Asia-Pacific
Economic Cooperation

Peer Review on
Low Carbon Energy Policies in Indonesia

Final Report

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Endorsed by the APEC Energy Working Group

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PREFACE

The APEC Peer Review on Low Carbon Energy Policies (PRLCE) was endorsed by the APEC Energy Ministers at the 2010 Energy Ministers Meeting. The review is an extension APEC's Peer Review on Energy Efficiency and follows its guidelines. The PRLCE seeks to achieve the following objectives:

- Share information on low carbon energy performance as well as on policies and measures for improving and promoting low carbon energy in respective economies;
- Provide opportunities for learning from the experiences of other economies and for broadening the network among low carbon policy experts;
- Explore how low carbon goals on an overall and/or sectoral basis and action plans could be effectively formulated in each economy under review, taking into account the range of possible strategies that could be used, according to the circumstance of each economy;
- Monitor progress on attaining low carbon energy goals on an overall and/or sectoral basis and implementing action plans, if such goal and action plans have been already formulated at the time of the review;
- Provide recommendations for voluntary implementation on how implementation of action plans could be improved with a view to achieving low carbon energy goals.

Indonesia volunteered to undertake the third low carbon energy peer review after Thailand and the Philippines. This report presents the results of a peer review of low carbon energy policies conducted in Jakarta, Indonesia. The primary accountability for each peer review is shared by the economy being reviewed and the Review Team. The peer review in Indonesia was conducted by a team of eight experts (see Appendix A) who visited Indonesia from 13 -17 May 2013.

During the visit, the Review Team had comprehensive discussion on low carbon energy policies with representatives and experts from the government ministries and agencies, energy state and private companies, academies, energy organizations, and financial institutions (see Appendix B).

The Review Team wishes to thank all the presenters and others that spent time with the team for discussions, especially the representatives of the Directorate of Bioenergy, Directorate General of New Renewable Energy and Energy Conservation, Ministry of Energy and Mineral Resources who organized the event.

EXECUTIVE SUMMARY

Blessed with the geographical position and location condition, Indonesia has an abundant potential of renewable energy such as geothermal, hydro, solar and etc. as a modal to promote low carbon energy development throughout the economy. In order to promote low carbon energy development through renewable energy development, the Indonesian Government has issued Law No. 30 Year 2007 regarding Energy as overall legal framework, and established related agencies, namely the National Energy Council (DEN) in 2008 and the Directorate General of New Renewable Energy and Energy Conservation (DGNREEC) in 2010 as a policy maker and regulator. The associations and organizations of renewable energy stakeholders are also encouraged to be established and organized for representing their interests. And to attract investors and developers participation in developing renewable energy, incentives framework such as feed in tariff, subsidies, tax exemptions, etc. are established by the government as well.

From an institutional context point of view, though the Indonesian Government has a clear framework set up, however the review team recommends that the DEN can play a pivotal role under the leadership of the chairman in formulating the National Energy Policy (KEN) and the National Energy Master Plan (RUEN). Since the DEN is in charge of energy policy in general whereas renewable energy entails specific technical/technological issues, an advisory body dedicated to renewable energy development might be needed. In addition it is recommended that further coordination between relevant government offices, not only in the central government but also among local (both provincial and municipal) governments in regulatory or promotional procedures for renewable energy development.

Indonesia has already set a very ambitious target for the promotion of renewable energy. Under the 2006 National Energy Policy (2006 KEN) which is still in force, the share target of renewable energy, nuclear and liquefied coal in total primary energy consumption mix is expected to become greater than 17% in 2025. Under the draft of the KEN, the renewable energy share target (not include nuclear) is expected to become 23% in 2025 and 31% in 2050. However, to achieve the renewable goals in the 2006 KEN or the draft of the KEN, Indonesia will likely need to reduce market barriers to investments in other renewable energy technologies and addressing other non-technical barriers like improving transparency in the permitting process will be critical for achieving the diversification and renewable energy goals. Thus the review team recommends finalizing approval of the draft of the KEN quickly, evaluating the various support mechanisms for renewable energy, developing permitting checklist which clearly define the path and timeline for each type of renewable energy technology and scale, increasing local capacity across renewable energy technologies particularly by providing students with knowledge needed to pursue a career in renewable energy in Indonesia, and adopting internationally recognized standards for renewable energy technologies to ensure quality of products used in Indonesia.

