploration and generation with proven experience in developing and operating geothermal power plants. In February 2011, the composition of the Company's shareholders has been changed, whereby PT Pertamina's shares were taken over by the Government of Indonesia. As a consequence from that corporate action, in December 2011, Geo Dipa Energi transform into a new State-Owned Company.

As of 2013, Geo Dipa Energi manages Dieng Geothermal Working Area and has become a Pertamina KOB partner in Patuha that operates Dieng-1 60 MW, constructing Patuha-1 60 MW and plan to build Dieng-2 60MW and Patuha-2&3 also 60MW respectively.

The homepage of PT. PLN Geo Dipa Energi is: www.Geo Dipa.co.id

10.4 PRIVATE DEVELOPERS

10.4.1 Existing IUP Holders

10.4.1.1 Chevron

Through its wholly owned subsidiary, Chevron Geothermal, Chevron is the world's largest producer of geothermal energy with operations in Indonesia.

Chevron Geothermal manages two geothermal projects in Indonesia—Darajat and Salak, both on the island of Java. The Darajat project supplies geothermal steam, which generates 275 MW of electricity. All power from the Darajat site is sold directly to the national grid. Chevron holds a 95 percent operating interest in Darajat. Chevron also owns and operates the Salak project, which is one of the largest geothermal operations in the world, with a total operating capacity of 377 MW.

Chevron has a 95 percent interest in the Suoh-Sekincau prospect in southern Sumatra. The Indonesian government issued Chevron a license to explore the area. Chevron has taken the first steps toward geological and geophysical assessment. If successful, additional development could potentially add about 200 MW to Chevron's geothermal portfolio.

In the 1990s, Chevron expanded operations to include electric power generation, relying on geothermal power production. In 2007, Darajat III was recognized as the world's largest project registered under the UN Clean Development Mechanisms. In 2009, Darajat III received Certified Emission Reduction certificates from the UN agency managing the Clean Development Mechanism.

Chevron
Sentral Senayan I Office Tower, Jakarta Barat, 10270 Indonesia
Phone : +62 021 5731020
Fax : +62 021 5731030

The homepage of Chevron is: www.chevron.com.
10.4.1.2 PT. Star Energy


Star Energy Tower Wisma Barito, Jalan Let. Jen. S. Parman Kav. 62-63 Jakarta, Barat 11410 Indonesia
Phone: +62 21 5325828

The homepage of PT Star Energy is: www.starenergy.co.id

10.4.2 Potential Developers

10.4.2.1 PT Supreme Energy

PT Supreme Energy was established in October 2007. In early 2008, PT Supreme Energy was assigned by the Minister of Mineral Resources to conduct four pre-feasibility studies in different areas of Sumatera. All were completed in 2009. In early 2010, the Liki Pinangawan Muarlaloboh and Gunung Rajabasa geothermal concessions were awarded to Supreme Energy, in a consortium with GDF Suez. Following this award, mining licenses were issued in April and May 2010. In December 2010, the concession for the Rantau Dedap resource area was awarded to the same consortium.

Sumitomo Corporation joined the consortium in 2010 to develop jointly with Supreme Energy and GDF Suez the Muara Laboh and Rajabasa concessions. PT Supreme Energy, GDF Suez and Sumitomo Corporation are now the shareholders of the Supreme Energy Muara Laboh and Supreme Energy Rajabasa project companies. For Rantau Dedap, Maruben Corporation joined Supreme Energy and GDF Suez as the third partner for further development of this project.

At present, Supreme Energy is conducting Exploration drilling in WKP Muara Labuh. Exploration drilling of WKP Rajabasa will be done on end of 2012 and Exploration drilling of WKP Rantau Dedap will be done on mid 2013.

Supreme Energy

Equity Tower, 18th Floor Sudirman Central Business District (SCBD) Lot 9
Jl. Jend. Sudirman Kav. 52 – 53, Jakarta 12190, Indonesia

The homepage of PT Supreme Energy is: www.supreme-energy.com

10.4.2.2 PT Sabang Geothermal Energy


10.4.2.3 PT Dizamatra Powerindo

PT Dizamatra Powerindo is a Pertamina Geothermal Energy partner in WKP Sibayak-Sinabung. Status as of October 2013 - Production, with a capacity of 10MW.

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247 GDF Suez combined its international assets with those of International Power Plc. in February 2011, thus becoming the world’s No 1 utility in terms of revenue, with a total installed capacity of 107 GW, and 25 GW under construction. GDF SUEZ now has a 70% shareholding in International Power.
10.4.2.4 Cons Medco-Itochu-Ormat

10.4.2.5 PT OTP Geothermal Services Indonesia
PT OTP Geothermal Services Indonesia is a Joint-Venture between Australia Company “Origin” and the India Company “Tata Power”. Under its subsidiary PT. OTP Sorik Marapi Geothermal, OTP Manage WKP Sorik Marapi is preparing to develop 240 MWe.

10.4.2.6 PT Optima Nusantara Energi
Optima PT Nusantara Energy is a company developing geothermal energy in the District Padangcermin Lampung province that could produce electricity for 2x70 MW. Status as of October 2013: Exploration
Jalan Danau Sunter Barat Blk A No.1, Sunter Agung
Tanjung Priok, Jakarta Utara 14350
Phone : +62 21 65832300

10.4.2.7 PT Sintesa Banten Geothermal
PT Banten Global Synergy is the winning bidder for WKP Kaldera Danau Banten. The IUP issuance by the Governor of Banten in 2011. Status as of October 2013: preparation for exploration.

10.4.2.8 PT Jabar Rekind Geothermal
PT Jabar Rekind Geothermal is the IUP Holder for concessions or WKP Cisolok Cisukarame with potency 140 MW, located at Pelabuhan Ratu, West Java with a total area of mining working area of approximately 15,580 hectares.
Cisolok geothermal area is located in the sub-Cisukarame Pelabuhan Ratu, Sukabumi, West Java. It can be reached by four-wheel vehicles is approximately 70 km from the town of Sukabumi or approximately 140 km from the city of Bandung.
The company is challenging the results of geological, geochemical and geophysical prospects that inferred the existence of three regions, namely:
Regional Cisolok
Regional Cisukarame
Regional Trance
Jabar Rekind Geothermal Head Office:
Jl. Tubagus Ismail Depan No. 1A Bandung 40134 Jawa Barat, Indonesia
Phone : +62 21 7975574
Homepage of PT Jabar Rekind Geothermal is: www.jabarrekindgeothermal.com

10.4.2.9 KJK Yala Teknosa
KJK Yala Teknois a developer of PLTP Cibuni, West Java. Total capacity of 140 MW. This WKP has drilled three wells and one of them is a production well with capacity 4.2 MW. The development of this WKP is pending due to internal and legal issues,
10.4.2.10 PT Tangkuban Perahu Geothermal Power
PT Tangkuban Perahu Geothermal Power is the developer of PLTP Tangkuban Perahu, West Java, has a capacity of 100 MW.
Status as of October 2013: PPA negotiations and forestry license.

10.4.2.11 PT Wahana Sambadhasakti
Established in 1994, the company has WKP Geothermal Ciater Tangkuban Perahu, West Java from the Minister of Mines and Energy No. accordance letter. 3970/30/M.DJM/1997 on 23 October 1997 with an area of 2,000 Ha.
Status as of October 2013: PPA negotiations
PT Wahana Sambadhasakti
Wisma Eka Karma; Jl. Kapten P. Tendean No. 15 Jakarta 12790
Phone: +62 21 7942715
The homepage of PT Wahana Sambadhasakti is: www.wahanasambadhasakti.webs.com

10.4.2.12 PT Wijaya Karya Jabar Power
PT Wijaya Karya Jabar Power is the IUP Holder of WKP Gunung Tampomas, enacted by the Governor of West Java No.540/Kep.461-Dis-ESDM/2009.
Status as of October 2013: PPA negotiations
Jalan Adipati Kertabumi No. 21, Bandung 40115,
Phone : +62 22 4220251
Fax : +62 22 4265158,
Mail : info@wikajabarpower.com,
The homepage of PT. Wijaya Karya Jabar Power is: www.wikajabarpower.com

10.4.2.13 PT Sejahtera Alam Energy
PT Prosperous Natural Energy (SAE) has Mining Business License (IUP) for WKP Regional Geothermal Baturaden, Central Java by Central Java Governor Decree No. 541/27/2011 dated 11 April 2011, comprising an area of 24,660 hectares, which includes 5 Districts. (Banyumas, Purbalingga, Tegal, Brebes and Pemalang).
Status as of October 2013: PPA negotiations
PT Sejahtera Alam Energy (SAE) Wisma Eka Karma
Jl. Kapten P. Tendean No. 15 Jakarta Selatan 12790
Email : info@saegeothermal.co.id
The homepage of PT. Sejahtera Alam Energy is: http://www.saegeothermal.co.id

10.4.2.14 PT Spring Energy
PT Spring Energy Sentosa established since 2007, domiciled Semarang city.
PT Spring Energy is a developer of WKP Guci, located in the location of three districts namely Pemalang, Tegal and Brebes.
Status as of October 2013: PPA negotiations
PT Spring Energy Sentosa,
Komplek Perkantoran Jurnatan B-28 Semarang 50121, Jawa Tengah
The homepage of PT Spring Energy Sentosa is: www.saegeothermal.co.id

**10.4.2.15 PT Giri Indah Sejahtera**
PT Giri Indah Sejahtera is a subsidiary of PT Golden Spike Energy Indonesia and the developer of WKP Gunung Ungaran.
Status as of October 2013: PPA negotiations
PT Giri Indah Sejahtera,
Wisma Kodel lantai 12 Jl. HR Rasuna Said Kav. 4 Jakarta 12920 Indonesia
Phone : +62 21 5221472
Fax : +62 21 5222252
The homepage of PT Giri Indah Sejahterai is: www.goldenspike.co.id

**10.4.2.16 PT Bakrie Darmakarya Energi**
Status as of October 2013: PPA negotiations
PT Bakrie Darmakarya Energi
Bakrie Tower 35th-37th Floor; Epicentrum Complex; Jalan HR Rasuna Said; Jakarta 12940 Indonesia
Phone : +62 21 2991 2222
Fax : +62 21 2991 2333
E-mail : bnbr.corcomm@bakrie.co.id
The homepage of PT Bakrie Darmakarya Energi is: www.bakrie-brothers.com

**10.4.2.17 PT Medco Cahaya Geothermal**
PT Medco Cahaya Geothermalis a subsidiary of PT Medco Energi International. It is a developer of WKP Blawan-Ijenwhich, located in 3 regencies (Kab Bondowoso, Banyuwangi, and Situbondo), with a capacity of 270 MW
Status as of October 2013: PPA negotiations and forestry permit.
PT Medco Cahaya Geothermal
The Energy 52nd Fl. SCBD Lot 11A, Sudirman Jakarta, 12190
Phone : +62 21 2995 3000
Fax : +62 21 2995 3001
The homepage of PT. Medco Cahaya Geothermal is: www.medcoenergi.com

**10.4.2.18 PT Bali Energy**
PT Bali Energy is the developer of Bedugul, Tabanan Regency, Bali Province, which has capacity of 276 MW.
Status as of October 2013: Regional Government Permit
PT Bali Energy Head Office
Jl Ridwan I 4, Grogol Utara, Kebayoran Lama
Jakarta Selatan 12210
Phone : +62 21 57901015
Fax : +62 21 57992664
The homepage for BT Bali Energy is: baliglobalenergy.com/

10.4.2.19 PT Pacific Geo Energy
PT Pacific Geo Energy (PGE) was the winning bidder on a geothermal project in WKP Hu'u Dompu NTB. This WKP comprises 19,310 Ha, with potential 63 MWe.

10.4.2.20 PT Sokoria Geothermal Indonesia
PT Sokoria Geothermal Indonesia operates as a subsidiary of PT Bakrie Power Corporation, which manages WKP Sukoria in NTT Province with capacity 30 MW.
Status as of October 2013: PPA negotiations and forestry permit.
The homepage of PT. Sokoria Geothermal Indonesia is: www.bakrie-brothers.com

10.4.2.21 PT Westindo Karya Utama
PT Westindo Karya Utama is a company that develops PLTP Atadei (2x 2.5 MW) in Lembata Regency, NTT. The PPA was signed in 2011.
PT Westindo Karya Utama
Jl. Buncit Raya No. 4 Jakarta Selatan
Phone : +62 21 7985268
The homepage for PT Westindo Karya Utama is: www.westindoutamakarya.com

10.5 FINANCIAL INSTITUTIONS

10.5.1 International & Bilateral Institutions

10.5.1.1 World Bank
The World Bank Group is a multilateral lending agency consisting of five closely related institutions: the International Bank for Reconstruction and Development (IBRD), the International Development Association (IDA), the International Finance Corporation (IFC), the Multilateral Investment Guarantee Agency (MIGA), and the International Center for Settlement of Investment Disputes (ICSID). The World Bank provides concessional loans to developing countries to help reduce poverty and to finance investments that contribute to economic growth.

As of September 2011, the World Bank’s active financing portfolio in Indonesia comprised of 77 projects with total commitments of US$6.977 billion. These lending commitments were made for roads, energy, education, health, irrigation and rural development. In addition, the World Bank supervises another 11 projects financed out the Aceh and Nias, and the Java Multi Donor Trust.
In 2009, the World Bank approved the new 2009 – 2012 Country Partnership Strategy (CPS) for Indonesia and increased lending to US$4.2 billion from US$2 billion annually. It includes the US$2 billion in financing to help Indonesia overcome the global economic crisis.

In November 2010, the World Bank approved the Seventh Development Policy Loan for Indonesia totaling US$600 million (a loan to support government reform efforts to improve the investment climate, strengthen public financial management and governance and enhance policy alleviation and service delivery efforts), and also approved the Fourth Infrastructure Development Policy Loan totaling US$200 million to increase the level and effectiveness of infrastructure financing.

The World Bank support of Indonesia’s infrastructure priorities in its medium-term development strategy includes a substantial program of investment lending, including energy (focus primarily on clean and renewable energy technologies).

The World Bank, Indonesia Office

Jakarta Stock Exchange Building; Tower 2, 12th & 13th Floor; Jl. Jendral Sudirman, Kav. 52-53; Jakarta 12190, Indonesia

Phone : +62 21 5299 3000


10.5.1.2 The International Bank for Reconstruction and Development (IBRD)

The IBRD provides funding for creditworthy developing countries with relatively high per capita income, as well as technical assistance and policy advice. Loans are made only to governments or to agencies that can obtain a government guarantee. The IBRD also provides partial risk or partial credit guarantees (with a counter-guarantee from their government) to private lenders on development projects.

IBRD

Jakarta Stock Exchange Building; Tower 2, 12th & 13th Floor; Jl. Jendral Sudirman, Kav. 52-53; Jakarta 12190, Indonesia

Phone : +62 21 5299 3156

The homepage of IBRD is: http://www.worldbank.org/

10.5.1.3 The International Finance Corporation (IFC)

IFC is an affiliate of the World Bank that provides project financing for private investment in developing countries. IFC offers long-term loans and equity investments, as well as other financing services. Unlike the IBRD and IDA, the IFC does not require government guarantees. IFC has a committed investment portfolio of US$695 million in Indonesia, of which 57 percent is invested in financial markets projects, 24 percent in agribusiness and 17 percent in manufacturing.

Currently, IFC committed US$960 million to various sectors such as energy, mining, manufacture, stock market, agribusiness, finance, technology and education. IFC expects to invest about US$300 million annually in Indonesia in priority sectors of finance, infrastructure and commodity-based supply chains.

Indonesia Stock Exchange, Tower II, 9th Floor; Jl. Jend. Sudirman Kav. 52–53; Jakarta 12190 Indonesia
10.5.1.4 KfW Development Bank

KfW banking group is a German government-owned development bank, based in Frankfurt. KfW Entwicklungsbank (KfW Development Bank) provides financing to governments, public enterprises and commercial banks engaged in microfinance and SME promotion in developing countries. Notably, KfW is a lender to the Seulawah Agam Geothermal Project.

KfW Entwicklungsbank Office Indonesia; KfW Office Jakarta; Menara BCA, 46th floor; Jalan M. H. Thamrin No. 1; Jakarta 10310 Indonesia

Phone : +62 21 23 58 74 31
Fax : +62 21 23 58 74 40
Email : kfw.jakarta@kfw.de
jochen.saleth@kfw.de

The homepage of KfW is: https://www.kfw-entwicklungsbank.de/

10.6.1.5 German Development Cooperation (GIZ)

Indonesia is a priority partner country of German Development Cooperation. On behalf of the Federal Ministry for Economic Cooperation and Development (BMZ), GIZ has been working in Indonesia since 1975 with an office in Jakarta. Technical cooperation with Indonesia began in 1958.

At government negotiations held in October 2007, it was agreed with the Indonesian Government that bilateral development cooperation should focus on three priority areas:

Climate Change Issues
Private Sector Development
Good Governance and Decentralization

GIZ Office Indonesia
Menara BCA, Level 46 Jl. M.H.; Thamrin No. 1; Jakarta 10310 Indonesia

Phone : +62 21 23587111
Fax : +62 21 23587110
Email : giz-indonesien@giz.de

The homepage the German Development Cooperation is:
http://www.giz.de/en/worldwide/352.htm

10.5.1.6 The Multilateral Investment Guarantee Agency (MIGA)

The Multilateral Investment Guarantee Agency promotes the flow of foreign direct investment among member countries by insuring investments against non-commercial (political) risk and by providing promotional and advisory services to help member countries
create an attractive investments. Indonesia is a member of MIGA. MIGA is part of the World Bank Group

MIGA
Jakarta Stock Exchange Building; Tower 2, 12th & 13th Floor; Jl. Jendral Sudirman, Kav. 52-53; Jakarta 12190, Indonesia
Phone : +1 202 458 2538
Fax : +1 202 522 2630
The homepage of MIGA is: http://www.miga.org

10.5.1.7 Asian Development Bank (ADB)
Indonesia was a founding member of the ADB in 1966 and is one of the bank’s largest borrowers. In 2011, Indonesia received US$1.1 billion in ADB assistance for projects such as regional roads, urban sanitation, water supply, and water resources management. For 2012, ADB has allocated US$840 million in lending and grant assistance to Indonesia for polytechnics development (US$75 million); geothermal and renewable energy development (US$90 million); the West Kalimantan Power Grid (US$50 million); capital markets development (US$300 million); and state audit reform (US$60 million). Two other projects are on stand-by: the Java-Bali power transmission (US$185 million); and neighborhood upgrade and shelter (US$100 million). ADB will draw up its future lending program when the government completes its on-going borrowing policy review.

ADB
Gedung BRI II, 7th Floor, Jakarta, 10210
Phone : +62 21 2512721
Fax : +62 21 2512749
The homepage of Asian Development Bank is: http://www.beta.adb.org

10.5.1.8 Islamic Development Bank (IDB)
The Islamic Development Bank seeks to foster the economic development and social progress of member countries and Muslim communities through participation inequity capital and grant loans for projects, as well as providing other types of financial assistance. The IDB has an active program in Indonesia.

Islamic Development Bank
Head Office; P.O. Box 5925; Jeddah 21432; Kingdom of Saudi Arabia
Phone : (966-2) 636-1400 (10 lines);
Fax : (966-2) 636-6871
E-mail : idbarchives@isdb.org
The homepage of The Islamic Development Bank is: http://www.isdb.org

10.5.1.9 The U.S. Export-Import Bank (ExIm)
The mission of the Export-Import Bank of the United States is to assist in financing the export of U.S. goods and services to international markets. ExIm provides export credit
insurance, loan guarantees and project and structured finance for U.S. exporters and foreign
buyers of U.S. goods and services.

Export-Import Bank of the United States (ExIm Bank)
811 Vermont Ave., N.W.; Washington, DC 20571 USA
Phone : (202) 565-3946 or (800) 565-3946;
Fax : (202) 565-3380;
Asia hotline : (800) 565-3911/3402
The homepage of Export-Import Bank is: http://www.exim.gov

10.5.1.10 Overseas Private Investment Corporation (OPIC)
The Overseas Private Investment Corporation plays an important role in helping U.S. firms
reach expanding markets. OPIC assists American investors through four principal activities:
Financing of businesses through loans and loan guarantees;
Supporting private investment funds;
Insuring investments against a broad range of political risks; and
Engaging in outreach activities designed to inform the American business community of
investment opportunities overseas.

Overseas Private Investment Corporation
Information Officer, Office of External Affairs; 1100 New York Avenue, NW; Washington,
D.C. 20527 USA
Tel : (202) 336-8400;
Fax : (202) 336-7949;
E-mail : info@opic.gov
The homepage of the Export-Import Bank is: http://www.opic.gov

10.5.1.11 The European Bank for Reconstruction and Development (EBRD)
Since our establishment in 1991 we have become the largest financial investor in our region
of operations which stretches from central Europe to central Asia and the southern and
eastern Mediterranean. With the ability and willingness to bear risk on behalf of our clients,
EBRD helps countries to become open, market economies. EBRD is owned by 64 countries,
the European Union and the European Investment Bank.

EBRD
One Exchange Square; London EC2A 2JN; United Kingdom
Phone : +44 20 7338 6000
The homepage of The European Bank for Reconstruction and Development is
http://www.ebrd.com/pages/homepage.shtml

10.5.2 Domestic

10.5.2.1 Indonesian Investment Agency (PIP)
The Government of Indonesia established the Pusat Investasi Pemerintah (PIP) to act as a special purpose investment entity and eventually as a sovereign wealth fund. To date, it has limited its investments to the domestic market in strategic sectors with the goal of stimulating national economic growth. PIP can invest in a variety of asset classes such as equity, debt, infrastructure, and direct investments. PIP is in addition to other Government of Indonesia SOEs that invest in domestic markets such as PT Sarana Multi Infrastructure, PT Indonesia Infrastructure Guarantee Facility, and Indonesia Infrastructure Finance. PIP manages the Geothermal Fund.