A critical step in the promotion of low carbon energy at the economy level is the development of an alternative energy master plan with aggressive and clear targets. For Indonesia, further implementation of the KEN will be elaborated in the RUEN and the Regional Energy Master Plan (RUED). However, the KEN has not yet been approved by the Parliament. Thus the RUEN and the RUED cannot be developed. In this case, it is strong recommended that the KEN can be approved and issued by Indonesia as soon as possible in which not only to provide a clear market signal to stakeholders but also the RUEN and the RUED can be developed soon. In addition, the mechanism to translate renewable energy target from the KEN to the state owned energy companies, such as through a Key Performance Index (KPI) or assignment to the state owned energy companies under special regulation, to implement is also

required. It is also important that even the national electrification ratio rate always increases significantly in every year, Indonesia should give priority of the development of electricity infrastructure to the provinces which have low electrification ratio as well as continuing to support and expand the development of hybrid systems, distributed generation and isolated systems in the regions with renewable energy potential that can be economically developed.

Indonesia has a priority to develop bioenergy in the form of biofuel (liquid), biogas, bio-solid (bio-briquettes, pellets), and bio-electricity) by establishing conducive policies and regulations; this is not only for environmental consideration but also for increasing the energy security. So far the biodiesel program in Indonesia became very successful therefore the implementation on biodiesel mixed fuel transportation sector has increased from 5% to 7.5% on the PSO transportation sector in 2013. However it is recommended that establishing clear goals for each bioenergy type and followed by applying Key Performance Index (KPI) for state owned energy companies are required. In addition, promoting human resource development and increasing public awareness about the importance of bioenergy in every aspect are necessary to be conducted.

Indonesia has already set a very ambitious target for the promotion of geothermal energy, meanwhile solar and wind energies will be developed and expanded to remote areas and small systems. It is an important that Indonesia continues to develop solar and wind energies for rural electrification and for the reduction of diesel consumption. On the other hand, periodically evaluate the cost effective mix of renewable energy and the cost/effectiveness of off-grid vs. grid extension for the promotion of renewable energy are important.

The promotion and development of hydro energy in Indonesia is already farther along compared to other renewable energy. However, the review team recommends that Indonesia could encourage further R&D on hydro technology to reduce costs and improve the local manufacturing capabilities to produce turbines with capacity greater than 500 kW as well as to increase training of technical personnel.

Indonesia has implemented FIT mechanism for hydro power, solar, wind, biomass, biogas and municipal solid waste (MSW) based on the Minister of Energy and Mineral Resources regulation, which made PLN is obliged to purchase renewable energy at a pre-determined price. For geothermal, the government is currently developing a pricing structure based on "Ceiling Price Mechanism". The new pricing structure is expected to reflect true cost of production and a fair margin for the developers. However, it is recommended that FIT rate can be reviewed on a periodic basis, and on top of the base rate, bonuses could be added to promote local content and to encourage the developers to choose the right and reliable technology for the sustainable system performance. FIT for plant capacity more than 10 MW for small hydro and biomass (including biogas and MSW) as well as for small PV system should be encouraged. Indonesia has demonstrated a keen interest in the utilization of smart grids throughout the economy. 1,000 islands project has been launched and Sumba Island as smart grid pilot program has been chosen. It is recommended that smart grid development in Indonesia to get in place as soon as possible, and the planning and implementation stages of this technology can be expedited through the involvement in APEC related activities on smart grid. Since the development of new and renewable energy is still at its infancy, the government requires more participation from the private sector. It is therefore important that the government could set up a higher local equity participation to encourage local investors to participate in renewable energy projects, educating the financing parties, providing the green financing schemes/loan, developing standardization of power purchase agreement (PPA) for projects under FIT, and establishing standard operating procedures and timeframe to ensure efficiency in renewable energy project implementation by private investors.

Indonesia has demonstrated its leadership among non-Annex I countries in regards to GHG mitigation by setting the goal to reduce GHG emissions by 26% from the projected baseline by 2020. Further, the government has set the target of reducing emissions by an additional 15% if international support, particularly financing, are made available. Though the Indonesian Government has been issued the National Action Plan on GHG Emission Reduction (RAN-GRK) which is already determined the goals for GHG reduction by each sectors and identified mitigation actions, however the review team recommends that Indonesia still needs ensuring the GHG emissions reductions targets align with the other related plans and establishing a clear policy regarding allocation of GHG savings for renewable energy projects. Moreover, capacity building on GHG emissions measurement and reporting for stakeholders as well as expanding the education program targeting the general public regarding the national GHG emissions goals and the benefits should be carried out.

RECOMMENDATIONS

Institutional Context

Recommendation 1

In formulating the KEN and the RUEN, the National Energy Council (DEN) can play a pivotal role under the leadership of the chairman, the President of Indonesia. The DEN should be strengthened to set up basic policy guidelines on energy issues in timely manner.

Recommendation 2

In the discussion at the DEN, its stakeholder members are recommended to increase feedback from the reality of energy businesses, especially renewable energy development which the private sector plays an important role.