Graha Mandiri Lantai 5, Jakarta, 10310
Phone : +62 21 39832091 94

The homepage of the Indonesian Investment Agency is: http://www.pip-indonesia.com

10.5.2.2 PT Indonesia Infrastructure Guarantee Fund (PT PII)
PT Indonesia Infrastructure Guarantee was established in 2009 to provide guarantees for infrastructure projects. It also acts as a strategic advisor to the Government and a transaction manager/lead arranger for infrastructure projects. PT PII is wholly owned by the Government with IDR 1 trillion in initial capital and plans to receive an additional IDR 1 trillion minimum per year until 2014 when it will reach IDR 6.5 trillion.

Sampoerna Strategic Square, North Tower, 14th Floor, Jakarta, 12930 Indonesia
Phone : +62 21 5795 0550
Fax : +62 21 5795 0040

The homepage of PT PII is: http://iigf.co.id/

10.5.2.3 PT Sarana Multi Infrastruktur (PT SMI) and PT Indonesia Infrastruktur Financing (PT IIF) or Infrastructure Fund
PT SMI is a special fund set up to support infrastructure financing in Indonesia. PT SMI was established in 2009 with IDR 1 trillion in start-up capital. Its subsidiary, PT IIF is a commercially oriented non-bank financial intermediary with an infrastructure project finance focus.

Wisma GKBI Building, 8th Fl, Jakarta, 10210 Indonesia
Phone : +62 21 5785 1499
Fax : +62 21 5785 4298

The homepage of PT SMI is: http://ptsmi.co.id/
The homepage of PT IIF is: http://ptsmi.co.id/ptiif.php

10.6 OTHER RELEVANT GEOTHERMAL RELATED PARTIES

10.6.1 Universities

10.6.1.1 Institute Technology Bandung (ITB)
Institut Teknologi Bandung (ITB), established in 1959, since 2008 ITB open Magister Program for Geothermal.
Jl. Tamansari 64, 40116
10.6.1.2 Universities Indonesia (UI)
Open Magister Program for Geothermal Exploration since 2012.
Depok, 16424
Phone: +62 21 786 7222
The homepage of UI is: http://www.ui.ac.id/en

10.6.1.3 Gadjah Mada University (UGM)
Gadjah Mada University was formally established in 1949.
Bulaksumur, Yogyakarta, 55281
Phone: +62 274 588688
Fax: +62 274 565223
The homepage of UGM is: http://www.ugm.ac.id/en

10.6.2 Associations

10.6.2.1 Indonesian Geothermal Association (INAGA/API)
The Indonesian Geothermal Association is an organization for professionals and industry
involved in geothermal businesses in Indonesia. As of 2013 the organization has about 600
members from various disciplines and 11 Charter Members.
The homepage INAGA is: http://www.inaga.org

10.6.2.2 The Indonesian Electric Power Society (MKI)
The Indonesian Electric Power Society (Masyarakat Ketenaga listrikan Indonesia or "MKI")
was established on 3 September 1998. It currently has about 200 members from various
stakeholders within the electricity industry. The main objective of MKI is to provide a forum
to discuss matters relating to the industry and PUI forward member's views to the
Government on topics such as technology, manpower, the environment and business
regulation. An active industry group that has vigorously pushed reform electricity legislation
forward and helped the government draft 2002 and 2009 laws.
Jl. Taruna No.1 Pulogadung, Jakarta, 13068
Phone: +62 21 4892325
Fax: +62 21 47863767
The homepage of MKI is: http://www.mki-online.org

10.6.2.3 The Independent Power Producers Association (APLSI)
The Independent Power Producers Association (Asosiasi Produsen Listrik Swasta Indonesia
or APLSI) serves as a forum for Indonesian IPPs to dialogue with the Government.
Sekretariat APPI:
10.6.2.4 The Indonesian Renewable Energy Society (METI)

METI was launched in 1999. METI is a forum for communication, consultation and cooperation among players of Renewable Energy (ET) including Solar PV, Geothermal, Micro Hydro, Biomass, Wind, Bio-Diesel, Bio-Ethanol, Ocean and other Renewable Energy. METI objective is to accelerate the improvement of the function of RE in the provision of national energy needs.

The homepage of METI is: http://meti.or.id

10.6.2.5 Indonesia Oil, Gas & Geothermal Drilling Contractor Associations (APMI)

APMI is an associate member of the International Association of Drilling Contractors. As of 2013, APMI has more than 400 company members.

APMI
Road Gandaria III / 5, Jakarta, Kebayoran Baru 12130
Phone : +62 21 7222 088
Fax : +62 21 725 3539

The homepage of APMI is: http://apmi-online.org

10.6.3 Major and Recommended Newspapers and Business Journals

A listing of the major and recommended newspapers and business journals (in the Indonesian language, except where noted) follow below. Website addresses are provided when available.

10.6.3.1 Newspapers (Dailies)

Bisnis Indonesia (www.bisnis.com)
Jakarta Globe (English) (www.thejakartaglobe.com)
Jakarta Post (English) (www.thejakartapost.com)
International Herald Tribune (English) (www.global.nytimes.com)
Kompas (www.kompas.com)
Kontan (www.kontan.co.id)
Media Indonesia (www.mediaindonesia.com)
Republika (www.republika.co.id)
Seputar Indonesia (www.seputar-indonesia.com)
SuaraPembaruan (www.suarapembaruan.com)
Tempo (www.koran/tempo.co)
The Wall Street Journal Asia (English) (www.wsj-asia.com)
10.6.3.2 News Magazines
Gatra (Weekly) (www.gatra.com)
Warta Ekonomi (Twice a week) (www.wartaekonomi.co.id)
Tempo (koran.tempo.co)

10.6.3.3 Business Journals
Financial Times (Daily, English) (http://www.ft.com)
The Wall Street Journal Asia (English) (www.wsj-asia.com)
Eksekutif (Monthly) (http://eksekutif.com)
Indochemical (Monthly, English and Indonesian)
Indocommercial (Monthly, English and Indonesian)
The Economist (Weekly, English) (http://www.economist.com/)
Indonesian Commercial Newsletter (Monthly, English and Indonesian)
(www.datacon.co.id/icn.htm)
Info Bank (Monthly) (www.infobanknews.com)
Kontan (Weekly) (www.kontan.co.id)
Swasembada (Monthly) (www.swa.co.id)
Detikcom (www.detik.com)
Okezone.com (www.okezone.com)
PT. New Viva Media (www.vivanews.com)
APPENDICES

APPENDIX A: TERMS AND TERMINOLOGY

ADB – Asian Development Bank

AMDAL – Analisa Mengenai Dampak Lingkungan
(Environmental Impact Studies)

APLSI – Asosiasi Produsen Listrik Swasta Indonesia
(Independent Power Producers Association)

BAL – Undang-undang Pokok Agraria
(Basic Agrarian Law)

BAPPENAS – Badan Perencanaan dan Pembangunan Nasional
(National Development Planning Agency)

BGL – Badan Geologi
(Indonesia Geological Agency)

BKPM – Badan Koordinasi Penanaman Modal
(Capital Investment Coordinating Board)

BKPRN – Badan Koordinasi Penataan Ruang Nasional
(National Spatial Layout Coordination Agency)

BLU – Badan Layanan Umum
(Public Service Agency)

BOO – Build-Own-Operate

BOT – Build-Operate-Transfer

BPKP – Badan Pengawasan Keuangan dan Pembangunan
(The Financial and Development Supervisory Agency)

BPN – Badan Pertanahan Nasional
(National Land Affairs Office)

BUMD – Badan Usaha Milik Daerah
(Regional Government Own Enterprises Company)

BUMN – Badan Usaha Milik Negara
(State-Owned Enterprises Company)

BVGL – Jaminan Kelayakan Usaha
(Business Viability Guarantee Letter)

CDM – Mekanisme Pembangunan Bersih
(Clean Development Mechanism)
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>CER</td>
<td>Certified Emission Reduction</td>
</tr>
<tr>
<td>CFU</td>
<td>(World Bank) Carbon Finance Unit</td>
</tr>
<tr>
<td>CGS</td>
<td>Pusat Sumber Daya Geologi</td>
</tr>
<tr>
<td></td>
<td>(Center for Geological Survey)</td>
</tr>
<tr>
<td>CIF</td>
<td>Climate Investment Funds</td>
</tr>
<tr>
<td>CJCPP</td>
<td>Central Java Coal-Fired Power Plant</td>
</tr>
<tr>
<td>COD</td>
<td>Commercial Operation Date</td>
</tr>
<tr>
<td>CO₂</td>
<td>Carbon dioxide</td>
</tr>
<tr>
<td>COP</td>
<td>Conferences of the Parties</td>
</tr>
<tr>
<td>CPS</td>
<td>Country Partnership Strategy</td>
</tr>
<tr>
<td>CSR</td>
<td>Corporate Social Responsibility</td>
</tr>
<tr>
<td>CTF</td>
<td>Clean Technology Fund</td>
</tr>
<tr>
<td>C&amp;I</td>
<td>Commercial &amp; Industrial</td>
</tr>
<tr>
<td>DGE</td>
<td>Direktorat Jenderal Kelistrikan</td>
</tr>
<tr>
<td></td>
<td>(Directorate General for Electricity)</td>
</tr>
<tr>
<td>DGNREEC</td>
<td>Direktorat Jenderal Energi Baru Terbarukan dan Konservasi Energi</td>
</tr>
<tr>
<td></td>
<td>(Directorate General of New and Renewable Energy &amp; Energy Conservation)</td>
</tr>
<tr>
<td>DOE</td>
<td>Department of Energy (US)</td>
</tr>
<tr>
<td>DPR</td>
<td>Dewan Perwakilan Rakyat</td>
</tr>
<tr>
<td></td>
<td>(House of People's Representatives)</td>
</tr>
<tr>
<td>E&amp;A</td>
<td>Exploration and Appraisal</td>
</tr>
<tr>
<td>EGS</td>
<td>Engineered (Enhanced) Geothermal Systems</td>
</tr>
<tr>
<td>EHS</td>
<td>Environmental, Health, and Safety</td>
</tr>
<tr>
<td>EPC</td>
<td>Engineering, Procurement and Construction</td>
</tr>
<tr>
<td>ERP</td>
<td>Equity Risk Premiums</td>
</tr>
<tr>
<td>ERU</td>
<td>Emission Reduction Unit</td>
</tr>
<tr>
<td>ESC</td>
<td>Energy Sales Contract</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>EU-ETS</td>
<td>European Union Emission Trading System</td>
</tr>
<tr>
<td>Ex-Im Bank</td>
<td>Export-Import Bank (of the United States)</td>
</tr>
<tr>
<td>FOB</td>
<td>Free on board</td>
</tr>
<tr>
<td>FS</td>
<td>Studi Kelayakan</td>
</tr>
<tr>
<td></td>
<td>(Feasibility Study)</td>
</tr>
<tr>
<td>G&amp;G</td>
<td>Geology and geophysics</td>
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<tr>
<td>Acronym</td>
<td>Definition</td>
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<tr>
<td>-----------</td>
<td>---------------------------------------------------------------------------</td>
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<tr>
<td>GAR</td>
<td>Gross as received</td>
</tr>
<tr>
<td>GDE</td>
<td>Geo Dipa Energy</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross domestic product</td>
</tr>
<tr>
<td>GEA</td>
<td>(US Geothermal Energy Association)</td>
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<tr>
<td>GHG</td>
<td>Gas Rumah Kaca (Greenhouse Gas)</td>
</tr>
<tr>
<td>GIIP</td>
<td>Good International Industry Practice</td>
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<tr>
<td>GoI</td>
<td>Government of Indonesia</td>
</tr>
<tr>
<td>GoJ</td>
<td>Government of Japan</td>
</tr>
<tr>
<td>GoNZ</td>
<td>Government of New Zealand</td>
</tr>
<tr>
<td>Govt</td>
<td>Government</td>
</tr>
<tr>
<td>GR</td>
<td>Peraturan Pemerintah (Government Regulation)</td>
</tr>
<tr>
<td>GW</td>
<td>Gigawatt</td>
</tr>
<tr>
<td>GWh</td>
<td>Gigawatt-hour (1 million kWh)</td>
</tr>
<tr>
<td>H₂S</td>
<td>Hydrogen Sulfide</td>
</tr>
<tr>
<td>HGB</td>
<td>Hak Guna Bangunan (Right of use of structures)</td>
</tr>
<tr>
<td>HGU</td>
<td>Hak Guna Usaha (Right of cultivation)</td>
</tr>
<tr>
<td>IAGI</td>
<td>Ikatan Ahli Geologi Indonesia (Indonesia Geologist Association)</td>
</tr>
<tr>
<td>IBRD</td>
<td>International Bank for Reconstruction and Development</td>
</tr>
<tr>
<td>ICSID</td>
<td>International Center for Settlement of Investment Disputes</td>
</tr>
<tr>
<td>IDA</td>
<td>International Development Association</td>
</tr>
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<td>IDB</td>
<td>Islamic Development Bank</td>
</tr>
<tr>
<td>IEA</td>
<td>International Energy Agency</td>
</tr>
<tr>
<td>IFC</td>
<td>International Finance Corporation</td>
</tr>
<tr>
<td>IGCE</td>
<td>Indonesian Centre of Excellence</td>
</tr>
<tr>
<td>INAGA</td>
<td>Asosiasi Panas Bumi Indonesia (Indonesian Geothermal Association)</td>
</tr>
<tr>
<td>IPPKHK</td>
<td>Izin Pin jam Pakai Kawasan Hutan (Forestry Area Borrow -Use Permit)</td>
</tr>
<tr>
<td>IPP</td>
<td>Pembangkit Listrik Swasta</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Full Form</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------</td>
</tr>
<tr>
<td>IT</td>
<td>Information technology</td>
</tr>
<tr>
<td>ITB</td>
<td>Institute Technology Bandung</td>
</tr>
<tr>
<td>IUKU</td>
<td>Izin Usaha Ketenagalistrikan Untuk Kepentingan Umum (Electricity Business License for Public Use)</td>
</tr>
<tr>
<td>IUP</td>
<td>Izin Usaha Pertambangan (Mining Permits or Geothermal business license)</td>
</tr>
<tr>
<td>IUPTL</td>
<td>Ijin Usaha Penyediaan Tenaga Listrik (Electricity Business Supply License for Public Use)</td>
</tr>
<tr>
<td>JAMALI</td>
<td>Java-Madura-Bali</td>
</tr>
<tr>
<td>JI</td>
<td>Joint Implementation</td>
</tr>
<tr>
<td>JICA</td>
<td>Japan International Cooperation Agency</td>
</tr>
<tr>
<td>JOC</td>
<td>Joint Operating Contract</td>
</tr>
<tr>
<td>KLH</td>
<td>Kementerian Negara Lingkungan Hidup (Ministry of Environment)</td>
</tr>
<tr>
<td>KKPPI</td>
<td>Komite Kebijakan Percepatan Penyediaan Infrastruktur (Policy Committee for the Acceleration of Infrastructure Provision)</td>
</tr>
<tr>
<td>Kcal</td>
<td>Kilo calorie</td>
</tr>
<tr>
<td>KfW</td>
<td>Kreditanstalt für Wiederaufbau (Reconstruction Credit Institute (Germany))</td>
</tr>
<tr>
<td>Keppres</td>
<td>Keputusan Presiden (Presidential Decree)</td>
</tr>
<tr>
<td>KPH</td>
<td>Kesatuan Pemangkuan Hutan (Forest Stewardship Unit)</td>
</tr>
<tr>
<td>Kv</td>
<td>Kilovolt</td>
</tr>
<tr>
<td>kWh</td>
<td>Kilowatt-hour</td>
</tr>
<tr>
<td>Legacy WKP</td>
<td>Wilayah Kuasa Pengusahaan</td>
</tr>
<tr>
<td>LCOE</td>
<td>Levelized cost of electricity</td>
</tr>
<tr>
<td>L Ext</td>
<td>Local externalities</td>
</tr>
<tr>
<td>MEMR</td>
<td>Kementrian Energi dan Sumber Daya Mineral (Ministry of Energy and Mineral Resources)</td>
</tr>
<tr>
<td>MEnv</td>
<td>Kementerian Lingkungan Hidup (Minister of Environment)</td>
</tr>
<tr>
<td>MoFor</td>
<td>Kementerian Kehutanan (Ministry of Forestry)</td>
</tr>
</tbody>
</table>
MIGA – Multilateral Investment Guarantee Agency
MKI – Masyarakat Ketenagalistrikan Indonesia
(Indonesian Electric Power Society)
MoF – Kementerian Keuangan
(Ministry of Finance)
MoU – Memory of understanding
MPR – Majelis Permusyawaratan Rakyat
(People's Consultative Assembly)
MSOE – Kementerian Badan Usaha Milik Pemerintah
(Ministry of State Owned Enterprises)
MT – Magnetotelluric
MW – Megawatt
MWe – Megawatt electric
NAMA – National Appropriate Mitigation Action
NAR – Net as received
NCG – Non-condensable gases
NEC
(also DEN) – Dewan Energi Nasional
(National Energy Council)
NEP – National Energy Policy
NOX – Nitrogen oxides
NPV – Net present value
NREL – National Renewable Energy Laboratory
NTT – Nusa Tenggara Timur
(East Nusa Tenggara Province)
O&M – Operations and Maintenance
OECD – Organization for Economic and Co-operation and Development
OPIC – Overseas Private Insurance Corporation
P3CU – PPP Central Unit
PELITA – Rencana Pembangunan Lima Tahun
(Five year development plan)
PD – Presidential Decree
PGE – Pertamina Geothermal Energy
PKPS – Pengembangan Kerjasama Pemerintah Swasta)
(Private Sector Cooperation Center)
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>PKUK and PIUK</td>
<td>Pemegang Kuasa Usaha Ketenagalistrikan dan Pemegang Izin Usaha Ketenagalistrikan (Electricity Business Power Licence and Electricity Power Licence Holder)</td>
</tr>
<tr>
<td>PIP</td>
<td>Pusat Investasi Pemerintah (Indonesia Investment Agency)</td>
</tr>
<tr>
<td>PLN</td>
<td>P.T. PLN (Persero), Perusahaan Listrik Negara (State Electricity Company)</td>
</tr>
<tr>
<td>PLTP</td>
<td>Pembangkit Listrik Panas Bumi (Geothermal Power Plant)</td>
</tr>
<tr>
<td>PM</td>
<td>Particulate Matter</td>
</tr>
<tr>
<td>PMA</td>
<td>Penamanan Modal Asing (Foreign Investment)</td>
</tr>
<tr>
<td>PMK</td>
<td>Peraturan Menteri Keuangan (Finance Ministry Regulation)</td>
</tr>
<tr>
<td>PP</td>
<td>Peraturan Pemerintah (Government Regulation)</td>
</tr>
<tr>
<td>PPA</td>
<td>Perjanjian Pemebelian Tenaga Listrik (Power purchase agreement)</td>
</tr>
<tr>
<td>PPP</td>
<td>Kerjasama Publik – Swasta (Public-private partnership)</td>
</tr>
<tr>
<td>PPU</td>
<td>Program Pengembangan Utama</td>
</tr>
<tr>
<td>PSO</td>
<td>Public Services Obligations</td>
</tr>
<tr>
<td>PT IIGF</td>
<td>PT Indonesia Infrastruktur Financing (Indonesia Infrastructure Guarantee Facility)</td>
</tr>
<tr>
<td>PT PGE</td>
<td>PT Pertamina Geothermal Energy</td>
</tr>
<tr>
<td>PT PII</td>
<td>PT Penjaminan Infrastruktur Indonesia (a GoI SOE that Guarantees Infrastructure Investments)</td>
</tr>
<tr>
<td>PT SMI</td>
<td>PT Sarana Muli Infrastruktur (a GoI SOE that Facility for Multi-Infrastructure)</td>
</tr>
<tr>
<td>PV</td>
<td>Present value</td>
</tr>
<tr>
<td>RE</td>
<td>Regarding</td>
</tr>
<tr>
<td>RJPM</td>
<td>Rencana Pembangunan Jangka Menengah (Medium Term Development Plan)</td>
</tr>
<tr>
<td>RMU</td>
<td>Risk Management Unit</td>
</tr>
<tr>
<td>RUKD</td>
<td>Rencana Umum Ketenagalistrikan Daerah</td>
</tr>
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<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>RUKN</td>
<td>Rencana Umum Ketenaqalistrikan Nasional (National Electricity Master Plan)</td>
</tr>
<tr>
<td>RUPTL</td>
<td>Rencana Usaha Penyediaan Tenaga Listrik (National Electricity Master Plan Supply)</td>
</tr>
<tr>
<td>SCF</td>
<td>Strategic Climate Fund</td>
</tr>
<tr>
<td>SNI</td>
<td>Standar Nasional Indonesia (Indonesia National Standard)</td>
</tr>
<tr>
<td>SPC</td>
<td>Special Purpose Company</td>
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<tr>
<td>SO2</td>
<td>Sulphur dioxide</td>
</tr>
<tr>
<td>SOE</td>
<td>State-Owned Enterprise</td>
</tr>
<tr>
<td>SPV</td>
<td>Special purpose vehicle</td>
</tr>
<tr>
<td>SSA</td>
<td>Steam Sales Agreement</td>
</tr>
<tr>
<td>T &amp; D</td>
<td>Transmission and distribution</td>
</tr>
<tr>
<td>Texaco</td>
<td>The Texas Company</td>
</tr>
<tr>
<td>T Ext</td>
<td>Total externalities</td>
</tr>
<tr>
<td>TNA</td>
<td>Technology Needs Assessment for Climate Change</td>
</tr>
<tr>
<td>TOR</td>
<td>Terms of reference</td>
</tr>
<tr>
<td>TSP</td>
<td>Total suspended particulates</td>
</tr>
<tr>
<td>UU</td>
<td>Undang-undang (Laws of Indonesia)</td>
</tr>
<tr>
<td>UGI</td>
<td>Unocal Geothermal Indonesia</td>
</tr>
<tr>
<td>UGM</td>
<td>Gadjah Mada University</td>
</tr>
<tr>
<td>UI</td>
<td>Universities Indonesia</td>
</tr>
<tr>
<td>UN</td>
<td>United Nations</td>
</tr>
<tr>
<td>UNCITRAL</td>
<td>International Commercial Arbitration &amp; Conciliation.</td>
</tr>
<tr>
<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change</td>
</tr>
<tr>
<td>UNGS</td>
<td>Unocal North Sumatra Geothermal Ltd.</td>
</tr>
<tr>
<td>US EPA</td>
<td>United States Environmental Protection Agency</td>
</tr>
<tr>
<td>UUD 1945</td>
<td>Undang Dasar 1945 (1945 Constitution of Indonesia)</td>
</tr>
<tr>
<td>VAT</td>
<td>Value Added Tax</td>
</tr>
<tr>
<td>VOCs</td>
<td>Volatile Organic Compounds</td>
</tr>
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<td>VSI</td>
<td>Volcanological Survey of Indonesia</td>
</tr>
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<td>WB</td>
<td>World Bank</td>
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</table>
APPENDIX B-1: 19 NEW GEOTHERMAL WORKING AREAS (TENDERED)