Recommendation 3

As renewable energy development proceeds, an advisory body dedicated to renewable energy development might be needed as a formal channel between the government and renewable energy stakeholders. Such an advisory body can be a subcommittee of the DEN if the DEN expands its mandate to oversight on the energy policy implementation or, if not, an independent advisory committee to the MEMR.

Recommendation 4

Further coordination between relevant government offices, not only in the central government but also among local (both provincial and municipal) governments, is recommended in regulatory or promotional procedures for renewable energy development.

Recommendation 5

Incentives for promoting renewable energy development should be fully used for the sake of renewable energy development itself, regardless of the profitability of the renewable energy developers. Even if the profits of renewable energy developers increase thanks to renewable energy incentives, increased profit should not be considered as a target of "profit sharing" by the public sector, especially local governments.

Renewable Energy Goals, Targets and Strategy

Recommendation 6

Finalize approval of the 2011 KEN quickly to provide a clear market signal to the private sector, financial institutions, international investors, and PLN regarding the long-term demand for electricity generation from renewable energy.

Recommendation 7

Evaluate the various energy support mechanisms (e.g. FITs, fossil-fuel subsidies) to ensure support for renewable energy is sustainable, coordinated, and complementary.

Recommendation 8

Develop permitting checklists that clearly define the path and timeline for permitting each type of renewable energy technology and list separate paths for large-scale and small-scale projects.

Recommendation 9

Increase local capacity for technical, financial, and project development across renewable energy technologies, particularly by providing students with the knowledge needed to pursue a career in renewable energy in Indonesia.

Recommendation 10

Adopt internationally recognized standards for renewable energy technologies to ensure quality of products used in Indonesia. This is particularly important for small-scale, distributed generation technologies such as solar photovoltaics.

Regulation and Infrastructure

Recommendation 11

Issue the National Energy Policy (KEN) as soon as possible so that the further implementation of this policy through the National Energy Master Plan (RUEN) and the Regional Energy Master Plan (RUED) can be developed.

Recommendation 12

Produce mechanism to translate renewable energy target from the National Energy Policy to state owned energy companies, such as through a Key Performance Index (KPI), to implement.

Recommendation 13

Harmonize the regulations between central government agencies, between central and local governments, and between local government agencies to prevent conflicting regulations that may hinder the development of renewable energy.

Recommendation 14

Set up regulations that encourage and support the development of the domestic renewable energy industry to achieve self-reliance and to strengthen renewable energy standards.

Recommendation 15

Give priority of the development of electricity infrastructure to the 3 provinces (NTB, NTT, & Papua) which have low electrification ratios by providing funding from the central and local governments.

Recommendation 16

Continue to support and expand the development of hybrid systems which use solar PV or wind turbines together with existing diesel power plants in the regions with renewable potential which can be economically implemented to reduce utilization of fossil fuels in power plants.

Recommendation 17

Continue to develop and support distributed generation and isolated systems in the regions with renewable energy potential that can be economically developed.

Recommendation 18

Continue to encourage dialogue between the government and investors and continue to improve the investment climate.

Recommendation 19

Strengthen cooperation with APEC economies as well as regional and international organizations in the fields of information exchange, technology transfer, human resources/capacity building, and financing.

Biofuels and Biomass Energy

Recommendation 20

Develop clear technical regulations for waste to energy activities in association with the 2008 Law on Waste Management.

Recommendation 21

Create a suitable environment for small-scale projects (mostly for thermal such as solid fuel and biogas) in order to promote production of bioenergy in remote areas.

Recommendation 22

Apply Key Performance Index (KPI) on bioenergy for large players in the energy business, especially state-owned energy companies such as Pertamina and PLN.

Recommendation 23

Promote human resource development and increase public awareness about the importance of bioenergy in every aspect (school, university, and public relation).

Recommendation 24

Establish clear goals for each bioenergy type in terms of primary energy of final energy (e.g. biofuel, thermal, power).

Geothermal, Solar and Wind Energy

Recommendation 25

Periodically evaluate the most cost effective mix of renewables within the budget constraints and while taking into consideration other values like new industries, agricultural development, environmental impacts, and rural electrification.

Recommendation 26

Solar, wind, micro hydro are important for rural electrification and for the reduction of diesel consumption. One can consider such measures like special support for the introduction of those renewable energies under "Rural Electrification with Renewables".

Recommendation 27

Periodically evaluate the cost/effectiveness of off-grid vs. grid extension for the promotion of renewable energy. For case of off-grid system, local governmental initiatives should also be encouraged.

Recommendation 28

Prepare tools for facilitating better communication considering that the transition of authority shifted from the central to local level making the issue of financing (ex. Taxes), level of experiences, and rules (ex. Land use) more complex.

Hydro Power Energy

Recommendation 29

Encourage further R&D on hydro technology to reduce costs.

Recommendation 30

Improve the local manufacturing capabilities to produce turbines with capacity greater than 500 kW.

Recommendation 31

Review and redesign the subsidy structure for hydro power project depending on the scale and remoteness of a system.

Recommendation 32

Establish stricter environmental compliance monitoring for hydro power projects, even for mini hydro power plants.

Recommendation 33

Accelerate the process of contract approval through better coordination among relevant government agencies and institutions.

Recommendation 34

Improve awareness and participation of local residents on the development of hydro power projects.

Recommendation 35

Increase training of technical personnel to ensure sufficient support for the operation and maintenance of hydro power plants in remote areas and on small islands.

Power Supply System- FIT, Smart Grid and Private Participation

Recommendation 36

Price structure - On top of the base rate, bonuses could be added to existing tariff to promote local content and also to encourage the renewable energy developer to choose the right and reliable technology for the sustainable system performance.

Recommendation 37

FIT for plant capacity > 10 MW for small hydro and biomass (include biogas and MSW) - Certain project sites may have resources that can produce more than 10 MW of electricity. Economies of scale may mean greater production of energy but with a lower FIT rate (e.g. a win-win situation).

Recommendation 38

Yearly FIT rate review - Sustainability of the FIT mechanism should be reviewed yearly in terms of achievements, tariff rate and funds required for the mechanism.

Recommendation 39

FIT for Small PV systems - Current proposed FIT rates are for solar farm size projects. For capacity building, FIT for rooftop system (<12 kW) should be encouraged to boost expertise of local players.

Recommendation 40

To get smart grids in place as soon as possible - 1,000 islands project requires proper monitoring in terms of system stability, supply and demand patterns, asset utilisation, and operating efficiency. Smart grid could be the solution. Sumba Island is a good start.

Recommendation 41

Capacity building - to be actively involved in APEC related activities on smart grid.

Recommendation 42

Higher local equity participation - To encourage local investors to participate in RE projects under FIT so that they will get the most benefit from the project.

Recommendation 43

Green Financing Schemes/Loan - Proper support mechanism in terms of "Green Loans" to be provided to renewable energy developers to encourage more participation from new players.

Recommendation 44

Standardization of PPA(s) for projects under FIT – Standard template of PPA(s) should be in place for projects to be awarded through FIT mechanism to reduce negotiation time for PPA signing.

Recommendation 45

Establish standard operating procedures and time frame– To ensure efficiency in renewable energy project implementation by private investors, standard operating procedures and timeframe should be established in terms of project award time, approval from ministries (Ministry of Finance), PPA signing, etc.

Green House Gas Management

Recommendation 46

Build capacity among developers, banks, local governments, and other stakeholders for measuring GHG emissions and reporting to the central government.

Recommendation 47

Expand the education program targeting the general public regarding the national GHG emissions goals and the benefits of achieving these goals.

Recommendation 48

Ensure the GHG emissions reductions targets are aligned with and incorporated into the national energy plan and the national electrification plan.

Recommendation 49

Establish a clear policy regarding allocation of GHG savings for renewable energy projects such that they are allocated to the project owner and not to an associated ministry for CDM or other carbon market purposes.

APEC PEER REVIEW
ON LOW-CARBON POLICIES (PRLCE)

PART 1 : BACKGROUND INFORMATION

This part of the report was contributed by Indonesia and includes basic information on renewable energy and the main institution associated with energy in the economy. The main purpose of this part is to provide the reader with the context within which the Review team based its recommendations.

The report shows the aspect of renewable energy including the current policy and objectives as well as renewable energy activities.

1. INTRODUCTION

1.1 Energy Situation

Indonesia is a large archipelago located at the south-east of mainland Asia, between the Pacific Ocean and the Indian Ocean. Indonesia's territory encompasses 17,508 large and small islands and large bodies of water at the equator over an area of 7.8 million square kilometres (including Indonesia's exclusive economic zone). Indonesia's total land area (24.5% of its territory) is about 1.91 million square kilometres. The population was 241.13 million in 2011 (KESDM, 2012).

Indonesia had a gross domestic product (GDP) of around USD 951 billion and a per capita GDP of USD 3,944 in 2011 (USD 2000 at PPP). Excluding the oil and gas sector, manufacturing accounted for the largest component of GDP in 2011 (24.3%), followed by agriculture, livestock, forestry and fisheries (14.7%); retail, hotel and restaurant (13.8%); mining and quarrying (11,8%); other services (10.6%); construction (10.2%); finance, leasing and corporate services (7.2%); transport and communications (6.6%); and electricity, gas and water supply (0.8%). In 2011, Indonesia attained economic growth of 6.46%, an increase of 6.2% from 2010 (BPS, 2012).