<table>
<thead>
<tr>
<th>No</th>
<th>WKP / Project Name</th>
<th>Developer</th>
<th>Province</th>
<th>Regency</th>
<th>PPA</th>
<th>Status</th>
<th>Forest Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jaboi</td>
<td>PT. SABANG GEOTHERMAL ENERGY</td>
<td>Aceh</td>
<td>Sabang City</td>
<td>1 x 10 MW</td>
<td>Exploration</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>SorikMerapi-Roburan-Sampuraga</td>
<td>PT. SORIK MARAPI GEOTHERMAL</td>
<td>North Sumatra</td>
<td>Mandailing Natal</td>
<td>240 MW (total)</td>
<td>Exploration</td>
<td>Protected</td>
</tr>
<tr>
<td>3</td>
<td>Liki Pinangawan Muara Labuh</td>
<td>PT. SUPREME ENERGY MUARA LABOH</td>
<td>West Sumatra</td>
<td>Solok Selatan</td>
<td>2 x 110 MW</td>
<td>Exploration Drilling</td>
<td>Conservation</td>
</tr>
<tr>
<td>4</td>
<td>Rantau Dadap</td>
<td>PT. SUPREME ENERGY</td>
<td>South Sumatra</td>
<td>Muara Enim, Lahat &amp; Pagar Alam City</td>
<td>2 x 110 MW</td>
<td>Exploration</td>
<td>Protected</td>
</tr>
<tr>
<td>5</td>
<td>Gn. Rajabasa</td>
<td>PT. SUPREME ENERGY RAJABASA</td>
<td>Lampung</td>
<td>Lampung Selatan</td>
<td>2 x 110 MW</td>
<td>Exploration</td>
<td>Protected</td>
</tr>
<tr>
<td>6</td>
<td>Suoh Sekincau</td>
<td>PT. Chevron Geothermal SuohSekincau</td>
<td>Lampung</td>
<td>Lampung Barat</td>
<td>2 x 110 MW</td>
<td>Exploration</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Kaldera – Danau Banten</td>
<td>PT. Sintesa Banten Geothermal</td>
<td>Banten</td>
<td>Serang &amp; Pandeglang</td>
<td>1 x 110 MW</td>
<td>Exploration</td>
<td>Production</td>
</tr>
<tr>
<td>8</td>
<td>Cisolok – Cisukarame</td>
<td>PT. JABAR REKIND GEOTHERMAL</td>
<td>West Java</td>
<td>Sukabumi</td>
<td>1 x 40 MW</td>
<td>Exploration</td>
<td>Conservation</td>
</tr>
<tr>
<td>9</td>
<td>Tangkuban Perahu</td>
<td>PT. TANGKUBAN PERAHU GEOTHERMAL POWER</td>
<td>West Java</td>
<td>Bandung</td>
<td>2 x 60 MW</td>
<td>Exploration</td>
<td>Protected and Production</td>
</tr>
<tr>
<td>10</td>
<td>Tampomas</td>
<td>PT. WIJAYA KARYA JABAR POWER</td>
<td>West Java</td>
<td>Subang &amp; Sumedang</td>
<td>1 x 45 MW</td>
<td>Exploration</td>
<td>Protected</td>
</tr>
<tr>
<td>11</td>
<td>Batu Raden</td>
<td>PT. Sejahtera Alam Energy</td>
<td>Central Java</td>
<td>Banyumas</td>
<td>2 x 110 MW</td>
<td>Exploration</td>
<td>Protected</td>
</tr>
<tr>
<td>No</td>
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<td>Developer</td>
<td>Province</td>
<td>Regency</td>
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<td>Status</td>
<td>Forest Category</td>
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<tr>
<td>12</td>
<td>Guci</td>
<td>SPRING ENERGY</td>
<td>Central Java</td>
<td>Pemalang</td>
<td>1 x 55 MW</td>
<td>Exploration</td>
<td></td>
</tr>
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<td>13</td>
<td>Unggaran</td>
<td>PT GIRI INDAH SEJAHERA</td>
<td>Central Java</td>
<td>Semarang &amp; Kendal</td>
<td>2 x 55 MW</td>
<td>Exploration, Protected</td>
<td></td>
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<tr>
<td>14</td>
<td>Ngebel - Willis</td>
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**MALUKU**

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**BALI & NUSA TENGGARA**

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**Appendix**

Spec  : Speculative  
Hyp   : Hypothetical  
Prob  : Probable  
Poss  : Possible  
Prov  : Proven
## APPENDIX B-3: LIST OF 299 GEOTHERMAL LOCATIONS IN INDONESIA

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**Total** | 655 | 320 | 332

### North Sumatera

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**West Sumatera**

|    |                             |                              |               | Spec | Hyp | Prob | Poss | Prov |
| 35 | Simisioh                   | Pasaman                      | 100           | -    | -   | -    | -    | -    |
| 36 | Cubadak                    | Pasaman                      | 75            | -    | 100 | -    | -    | -    |
| 37 | Talu                       | Pasaman Barat                | 50            | -    | -   | -    | -    | -    |
| 38 | Panti                      | Pasaman                      | 150           | -    | -   | -    | -    | -    |
| 39 | Lubuk Sikaping             | Pasaman                      | 100           | -    | -   | -    | -    | -    |
| 40 | Situjuh                    | Lima Puluh Koto              | 25            | -    | -   | -    | -    | -    |
| 41 | Bonjol                     | Pasaman                      | -             | 140  | 200 | -    | -    | -    |
| 42 | Kota Baru Merapi           | Bukit Tinggi                 | 50            | -    | -   | -    | -    | -    |
| 43 | Maninjau                   | Agam                         | 25            | -    | -   | -    | -    | -    |
| 44 | Sumani                     | Solok                        | 25            | -    | -   | -    | -    | -    |
| 45 | Priangan                   | Tanah Datar                  | 25            | -    | -   | -    | -    | -    |
| 46 | Talago Biru*               | Tanah Datar                  | -             | 27   | -   | -    | -    | -    |
| 47 | Gunung Talang Bukit Kili   | Solok                        | -             | 64   | 110 | -    | -    | -    |

216
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* : New Data 2015

Appendix

Spec : Speculative  
Hyp : Hypotetical  
Prob : Probable  
Poss : Possible  
Prov : Proven
APPENDIX C - POWER PURCHASE AGREEMENT

FOR
PLTP UNIT... and ... (X ... MW)
[......] BETWEEN

PT ....
And
PT PLN (Persero)

Number of PT ...
Number of PT PLN (Persero):

POWER PURCHASE AGREEMENT ("AGREEMENT") is made and signed on this day of
________, __________ dated ________ months of the year two thousand...( ... ............
201) on ________, by and between:

I. PT..., a State-Owned Company incorporated under the laws of the Republic of Indonesia, the
statutes contained in Deed number... dated.... created by ... , Notary ..... at ..... Office address
at.... Indonesia, in this case represented by ... as President, thus act for and on behalf of the
above companies, hereinafter in this AGREEMENT will be called SELLER.

II. PT PLN (Persero), a state-owned company under the Deed Sutjipto, S.H. no.169 dated July
thirtieth in year nineteen ninety four (30-07-1994) as amended and the last change by Deed
Haryanto, S.H. No.43 dated October twenty-sixth in year two thousand one (26-10-2001)
located at Trunojoyo Street Block MI/135 KebayoranBaru, Jakarta 12160, in this case
represented by DahlanIskan, as Managing Director, thus act for and on behalf of the company
mentioned above, hereinafter in this AGREEMENT will be called BUYER.

SELLER and BUYER in this AGREEMENT may also be referred to as the PARTY if called
individually and THE PARTIES if called together.

CONSIDERATION

THE PARTIES first explain the things that underlie this AGREEMENT made as follows:

1. That THE PARTIES have agreed to cooperate in the development of geothermal business in
WKP ...

2. That the SELLER according to Decree ....been given MINING PERMIT (IUP) of the
Government ......no ... dated ... about ....

3. That the SELLER and BUYER agrees to utilize GEOTHERMAL ENERGY that will be
developed and manufactured from the WKP. SELLER is willing to develop GEOTHERMAL
POWER of GEOTHERMAL FIELD ..... located within the WKP for the generation of
POWER which will be distributed and sold to PURCHASER and PURCHASER are willing
to accept and purchase from the SELLER in POWER POINT SWITCHING;

4. That to this purpose SELLER is willing to carry out exploration and exploitation of
geothermal energy, building STEAM GEOTHERMAL FIELD FACILITIES and
GEOTHERMAL POWER CENTER ("PLTP") with INSTALLED CAPACITY .... x ... MW
and the construction schedule as detailed in Annex [4]; all according to the terms and conditions set forth in this AGREEMENT.

5. BUYER agrees to purchase and pay Electricity generated from geothermal power that are supplied and or available from the Mining Working Area, and the SELLER, agrees to sell electric power to the PURCHASER under the legislation as follows:

a. Law No. 30 Year 2009 on Electricity
b. Law No. 27 Year 2003 regarding Geothermal
c. Government Regulation no. 59 Year 2007 about Geothermal Operations
d. Government Regulation no. No. 10 of 1989 jo. No. 3 of 2005 Jis no. 26 of 2006 on the Provision and Use of Electricity
e. Presidential Decree. 76 Year 2,000 on the Utilization of Geothermal Energy Sources for Electricity Generation
f. Regulation of the Minister of Energy and Mineral Resources No.. 32 Year 2009 on Electricity Standard Price PURCHASER by PT PLN (Limited) of the Geothermal Power Plant
g. .................

Based on the foregoing considerations, THE PARTIES agree to entering into this Agreement with the terms and conditions stated in Articles below:

ARTICLE 1
DEFINITIONS AND INTERPRETATION

a. DEFINITIONS
The terms are written in capital letters used in this AGREEMENT, unless expressly stated to have other meanings or are used in different contexts, each of which shall have the meanings as defined below.

1.1.1 MONTH is the period that began in 00.00 Western Indonesian Time … (WIB ....) first day of a calendar month and ending at 24.00 WIB ....last day of the same calendar month.

1.1.2 DOLLAR is the official currency of the United States

1.1.3 FINANCIAL CLOSING is the period since the signing of the AGREEMENT until the achievement FINANCIAL CLOSING DATE.

1.1.4 FINANCIAL CLOSING DATE is:
   b. Realization of a major decline in the early stages of the loan (senior debt initial drawdown) from the "Lenders" for the source of loans based on credit agreements between the "Lenders" by SELLER, which has been declared effective by the "Lenders", or
c. the realization of the first payment when the construction for which the source of its funding comes from the SELLER their self.

1.1.5 FINANCING DATE is the date on which the conditions as required for .....has been reached.

1.1.6 DAY is a time series of length 24 (twenty four) hours that began at 0:00 WIB ... and ended at 24.00 WIB ... the same day.

1.1.7 WEIGHTED AVERAGE PRICE is the average price is calculated in 1 (one) YEAR CALENDAR taking into account validity period of each ELECTRICITY prices prevailing in
the CALENDAR YEAR.

1.1.8 **DURATION OF AGREEMENT** is as described in article 4 of this **AGREEMENT**.

1.1.9 **NETWORK TRANSMISSION** is **ELECTRICITY** transmission facilities built by SELLER from POINT SWITCHING to the BUYER's existing network.

1.1.10 **TOTAL ANNUAL CONTRACT** or "JKT" is the amount of **POWER** (in units of kWh) provided to be distributed and delivered by the SELLER of each unit of PLTP in each CALENDAR YEAR TERM CONTRACT for, according to the calculations set forth in Section 6.2.1 of this **AGREEMENT**. First JKT YEAR CALENDAR YEAR CALENDAR and last YEAR CALENDER will be calculated in proportion to and agreed by the parties no later than thirty (30) DAYS after the DATE OF COMMERCIAL OPERATIONS each UNIT respectively.

1.1.11 **RULES OF GOOD INDUSTRIAL** is rules, methods and actions related to raw materials, personnel, maintenance, monitoring, testing and operation of the industry is at a certain time to carry out a reasonable valuation for the purpose of obtaining the desired results in a manner consistent with laws and regulations, guidelines and recommendations of the manufacturer.

1.1.12 **Unit Rated Capacity (URC)** means a net generating capacity of the average kilowatt of a Unit which is determined based on the results of the last URC Test according to the Grid Code.... (Lampiran...). Tests conducted at least every 1 (one) YEAR once or at the request of one of the PARTY, by operating UNIT at maximum output that can be achieved for testing during the seventy-two (72) continuous hours, where all equipment operate in accordance with the manufacturer's specifications, and while the tests took place, BUYER take all POWER that can be supplied by the associated UNIT. Generating capacity must be measured in POINT SWITCHING. Data generation and equipment should be recorded during each test and generating capacity UNIT must be corrected to the provisions of the design in accordance with testing procedures provided by the manufacturer and approved by THE PARTIES. URC Test results of more than 105% Capacity Contract shall be deemed equal to 105% Capacity Contract.

1.1.13 **COMMISSIONING** is the testing of all activities to FIELD FACILITIES and PLTP belong to the SELLER to prove that equipment FACILITIES works really well and commercially feasible.

1.1.14 **GEOTHERMAL FIELD** ....is a field of geothermal resources with coordinates boundaries ...., administratively included in the district ...., Province .... As referred to in Appendix 1, and is part of the WKP .... set by .... No ...., date ...., about ..... 

1.1.15 **GEOTHERMAL POWER CENTER** or "PLTP" means all facilities owned by SELLER, including UNIT needed for POWER generation by using GEOTHERMAL POWER and to channel it is raised to a network owned by BUYER in POINT SWITCHING.

1.1.16 **NOTICE OF INTENT TO DEVELOP** or "P3DP" (or "NOID") is given notice of intention BUYER to SELLER about SELLER to develop GEOTHERMAL FIELD .... DEVELOPMENT PLTP and related units, as referred to in Article 6.2.
1.1.17 **FACILITIES OF GEOTHERMAL FIELD** are owned by SELLER all the needs to produce, process and distribute to each GEOTHERMAL POWER UNIT, which included but are not limited to roads, buildings, camps, sitting wells, wells, piping systems, separators, pumps and water treatment facilities and disposal of condensate.

1.1.18 **YEAR** is a period of 12 (twelve) MONTHS in a row, beginning at 0:00 pm ..... The first DAY of a MONTH and ended at 24.00 pm ..... Last DAY of the twelfth MONTH, according to the calendar year AD.

1.1.19 **CALENDAR YEAR** means a period of 12 (twelve) MONTHS beginning on the date January 1 and ending on 31 December in the same YEAR, according to the calendar year AD; except, for the first year of AGREEMENT, calculated from the DATE OF COMMERCIAL OPERATIONS UNIT linked up to December 31st the same YEAR, and for the last years of AGREEMENT, counted from January 1 last year until the expiration date of AGREEMENT AGREEMENT.

1.1.20 **TAKE OR PAY** or "TOP" is POWER minimum amount that must be accepted and / or paid by the BUYER to the SELLER from each UNIT in the period of one (1) CALENDAR YEAR, that is equal to [85-90%] x JKT, which calculated at each end of the CALENDAR YEAR by THE PARTIES for DURATION OF AGREEMENT; whereas first TOP CALENDAR YEAR and last CALENDAR YEAR in TERM AGREEMENT, will be calculated in proportion to and agreed by THE PARTIES no later than thirty (30) DAYS after the DATE OF COMMERCIAL OPERATION.

1.1.21 **DATE OF ENTRY STARTS** is the effective date of this AGREEMENT, on the date of signing of this AGREEMENT by THE PARTIES.

1.1.22 **EFFECTIVE DATE** is the date when the SELLER give P3DP and the occurrence of FINANCIAL CLOSING DATE to the BUYER, no later than 3 (three) years from the DATE OF ENTRY STARTS.

1.1.23 **COMMERCIAL OPERATIONS DATE** is the date the first time POWER of UNIT from associated PLTP that have been available to be supplied and distributed to the STOP SWITCHING, starting from the completion of COMMISSIONING, which will be stated in the COMMERCIAL OPERATION DATE

As a reference, COMMERCIAL OPERATIONS DATE is no later than ... (according to class project ).... months after the EFFECTIVE DATE corresponding set out in Annex [4]. ..... 

1.1.24 **DATE OF COMMISSIONING** is the date of which the SELLER have completed the construction FACILITIES OF GEOTHERMAL FIELD and associated PLTP and are ready to begin to do the commissioning, during which the BUYER is obliged to accept delivery of POWER at POINT SWITCHING. DATE OF COMMISSIONING of a PLTP unit would be implemented no later than ......(........) DAY before COMMERCIAL OPERATIONS DATE of associated PLTP units and will be notified to the PURCHASER of 30 (thirty) DAYS prior to commencement of the DATE OF COMMISSIONING. Implementation of COMMISSIONING will be expressed in the "Official Start of COMMISSIONING".

1.1.25 **POWER** is the electrical energy (kWh) generated by the UNIT PLTP in accordance with this AGREEMENT.
1.1.26 **GEOTHERMAL ENERGY** is the geothermal resources in the form of water and / or natural geothermal steam and energy contained in it, which comes from or which may be obtained from natural or geothermal heat under the earth's surface in the form of power or heat.

1.1.27 **POINT SWITCHING** is the point of delivering POWER from SELLER to BUYER where the shifting of responsibility and ownership of POWER from SELLER to the BUYERS starts, as described in Annex [3].

1.1.28 **MEASURING POINT** is a point where POWER is supplied by the SELLER from a UNIT measured and submitted to the PURCHASER at POINT SWITCHING as described in Appendix 3.

1.1.29 **QUARTER** means a period of three MONTH that ended on the last DAY of March, June, September or December.

1.1.30 **UNIT** is the turbine, generator, auxiliary equipment and transformers that are owned by the SELLER that is required to convert into GEOTHERMAL ENERGY to POWER.

1.1.31 **WIB** ...........Western Indonesia Time .......

1.1.32 **WKP** is Geothermal Mining Working Area as described in consideration no. 1.

   a. **INTERPRETATION**

1.1.33 All references to a consideration, Article, or Appendix in this AGREEMENT, unless stated otherwise, are intended to refer to the considerations, Article, or Appendix of this AGREEMENT.

1.1.34 The title of the Articles in this AGREEMENT cannot be used to interpret the content and intent of the provisions stated in the relevant article. The titles are only used solely for the ease of reference.

1.1.35 All Laws, Government Regulations, Presidential Decree, Presidential Regulations, Ministerial Decree or Ministerial Regulations referred in this AGREEMENT, unless stated otherwise, each intended to be Laws, Government Regulations, Presidential Decree, Presidential Regulations, Ministerial Decree or Ministerial Regulations of the Republic of Indonesia.

1.1.36 The mention of the serial number of each unit of PLTP into "PLTP UNIT I", "PLTP UNIT II" and so on, will be based on the order of occurrence COMMERCIAL OPERATION DATE of each PLTP unit.

**ARTICLE 2**

**PURPOSE AND SCOPE OF AGREEMENT**

   a. SELLER agrees to provide and / or distribute, sell and deliver POWER generated by the SELLER of GEOTHERMAL FIELD ...... to BUYER at POINT SWITCHING; and BUYER is willing to buy, receive and / or pay ELECTRICITY provided and / or distributed by the SELLER to the POINT SWITCHING.
b. SELLER willing to construct transmission facilities ... kV for the length of .kms from the point of connecting to the GI ... (existing) that belongs to BUYER prior to DATE OF COMMERCIAL OPERATION.

ARTICLE 3
IMPLEMENTATION OF SECURITY

c. SELLER shall give BUYER "Security Implementation Phase I" of 2% of JKT payments at the latest DATE OF ENTRY STARTS which is effective up to 30 DAYS after the EFFECTIVE DATE.

d. SELLER shall give BUYER "Security Implementation of Phase II" of 5% of JKT payment at the latest DATE OF ENTRY STARTS is valid until 60 days after the COMMERCIAL OPERATION DATE

e. Assurance Implementation Phase I and Assurance Implementation Phase II issued by Commercial Banks (excluding the Rural Bank), Foreign Banks that operate and has representative offices in Indonesia or the Insurance Company that has an insurance program (surety bond) which support the Re-insurance companies that has a rating of A issued by the agency.

f. BUYER will disburse Assurance Implementation Phase I for Rp.........( 2% of the JKT payment), when FINANCIAL CLOSING DATE has past the scheduled date.

g. BUYER will disburse Assurance Implementation Phase II for Rp.........( 5% of payment JKT), if the COMMERCIAL OPERATIONS DATE has past the scheduled date.