Domestic oil, gas and coal reserves have played an important role in Indonesia's economy as a source of energy, industrial raw material and foreign exchange. In 2011, oil and gas exports contributed 20.4% and coal exports contributed 13.5% of Indonesia's total exports of about USD 203.6 billion. Overall, tax and non-tax revenue from oil, gas and minerals including coal accounted for 49.8% of the Indonesian Government's budget in 2010 (Kemenkeu, 2010). In 2011, coal export contribution increased 46.6% of Indonesia's coal exports in 2010 (KESDM, 2012).

Indonesia's proven fossil energy reserves at the end of 2011 comprised 4 billion barrels of oil; 3 trillion cubic metres of natural gas and 5.5 billion tonnes (Bt) of coal.

Table 1. Key data and economic profile, 2011

Key Data		Energy Reserves[a]	
Area (million sq. km)	7.8	Oil (billion barrels)	4.0
Population (million)	241.1	Natural Gas (trillion of cubic metres)	3.0
GDP (USD (2000) billion at PPP)	951	Coal (billion tonnes)	5.5
GDP (USD (2000) per capita at PPP)	3,944		

a Proven reserves at the end of 2011 (BP, 2012).
Source: EDMC (2012).

In 2011, Indonesia's total primary energy supply (TPES) was 1 236 million barrel of oil equivalent (boe) of commercial energy—made up of oil (47.93%), coal (27.03%), natural gas (21.17%) and other energy (mainly hydropower and geothermal) (3.86%)—and 280.2 million boe of biomass. Indonesia is a net exporter of energy; overall energy exports of crude oil, condensates, natural gas, liquefied natural gas (LNG), petroleum products and coal totalled 1 569 million boe in 2011. Total energy exports in 2011 increased by 18.13% from 2010 (1,328.3 thousand boe), an increase driven primarily by coal exports (KESDM, 2012).

Total final energy consumption of final energy was 1,114.77 million boe in 2011, an increase of 4.43% from 1,067.53 million boe in 2010. The share of the final energy consumption by sector in 2011 was 32.3% for industry, 28.7% for household, 24.9% for transport and 14.1 % for other sectors. Indonesia's economy is highly dependent on oil; final energy consumption of oil in 2011 was 363.83 million boe (32.64% of the total final energy consumption).

Table 2. Key data and economic profile, 2011

Primary Energy Supply (million boe)		Final Energy Consumption (million boe)		Power Generation (GWh)	
Indigenous production[a]	2 426.7	Industry sector	359.7	Total	183,419
Net imports & other	–1 286.3	Transport sector	277.4	Geothermal PP	9,371
Total PES[a]	1 236.0	Household Sector	320.4	Hydro PP	12,419
Coal	334.1	Other sectors	157.3	Steam PP	88,737
Oil	592.4	Total FEC	1,114.8	Gas PP	56,302
Gas	261.7	Coal	144.6	Diesel PP	16,584
Others	47.8	Oil	433.8	Nuclear PP	–
		Gas	158.3	Others	5.46
		Electricity	98.0		

a Excludes biomass.
Source: EDMC (2012).
Steam PP = coal, gas, and biomass.

1.1.1 Oil

In 2011, Indonesia produced 375.9 million boe of crude oil, biofuel and condensates; of this, 135.6 million boe (36%) was exported, representing a decrease of 2.8% from 2010. Since oil production has declined significantly over the past decade (in 1997 Indonesia produced 72,474 ktoe of crude oil and condensates) in order to meet its domestic oil requirements, the economy imported 96.9 million boe of crude oil and 167.2 million boe of petroleum products in 2011, up 1.54% from total of 260 million boe in 2010 (KESDM, 2012).

Most crude oil is produced onshore from two of Indonesia's largest oil fields: the Minas and Duri oil fields in the province of Riau on the eastern coast of central Sumatra. As these fields are considered mature, the Duri oil field in particular has been subject to one of the world's largest enhanced oil recovery efforts.

1.1.2 Natural gas

Indonesia produced 519 million boe of natural gas in 2011, a decrease of 5.1% from the 542.9 million boe in 2010. Of the total natural gas production, 38% was converted to LNG for export shipping. The economy produced 35,197.2 million boe of LNG in 2011, a decrease of 2.17% from 201.5 million boe in 2010. In 2011, Indonesia also exported 60.3 million boe of natural gas (11.6% of its total natural gas production) through pipelines to Singapore and Malaysia. Overall, 49.6% of Indonesia's natural gas production is exported; the balance is made available for domestic requirements (KESDM, 2012).

Indonesia's large natural gas reserves are located near Arun in Aceh, around Badak in East Kalimantan, South Sumatra, the Natuna Sea, the Makassar Strait, and Papua; with smaller gas offshore from West and East Java. LNG exports from Tangguh, Papua began in 2009 with gas being supplied from the onshore and offshore Wiriagar and Berau gas blocks, which are estimated to have reserves of 14 trillion cubic feet (Tcf).