ARTICLE 4
TERM

4.1 DURATION OF AGREEMENT

4.1.1 This AGREEMENT valid from 420 (four hundred twenty) MONTH since DATE OF ENTRY STARTS.

4.1.2 In terms of Sale and Purchase of POWER are delayed, limited or prevented by Force Majeure as defined in Article 18, then THE PARTIES agree to immediately extend the period AGREEMENT, with a period equal to the period of Force Majeure.

4.1.3 In addition, DURATION OF AGREEMENT as stated in Paragraph 4.1.1 or if it has been extended pursuant to Section 4.1.2 above, can be extended with the written approval of THE PARTIES, in accordance with the provisions of applicable legislation and applicable throughout the WKP.

4.2 Intentionally left blank
ARTICLE 5
TERMS AND CONDITIONS

6.1 Terms and Conditions since DATE OF ENTRY STARTS until the EFFECTIVE DATE

6.1.1 SELLER shall submit phase 1 assurance as defined in Section 3.1 of this AGREEMENT to the buyer no later than the DATE OF ENTRY STARTS

6.1.2 SELLER shall complete the exploration, feasibility studies, and the funding process

6.1.3 If SELLER does not do the clause 5.1.2 no later than up to the EFFECTIVE DATE, then the BUYER dilute phase 1 guarantees, except if it can be proven that it is not the SELLER’s fault.

6.1.4 If BUYER dilute phase 1 guarantees, CONTRACT will be declare as over, and SELLER can not file charges, claims, damages in the form and any means to the PURCHASER

6.2 Terms and Condition of EFFECTIVE DATE

6.2.1 SELLER shall submit phase 2 assurance as defined in article 3.2 of this AGREEMENT to the buyer no later than on the EFFECTIVE DATE.

6.2.2 SELLER shall have submitted P3DP to BUYER.

6.2.3 SELLER has reached FINANCIAL CLOSING DATE.

6.2.4 SELLER shall complete construction no later than DATE OF COMMERCIAL OPERATION.

6.2.5 If SELLER does not carry items 5.2.2, 5.2.3, and 5.2.4 until no later than DATE OF COMMERCIAL OPERATION, then BUYER dilute phase 2 guarantees, except if it can be proven that it is not SELLER’s fault.

6.2.6 If BUYER dilute phase 2 guarantees, CONTRACT will be declare as over, unless there is another agreement between THE PARTIES, and SELLER can not file a claim, claim or compensation in any form and manner to the BUYER.

ARTICLE 6
FUNDING, CONSTRUCTION, OPERATION, AND DEVELOPMENT FACILITIES FOR GEOTHERMAL STEAM AND FIELD PLTP

7.1 Funding

6.2.7 SELLER is responsible for the availability of funds required for the development of GEOTHERMAL ENERGY and development and operation of the STEAM GEOTHERMAL FIELD FACILITIES and PLTP units referred to in this AGREEMENT.

6.2.8 SELLER shall reach FINANCIAL CLOSING DATE no later than 2 (two) years from the DATE OF ENTRY STARTS
6.2.9 Certainty of funding must be proven by SELLER before this AGREEMENT reach FINANCIAL CLOSING DATE.

6.2.10 If the main source of funding comes from bank loans, then the certainty of funding must be evidenced by a valid credit agreement and the disbursement of prime loans (initial drawdawn).

6.2.11 If the source of funding comes from SELLER (Corporate Financing), then the certainty of funding must be supported by an approved funding commitment from notary, equipped with Ability Funding Report which is audited by Public Accountant Office.

7.2 Notice of Implementation of Development And Construction.

6.2.12 After SELLER find reserved the GEOTHERMAL ENERGY in a sufficient amount for the generation of POWER up to ....... MW and for the utilization of these GEOTHERMAL POWER, SELLER shall construct and operate .... PLTP unit. To make this purpose come into reality, SELLER shall carry out the development of GEOTHERMAL FIELD and build STEAM GEOTHERMAL FIELD FACILITIES required to support the operation of the units that will be built and operated by the SELLER.

6.2.13 UNIT DEVELOPMENT mentioned above shall be performed by SELLER in accordance with development plans and COMMERCIAL OPERATIONS DATE and the capacity of each UNIT as set out in Annex.... Confirmation of the implementation development of each UNIT with COMMERCIAL OPERATIONS DATE and its schedule will be notified by the SELLER to the BUYER within a NOTICE OF DEVELOPMENT AND DEVELOPMENT ("P3DP") in no less than.... (..........) MONTH before the schedule of the DATE OF COMMERCIAL OPERATION from related UNIT.

6.2.14 P3DP submitted to BUYER shall be equipped with technical specification design of geothermal power plants to be built.

7.3 Implementation of PLTP And TRANSMISSION NETWORK

6.2.15 SELLER at the time of giving P3DP that is coordinated with the BUYER, in addition to completing the engineering design specifications of PLTP that is to be built, also have the obligation to notify PURCHASER about the date of commencement of construction of the PLTP and also the estimation of DATE OF COMMERCIAL OPERATION from the UNIT.

6.2.16 SELLER shall also submit progress reports to the PURCHASER PLTP development periodically, at least once every 3 (three) MONTH.

6.2.17 SELLER shall obtain approval from PURCHASER about the specification of design techniques TRANSMISSION NETWORK that will be built.

6.2.18 SELLER shall schedule and carry out the construction of NETWORK TRANSMISSION as well as other necessary equipment, in accordance with the RULES OF GOOD INDUSTRIAL, which allows the BUYER to receive delivery POWER SELLER provided and channeled from UNIT related to the commissioning of the STOP SWITCHING DATES.

6.2.19 SELLER shall submit development progress reports of TRANSMISSION NETWORK to the
BUYER periodically, at least once every 3 (three) MONTH.

6.2.20 TRANSMISSION NETWORK that has been built by the SELLER must be submitted to BUYER not later than COD, so that TRANSMISSION NETWORK becomes the BUYER’s assets and operations as well as maintenance became responsibility of the BUYER.

6.2.21 Pure costs from the construction of TRANSMISSION NETWORK are in Rupiah, then replaced entirely by the BUYER through monthly TRANSMISSION payment, which will be paid fixed every month, and apart from the POWER transactions settlement of this AGREEMENT.

7.4 Responsibility for Operation and Maintenance

6.2.22 SELLER, at its own expense, shall operate and maintain all STEAM GEOTHERMAL FIELD FACILITIES, and PLTP that must be built by the SELLER under this AGREEMENT in accordance with the RULES OF GOOD INDUSTRIAL.

6.2.23 SELLER each YEAR shall submit an annual maintenance schedule of STEAM GEOTHERMAL FIELD FACILITIES, PLTP is owned and operated by the SELLER to the BUYER for the next CALENDAR YEAR, at the latest within 30 (thirty) DAYS prior to the end of the related CALENDAR YEAR.

6.2.24 SELLER obligation is to submit an annual maintenance schedule as referred to in Article 6.4.2 shall not apply to last year of the AGREEMENT.

6.2.25 If there is maintenance work beyond the planned annual maintenance of facilities owned by the SELLER, or if changes in the planned maintenance schedule that has been submitted to the BUYER, the SELLER shall notify in writing to BUYER not later than 30 (thirty) days before the date of execution of the maintenance work.

6.2.26 If there is maintenance work as a result of the sudden disruption, must be notified verbally by the SELLER to the BUYER, not later than 24 (twenty four) hours after the disruption and then followed with written notification no later than 7 (seven) days of verbal notification.

7.5 Capacity Development PLTP

6.2.27 PLTP capacity development is possible if exploration product on WKP ....showed a greater capacity than the capacity in this AGREEMENT.

6.2.28 PLTP capacity development that occurs within the DURATION OF AGREEMENT or outside the DURATION OF AGREEMENT can be made if THE PARTIES agreed.

6.2.29 POWER from the new UNIT that was built as a result of the PLT capacity development, purchased at a price and terms to be negotiated and included in the amendment on this AGREEMENT.
ARTICLE 7
ELECTRICITY DELIVERY AND ACCEPTANCE

a. BUYER and SELLER obligations during the commissioning

7.5.1 On the DATE OF COMMISSIONING and during the period of COMMISSIONING of a UNIT, SELLER shall deliver all POWER generated by related UNITS to the NETWORK TRANSMISSION on POINT OF SWITCHING.

7.5.2 During the period of COMMISSIONING of a UNIT, BUYER shall accept all ELECTRICITY that may be produced and distributed by the UNIT to the NETWORK TRANSMISSION in POINT SWITCHING.

7.5.3 During the COMMISSIONING of a UNIT, BUYER shall pay the ELECTRICITY which is distributed by SELLER along the distribution of ELECTRICITY continuously for no less than 6 (six) hours for 25% of contract price.

b. Delay or failure of implementation of Commissioning

7.5.4 If SELLER fails or late on COMMISSIONING on specified date agreed by THE PARTIES as referred to in this Article, or fails to perform COMMISSIONING at any time during the period of COMMISSIONING, and the failure or delay does not delay the DATE OF COMMERCIAL OPERATION of PLTP units, then the SELLER is not given a penalty.

7.5.5 If SELLER fails or late on COMMISSIONING on specified date agreed by THE PARTIES as referred to in this Article, or fails to perform COMMISSIONING at any time during the period of COMMISSIONING, and the failure or delay does not delay the DATE OF COMMERCIAL OPERATION of PLTP units, with the provision that the delay or failure of the COMMISSIONING is not caused by SELLER unpreparedness for COMMISSIONING or because of FORCE MAJEURE, but because BUYER fail to receive ELECTRICITY in POINT SWITCHING on the DATE OF COMMISSIONING or during the period of COMMISSIONING, therefore the DATE OF OPERATION COMMERCIAL PLTP UNIT deemed to have occurred on the date as stated in Appendix ..., keeping in mind the provisions of Article ......

c. Obligations of Delivery and Acceptance of ELECTRICITY during the DURATION OF AGREEMENT

7.5.6 During DURATION OF AGREEMENT, SELLER shall ensure the smooth delivery and acceptance of ELECTRICITY to BUYER, and BUYER shall ensure smooth acceptance of ELECTRICITY from SELLER in POINT SWITCHING and pay the ELECTRICITY in accordance with this AGREEMENT based on the price as provided in Article 10.

7.5.7 Subject to the provisions of Article .....and Article ..... , SELLER, during DURATION TERM AGREEMENT, is willing to distribute and deliver ELECTRICITY to BUYER and BUYER is willing to accept ELECTRICITY channeled through TRANSMISSION NETWORK and handed over to the BUYER at POINT SWITCHING with number Daily Delivery ("JPH") as follows:
(b) JPH for each unit of PLTP = URC x 24 hours
(c) Number of Annual Contracts (JKT) each UNIT = 365 or 366 (in leap years) DAY multiplied JPH each unit of PLTP.

7.5.8 In a CALENDAR YEAR, the BUYER can only accept ELECTRICITY supplied and delivered by the SELLER to the BUYER less than 80% (eighty percent) x JKT of each PLTP unit for CALENDAR YEAR after DATE OF OPERATION COMMERCIAL referred in Article. ...., therefore the BUYER shall pay the deficiency of ELECTRICITY based on TOP, except in cases described in Article ..... and Article .... point ..... point ....

7.5.9 However, in CALENDAR YEAR, the amount of ELECTRICITY received by BUYER exceeds TOP, then the BUYER will only make payment of the amount of ELECTRICITY delivered by TOP based on the price of 50% x WEIGHTED AVERAGE PRICE applicable to CALENDAR YEAR.

7.5.10 POWER distribution and delivery by SELLER to BUYER PURCHASER in accordance with the request must be done continuously for DURATION OF AGREEMENT, except:

a. The existence of Force Majeure that directly caused discontinuation of PLTP operation or malfunction of TRANSMISSION NETWORK or stoppage of ELECTRICITY delivery to BUYER referred to in Article 18 of this AGREEMENT.

b. A temporary discontinuation of delivery and acceptance of ELECTRICITY by SELLER due to from planned maintenance work on STEAM GEOTHERMAL FIELD FACILITIES or PLTP that belongs to SELLER.

c. A temporary discontinuation of ELECTRICITY delivery by SELLER due to an unplanned maintenance work on STEAM GEOTHERMAL FIELD FACILITIES or PLTP that belongs to SELLER.

d. A disturbance on STEAM GEOTHERMAL FIELD FACILITIES or PLTP that belongs to SELLER.

7.5.11 Due to Article 7.3.3 and Article 7.3.4 above, THE PARTIES agree that every CALENDAR YEAR, at least 15 (fifteen) DAYS after the end of YEAR CALENDAR, or, in the YEAR CALENDAR on AGREEMENT, 15 (fifteen) DAYS after the date of expiration of AGREEMENT, to the recapitulation of payment as follows:

8 As ELECTRICITY received by BUYER less than TOP due to BUYER incapability, unless caused by Force Majeure in article 18, to receive ELECTRICITY in the amount of TOP only if SELLER are ready to distribute ELECTRICITY in the amount of TOP, then the BUYER shall pay the difference between TOP and the real ELECTRICITY that has been accepted and paid for by BUYER with the following formulation:

\[
PLN \text{ Penalty} = (TOP - \text{Actual kWh}) \times \text{average price weighted of the current year.}
\]

9 If ELECTRICITY received by BUYER less than TOP due to SELLER incapability, unless caused by Force Majeure provided for in article 18, to channel ELECTRICITY in the amount of TOP only if BUYERS are ready to accept ELECTRICITY in the amount of TOP, then the SELLER shall pay the difference between TOP and the real ELECTRICITY that has been accepted and paid for by BUYER multiple by the average price weighted of the current year with the following formulation:

\[
IPP \text{ Penalty} = (TOP - \text{Actual kWh}) \times \text{average price weighted of the current year.}
\]
10. If kWh realization less than TOP caused by THE PARTIES, then each party has its share of failed to send / receive, then each party will be subject to penalty according to the formulation as follows:

\[
P_{IPP\text{ Penalty}} = \frac{(\text{kWh failed to send})}{(\text{kWh of failed to receive} + \text{kWh of failed to send})} \times (\text{TOP} - \text{Actual kWh}) \times \text{average price weighted of the current year}
\]

\[
P_{PLN\text{ Penalty}} = \frac{(\text{kWh failed to receive})}{(\text{kWh of failed to receive} + \text{kWh of failed to send})} \times (\text{TOP} - \text{Actual kWh}) \times \text{average price weighted of the current year}
\]

where:
- kWh failed to send is the result of recording failures of electricity delivery caused by the IPP in the amount of MW URC x duration of failure, in BA sending / receiving monthly energy;
- kWh failed to receive is the result of recording failures of energy received because of PLN in the amount of URC MW x Length of time of failure, in BA in sending / receive monthly energy.

e. If ELECTRICITY accepted by BUYER larger than TOP, then BUYER are entitled to get the overpayment for the difference between TOP and the real ELECTRICITY that has been accepted and paid for by BUYER with the terms of the return value of 50% (fifty percent) of the average price weighted of the current year;

f. The results of calculations from the article above will be in the NEWS EVENT Recapitulation of Current Year Payment signed by THE PARTIES.

**ARTICLE 8**

**MEASURING TOOLS AND CALIBRATION**

9.1 **Installation and Operation of Measurement Tools**

10.1.1 SELLER is obliged to make, install and maintain a pair of measuring tools, primary and comparators, for each PLTP unit in the form of "kWh meter" to measure the amount of ELECTRICITY delivered and handed over to the BUYER at POINT SWITCHING, where the specification and location of placement described in Appendix 3 of this AGREEMENT.

10.1.2 All costs associated with the procurement, installation, and operation along with maintenance of measuring devices as defined in Article 8.1.1 above will be the responsibility of SELLER

9.2 **Measurement calibration**

10.1.3 kWh meter referred to in Section 8.1.1 above must first be calibrated by the competent authority and witnessed by a representative of THE PARTIES and must be re-calibrated annually.

10.1.4 The cost for re-calibration and calibration of kWh meter referred to in Section 8.2.1 above will be the responsibility of SELLER.

10.1.5 In case one of the PARTY wants a re-calibration of kWh meter outside of the calibration referred to in Section 8.2.1 above, the concerned PARTY will notify his will in writing no later than fourteen (14) DAYS prior to the re-calibration to the other PARTY, and any costs incurred in connection with re-calibration will be the responsibility to the concerned PARTY.
ARTICLE 9
TO MEASUREMENT KWH

a. Reading And Recording

9.2.1 Numbers reading and recording on the kWh meter referred to in Article 8 above is conducted by SELLER for every in the beginning of transaction month by downloading kWh data 1 (one) MONTH transactions starting at 00.00 on the 1st to 24.00 last date of transaction month. The Reading and Recording will be witnessed and authorized by the officers from the BUYER for the number of ELECTRICITY that have been channeled to NETWORK TRANSMISSION and accepted at the STOP SWITCHING.

9.2.2 The results of kWh meter reading and recording for 1 (one) MONTH referred to in Section 9.1.1 above, made in the “News Report of Monthly Recapitulation of the Result of kWh Meter Reading and Recording” at the beginning of each subsequent MONTH, signed by an authorized officer of THE PARTIES on a revenue stamp and stamped of each PARTY’s companies, in accordance with Appendix 8.

ARTICLE 10
PRICES

10 BASIC ELECTRICITY PRICE

10.1.1 POWER Price stated in U.S. Dollars (USD).

10.1.2 ELECTRICITY base price, hereinafter referred to as $P_b$, which became valid since DATE OF COMMERCIAL OPERATIONS UNIT The first is USD ...... (............) Cents per kWh.

11.1 ESCALATION of ELECTRICITY Rates Basics

10.1.3 25% of basic price ELECTRICITY can escalated by using average figures for months of the previous quarter from US-CPI (United State Consumer Price Index) for the General Index published by the U.S. Department of Labor, Bureau of Labor Statistics, Producer Prices and Indexes.

10.1.4 ELECTRICITY price calculation formula after escalation imposed are as follows:

\[ P_m = P_b \times (0.75 + 0.25 \times \frac{U.S. CPI}{US CPIb}) \]

\( P_m \) = ELECTRICITY prices in billing month

\( U.S. CPI \) = index USCPI average in quarter prior to billing month

\( U.S. CPIb \) = index USCPI average in quarter prior to quarter of the first DATE UNIT OF COMMERCIAL OPERATION
ARTICLE 11
PAYMENT

13.1 Payment Claims and Payment of Claims Documents

11.1.1 BUYER shall pay the entire price of ELECTRICITY that has been distributed and handed over by the SELLER to the BUYER, every MONTH as mentioned on Article 11, as of the DATE OF COMMERCIAL OPERATIONS, each UNIT until the end DURATION OF AGREEMENT.

11.1.2 In addition to the Article 11.1.1 above, BUYER shall pay for all ELECTRICITY that has been distributed and handed over by the SELLER to the BUYER, since the DATE OF COMMISSIONING until the DATE OF OPERATION COMMERCIAL with the provisions in Section 7.1.3, Billing done simultaneously along with the first month billing after DATE OF COMMERCIAL OPERATIONS.

11.1.3 The amount of bill ("Invoice") monthly for ELECTRICITY distribution submitted by the SELLER and accepted by BUYER for one MONTHS before which will be calculated based on the number of ELECTRICITY submitted which then here on forward will be called Gm, as recorded in the "News Report of Monthly Recapitulation of the Result of kWh Meter Reading and Recording" referred to in Article 9.1.2 multiplied by the price of POWER (Pm) which applies on the MONTH of distribution and handing over of ELECTRICITY corresponding specified in Article 10.2.2.

11.1.4 Payments based on News Event Recapitulation of Current Year Payment will be included in ELECTRICITY bill in December of the current year.

11.1.5 Value of bills referred to in Article 11.1.3 are as follows:
\[ Em = Gm \times Pm \]
\[ Em = \text{The sum of ELECTRICITY bill in the billing month} \]

11.1.6 The bill referred to in Article 11.1.5 above, submitted by the SELLER to the BUYER within the first week after ELECTRICITY was delivered in the current MONTH. The bill will be accompanied with billing documents referred to in Article 11.1.7 below.

11.1.7 Billing documents submitted by the SELLER to the BUYER referred to in Article 11.1.6 above consisting of 1 (one) original and 4 (four) copies of:
   a. Letter Request for Payment.
   b. The bills.
   c. Receipt with a revenue stamp and stamp of the company.
   d. "News Report of Monthly Recapitulation of the Result of kWh Meter Reading and Recording", as referred to in Section 9.1.2.
   e. News events of Correction / Repair Bill Payment", as mentioned in Article... (If any).
   f. News events for TOP Offset Calculation CALENDAR YEAR every TOP bill.
   g. Photocopy of AGREEMENT, for the first bill.

11.1.8 Payment will be addressed to:
Manager of Cash Management PT PLN (Persero)
Main Building Lt. 6
11.2 Payment and Late Payment

11.2.1 BUYER pay every bill in Euro with an option to pay in a U.S. Dollar to SELLER via Telegraphic / Bank Transfer to Bank Account designated by the SELLER, not later than 30 (thirty) DAYS after BUYER accept the bill. If the 30th DAY after the acceptance of the bill mentioned above falls on a Saturday, Sunday or public holidays, then the 30th DAY shall be deemed to fall on the next working day. If BUYER pay in Rupiah, then the payment will be: EmRpFXm x = Em Em = ELECTRICITY payments in the billing month FXm = selling price of U.S. dollar against the rupiah at 11:00 hours on payment of foreign exchange transactions in BI

11.2.2 If there is any delay for the payment because of the BUYER, BUYER shall pay a penalty on the unpaid amount starting from the due date up until the BUYER pays the entire bill, at LIBOR + 2% per year for 1 (one) MONTH time deposits, starting from the due date. The calculation is done in daily fines on fixed divider of 365 (three hundred sixty five) DAYS a year up until full payment has been received by SELLER.

11.2.3 If within 30 (thirty) DAYS after the payment due date, BUYER have not pay the bill, then the SELLER, in addition to imposing a late fee as referred to in Article 11.2.2, will submit a first warning letter to the BUYER for late payment. If up to 10 (ten thirty) DAYS of first warning letter, BUYER still does not pay the bill, then the SELLER will deliver the second warning letter. If within 10 (ten) DAYS after the date of the second warning letter BUYERS still does not pay the bill, then the SELLER have the right to stop delivery of ELECTRICITY to the BUYER. If after 1 (one) MONTH after SELLER stop the distribution of ELECTRICITY to BUYER, BUYER still have not pay the bill, then the SELLER will deliver the third warning letter, and if within 2 (two) MONTHS after the third warning letters BUYER have not pay the bill, then, unless there are other alternative settlement, SELLER, at any time after the expiration of the time of 2 (two) MONTH mentioned above, may terminate this Agreement by sending a "Notice of Termination of Agreement" in accordance with the provisions of Article .... to BUYER, at least 30 (thirty) DAYS before the end of AGREEMENT stated on the Notice of Termination of AGREEMENT

11.2.4 Termination of AGREEMENT referred to in Article 11.2.3 above will not eliminate the obligation of BUYER to meet all obligations on ELECTRICITY supplied or distributed by the SELLER for to the BUYER under this AGREEMENT, including payment and late payment penalties mentioned in Article 11.2. 2 above.

11.3 Payment Claims at Stake

11.3.1 Apart from the provisions of Article 11.1.5, if BUYER argued that the billing documents from SELLER is not complete (as defined in Section 11.1.7) or there is a miscalculation of the number of billing by the SELLER to the BUYER, the settlement payment will be made as follows:

10.2 Within 4 (four) working days after receiving the billing document that is incomplete or there is a miscalculation of the amount referred to above, then the BUYER shall return the billing documents to the SELLER to identify the mistake or miscalculation of the amount billed to the SELLER.
10.3 If the SELLER agree with the BUYER, then the SELLER will as soon as possible complete
the document or make a correction to the calculation of the bill according with the request
and hand back the documents that have been completed or corrected to the BUYER, and
BUYER shall pay the bills that have been completed or corrected, no later than 30 (thirty)
DAYS after receiving the bill that have been completed or corrected.

10.4 If SELLER say that the documents that has been handed to the BUYER are complete or the
calculation is correct, then the SELLER will notify his opinion in writing to BUYER, on
behalf of Cash Management Manager PT BUYER (Limited), with adequate explanation; and
if BUYERS can accept the explanation by the SELLER, BUYER shall pay SELLER for the
bills according with the provisions of paragraph 11.3.1.a on this Article, no later than 30
(thirty) DAYS after accepting the notice with explanation from the SELLER describe above.

10.5 If BUYER does not agree with SELLER’s explanation referred to in clause (c) of this Article,
in terms of differences in the calculation of the amount billed, BUYER will pay bill from
SELLER for the amount according to BUYER’s calculation, and then give a written
notification to the SELLER of the different opinions and to later be discussed together with
the SELLER.

11.3.2 If the different opinion as referred to in Article 11.3.1 above has been solved, then the
settlement of the difference in charges will be on "Correction / Improvement Payment
News Event", which was signed by THE PARTIES in Annex ....and any difference will be
paid by the BUYER will be accounted for by the SELLER on next MONTH payments.

11.3.3 If the transaction errors were found in the past, then the both PARTY agreed to correct them.

ARTICLE 12
TAX

Each PARTY is responsible for taxes, duties and other levies incurred / charged related to
this AGREEMENT and become a responsibility for each PARTY according to the laws and
regulations in the Republic of Indonesia.

ARTICLE 13
HANDLING ENVIRONMENTAL IMPACT AND PLTP CONDENSATE
TREATMENT FACILITIES

14.1 Obligation to Maintain Environmental Sustainability
THE PARTIES have the responsibility to maintain environmental sustainability and to
prevent any environmental damage and pollution caused by operating activities and the
development and operation of facilities which are the responsibility of each PARTY, in
accordance with existing regulations.

14.2 The Obligation to Obtaining Licensing and Approval Required
In the implementation of operations and construction and also operation of facilities which
are the responsibility of each PARTY, each PARTY shall make the Environmental Impact
Assessment (EIA) and Environmental Management Effort (UKL) and Environmental
Monitoring Effort (UPL) required by the law for GEOTHERMAL FIELD activities ...... STEAM GEOTHERMAL FIELD FACILITIES development, construction PLTP units, and
NETWORK TRANSMISSION development and to obtain approval from government
authorities and obtain permits required, including Building Permits and other permits, with the appropriate legislation and regulations.

ARTICLE 14
OWNERSHIP LIMIT

15.1 SELLER-Owned Facilities
All installations and equipment needed to generate and distribute ELECTRICITY at a point before POINT SWITCHING, as described in Appendix ....of this AGREEMENT, are the property and the responsibility of the SELLER.

14.3 BUYER-Owned Facilities
All installations and equipment needed to receive ELECTRICITY at a point before SWITCHING POINT, as described in Appendix ... in this AGREEMENT, are the property and the responsibility of the BUYER.

14.4 Entry Permit for Road and Property Owned by Other PARTY.
SELLER or those who are appointed by the SELLER can go through the roads, properties, BUYER’s area at any time during this AGREEMENT, to inspect, move, fix and / or replace all or part of other equipment that belongs to BUYER with the consent of SELLER, and so are those who are appointed by the BUYER, can go through the roads, properties, SELLER area at any time during this AGREEMENT.

ARTICLE 15
COORDINATION

16.1 Establishment of the Coordination Team
THE PARTIES will coordinate activities according to this AGREEMENT. For the purposes of the coordination THE PARTIES, within six (6) MONTHS after the FINANCING DATE will establish a coordination team that consist of the 3 (three) representatives from PARTY.

15.2 Team Coordination Assignment
Coordination Team Assignment as referred to in Article 15.1 above include the following:

15.2.1 To coordinate THE PARTIES for construction works and COMMISSIONING.

15.2.2 To coordinate activities for THE PARTIES for operation and maintenance of STEAM GEOTHERMAL FIELD FACILITIES, PLTP and NETWORK TRANSMISSION.

15.2.3 To discuss additional equipment for environmental handling that may be needed as a result of the enactment of new legislation and / or modified by the Government that will be the responsibility of each PARTY, and

15.2.4 To discussing other issues that may be important for THE PARTIES related to this AGREEMENT

15.3 Coordination Team Meeting
15.3.1 For the purposes of coordination as referred to in Article 15.2, the Coordination Team will meet in an agreed time or at least once a year.
15.3.2 If there is any emergency that needs immediate attention, one of the PARTY shall notify the other PARTY to immediately conduct a Coordination Team meeting to discuss the problem and to take any necessary action.

15.3.3 Coordination Team will make a summary of Coordination Team meeting (Minutes Of Meeting) which will be signed by representatives of THE PARTIES, to be used as a guide and a reference in conducting a follow-up of issues discussed in the meeting, and each PARTY shall, with good faith, respect for the things that have been decided in the Coordination Team meeting.

ARTICLE 16
REGULATORY COMPLIANCE AND TO APPLICABLE LAW

16.2 Applicable Law
This AGREEMENT and documents that are a part of this AGREEMENT, shall be governed by and obey the law and legislation of the Republic of Indonesia.

16.2.1 Compliance to Applicable Law
THE PARTIES in performing this AGREEMENT will comply with the law and legislation and each PARTY shall bear the consequences for not complying with the law and legislation of the Republic of Indonesia.

ARTICLE 17
CONFLICT SETTLEMENT

17.1.1 Conflict Settlement Forum
Conflict arising between THE PARTIES in relation with this AGREEMENT, either about the content, interpretation, validity, execution, or termination of this Agreement, including any related conflict to the calculation of payment, to Force Majeure and other matters in relation with the implementation of this AGREEMENT that can not be resolved by discussion or peacefully by THE PARTIES, then EXPERT that both PARTY agree on will solve the conflict. Cost for expert will be the responsibility of the prosecutor. If EXPERT’s decision can not be accepted by both PARTIES, the final step is to submit the issue to the Indonesian National Arbitration Board (BANI) in Jakarta by arbitral council that consist of 3 (three) arbitrators appointed according to BANI’s regulations using Bahasa Indonesia both in process and the arbitration decision.

17.2 Conflict Settlement Procedure

17.2.1 A conflict has appeared, if one of the PARTY informed the other PARTY in writing about the conflict. If within thirty (30) DAYS (or a longer period of time approved by both PARTIES) after the notice both PARTIES did not reach an agreement to settle the conflict by discussion or peacefully, the one of the PARTY may submit the conflict to an Expert both PARTIES mutually agreed on. Cost for Expert will be the responsibility of the prosecutor. If EXPERT’s decision cannot be accepted by both PARTIES, the final step is to submit the issue to the Indonesian National Arbitration Board (BANI) by first notifying to the other PARTY in writing with the names of arbitrators who have been chosen.

17.2.2 Within fourteen (14) DAYS after receiving the notice referred to in under 2.1 of this Article, the recipient of the notice shall appoint 1 (one) person as arbitrator and notify in writing to
the other PARTY and BANI. The arbitrators are appointed are those listed on BANI. The two
appointed arbitrators will select a third arbitrator who will act as leader of the arbitral council
within 7 (seven) DAYS from the date of appointment of the second arbitrators. If within the
specified time appointed by the recipient of the notification referred to in under 2.1 is
unsuccessful picking the arbitrator or arbitrators have been appointed was unsuccessful on
picking the third arbitrator, the Chairman of BANI will choose the arbitrator instead.

17.2.3 Decisions given by the arbitral council is final and bound the PARTIES and could be enforce
in any court with jurisdiction. Thus THE PARTIES hereby exclude all laws and regulations
as well as policy decisions or legal policy, which gives the right to apply for cancellation and /
or appeal against the decision of the arbitral tribunal.

17.2.4 THE PARTIES agree that, under Article 60 of Law No.30 of 1999 on Arbitration and
Alternative Dispute Resolution (Arbitration Law Indonesia), no PARTY who filed the appeal
in any court against a decision made by the arbitral council, so based on that verdict there will
not be any other authority or council that has the authority to change or cancel the decision.
THE PARTIES will maintain its confidentiality, presence, proceedings, content (including
information or materials provided) and the outcome of the arbitration. THE PARTIES
specifically exclude the operation of Article 48 (1) of the Indonesian Arbitration Act and
agree that the arbitration is to be completed within a certain time. In accordance with Article
56 (1) of the Indonesian Arbitration Act, THE PARTIES hereinafter agree that the arbitral
council in making a decision will only be bound and subject to the laws and regulations,
terms and conditions of this AGREEMENT, and will not give the verdict based on the
principles of justice and propriety (ex aequo et bono).

17.2.5 During the arbitration process, THE PARTIES shall continue to fulfill their obligations
according to this AGREEMENT.

ARTICLE 18
FORCE MAJEURE

18.1 Definition of Force Majeure

18.1.1 The term "Force Majeure" in this AGREEMENT is a condition which is a direct result of an
event that occurs outside the control and / or ability PARTY affected by such Force Majeure
and not due to negligence or mistake of PARTY affected by Force Majeure, the unexpected,
unjustified and forced which part or all of the PARTY facilities are not operating and / or
cause PARTY fail or late in carrying out the duties and obligations under this
AGREEMENT, including, but not limited to riot, rebellions, explosions, strikes, undeclared
wars or not, embargo, blockade, lightning, floods, fires, earthquakes, natural disasters,
government action in terms of taxes and the Environment (related to licensing, approval,
enactment of new legislation, new interpretations or amendments to existing legislation) that
cause delays in implementation or part or all PARTY’s duty or obligation can not be
implemented in this AGREEMENT. For clarity:

a. Failure or delay of a PARTY in obtaining funds from third parties to finance a project is not a
Force Majeure.

b. The term "Force Majeure Period" means the period of the ongoing impact of the event
causing such Force Majeure, in which the Force Majeure Period PARTY who experience and
/or affected by Force Majeure unable to perform its obligations under this AGREEMENT,
including the time required to repair the installation and equipment necessary to implement
this AGREEMENT, and will end until the PARTY that are affected by such Force Majeure can carry back its obligations under this AGREEMENT.

18.1.2 Each PARTY released from responsibility for any delay or failure in fulfilling its obligations in this AGREEMENT to the other PARTY if the delay or failure is due to Force Majeure as referred to in Article 18.1.1 above, and where the relevant PARTY has taken every effort needed according with applicable procedures to deal with the cause or event.

18.2 Procedures for Obtaining Recognition of occurrence of Force Majeure.

18.2.1 If an events that are categorized as Force Majeure occur, then the PARTY who experience and / or affected by Force Majeure shall notify the other PARTY verbally within 48 (forty eight) hours or within the first possible chance, and followed in writing no later than within 14 (fourteen) DAYS after the occurrence of such Force Majeure or after the discovery of such Force Majeure event, accompanied by details of the incident, the estimated time of Force Majeure Period and the effects it has and it would cause by providing supplementary / added data as supporting evidence in the form of testimony from competent authority and the estimates or measures that will be or has been done in order to deal with the Force Majeure.

18.2.2 The PARTY who receives notice to Force Majeure may reject or approve the declared or claimed Force Majeure by the informing PARTY, no later than within 14 (fourteen) DAYS, starting from the acceptance of written notice from PARTY that experience and / or affected by Force Majeure.

18.2.3 If such notice (claims) about the existence of Force Majeure was rejected by the PARTY receiving the notice, the PARTIES will continue its obligations in according to this AGREEMENT, and bear all the consequences or risks arising as a result of such delay or failure in performing its obligations PARTY under this AGREEMENT

Whereas the existence of Force Majeure if it is approved by the PARTY who received notice to Force Majeure, then the PARTY who experience such Force Majeure will do its best, in the capacity and competence to immediately put an end to the Force Majeure and its effect.

18.2.4 If within fourteen (14) DAYS after receiving the written notification referred in Article 18.2.2 above, the PARTY receiving the notice does not provide an answer to Force Majeure in writing to the other PARTY, the PARTY who receives notice to Force Majeure will be deemed to have consented the circumstances as told before as Force Majeure.

18.3 Follow-up Due to Force Majeure

18.3.1 After the Force Majeure Period ends, THE PARTIES shall re-negotiate the continuation of the AGREEMENT, including to set up an ELECTRICITY distribution and reception schedule, TOP calculation that occurred before Force Majeure, as well as other matters that are important and necessary for the implementation of the next AGREEMENT.

18.3.2 In the event of Force Majeure, within 10 (ten) DAYS from the expiration of the Force Majeure Period, THE PARTIES will inform each other and decide on the number of DAYS Force Majeure Period has occurred.
18.3.3 THE PARTIES agree that the number of DAYS Force Majeure Period has occurred is not counted as part of the period of AGREEMENT expiration date under Article 4 of this AGREEMENT will be postponed for a period of time equal to the amount DAY Force Majeure Period had occur. Approval from THE PARTIES about the total of Force Majeure Period DAYS and the expiration date delays of this DURATION OF AGREEMENT will be validated in an amendment signed by their authorized representatives of THE PARTIES; and this amendment will be a part of this AGREEMENT.

18.3.4 Although the Force Majeure event occurs, the provisions of Article 18 of this AGREEMENT, BUYER still be obligated to pay to the SELLER for ELECTRICITY given by the SELLER to the BUYER up to the date of Force Majeure. However, if BUYER is the PARTY that is experiencing and / or affected by Force Majeure, the obligation of BUYER to pay for ELECTRICITY given by the SELLER to the BUYER before within the same MONTH as Force Majeure, suspended up to 30 (thirty) DAYS after the end of the Force Majeure Period or after accepting of invoice payment documents for ELECTRICITY, whichever occurs last.

18.3.5 If estimated by THE PARTIES that the Force Majeure Period will last for 12 (twelve) MONTHS continuously or more; then THE PARTIES will conduct negotiations to consider and decide whether, given the economic calculation of each PARTY, AGREEMENT will continue on, or continuing with some changes to the AGREEMENT; or terminated in referred in Article 20.2.4 (item (a)] of this AGREEMENT.

ARTICLE 19
CHANGES AND AMENDMENTS

19.1 Changes
THE PARTIES agree that every change in this AGREEMENT can only be done on PARTY’s agreement.

19.2 AMENDMENTS
Every change in this AGREEMENT as referred in Article 19.1, after PARTY’s agreement, an amendment will be made signed by THE PARTIES, and will be an inseparable part of this AGREEMENT.

ARTICLE 20
EARLY CLOSURE

20.1 Early Closure

20.1.1 Except if described in the acts below, each PARTY may not end this AGREEMENT before the AGREEMENT period referred to in Article 4 of this AGREEMENT ends.

20.1.2 However, if one of the PARTY has failed to meet its obligations of this AGREEMENT, especially if its failure to fulfill its obligations as described below, then the other PARTY has the right to end this AGREEMENT early with know-how in Article 20.2 below.

20.2 Procedure for AGREEMENT’s Early Closure

20.2.1 If SELLER fails to achieve COMMISSIONING of a UNIT on specified date and agreed by THE PARTIES the COMMISSIONING DATE as referred to in Article 1.1.22 of this AGREEMENT, and the failure is not because of Force Majeure or because of BUYER’s
mistake to receive ELECTRICITY supplied and delivered by the SELLER from UNIT to the PURCHASER who performed the COMMISSIONING, or otherwise, if the SELLER fails to perform the COMMISSIONING of a UNIT on the specified date and agreed THE PARTIES as COMMISSIONING DATE as referred to in Section 1.1.22, and the failure is solely due to failure of BUYER to receive ELECTRICITY supplied and delivered by the SELLER to the BUYER from a UNIT that performed the COMMISSIONING, then the PARTY that did not fail in meeting its obligations associated with the failure of the implementation of the COMMISSIONING ("PARTY that does not fail") deserve the right to send a " Failure Notice " to the other PARTY ("PARTY that is considered failed"), in Article 7.2, that mentions the failure that has been done by the PARTY that is considered failed in detail, with a request that the PARTY that is considered failed complete its obligations no later than .... (....) MONTHS after receiving the Failure Notice.

20.2.2 If within .... (....) MONTHS after receiving a Failure Notice as defined in Article 20.2.1 above PARTY that is considered failed has not yet successfully completed the obligations, one of the PARTY, in good intention can invite the other PARTY to meet and discuss progress and efforts made by PARTY that is considered failed to resolve the failed obligations.

20.2.3 If, in the meeting the PARTY that is considered failed has been considered as having a good intention or with concrete and serious effort by the PARTY that is considered failed to meet its obligations, and agreed that in the period of time ... (....) MONTH given in the Failure Notice meet its obligation, but need an additional time then the PARTY that is considered failed may approve in writing the additional time needed, as agreed by both PARTIES, to settle the obligation of the PARTY that is considered failed that receiving the Failure Notice.

20.2.4 However, if in the meeting, the PARTY that is considered failed does not have a good intention or with concrete and serious effort made by the PARTY that is considered failed to meet its obligations within the time specified in the Failure Notice; or the PARTIES argues that the obligations of the PARTY that is considered failed considered to be finish in the near future, thus needing additional time for completion may alter economic calculation one PARTY or the PARTIES significantly, then:

a. THE PARTIES may agree to terminate this AGREEMENT immediately. If ending this Agreement has been agreed on, THE PARTIES will make a AGREEMENT Closure Agreement, where in the AGREEMENT Closure Agreement will include:

   i. The start date of AGREEMENT Closure Agreement;

   ii. That by ending this AGREEMENT each PARTY will be released from all rights and obligations and legal responsibilities against the other PARTY as the result of this AGREEMENT, except for obligations which have come up and have not been done (other than the obligation to complete the work as mentioned in the Failure Notice referred to in Article 20.2.1 above) before ending this AGREEMENT, and

   iii. Each PARTY will be responsible for claims settlement, demands or claims from any third party (including from the workers or their affiliates) and free the other PARTY from any obligations and responsibilities associated with lawsuits, demands or claims from the third party from the relevant PARTY.

b. If the PARTIES can not reach an agreement to end the AGREEMENT as referred to in point (a) of this Article, then after the expiration of a period of 6 (six) MONTHS as set forth in the Failure Notice (or a longer period of time agreed by THE PARTIES as referred to in Article 20.2.3), PARTY that is considered failed has failed to meet its obligations, the PARTY that does not fail have the right to terminate this AGREEMENT by sending a "Notice of AGREEMENT Closure" to PARTY that is considered failed according to Article 20.3
Notice of AGREEMENT Closure must be received by the PARTY that is considered failed within 30 (thirty) DAYS before the start of the date of AGREEMENT Closure set forth in the Notice of AGREEMENT Closure.