1.1.3 Coal

In 2011, Indonesia produced 1,483.7 million boe of coal, an increase of 28.39% from 1,155.7 ktoe in 2010. Most of Indonesia's coal production in 2011 (1,145.2 million boe, or 77.2%) was exported with domestic demand (334.1 million boe in 2011) being allocated for power generation (56.7%), and industry (43.3%) uses (KESDM, 2012).

About 57% of Indonesia's total recoverable coal reserve is lignite, 27% is sub-bituminous coal, 14% is bituminous coal, and less than 0.5% is anthracite. Most of Indonesia's coal reserves

are in South Sumatra and East Kalimantan; relatively small deposits of coal are in West Java and in Sulawesi. In consequence, while Indonesian coal's heating value can range from 5,000 to 7,000 kilocalories per kilogram, it is generally distinctive for its low ash and sulphur content (typically less than 1%).

1.2 Electricity Situation

Indonesia had 39,885 MW of electricity generation capacity in 2011, which was owned by the state-owned electricity company (PLN), independent power producers (IPPs) and private power utilities (PPU). In 2011, 182,622 GWh of electricity had been generated, of which 22.2% was supplied by IPPs. In 2011, electricity production by energy mix was still dominated by coal (50.8%), followed by renewable energy (20.3%), natural gas (16.1%) and oil (12.8%) (KESDM, 2012).

To increase the national electrification ratio, the Government of Indonesia launched the 10,000 MW Fast Track Program Phase I (FTP1) in 2006 and Phase II (FTP2) in 2010. The impact of the program is the increase of national electrification ratio from 63.0% in 2006 to 72.95% in 2011. The FTP2 will add 10,047 MW capacity, of which 49% will be developed from geothermal, 30% from coal, 17% from hydropower, 3% from gas, and 1% from gassified coal. The government has been mandated the state-owned electricity company (*Perusahaan Listrik Negara*, PLN) to implement fast-track programs to accelerate development of generating facilities. In this case, PLN will focus on the development of medium scale renewable energy generation.

1.2.1 Indonesia Electricity Current Condition and Planning

As of May, 2013, Indonesia had an installed electrical generating capacity of approximately 44,346 MW, of which 5% coming from gas/oil steam power plant, 13.0% from diesel power plant, 9.0% from hydro power plant, 28.9% from gas power plant, 3% from geothermal power plant, 41.0% from coal fired power plant, and 0.4% coming from renewable energy mini scale power plant. PLN owned about 73% of the total installed capacity, IPP about 23% and the rest belonging to PPU. The Indonesia's electricity sector is facing numerous challenges in its development, including (1) a mismatch between the availability of primary energy resources, which the supply of energy is located mostly in outside Java and Bali, and the demand for electricity, which came mostly from Java and Bali, (2) In 2012, the percentage of oil for producing electricity (fuel mix) was still high (15.02%) despite the abundance of coal resources within the country and (3) the limited availability of the government funds and other resources to finance the construction of new power plants as well as transmission and distribution networks. Regarding infrastructure development initiatives, the government has been placed a special emphasis on the development of power generation plants, particularly coal-fired power plants, in order to reduce dependence on oil for power generation. One of the government's ten model projects introduced at the Indonesia Infrastructure Conference and Exhibition (IICE) was a power generation project, namely the Central Java Coal-Fired Power Plant. The Indonesian Goverment has been issued Presidential Regulation No. 78 Year 2010 regarding Infrastructure Guarantee for Public Private Partnership Projects through the Infrastructure Guarantee Agency, in which the Indonesia Government will give Goverment Guarantee to the 2 x 1,000 MW Central Java Coal-Fired Power Plant. The winner of the tender of Central Java Coal-Fired Power Plant had been announced by PLN since June 17, 2011. The Central Java Coal-Fired Power Plant was divided into 2 units and expected to be operational in 2018.

In addition, the government assigned PLN to accelerate its construction of coal power plants with aggregate capacity of 10,000 MW and associated transmission line which called the 10,000 MW Fast Track Program Phase 1 (FTP1) in 2006. The total investment needed for constructing the power generation and transmission was estimated to Rp 95.89 Trillion, and for which the

government has pledged certain credit support. Currently, all of the power generation projects are entered to the construction stages, in which 11 power plants have been already in the commercial operation, and the rest of the projects are expected to be completed by the end of 2014. The aggregate value of the construction contracts is noted to approximately USD 10 billion (with assumption of 1 USD = Rp. 9,000 and 1 EUR = Rp. 12,153.86). As of June 2013, a total of 5,005 MW of power plants under the FTP1 were in the commercial operation (50% of the total capacity of projects).

Indonesia still needs high investment for developing power generation, transmission and distribution lines and facilities in order to meet the expected demand in the future. The government indicated that from year 2012 to 2021 the electricity sector will need the total investment approximately USD 107.13 billion, of which USD 77.38 billion for developing the additional capacity of power plant, USD 15.98 billion for transmission, and USD 13.77 billion for electricity distribution.

On December 19, 2012, the Ministry of Energy and Mineral Resources submitted the draft of the National Electricity General Plan (*Rencana Umum Ketenagalistrikan Nasional*, RUKN) 2012-2031 to the Chairman of the House of Representatives Commission VII of Republic of Indonesia for consultation before it stipulated by the government as mandated by the Electricity Law. The RUKN 2012-2031 is intended to coordinate electricity infrastructure development for the various regions of Indonesia. Based on this plan, Indonesia's demand for electricity is expected to grow at an average annual rate of 10.1% over the period 2012 to 2031. In order to meet high electricity demand growth, Indonesia will need the additional power plant capacity of approximately 237 GW by 2031. As a result, the electricity sector will need high investment in developing power generation, transmission and distribution lines and facilities.

Based on the PLN's 2012-2021 Electricity Supply Business Plan (*Rencana Usaha Penyediaan Tenaga Listrik*, RUPTL), the national electricity demand is expected to grow at an average annual rate of 8.65%. In order to meet this demand as well as to support the Masterplan for Acceleration and Expansion of Indonesia Economic Development (MP3EI) program, the government has been planned to increase the capacity of power plants about 57,250 MW by 2021 or an average about 5,725 MW per year. Noting that the demand for electricity is still expected to be concentrated in the Java-Bali electricity system and in Sumatera electricity system by 2021, the additional capacity of power plant portion will be developed more in Java-Bali electricity system (32,637 MW) and in Sumatera electricity system (14,513 MW).

1.3 National Energy Policy

On 10 August 2007, Indonesia enacted Law No. 30 Year 2007 regarding Energy. This Energy Law contains two main principles of the National Energy Policy, which are the energy diversification and conservation energy. The Law mandates the utilization of energy resources on the priority of renewable energy sources. It also defines the roles and responsibilities of the Government and Local Government to prioritize the renewable energy sources.

Further, the Energy Law mandates the formation of the National Energy Council (*Dewan Energi Nasional*, DEN). The National Energy Council has some tasks as follow:

- drafts the National Energy Policy (KEN); and
- endorses the National Energy Master Plan (*Rencana Umum Energi Nasional*, RUEN); and
- declares measures to resolve conditions of energy crisis and energy emergency; and
- provides oversight on the implementation of energy policies that are cross-sectoral.

The assembly of the DEN members is chaired by the President. As an institution, the DEN is headed by the minister responsible for energy affairs. The DEN has 15 members: Seven

ministers and high-ranking government officials responsible for the supply, transportation, distribution and use of energy; and eight stakeholder members from industry, academia, expert groups, environmental groups, and consumer groups. The selection and appointment of members of the DEN was finalized in late 2008.

Both the National Energy Policy and the National Energy Master Plan are now still being formulated, which are expected to address some issues related to the sufficiency of energy to meet the economy's needs, energy development priorities, utilization of indigenous energy resources, and energy reserves.

Regarding the utilization of energy resources and final energy use, security of supply, energy conservation, protection of the environment with regard to energy use, pricing of energy, and international cooperation, the Energy Law defines the outline of the National Energy Policy (*Kebijakan Energi Nasional,* or KEN); the roles and responsibilities of the government and regional governments in planning, policy and regulation; energy development priorities; energy research and development; and the role of enterprises.

The National Energy Master Plan (RUEN) implements the KEN. By law, the RUEN is drafted by the government, namely the Ministry of Energy and Mineral Resources, in a process that involves the related ministries and other government institutions, state-owned companies in the energy sector, and regional governments as well as academia and other energy stakeholders, and has due regard to input from the public.

The DEN finalised the draft of the National Energy Policy in March 2011, a document which would need to be discussed with the parliament (the DPR) before being enacted by the government. Thus, this new national energy policy would replace the existing the National Energy Policy that was established by the Presidential Regulation No. 5 Year 2006.

Over the past decade, Indonesia has reformed its energy sector through a series of new laws: the Oil and Gas Law (Law No. 22 Year 2001), the Geothermal Energy Law (Law No. 27 Year 2003), the Mineral and Coal Mining Law (Law No. 4 Year 2009), and the Electricity Law (Law No. 30 Year 2009).

These laws were established to promote an increased role for enterprises in the energy supply chain, in terms of fair competition on an equal playing field (as an alternative to a monopolistic industry), direct contracts between energy producers and buyers, and a transparent regulatory framework.

An advanced reformation in the electricity sector, which would have to establish the possibility of direct competition in power generation, transmission and distribution through Law No. 20 Year 2002 (currently annulled), was rejected by the Constitutional Court in 2004.