20.2.5 If one of PARTIES, after the COMMERCIAL OPERATION DATE of a PLTP unit, failed to meet its obligations ("PARTY that is considered failed ") and the failure is not because of Force Majeure or due to failure of the other PARTY that directly caused the failure of PARTY that is considered failed, and the result of this failure is the disruption of the distribution and delivery and / or acceptance of ELECTRICITY, within a period of three (3) MONTHS continuously, the PARTY that does not failed entitled to send " Failure Notice " to the PARTY that is considered failed; and then the PARTY that does not failed have the right to end this AGREEMENT, according to the procedure and to the Article 20.2.2, Article 20.2.3, and Article 20.2.4 above, mutatis mutandis, if the case of failure referred to in this article:

a. Time given to complete its obligations to the PARTY that is considered failed stated in Failure Notice is three (3) MONTHS, since receiving the Failure Notice by the PARTY that is considered failed;

b. Discussion meeting referred to in Article 20.2.2 can be performed within 2 (two) MONTHS since receiving the Failure Notice by PARTY that is considered failed; and

c. Notice of AGREEMENT Closure may be given after the end of the three (3) MONTHS as set forth in Failure Notice (or a longer period of time is agreed by the parties as set forth in Section 20.2.3),

20.2.6 If PARTY that is considered failed receive a Notice of AGREEMENT Closure, if before the end of thirty (30) DAYS after receiving the Notice of AGREEMENT Closure, the PARTY that is considered failed has successfully complete its obligations that had been said as a failure and the completion had been well-received by the other PARTY, then the Notice of AGREEMENT Closure will cancel and will not be valid for the failure of the obligations which resulted the Notice of AGREEMENT Closure. This provision also applies to giving Notice of AGREEMENT Closure referred to in Article 20.2.4.

20.2.7 If the failure referred to in Article 20.2 is only about one PLTP unit, the Agreement Closure referred to above are only partial, in the sense that this AGREEMENT remains valid for the other units of PLTP.

20.3 AGREEMENT’s Early Closure Due to Other Causes

This AGREEMENT may also end before the time of AGREEMENT referred to in Article 4 of this AGREEMENT if:

20.3.1 If the declaration of bankruptcy against in PARTY has been filed to court that have a jurisdiction over such PARTY, whether if the application is submitted by the relevant PARTY itself or by another party, then the other PARTY has the right to end this AGREEMENT with these following procedures:

a. PARTY of whom bankruptcy petition has been filed ("Respondent PARTY "), shall notify the other PARTY in writing no later than 7 (seven) DAYS after the bankruptcy petition was filed to Court.

b. The other PARTY, soon after learning that there has been a declaration of bankruptcy to the Respondent PARTY, whether such knowledge is obtained from the Respondent PARTY or from other sources, are entitled to give Notice of AGREEMENT Closure to the Respondent
PARTY.

c. Notice of AGREEMENT Closure mention above stated that the AGREEMENT would end in the 90th (ninetieth) DAY after the Respondent PARTY accepted the Notice of AGREEMENT Closure.

d. If before the 90 (ninety) DAYS time frame mention in point (c) of this Article, Respondent PARTY succeeded in obtaining Court’s decision to rejected the declaration of bankruptcy against the Respondent PARTY and the decision of the Court has obtained legal power, then the Notice of AGREEMENT Closure will cancel and will not be valid for law, specifically for the rejected declaration of bankruptcy against the Respondent PARTY.

20.3.2 With regard to the provisions of Article 20.3.1 above, this AGREEMENT will expire by law on the DAY one of the PARTY declared bankrupt or liquidated.

20.3.3 In the event of Force Majeure and THE PARTIES, in the provisions of Article 18.3.5, agreed to terminate this AGREEMENT. If THE PARTIES agree to terminate this AGREEMENT, THE PARTIES will then prepare and sign a AGREEMENT Closure Agreement as stated in Article 20.2.4 (a), mutatis mutandis. But if no agreement is reached to end this AGREEMENT, then one PARTY may settle the conflict according Article 17 of this AGREEMENT.

20.4 To Waive Section 1266 Book of the Civil Code Act Validity
THE PARTIES agree to waive Article 1266 of Act Book of the Civil Code regarding termination of the AGREEMENT without going through a court decision.

ARTICLE 21
LEGAL RESPONSIBILITIES

Each PARTY shall be responsible for any consequences arising from the implementation of their tasks and their obligations under this AGREEMENT, including responsibility for completion and payment of compensation demanded by any third party, and thus:

21.1 SELLER shall release BUYER from any legal responsibilities for claims or compensation for damages, compensation or compensation, in any form, requested by any third party due to injury, disability or death of a person; and / or damage, loss or destruction of property suffered by a third party, as a result of the implementation of SELLER’s obligations to the construction and / or operation of GEOTHERMAL FIELD and PLTP Units, as well as ELECTRICITY distribution and delivery to the BUYER in this AGREEMENT, and then SELLER shall defend and reimburse the loss to the BUYER to settle and pay claims or compensation for damages, compensation referred above according to the decision of the Court or from the negotiations conducted by BUYER with the party who filed the claim or its representative, with the provision that the amount that will be approved by the BUYER to be paid is decent and reasonable and has been approved in advance by the SELLER, including court fees and advocate costs in a decent and reasonable amount spent by BUYER for handling and settlement of the case, except if it is proven that the injury, disability, death and / or losses by third parties who filed a claim or claim damages or compensation is solely as a result of negligence or mistake of the BUYER; and
21.2 BUYER shall release SELLER from any legal responsibility for claims or compensation for damages, compensation or compensation, in any form, filed by any third party due to injury, disability or death of a person; and / or damage, loss or destruction of property suffered by the such third party, as a result of the implementation of BUYER’s obligations in receiving ELECTRICITY from SELLER and / or utilization and / or its distribution according to this AGREEMENT, and then BUYER shall defend and give compensation to the SELLER to resolve and pay claims or claim for damages or compensation referred above according to the decision of the Court or from the negotiations conducted by the SELLER with the party who filed the claim or its representative, with the provision that the amount that will be approved by the SELLER to be paid is decent and reasonable and has been approved in advance by the BUYER, including court fees and advocate costs in a decent and reasonable amount spent by SELLER for handling and settlement of the case, except if it is proven that the injury, disability, death and / or losses by third parties who filed a claim or claim damages or compensation is solely as a result of negligence or mistake of the SELLER.

21.3 Regardless of the provisions outlined in Article 21.1 and 21.2 above, each PARTY shall be liable for injury, disability, or death suffered by their employees, including responsibility for damage, loss or destruction of property suffered by the employees and property of each PARTY that occur within the framework of the implementation of this AGREEMENT, and therefore each PARTY will free other PARTY from all charges, claims and responsibility from injury, disability, or employees death of each PARTY and / or damaged, lost or destroyed property mentioned above regardless of place, time and cause of injury, disability, or death of the employee and / or damaged, lost or destruction of property mentioned above, unless because of injury, disability, or death of the employee and / or damaged, lost or destruction of property above were caused by deliberate actions performed by other PARTY.

21.4 THE PARTIES agree that each PARTY shall not be responsible for other PARTY’s indirect loss (consequential damages) suffered by the other PARTY from the implementation of this Agreement, regardless of the cause of the indirect losses. A PARTY’s responsibility for any loss suffered by the other PARTY as a result of the failure or negligence in carrying out such PARTY with its obligations under this AGREEMENT only limited to those mentioned and explicitly specified in this AGREEMENT.

ARTICLE 22
AGREEMENT TRANSFER

22.1 Each PARTY are not entitled to assign its rights and obligations in this AGREEMENT, either in part or fully, before obtaining the written consent of the other PARTY.

22.2 If an event of transfer as referred to in Article 22.1 above, then this AGREEMENT remains valid and binding on the transferred PARTY, replacement and / or successors, before the transfer was carried out in writing and comply with laws and regulations.

ARTICLE 23
ADMINISTRATION AND CORRESPONDENCE

23.1 THE PARTIES Addresses

23.1.1 All correspondence concerned or related to this AGREEMENT and / or its implementation shall be in writing and must be submitted in person, or sent via fax or via courier where its customs duty has been paid by sending PARTY, with the following address:
To the SELLER:
PT ....
Address ...
u.p. Director of ...
Telephone:
Fax:

To the BUYER:
PT PLN (Persero)
Jl.Trunojoyo Blok M I/135 – KebayoranBaru
Jakarta 12160, Indonesia.
UP STRATEGIC PROCUREMENT DIRECTOR
Phone: (021) 739 7411
Fax: (021) 725 1341
cc. OPERATIONS DIRECTOR (REGIONAL) ....
Phone: (021) 727 8440 7
Fax: (021) 727 9422 8

23.2 Time of Receiving the Letter
23.2.1 Correspondence referred in Article 23.1 above shall be considered as received by the receiving PARTY as follows:
   a. Correspondence that handed directly to the recipient PARTY shall be deemed received on the date shown in the receipt of the letter concerned, which was signed in initials or signed by an officer from the receiving PARTY;
   b. Correspondence sent by fax shall be deemed received by the receiving PARTY on the date stamped on the fax report; and
   c. Correspondence sent by courier shall be deemed received by the receiving PARTY on the date shown in the receipt of the letter concerned, which was signed in initials or signed by an officer from the receiving PARTY.
23.2.2 Apart from these provisions in Article 23.2.1 above, if the correspondence is received by the receiving PARTY under the terms above on Saturday, Sunday, or any other national holidays or after 15:00 pm on weekdays LOCAL time, then the corresponding letter is considered accepted by the recipient PARTY on the date of the next business day.

ARTICLE 24
OVERALL AGREEMENT AND SEPARATION

24.1 The Entire Agreement
THE PARTIES understand and agree that all provisions set forth in this AGREEMENT, including Attachments and other documents which are declared to be an inseparable part of this AGREEMENT, is entirely on the agreement of THE PARTIES regarding the sale and purchase of ELECTRICITY generated from the PLTP Unit according to this AGREEMENT, so that all things that have never been discussed, presented or approved by THE PARTIES before the signing this AGREEMENT, either verbally or written, is not a part of and will not alter the understanding or agreement of THE PARTIES on this AGREEMENT this, unless this or things that have never been discussed, presented or agreed on expressed in, or a part of this AGREEMENT.

24.2 Separation
THE PARTIES understand and agree that if any provision in this AGREEMENT and in the
appendix or other document that is a part of this AGREEMENT, because if something is impossible to be done or against or inconsistent with the law, then this AGREEMENT remains in force, and the conflicting provision shall be removed, and is not a part of the conditions set forth in this AGREEMENT. Furthermore, THE PARTIES agree to, with good intention, to modify or replace the provisions that cannot be implemented, or against or stated as against the law that have the same meaning and intention, or at least have a close meaning and intention of the provisions to be amended or replaced it. Changes that has been approve by THE PARTIES to replace the provisions mentioned above will be made in the form of Amendment signed by authorized representatives of each of the PARTIES, and the amendment becomes a part of this AGREEMENT.

**ARTICLE 25**

**OTHERS**

25.1 Agreement Implementation with the Spirit of Cooperation and Good Intention.
THE PARTIES agree to execute this AGREEMENT in a spirit of cooperation and good intention.

25.2 Embodiment spirit of cooperation and goodwill.
In creating the spirit of cooperation and good intention as referred to in Article 25.1 above, THE PARTIES agree to provide information, data and other necessary information for the execution of this AGREEMENT to the other PARTY (including providing data and information referred to in Article 25.3 below), as soon as possible after receiving the written request from the PARTY who need the information, data or other information.

25.3 Confidentiality
Each PARTY agrees to maintain the confidentiality of all information, data and other information received from the other PARTY marked as information, data or "CONFIDENTIAL" information and will not provide or leak information, data or confidential information to any other party without prior written consent of the PARTIES that provide the information, data or confidential information unless the information, data or confidential information given to or from governmental institutions or Court, according to applicable law and / or to potential interest buyers, (potential) funders, consultants or advisers or contractors who need the information, data or confidential information for purposes of execution of work, only if potential interest buyers, (potential) funders, consultants or advisers or contractors who need the information, data or confidential information has made a statement in writing to keep the information, data or confidential information they receive.

25.4 Environment Friendly Development Mechanism (Clean Development Mechanism)
If the project of PLTP development can be categorized under the Clean Development Mechanism (CDM) as defined in the Kyoto Protocol and can get certified emission reduction certificates (CERs), then the CERs would be at 50% for SELLER and BUYER for 50%

25.5 Standard Operating Procedure
THE PARTIES will create a Standard Operating Procedure (SOP) regarding the operational implementation of this AGREEMENT, no later than 90 (ninety) days from the DATE OF ENTRY STARTS and SOPs will become an part of this AGREEMENT.
ARTICLE 26
CLOSING

This AGREEMENT is made within 2 (two) original copies, each of which has the same legal force, with sufficient stamp of duty and signed by THE PARTIES on the day, date, month and year mentioned above.
APPENDIX D: COST CURVES

Figure D 1  Incremental Drilling Cost Increased x2

Figure D 2  Incremental Coal Increased
Figure D 3  Incremental Combined – Both Coal 40–90 and Drilling X2

National Cost Supply Curve of Geothermal in Indonesia
(Combined - both Coal-increased 40$/ton - 90$/ton and Drilling Cost Increased 2x)

- Cost Supply Curve of Geothermal
- Coal (Without Env.)
- Coal (With Local)
- Coal (With Local+Global)

Incremental Levelized Cost (Cent/kWh)

Installed Capacity of Geothermal (GW)
Like all forms of electric generation, both renewable and non-renewable, geothermal power generation has environmental impacts and benefits. By comparing geothermal electricity generation to other forms of electricity generation, this Section highlights the benefits of choosing geothermal energy over other sources. Topics discussed include air emissions, noise pollution, water usage, land usage, waste disposal, subsidence, induced seismicity, and impacts on wildlife and vegetation. Geothermal energy, whether utilized in a binary, steam, or flash power plant, cooled by air or water systems is a clean, reliable source of electricity with only minimal environmental impacts, even when compared with other renewable energy sources.

With respect to mitigation of any potential environmental impact the International Finance Corporation published *Environmental, Health, and Safety (EHS) Guidelines* are technical reference documents with general and industry specific examples of Good International Industry Practice (GIIP). When one or more members of the World Bank Group are involved in a project, these *EHS Guidelines* may be applied. In terms of environmental sustainability, the maintenance of stable, close-to-original temperature and pressure status of an exploited groundwater reservoir is of prime importance as well as the protection against pollution of surface waters by untreated outflow of saline or used thermal waters. The IFC geothermal industry guidelines promulgated by the World Bank Group are designed to be used together with the General EHS Guidelines document, which provides guidance to users on common EHS issues potentially applicable to all industry sectors. For complex projects, use of multiple industry-sector guidelines may be necessary. These EHS and IFC guidelines have been applied in geothermal projects in Indonesia.

The *EHS Guidelines* for geothermal projects contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs. Application of the *Guidelines* to existing facilities may involve the establishment of site-specific targets, with an appropriate timetable for achieving them. The applicability of the EHS Guidelines should be tailored to the hazards and risks established for each project on the basis of the results of an environmental assessment in which site-specific variables are weighed. The following discussion highlights the environmental sustainability impact issues that are associated with the explanation, drilling and exploitation of geothermal resources.

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249 Defined as the exercise of professional skill, diligence, prudence and foresight that would be reasonably expected from skilled and experienced professionals engaged in the same type of undertaking under the same or similar circumstances globally. The circumstances that skilled and experienced control techniques available to a project may include, but are not limited to, varying levels of environmental degradation and environmental assimilative capacity as well as varying levels of financial and technical feasibility.

250 A complete list of industry-sector guidelines can be found at: International Finance Corporation, *IFC Sustainability – Site Map*, [Online], www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines
E.1 Emissions

Most fossil fuel power plant emissions are either a product of fuel combustion or a waste product from that process. Geothermal plants avoid both environmental impacts associated with burning fuels as well as those associated with transporting and processing fuel sources. Geothermal plants emit only trace amounts of nitrogen oxides, almost no sulfur dioxide or particulate matter, and small amounts of carbon dioxide. The primary pollutant some geothermal plants must sometimes abate is hydrogen sulfide, which is naturally present in many subsurface geothermal reservoirs (total non condensable gasses are usually below 2-3%).

A case study of a coal plant updated with scrubbers and other emissions control technologies emits 24 times more carbon dioxide, 10,837 times more sulfur dioxide, and 3,865 times more nitrous oxides per megawatt hour than a geothermal steam plant.  

It is important to note that air emissions from all power plants, including but not limited to geothermal, come from a variety of sources. For example, additional fossil fuel emissions, which come from the transportation of fuel to the power plant, are often omitted from emissions data.

Average life cycle emissions at coal facilities are substantially higher than their average operational emissions. Operational emissions do not consider the effects of coal mining, transport, construction, and decommissioning. Life cycle emissions from geothermal facilities, in contrast, generally remain in the same range as operational emissions.

Recommended methods for the management of air emissions include the following:

- Electing from among technological options that include total or partial re-injection of gases with geothermal fluids within the context of potential environmental impacts from alternative generating technologies together with

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other primary factors, such as the fit of the technology to the geologic resource and economic considerations (e.g., capital and operation/maintenance costs);

- When total re-injection is not feasible, venting of hydrogen sulfide and non-condensable volatile mercury if, based on an assessment of potential impact to ambient concentrations, pollutant levels do not exceed applicable safety and health standards;

- If necessary, use of abatement systems to remove hydrogen sulfide and mercury emissions from total non-condensable gases. Examples of hydrogen sulfide controls can include wet or dry scrubber systems or a liquid phase reduction/oxidation system, while mercury emissions controls may include gas stream condensation with further separation or adsorption methods.

- Following is an overview of emissions that have sometimes been associated with geothermal development.

E.1.1 Nitrogen Oxides (NOx)

Nitrogen oxides are most often colorless and odorless, or from time-to-time reddish brown as nitrogen dioxide. Nitrogen oxides form during high temperature combustion processes from the oxidation of nitrogen in the air. Motor vehicles are the major source of these pollutants, followed by industrial fuel-burning sources such as fossil fuel-fired power plants. Fossil fuel-fired power plants are responsible for 23 percent of nitrogen oxide emissions.252

Because geothermal power plants do not burn fuel, they emit very low levels of nitrogen oxides. In most cases, geothermal facilities emit no nitrogen oxides at all. The small amounts of nitrogen oxides released by some geothermal facilities result from the combustion of hydrogen sulfide. It is best practice for geothermal plants to maintain hydrogen sulfide abatement systems.

E.1.2 Hydrogen Sulfide (H₂S)

Hydrogen sulfide is now routinely abated at geothermal power plants, resulting in the conversion of over 99.9 percent of the hydrogen sulfide from geothermal non-condensable gases, some abatement methods produce elemental sulfur which can then be used as a non-hazardous soil amendment and fertilizer.

The Ulubelu and Lahendong (Tompaso) greenfield sites offer an instructive example. In these sites, the World Bank (as a lender), utilizing EHS guidelines, deemed potential emissions of hydrogen sulfide from power plant cooling towers during operation to be the most significant environmental management challenge in the proposed project.253

In this instance, among four different environmental standards or guidelines applied, three are typical in air quality management:

- Emission limits,
- Workplace exposure limits,
- Ambient air quality standards — and

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An odor standard that is unique to Indonesia.

In this example, both plants were designed to comply with the Indonesian emission limit of 35 milligrams per cubic meter (mg/m\(^3\)) averaged over one hour, and with the Indonesian workplace safety standard that set the maximum H\(_2\)S concentration for an eight-hour exposure period at 14 mg/m\(^3\). The Bank concluded that both Indonesia-specific standards are consistent with international practice. Since Indonesian regulations in the 2011 World Bank Report did not include a health-based ambient air quality standard for H\(_2\)S, the World Bank Group applied the Environmental, Health and Safety Guidelines.

The EHS Guidelines do not set a standard for H\(_2\)S but advise the use of an internationally accepted standard. In this case, PGE agreed with the Bank to use the health guideline recommended by the World Health Organization as the ambient standard for the project – 150 micrograms per cubic meter (\(\mu g/m^3\)) averaged over 24 hours.

In addition to the prevention and control of emissions and exposure to hydrogen sulfide gas described in the environmental and occupational health and safety sections cited above, the potential for exposures to members of the community should be carefully considered during the planning process and the necessary precautions implemented.

Where the potential for community exposure is significant, examples of mitigation measures include:

Siting of potential significant emissions sources with consideration of hydrogen sulfide gas exposure to nearby communities (considering key environmental factors such as proximity, morphology and prevailing wind directions);

Installation of a hydrogen sulfide gas monitoring network with the number and location of monitoring stations determined through air dispersion modeling, taking into account the location of emissions sources and areas of community use and habitation; and

Continuous operation of the hydrogen sulfide gas monitoring systems to facilitate early detection and warning.

### E.1.3 Particulate Matter ("PM")

Particulate matter is a broad term for a range of substances that exist as discrete particles. Particulate matter includes liquid droplets or particles from smoke, dust, or fly ash. Primary particles such as soot or smoke come from a variety of sources where fuel is burned, including fossil-fuel power plants and vehicles. Secondary particles form when gases of burned fuel react with water vapor and sunlight. Secondary particulate matter can be formed by NOx, SOx, and Volatile Organic Compounds (VOCs). Large particulates in the form of soot or smoke can be detected by the naked eye, while small particulates (PM2.5) require a microscope for viewing. “PM10” refers to all particulates less than or equal to 10 microns in diameter of particulate mass per volume of air.

Particulate matter is emitted through the full process of fossil-fuel electricity production, particularly coal mining. Health effects from particulate matter include eye irritation, asthma, bronchitis, lung damage, cancer, heavy metal poisoning, and cardiovascular complications.\(^{254}\) Particulate matter contributes to atmospheric deposition, visibility impairment, and aesthetic damage. In general, power plants employing best practices comply with PM10 standards.

Although coal and oil plants produce hundreds of short tons of PM on an annual basis (where one short ton equals 2,000 pounds), geothermal plants emit almost no particulate matter. Water-cooled geothermal plants do emit small amounts of particulate matter from the cooling tower when steam condensate is evaporated as part of the cooling cycle. However, the amount of particulate matter given off from the cooling tower is quite small when compared to coal or oil plants which have burning processes in combination with cooling towers.

**E.1.4 Carbon Dioxide (CO2)**

Carbon dioxide, a colorless, odorless gas, is released into the atmosphere as a byproduct of burning fuel. While carbon dioxide emissions are also produced by natural sources, most experts agree that increased atmospheric carbon dioxide concentrations are caused by human fossil fuel burning. Concentrations in the atmosphere have increased by in excess of 20% since 1960.\(^{255}\) The increase in carbon dioxide is typically attributed to power plant (primarily coal) and vehicle emissions, and secondarily to deforestation and land-use change.\(^{256}\) While carbon dioxide does not pose any direct human health threat (Humans exhale carbon dioxide with every breath), experts generally agree that global warming poses significant environmental and health impacts, including flood risks, glacial melting problems, forest fires, increases in sea level, and loss of biodiversity.\(^{257}\)

Geothermal plants do emit carbon dioxide, but in quantities that are small compared to fossil fuel-fired emissions. Most geothermal reservoir fluids contain varying amounts of non-condensable gases, including carbon dioxide.

Despite these disparities, geothermal power plants will emit only a small fraction of the carbon dioxide emitted by traditional power plants on a per-megawatt hour basis.

**E.2 Mercury**

Although mercury (Hg) is not present in every geothermal resource, where it is present, mercury abatement equipment typically reduces emissions by 90 percent or more. Geothermal plants have no recorded instance of releasing mercury at levels that trigger any health risk.

**E.3 Solid and Liquid Waste**

In most geothermal facilities, air emissions are the most significant environmental issue of concern. Solid wastes discharged from geothermal power plants are generally deemed nonhazardous and in low quantities.\(^{258}\) The substances are typically either too low to cause

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any concern, or are recycled through the system and do not make contact with water, land, or air.

E.4 Noise Pollution

Noise sources in geothermal facilities are mainly related to well drilling and steam venting. Other sources include the operation of equipment related to pumping facilities, turbines, and temporary pipe flushing activities. Temporary noise levels may exceed 100 dBA during certain drilling and steam venting activities. Noise abatement technology includes the use of rock mufflers, sound insulation, and barriers during drilling, in addition to silencers on equipment in the steam processing facility. Further recommendations for the management of occupational noise and vibration, such as the use of appropriate Personal Protective Equipment (PPE), are discussed in the general EHS Guidelines.

E.5 Water Use

Most geothermal reservoirs are found deep in the subsurface well below groundwater reservoirs. As a result, these deep reservoirs generally pose almost no negative impact on water quality and use. While no record of water use problems exists in Indonesia, potable groundwater and clean surface water are important resources that require continued attention as the use of domestic geothermal resources grows.

Geothermal plants use approximately five gallons of freshwater per megawatt hour, while binary air-cooled plants use no fresh water. This compares with 361 gallons per megawatt hour used by natural gas facilities.\(^{259}\) Note, however, that water usage changes drastically with different types of conversion technologies.

Spent geothermal fluids are typically injected back into the reservoir formation at a location that prevents cooling of the reservoir while maintaining maximum reheating and pressure support. If spent geothermal fluids are not injected, effluents should meet site-specific discharge levels for surface water as discussed in the general EHS Guidelines.

Occasionally, geothermal effluents, if stored rather than injected back into the system, deliver beneficial environmental effects. For example, the Icelandic tourist attraction, the Blue Lagoon (a turquoise body of mineral rich water) was actually created by geothermal water discharged from a power plant. Not only is the Blue Lagoon safe for swimming, but the waters are also touted as soothing, and as sources of curative powers. Although the geothermal community in general agrees that injection is the most environmentally beneficial method of disposing of geothermal fluids, there are instances where other beneficial approaches have been taken.

The extraction, injection, and discharge of geothermal fluids may affect the quality and quantity of surface and groundwater resources. Examples of specific impacts include the inadvertent introduction of geothermal fluids into shallower productive aquifers during extraction and reinjection activities or a reduction in the flow of hot thermal springs due to withdrawal activities.

Recommended measures to prevent and control these impacts include:

- Elaboration of a comprehensive geological and hydro-geological model including overall geologic, structural and tectonic settings, reservoir size, boundaries, geotechnical and hydraulic host rock properties;

- Completion of a hydro-geological and water balance assessment during the project planning stage to identify hydraulic interconnections between the geothermal extraction and reinjection points and any sources of potable water or surface water features;
- Isolation of steam producing sources from shallower hydrologic formations, which may be used as sources of potable water through careful site selection and properly designed and installed well casing systems; and
- Avoiding negative impacts on surface water by introducing strict discharge criteria and appropriate means to bring water quality and temperature to acceptable standards.

Given that springs and wells are used for the communities’ daily needs, water quality from these sources need to be measured against Indonesian drinking water standards as prescribed in the Minister of Health Decree RI 907/MENKES/SK/VII/2002. Discharge measurements and water quality analyses are often taken as part of an AMDAL in consideration of the fact that these water bodies could be potentially affected by the activities associated with the project development. Water quality analyses for rivers need to be assessed against Indonesian water quality standards for Class II (water suitable for recreational, fresh water fish cultivation, livestock and irrigation purposes) as prescribed in Government Regulation 82/2001 on Water Quality Management and Water Pollution Control.²⁶⁰

E.6 Land Use

Geothermal power plants can be designed to blend in to their surrounding more so than fossil-fired plants, and can be located on multiple-use lands that incorporate farming and the raising of animals. Over 30 years, the period of time commonly used to compare the life cycle impacts from different power sources; a geothermal facility uses approximately 404 square meters of land per GWh, while a coal facility uses approximately 3632 square meters per GWh.

E.7 Subsidence

Subsidence, or the slow, downward sinking of land, may be linked to geothermal reservoir pressure decline. Subsidence can be a problem especially when injection practices are not followed. Extracting fluids at the New Zealand Wairākei Field has caused the ground to subside. A 50-year study showed subsidence, up to 14 meters.²⁶¹ Injection technology is an effective and proven mitigating technique.

Subsidence is most commonly thought of as the downward sinking of the land surface, but other types of ground deformation include upward motion (inflation) and horizontal movements. In some cases, subsidence can damage facilities such as roads, buildings and irrigation systems, or even cause tracts of land to become submerged by nearby bodies of water. Although subsidence often occurs naturally, subsidence can also occur as a result of the extraction of subsurface fluids, including groundwater, hydrocarbons, and geothermal fluids. In these cases, a reduction in reservoir pressure reduces the support for the reservoir rock itself and for the rock overlying the reservoir, potentially leading to a slow, downward deformation of the land surface. In most areas where subsidence has been


attributed to geothermal operations, the region of Earth deformation has been confined to the well field area itself, and has not disturbed anything off-site.

While subsidence can be induced by thermal contraction of the reservoir due to extraction and natural recharge, properly placed injection reduces the potential for subsidence by maintaining reservoir pressures. At fields producing from sedimentary rocks where the porosity and permeability is primarily between rock grains, injection can successfully mitigate subsidence.

Naturally-occurring subsidence most frequently takes place in areas that are tectonically active such as volcanic regions and fault zones. Subsidence can also typically occur in areas where sedimentary basins are filled with unconsolidated sands, silts, clays and gravels. Most known geothermal resources are located in areas that are tectonically active, and may experience natural subsidence. Because geothermal operations occur at tectonically active sites, it is sometimes difficult to distinguish between induced and naturally occurring subsidence. Subsidence related to geothermal development is more likely in areas where the geothermal reservoir occurs in weak, porous sedimentary or pyroclastic formations.262

E.8 Induced Seismicity

While earthquake activity – or seismicity – is a natural phenomenon, geothermal production and injection operations have at times resulted in low-magnitude events known as “micro earthquakes”.

Earthquake activity, or seismicity, is generally caused by displacement across active faults in tectonically active zones. An earthquake occurs when a body of rock is ruptured and radiates seismic waves that shake the ground. Although it typically occurs naturally, seismicity has at times been induced by human activity, including development of geothermal fields, through both production and injection operations. In these cases, seismicity has resulted in the form of low magnitude events known as micro earthquakes that have Richter magnitudes below 2 or 3 and which are generally not felt by humans. The injection of geothermal fluid back into the geothermal system can sometimes cause these micro earthquakes to occur in the vicinity of the injection site. The micro earthquakes sometimes associated with geothermal development are not considered to be a hazard to the geothermal power plants or the surrounding communities and will usually go undetected unless sensitive seismometers are located nearby.263

Historically, induced seismicity has occurred in many different energy and industrial applications (reservoir impoundment, mining, construction, waste disposal, and oil and gas production). Although certain projects have stopped because of induced seismicity issues, proper study and engineering controls have always been applied to enable the safe and economic implementation of these technologies. Recent publicity surrounding induced seismicity at several geothermal sites points out the need to address and mitigate any potential problems that induced seismicity may cause in geothermal projects.264 Therefore, it


is critical that the policy makers and the general community are assured geothermal technologies relying on fluid injections will be engineered to minimize induced seismicity risks, ensuring the resource is developed in a safe and cost effective manner.

E.9 Geysers, Fumaroles, & Geothermal Resources

While most geothermal resources currently developed for electricity production are located in the vicinity of natural geothermal surface features, much of the undeveloped geothermal resource base may be found deep under the Earth without any corresponding surface thermal manifestations. Geothermal surface features, while useful in identifying possible resource locations, are not used during geothermal development.

E.10 Impact on Wildlife & Vegetation

Before geothermal construction can begin, an environmental review may be required to categorize potential effects upon plants and animals. Power plants are designed to minimize the potential effect upon wildlife and vegetation.

E.10.1 Flora

If the main components of the project (steam field, power plant and transmission line) are located within an area of Protected Forest under management, the flora, even the Indonesian common pine plantation (Pinus merkusi) may be protected. In addition, agricultural crops that are frequently grown within a forested area (such as cabbage, carrot, potato and maize) will need to be considered.

E.10.1 Fauna

Project development environmental impact will be focused on those mammal, bird species and aquatic biota that are recorded in woods around the steam field and power plant project area sites that are identified on the IUCN Red List as being endangered or threatened. For example, in the Karaha Bodas AMDAL (2009), forty species of birds belonging to nineteen families were observed within the project area. The AMDAL noted that eight species identified have national protected status (P) based on their relative rarity, limited global distribution and the beneficial ecological functions they provide. One of the eight species, the Javan White eye (Zosterops flavus) is classified as near threatened (NT) under the IUCN Red List categories, but was frequently encountered in the project area. In these circumstances, the project proponent should take practical measures to ensure that protected status of these birds is not compromised. Such measures should include forbidding the hunting of birds within the project area and raising public awareness of the conservation status of birds in the area through strategically located bulletin boards.

E.11 Well Blowouts & Pipeline Failures

Although very rare, well blowouts and pipeline failures may occur during well drilling or facility operations. Such failures can result in the release of drilling additives and fluids, as

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265 Note that in Java and Banten a “Protected Forest” is essentially equivalent to a “Production Forest” in other provinces of Indonesia. Asian Development Bank, Karaha Initial Environmental Examination, Geothermal Power Development Project 43249, pp.29-30 (Oct. 2011).

266 See <http://www.iucnredlist.org/>

well as hydrogen sulfide gases from subsurface formations. Pipeline ruptures may also result in the surface release of geothermal fluids and steam containing pollutants. Recommended pollution prevention and control methods to address well blowouts and pipeline ruptures include:

- Regular maintenance of wellheads and geothermal fluid pipelines, including corrosion control and inspection; pressure monitoring; and use of appropriate blowout prevention equipment during drilling; and
- Design of emergency response for well blowout and pipeline rupture, including measures for containment of geothermal fluid spills.

E.12 Social Impacts and Mitigation Measures

Cultural dynamics, gender issues, community interaction and development aspirations are extremely important environmental considerations in an AMDAL — especially in remote project areas. In remote areas project developers should be sensitive to the potential for issues resulting from interactions between various ethnic groups such as the Javanese, the largest ethnic group in Indonesia and the Sundanese, who respectively are the first and second largest ethnic minority groups in Indonesia. Similar considerations apply to projects in which interrelation among various religious groups that would have socially and religiously conservative local population interacts with a more liberal workforce.

Particularly if there will be an influx of workers from other areas, community conflicts associated with different cultural and religious practices may occur. Mitigation measures include avoidance of establishment of on-site work camps. Also, the developer may prudently establish appropriate codes of conduct for worker population in consultation with local community and write this code into construction contracts and enforce the rules through site supervision and routine monitoring.

E.13 Environmental Mitigation and Monitoring Matrices

A hypothetical Environmental Impacts Mitigation Matrix for a typical geothermal project is provided in the Figure E.1. It identifies potential environmental impacts that could occur during each stage of the project and proposed mitigation measures to address each impact. A developer would also identify the institutional responsibilities for implementing the Plan including an environmental monitoring plan to ensure its effectiveness.

This hypothetical matrix identifies the potential environmental impacts arising from the project along with a corresponding schedule of mitigation measures to reduce the impacts to acceptable levels. In summary:

Natural habitats within a project area footprint will usually be highly modified (in the hypothetical the flora is primarily pine plantation and agricultural land and no critical habitats are recognized within or adjacent to the project area). Usually geothermal projects will result in insignificant loss of natural habit and have an insignificant impact on biodiversity conservation, mitigation measures are proposed to minimize impacts as much as possible.

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268 Asian Development Bank, Karaha Initial Environmental Examination, Geothermal Power Development Project 43249, pp. 63-71 (Oct. 2011). Figure 7.6.11, relies on the Karaha environmental Impact and Mitigation Study.
<table>
<thead>
<tr>
<th>Project Activity</th>
<th>Potential Impact</th>
<th>Hypothetical Mitigation Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of forest resources and encroachment into precious ecological areas</td>
<td>Reduction in forest biodiversity</td>
<td>Compensation for loss of forest land at ratio of 1:2 in accordance with Forest Lease Permit</td>
</tr>
<tr>
<td></td>
<td>Fragmentation of diminishing wildlife habitat</td>
<td>Forest area where project components sited is predominantly pine plantation with low biodiversity value</td>
</tr>
<tr>
<td>Siting of power plant and transmission line alignment</td>
<td>Visual intrusion and associated loss of land value in vicinity</td>
<td>Power plant and SAGS located out of site from human settlements</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Transmission line aligned along flanks of mountain range blending easily into surrounding countryside</td>
</tr>
<tr>
<td>Vegetation clearance</td>
<td>Potential fragmentation of diminishing wildlife habitat</td>
<td>Minimise forest clearance required for power plant, SAGS and transmission line ROW in accordance with and not exceeding standard safety clearances.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No motorable access tracks to be cut through Protection Forest for construction of transmission towers. (Access by foot only)</td>
</tr>
<tr>
<td>Hunting for birds in project area by construction and operational workforce</td>
<td>Reduced population of protected bird species</td>
<td>Hunting of wildlife by contractor’s workforce to be strictly forbidden and enforced. (Immediate dismissal for breach of requirement)</td>
</tr>
<tr>
<td>Project Activity</td>
<td>Potential Impact</td>
<td>Hypothetical Mitigation Measure</td>
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<td>------------------------------------------------------</td>
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</tr>
<tr>
<td>Surface water abstraction for drilling and power plant construction</td>
<td>Interference to or reduction in agricultural water resources resulting in loss of production</td>
<td>Raise public awareness regarding, protected bird species in the area including regulations concerning protected status.</td>
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<td>Regular inspections and maintenance of existing weirs and water pumping stations to ensure safe operations.</td>
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<td>Full compliance with valid water abstraction licences, which specify limited abstraction rates to ensure downstream agricultural requirements are not impacted.</td>
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<td></td>
<td>Compensation will be paid to farmers for project-related losses in the case of unforeseen impacts.</td>
</tr>
<tr>
<td>Vegetation clearance and excavation.</td>
<td>Uncontrolled erosion and silt runoff leading to soil loss and siltation of water courses</td>
<td>Construction contract clauses to include provisions for:</td>
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<tr>
<td></td>
<td></td>
<td>Minimal clearance of surrounding vegetation and topsoil removal during site preparation.</td>
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<td>Bunding of work areas with runoff directed to settlement ponds prior to discharge into water courses.</td>
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<td></td>
<td>Protection of unstable soil surfaces from high velocity runoff.</td>
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<tr>
<td>Project Activity</td>
<td>Potential Impact</td>
<td>Hypothetical Mitigation Measure</td>
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<tr>
<td>Avoidance of temporary or permanent diversion of watercourses.</td>
<td>Good site supervision to ensure proper implementation of the above</td>
<td></td>
</tr>
<tr>
<td>Utilise and maintain existing drilling water and mud treatment system at the drill pads,</td>
<td>Only water-based drilling muds to be used</td>
<td></td>
</tr>
<tr>
<td>Drilling water and mud discharges</td>
<td>Pollution of nearby water courses</td>
<td>Ensure integrity of impermeable mud treatment pond membranes</td>
</tr>
<tr>
<td>Geothermal fluid (brine and condensate) discharges during production well tests</td>
<td>Localised heavy metal pollution of nearby water courses</td>
<td>Brine and condensate channelled into impermeable storage tank/pond prior to reinjection into reinjection well</td>
</tr>
<tr>
<td>Use, storage and potential spillage of fuels and chemicals</td>
<td>Pollution of nearby water courses</td>
<td>Appropriate siting of hard standing storage facilities for fuels and chemicals with adequate bunding to prevent accidental contamination</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hard standing facilities for equipment servicing, refuelling and wash down where drainage is directed through oil and grease traps before discharge into a settling pond before final discharge into offsite drainage channels</td>
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<tr>
<td>Project Activity</td>
<td>Potential Impact</td>
<td>Hypothetical Mitigation Measure</td>
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<tr>
<td>Provision of spill kits at fuel and chemical storage and handling facilities</td>
<td>Preparation of an oil and chemical spill emergency response plan</td>
<td>Good operation and maintenance practices for construction equipment</td>
</tr>
<tr>
<td>Good site supervision to ensure proper implementation of the above</td>
<td>Provision of adequate on-site sanitation facilities that do not allow untreated disposal of sewage to adjacent water bodies</td>
<td>Appropriate domestic solid waste and construction waste collection and disposal system</td>
</tr>
<tr>
<td>Fugitive dust emissions</td>
<td>Nuisance and health impacts for work force and nearby community</td>
<td>During dry periods spraying surfaces with water, in particular, access roads</td>
</tr>
<tr>
<td>Domestic waste water and solid waste from construction workforce</td>
<td>Pollution of nearby water courses</td>
<td>Re-vegetation as soon as practicable after completion of earthworks</td>
</tr>
<tr>
<td>Project Activity</td>
<td>Potential Impact</td>
<td>Hypothetical Mitigation Measure</td>
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<tr>
<td>Minimizing dust from open area sources including storage piles by using control measures such as enclosures and covers</td>
<td>Good site management and monitoring to ensure above mitigation measures are properly implemented</td>
<td></td>
</tr>
<tr>
<td>Hydrogen sulphide emissions during well testing</td>
<td>Risk to health of workers and nearby community</td>
<td>Production well testing to be undertaken one well at a time. (Not simultaneously)</td>
</tr>
<tr>
<td>Use of powered mechanical equipment on site</td>
<td></td>
<td>Provision of appropriately designed and located rock muffler to maximise dispersion and minimise risk to workers and nearby community</td>
</tr>
<tr>
<td>Traffic noise from heavy vehicles transporting materials and equipment to site</td>
<td>Community nuisance and worker health hazard</td>
<td>Good construction practice to minimise noise impacts to be specified in contract documents including:</td>
</tr>
<tr>
<td>Horizontal well testing</td>
<td></td>
<td>Scheduling activities during day time working hours</td>
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<tr>
<td></td>
<td></td>
<td>Maintenance of machinery and vehicles to keep noise at a minimum</td>
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<tr>
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<td></td>
<td>Use of noise abatement technologies including mufflers, sound insulation, equipment silencers</td>
</tr>
<tr>
<td>Project Activity</td>
<td>Potential Impact</td>
<td>Hypothetical Mitigation Measure</td>
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</tr>
<tr>
<td>Improper disposal of excess excavated spoil and other construction wastes (timber, packaging, domestic refuse)</td>
<td>Soil and water pollution,</td>
<td>Use of temporary noise barriers when noisy activities are undertaken close to residential areas, schools, hospitals,</td>
</tr>
<tr>
<td></td>
<td>Hazards to human health</td>
<td>Preparation of a Construction Waste Management Plan to include the following provisions</td>
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<tr>
<td></td>
<td></td>
<td>Implementation of an overall “reduce, reuse and recycle” approach to construction waste management</td>
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<tr>
<td></td>
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<td>Excess spoil to be used on-site for levelling/landscaping. Or provided to community for community projects</td>
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<td></td>
<td>Ensure spoil disposal areas are properly engineered to prevent risks of landslides and erosion (include appropriate drainage and settling basins)</td>
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<td></td>
<td></td>
<td>Liaise with local community to identify reuse and recycle options</td>
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<td>Appropriate storage of general waste and disposal at a landfill</td>
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<td>Disposal of hazardous waste by a licensed contractor</td>
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<tr>
<td>Project Activity</td>
<td>Potential Impact</td>
<td>Hypothetical Mitigation Measure</td>
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</tr>
<tr>
<td>Site sanitation</td>
<td>Communicable diseases</td>
<td>Provision of proper on-site sanitation facilities for site staff</td>
</tr>
<tr>
<td>Site access and transportation</td>
<td>Road accidents</td>
<td>Provision of workers transportation vehicles that are appropriately registered and well maintained and have experienced and qualified drivers</td>
</tr>
<tr>
<td>Well drilling and testing</td>
<td>Exposure to high concentrations of (H_2S) gas</td>
<td>Developer to prepare and implement (H_2S) safety procedures for well testing.</td>
</tr>
<tr>
<td></td>
<td>Exposure to heat</td>
<td>Provision of personal protective equipment (PPE) (hard hats, insulated gloves and boots, ear protection)</td>
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<td></td>
<td>Exposure to noise</td>
<td>Safety training for workers</td>
</tr>
<tr>
<td>Transmission line L construction</td>
<td>Safety risks working at height</td>
<td>Provision of PPE (hard hats, safety harnesses)</td>
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<tr>
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<td></td>
<td>Safety training for workers</td>
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<td>Project Activity</td>
<td>Potential Impact</td>
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<td>------------------------------------------------------</td>
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</tr>
<tr>
<td>Influx of workers from other areas and camp followers</td>
<td>Spread of HIV/AIDS</td>
<td>HIV/AIDS awareness briefings and screenings for workers</td>
</tr>
<tr>
<td></td>
<td>Malaria</td>
<td>Malaria awareness and prevention briefings for site staff</td>
</tr>
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<td></td>
<td></td>
<td>Maintain work site free of stagnant pools</td>
</tr>
<tr>
<td>Infrastructure Safety</td>
<td>Community exposure to physical hazards associated with drilling and construction works</td>
<td>Appropriate fencing around hazardous installations (drilling rigs, SAGS, power plant transmission towers);</td>
</tr>
<tr>
<td></td>
<td>Community conflicts due to lack of information and/or understanding of project activities</td>
<td>Appropriate signage around site perimeter, especially in areas of high security and hazardous installations</td>
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<td></td>
<td>Regular and timely disclosure of relevant information is required at key stages of the project.</td>
</tr>
<tr>
<td>Disruption to informal forest access</td>
<td>Loss of livelihood from gathering of forest products - an important subsistence strategy</td>
<td>Negotiation with village leaders to establish arrangements for ensuring access for gathering forest products while at the same time defining restricted areas.</td>
</tr>
<tr>
<td>Construction and operation traffic</td>
<td>Risks to pedestrians using or living alongside site access road and local roads used for construction site access</td>
<td>Development and implementation of road safety plans and maximum speed limits for site and access routes to be specified in contract documents;</td>
</tr>
<tr>
<td>Project Activity</td>
<td>Potential Impact</td>
<td>Hypothetical Mitigation Measure</td>
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<tr>
<td></td>
<td>Possible disruption to informal forest access to gather fodder and non-timber</td>
<td>Contractors to monitor and enforce safety plans, accident reporting and statistics and establish</td>
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<td></td>
<td>forest products</td>
<td>penalties for violations; maintenance of site and access roads under Developer’s responsibility;</td>
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<td>Public information campaign to inform local residents including traffic safety awareness for</td>
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<td>children in schools</td>
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<td></td>
<td>Damage to village irrigation systems</td>
<td>Contractor to properly maintain water abstraction facilities and ensure compliance with water</td>
</tr>
<tr>
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<td>use licenses</td>
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<td></td>
<td>Loss of agricultural production</td>
<td>Contractor to advise downstream water uses if any disruption is anticipated or if any failure</td>
</tr>
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<td>occurs</td>
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<td></td>
<td>Contractor to pay compensation to farmers in the event of production losses/infrastructure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>damage caused by the contractors works</td>
</tr>
<tr>
<td>Failure/damage to water abstraction facilities located upstream of village irrigation systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Influx of workers from other areas and camp followers</td>
<td>Community conflicts associated with different cultural and religious practices</td>
<td>Avoid establishment of on-site work camps</td>
</tr>
<tr>
<td></td>
<td>Spread of HIV/AIDS</td>
<td>Developer to establish appropriate codes of conduct for worker population in consultation with</td>
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<td></td>
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<td>local community. This code will be written into construction contracts and enforced through site</td>
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<td>supervision and routine monitoring.</td>
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</tbody>
</table>

Tabel E 1 (Continued)
<table>
<thead>
<tr>
<th>Project Activity</th>
<th>Potential Impact</th>
<th>Hypothetical Mitigation Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction labour</td>
<td>Economic benefits to local community due to work opportunities during construction</td>
<td>Developer to require contractors to prioritise employment of local labour.</td>
</tr>
<tr>
<td>Surface water abstraction for power plant operations</td>
<td>Interference to or reduction in agricultural water resources resulting in loss of production</td>
<td>Utilise closed re-circulation cooling system for power plant thereby minimising operational water requirements.</td>
</tr>
<tr>
<td>Spent geothermal fluid discharges</td>
<td>Heavy metal pollution of nearby water courses</td>
<td>Re-injection of all geothermal fluid discharges (brine, condensate and sludge from cooling towers) into re-injection well (s)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>When reinjection system unavailable, spent geothermal fluids will be pumped to a thermal pond for future reinjection.</td>
</tr>
<tr>
<td>Waste water drainage from powerhouse, workshop etc.</td>
<td>Oil, grease and chemical pollution of water courses</td>
<td>All waste water drainage from powerhouse workshop and other site facilities likely to contain potential pollutants must pass through oil and grease traps prior to discharge to ground and water courses.</td>
</tr>
<tr>
<td>Sewage and domestic waste water discharge</td>
<td>Pollution of nearby water courses</td>
<td>Installation of an appropriately sized septic tank system to manage waste water from power plant staff facilities.</td>
</tr>
<tr>
<td>Handling and storage of hazardous substances (fuels, / chemicals)</td>
<td>Contamination of nearby water courses</td>
<td>Preparation and implementation of a Hazardous Substances Management Plan.</td>
</tr>
</tbody>
</table>

HIV/AIDS awareness and prevention briefings for local communities.
<table>
<thead>
<tr>
<th>Project Activity</th>
<th>Potential Impact</th>
<th>Hypothetical Mitigation Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risks to human health and safety</td>
<td>Provision of purpose-built oil, lubricant and fuel storage system with adequate bunding and complete with spill cleanup equipment.</td>
<td>Provision of purpose-built storage system for other hazardous chemicals, with adequate bunding and complete with spill cleanup equipment</td>
</tr>
<tr>
<td>Cooling tower emissions</td>
<td>Exceed WHO ambient air quality guideline for H$_2$S at nearby villages</td>
<td>Cooling tower emissions to comply with Indonesian Ministry of Environment Regulation No. 21, 2008 and not exceed 35 mg/Nm$^3$</td>
</tr>
<tr>
<td>Improper disposal of solid waste</td>
<td>Soil and water pollution</td>
<td>All wastes will be minimised, sorted reused and recycled wherever possible and otherwise collected and disposed of at a landfill</td>
</tr>
<tr>
<td>Hazards to human health</td>
<td>Disposal of hazardous waste by a licensed contractor</td>
<td></td>
</tr>
<tr>
<td>Geothermal power plant operation</td>
<td>Exposure to high concentrations of H$_2$S gas</td>
<td>Installation of H$_2$S monitoring and warning systems at appropriate locations within the power plant facilities (in accordance with SOPs) set to internationally published exposure guidelines</td>
</tr>
<tr>
<td>Exposure to heat</td>
<td>Provision of contingency plan for H$_2$S release events and emergency response teams including necessary equipment and training</td>
<td></td>
</tr>
<tr>
<td>Exposure to noise</td>
<td>Development of confined space entry procedures</td>
<td></td>
</tr>
<tr>
<td>Project Activity</td>
<td>Potential Impact</td>
<td>Hypothetical Mitigation Measure</td>
</tr>
<tr>
<td>------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Exposure to electro-magnetic fields (EMF)</td>
<td>Development of standard operating practices (SOPS) in relation to all operation and maintenance activities associated with geothermal power plant</td>
<td>Provision of shielding for hot surfaces</td>
</tr>
<tr>
<td>Monitor EMF levels to ensure levels are within national and international standards. (See Environmental Monitoring Plan)</td>
<td></td>
<td>Provision of safety awareness program for all staff</td>
</tr>
<tr>
<td>Transmission line and switchyard maintenance</td>
<td>Exposure to high voltage power lines</td>
<td>Development of standard operating practices (SOPS) in relation to all operation and maintenance activities associated with transmission line</td>
</tr>
<tr>
<td></td>
<td>Provision of safety awareness program for all staff</td>
<td></td>
</tr>
<tr>
<td>Transmission line operation</td>
<td>Electric shocks from high voltage transmission line</td>
<td>Electricity safety awareness raising sessions for communities (including schools) adjacent to transmission line</td>
</tr>
<tr>
<td></td>
<td>Community concerns over potential health effects associated with EMF</td>
<td>Community awareness raising and periodic monitoring of EMF levels to ensure levels are within national and international standards. (See Environmental Monitoring Plan)</td>
</tr>
<tr>
<td>Project Activity</td>
<td>Potential Impact</td>
<td>Hypothetical Mitigation Measure</td>
</tr>
<tr>
<td>-----------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Local employment opportunities for operation maintenance</td>
<td>Economic benefits to local communities.</td>
<td>Developer to liaise with community leaders outlining types of skills and training required to be</td>
</tr>
<tr>
<td>and security of project components</td>
<td>Impetus for community to acquire requisite skills and training to take advantage</td>
<td>eligible for future work opportunities during project operation.</td>
</tr>
<tr>
<td></td>
<td>of work opportunities.</td>
<td></td>
</tr>
<tr>
<td>Re-development of tourism facilities</td>
<td><em>Economic benefits to local community.</em></td>
<td><em>Discuss with leaders how Developer might assist in promoting tourism activities</em></td>
</tr>
<tr>
<td></td>
<td><em>Opportunities for local entrepreneurs</em></td>
<td></td>
</tr>
</tbody>
</table>

Source: ADB Karaha Initial Environmental Examination

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Source: ADB Karaha Initial Environmental Examination 269

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**BIBLIOGRAPHY**

*Legislative hierarchy in descending order of authority is the Constitution, Laws, Government Regulations, Presidential Decrees (Keppres/Perpres) and Ministerial decrees.*

**Laws**

Law No. 5/1960 on Basic Agrarian Law governing Land Rights and recognizes the right of Private Ownership

Law No. 15/1985 on Electricity Law (permitted limited private participation in electricity generation)

Law No. 05/1990 on the Conservation of Natural Resources and their Ecosystems

Law No. 18/1997 on Regional Taxes and Retributions

Law No. 30/1999 on Arbitration and Alternative Dispute Resolution

Law No. 41/1999 on Forestry

Law No. 22/1999 on Decentralized Government

Law No. 34/2000 on Regional Taxes and Retributions (Amendment to the Law No. 18/1997)

Law No. 22/2001 on Oil and Gas

Law No. 20/2002 on Electricity Law (annulled by Constitutional Court and replaced with the 2009 Electricity Law)

Law No. 17/2003 on the State’s Financing

Law No. 27/2003 on Geothermal Law

Law No. 01/2004 on Forestry (Amendment to the Law No. 41/1999)

Law No. 07/2004 on Water Resources

Law No. 19/2004 on Determination of Law No. 1/2004 Becoming Law

Law No. 32/2004 on Regional Governments

Law No. 33/2004 on the Balance of Financing Between Central and Regional Governments

Law No. 30/2007 on Formulation of a National Energy Policy

Law No. 25/2007 on Capital Investment

Law No. 39/2008 on State Ministries

Law No. 30/2009 on Electricity, which removed monopoly power of PLN

Law No. 32/2009 on Environmental Protection and Management

Law No. 04/2011 on Geospatial Information

Law No. 12/2011 on the Formulation of Laws and Regulations

Law No. 02/2012 on Land Procurement for Public Use
Government Regulations (GR)
GR No. 10/1989 on Electricity Supply and Utilization
GR No. 24/1997 on Registration of land with National Land Agency
GR No. 27/1999 on Environmental Impact Analysis
GR No. 27/2003 on Authority given to Provincial and Regency/Municipality Governments to Regulate, Supervise and License Geothermal Energy Developments
GR No. 03/2005 permitting IPPs to develop and supply power to “Electric Power Business License” holder (Amendment of unconstitutional regulation GR10/1989)
GR No. 16/2005 on Water Supply System Development
GR No. 26/2006 on Capacity Expansion of Electricity Supply and Utilization of Existing Projects or Renewable Energy sourced projects (Second Amendment of Government Regulation No. 10/1989)
GR No. 59/2007 on Geothermal Business Activities Relating to Preliminary Surveys
GR No. 05/2010 on Facility and Operational Permits for Captive Power Plants
GR No. 24/2010 on the Use of Forest Areas
GR No. 70/2010 on amendment to GR No. 59/2007 concerning geothermal business activity
GR No. 14/2012 on Electricity Supply and Utilization (which implements certain articles of the Electricity Law 30/2009)
GR No. 27/2012 issued to regulate the environmental impact documents (AMDAI, UPL & UKL), and the protection of the environment (implementing regulation for Law No. 32/2009 on Environmental Protection and Management, which replaced GR No. 27/1999)

Presidential Regulations (PR)
PR No. 36/2005 on Land Acquisition for Public Projects
PR No. 67/2005 on the Government and Private Business Entities Cooperation in the Provision of Infrastructure, This PR regulating Indonesian PPPs
PR No. 10/2006 on National Land Agency governance of Land Sector (Nationally, Regionally and Sectorally)
PR No. 65/2006 on Land Acquisition for Public Projects (Amendment to the Presidential PR No. 5/2006 on National Energy Policy)
PR No. 71/2006 on the regulation of the First Fast Track Program (on Appointment to PT PLN (Persero) to carry out the Accelerated Development of Coal Fired Power Plants)
PR No. 72/2006 on the Coordination Team for the Accelerated Power Plant Project
PR No. 86/2006 on Provision for the Government Guarantee for the Accelerated Development of Coal Fired Power Plants

PR No. 27/2009 on Integrated/Simplify Government Service through “One Door” for Capital Investment

PR No. 04/2010 on the regulation of the Second Fast Track Program (on Appointment of PT PLN (Persero) to carry out the acceleration of Development of Power Plants using Renewable Energy, Coal, and Gas)

PR No. 13/2010 on PPA as "Cooperation Contract" (Amendment of PD 67/2005)

PR No. 36/2010 on List of Closed Business Sector and Open Business Sector with Requirement in Capital Investment

PR No. 78/2010 on Infrastructure Guarantee for Public Private Partnership Infrastructure Entity

PN No. 56/2011 on provision for allowing Foreign Legal Entities to apply to initiate Public-Private Partnership (Amendment to Presidential Regulations 67/2005)

PR No. 12/2012 on Capital Investment Master Plan

PR No. 16/2012 on Capital Investment Policy in the Energy Sector (optimizing renewable energy resources and encouraging capital investment to fulfill the domestic power demand)

Ministerial Regulations (Peraturan Menteri or Permen270)

Ministry of Energy and Mineral Resources (MEMR) Regulations

MEMR Regulation No. 667K/11/2002 on Director General of Electricity Responsibility to Regulate and Supervise the Development of Geothermal Power Plants

MEMR Regulation No. 10/2005 on Licensing and Commissioning for Electricity Supply

MEMR Regulation No. 01/2006 on procedure for Purchase of Electricity and Rental of Grids in the Power Supply Business for the Public Interests

MEMR Regulation No. 44/2006 on promoting Direct Tender for the First Fast Track Programs

MEMR Regulation No. 04/2007 on conducting Electricity Supply Businesses and Activities and Procedure for Purchasing Electricity

MEMR Regulation No. 11/2008 on the Procedure for the Determination of Geothermal Mining Working Area

MEMR Regulation No. 26/2008 on Licensing and Commissioning for Electricity Supply (Amendment of MEMR Regulation No.10/2005)

MEMR Regulation No. 02/2009 on Guidelines for the Appointment and Procedure for Tendering Preliminary Geothermal Survey Assignments to the Private Sector

270 “Permen” is the Indonesian acronym for Peraturan Menteri, or Ministerial Regulation. Permen are issued by each Ministry.
MEMR Regulation No. 05/2009 on Price of Electricity Purchase by PT PLN (Persero) from Cooperatives and other Business Entities and Guidelines for Electricity Purchasing Price by PLN


MEMR Regulation No. 31/2009 on Buying Price of Electricity by PT PLN (Persero) from Small and Medium Scale Electric Power Generation Using Renewable Energy or Excess Electricity

MEMR Regulation No. 32/2009 on Reference Prices for Purchase of Electricity by PT PLN (Persero) from Geothermal Power Plants

MEMR Regulation No. 02/2010 on Details of the Location and Capacity of each Power Plant to be implemented under Presidential Regulation 4/2010

MEMR Regulation No. 05/2010 on the Indonesia Investment Coordinating Board issuing of Operational Licenses for Power Plants for Captive Use.


MEMR Regulation No. 02/2011 on Buying Electrical Power resulting from Geothermal Energy

MEMR Regulation No. 01/2012 on Geothermal Power Development Priority

MEMR Regulation No. 22/2012 on Feed-In Tariff for Geothermal

MEMR Regulation No. 21/2013 on IPP Second Fast Track Program projects eligible for Sovereign Guarantees

**Chairman of Investment Coordinating Board (CICB) Regulation**

CICB Regulation No. 12/2009 on the Guidance, Customs and Means of Capital Investment Application

**Ministry of Finance (MoF) Regulations**


MoF Regulation No. 242/PMK.011/2008 on VAT on the Import of Goods for Exploration Business Activities of Oil, Gas and Geothermal

MoF Regulation No. 100/2009 on Infrastructure Financing Company

MoF Regulation No. 24/PMK.011/2010 on Tax Concessions for Renewable Energy Projects

MoF 22/PMK.011/2011 on Tax Incentives

MoF Regulation 22/2011 on the Provision of Fiscal Incentives for Geothermal Development
MoF Regulation No. 135/PMK.01/2011 on the Structure and Organization of PIP (Centre of Government's Investment)
MoF Regulation No. 178/PMK.05/2011 on the Procedures to the Provision and disbursement of Geothermal Fund to the centre investment account of PIP
MoF Regulation No. 139/2011 on Government Guarantees and the Financial Obligations of PLN under a Power Purchase Agreements
MoF Regulation No. 03/PMK.011/2012 on the Procedures for the Geothermal Fund

Ministry of Forestry (MoFor) Regulation
MoFor Law No. 41/1999 on forbidding Mining Activities in Conservation Forests

Coordinating Ministry of Economic Affairs Regulation (CMEA)
CMEA Regulation No. 4/2006 on Evaluation Methodology for PPP Infrastructure Projects that require Government Support

Presidential Decrees (Keputusan Presiden or Keppres271)
PD No. 16/1974 on Pertamina responsibility to Explore and Develop Geothermal Resources in Java and Bali
PD No. 22/1981 on Pertamina (national oil company) Right to Explore and Exploit Geothermal Energy for Generating Electricity and to sell the Energy/Electricity to PLN (Pertamina may cooperate with investor under the Joint Operation Contract (JOC)).
PD No. 23/1981 on Corporate Tax and Taxes on Interests, Dividends and Royalty (46% of Pertamina’s net operating income from the geothermal business goes to the Government)
PD No. 49/1991 on Integrated Projects: Pertamina & Contractor (conduct exploration and steam development and build power plant) and PLN purchase the electricity under the Energy Sales Contract (ESC).
PD No. 37/1992 on Integrated Projects: Pertamina & Contractor (conduct exploration and steam development and build power plant) and PLN purchase the electricity under the ESC.
PD No. 39/1997 on the Provision of Tax Facilitation to Certain Industry Businesses
PD No. 5/1998 annulled and cancelled PD 47/1997 (thereby postponing several Government Projects and resulting in PLN no longer honor the Energy Sales Contract with Unocol)
PD No. 38/1998 on the Amendment of PD No. 37/1992
PD No. 76/2000 on the Utilization of Geothermal Energy Sources for Electricity Generation
PD No. 02/2004 on Green Energy Policy (implementing the maximum utilization of renewable energy, efficient utilization of energy, and public awareness in energy efficiency)
PD No. 42/2005 on Inter-Ministerial Committee for the Acceleration Programs

271 “Keppres” is the Indonesian acronym for KeputusanPresiden, or Presidential Decrees.
PD No. 05/2006 on National Energy Policy

PD No. 27/2009 on Investment Coordinating Board announced PTSP, integrated service through One Door (aims to cut bureaucracy complicated procedure and accelerate business licensing process for investors).

Ministry of Energy and Mineral Resources Degrees


MEMR Decree 667/2002 on Regulation and Management of Upstream - Exploration, Exploitation and Development of Geothermal Resources under the auspices of the Directorate General New and Renewable Energy and Energy Conservation (DG-NRE-EC), and Downstream - Power Generation Activities of geothermal energy under the auspices of the Directorate General of Electricity and Energy Utilization (which since 2010 has been split into 2 Directorate Generals, the Directorate General of Electricity and DG-NRE-EC) within the Ministry of Energy and Mineral Resources

MEMR Decree No. 1786 K/33/MEM/2007 establishing an area of 45,000 hectors (ha) as the Seulawah Agam Geothermal Work Area

Ministry of Finance Degrees


MoF Decree 99/2008 on the Geothermal Fund to be managed by a Special Agency named the Public Service Agency (Badan Layanan Umum)

MoF Decree No. 286/KMK.011/2011 on the Assignment to PIP to Manage Geothermal Fund

Indonesia National Standards (SNI)

SNI No.13/5012/1998 on determining geothermal prospects throughout Indonesia

Publications

Anullah & Partners Law Firm, Legal Memorandum on Forestry Law and Land Use Related to Geothermal Activities


Townsend, J et al., 2007. *How faulting keeps the crust strong,* *Geothermics* 36, v. 28, no. 5 185–222; [Online], http://geology.gsapubs.org/content/28/5/399.abstract.

United Nations Framework Convention on Climate Change (UNFCCC), [Online], http://cdm.unfccc.int/.