1.3.1 The Law on Oil and Gas

Indonesia's oil and gas industry is currently undergoing regulatory changes. The industry was reformed in 2001 under the Oil and Gas Law (Law No. 21 Year 2001). The regulatory bodies known as BP MIGAS and BPH MIGAS were created to address oil upstream and downstream activities, respectively. Exploration and production activities were conducted based on a fiscal contractual system that relies mainly on production sharing contracts (PSCs) between government and private investors, which may include foreign and domestic companies, as well as the government-owned oil company (Pertamina).

However, on 13 November 2012, the Constitutional Court declared that the existence of BP MIGAS was in conflict with the Constitution of 1945 and ordered its dissolution. At the time of this writing, the government is drafting a new Oil and Gas Law that will determine a new industry structure and until this law can be enacted, an Interim Working Unit for Upstream Oil and Gas Business Activities (SKSPMIGAS) has been established under the Ministry of Energy

and Mineral Resources (MEMR) to undertake all BP MIGAS roles and responsibilities. Furthermore, on 14 January 2013, the government issued the Presidential Regulation No. 9 Year 2013 as the umbrella for the establishment of the Working Unit for Upstream Oil and Gas Business Activities (SKKMIGAS) with its tasks in managing the upstream oil and gas business in Indonesia.

BPH MIGAS has supervisory and regulatory functions in the downstream oil and gas sector with the aims of ensuring availability and distribution of fuel throughout Indonesia, and the promotion of gas utilization in the domestic market through fair and transparent market competition.

The enactment of the Oil and Gas Law required that the state-owned oil company, Pertamina, relinquish its governmental roles to the new regulatory bodies BP MIGAS (now handed over to SKKMIGAS) and BPH MIGAS, and mandated the termination of Pertamina's monopoly in upstream oil and gas activities.

1.3.2 The Law on Mining

On 16 December 2008, the parliament passed a new law on minerals and coal mining to replace Law No. 11 Year 1967, which had been in place for 41 years. The new law was enacted by the government on 12 January 2009 as Law No. 4 Year 2009 regarding Mineral and Coal Mining. The new Mining Law basically ended the concession of work areas by contracts of work (COW) and by work agreements for coal mining enterprises, *Perjanjian Karya Perusahaan Pertambangan Batubara* (PKP2B). Concessions are now based on permits from the central and regional governments. However, as the principle and objective of exertion in mining, in article 5 said that the government have an obligation to make policy about priory of minerals for domestic purposes/Domestic Market Obligation (DMO).

Prior to the new law, the government arguably had less regulatory control over its concessions. For example, any changes to concession terms needed to be agreed to by both the government and the investor. By instituting permits, the government expects to be better positioned to promote investments and to regulate mining.

The law creates greater opportunity for smaller investments in mining and gives regional governments a greater role in regulating the industry, along with revenue from mining. The Mining Law called for regulations on:

- concession areas and concession periods (for exploration permits) and production limits (for production permits) in mining for metals, non-metals and specific non-metals;
- a requirement that prospective investors submit post-mining and reclamation plans before applying for a permit;
- an obligation on permit holders to build smelters;
- an obligation on foreign companies to divest shares to the government, or state-owned enterprises and private companies registered in Indonesia;
- payment of taxes, fees and allocation of profits; and
- reclamation and post-mining costs.

The set of Government Regulations with regard to the Mining Law was completed in 2010 and these are now operational.

1.3.3 The Law on Electricity

On 23 September 2009, the government enacted Law No. 30 Year 2009 regarding Electricity. This new Electricity Law replaced Law No. 15 Year 1985, which the Constitutional Court had reinstated in December 2004 as a provisional law, upon annulment of Law No. 20 Year 2002.

A notable difference between Law No. 30 Year 2009 and Law No. 15 Year 1985 is the absence of a Holder of Electricity Business Authority (*Pemegang Kuasa Usaha Ketenagalistrikan*, PKUK). Under Law No. 15 Year 1985, the government had appointed the state-owned electricity company, PLN, as the sole PKUK and so had made it responsible for providing electricity to all parts of Indonesia.

Under the new Electricity Law, the electricity industry will be made up of electricity business entities that are title holders of electricity supply business licences, *Izin Usaha Penyediaan Tenaga Listrik* (IUPTL). The IUPTL could either be in integrated electricity supply, power generation, transmission, distribution or retailing of electricity. Indonesia's electricity systems would retain vertically integrated configurations; however, these could comprise several licensed systems—such as PLN's numerous power systems, provincial government owned systems (to be established, where necessary), and private sector power systems, each operating within their respective business areas Licence holders of specific electricity supply types (such as the IPPs, as licence holders in power generation for supply of electricity to the public) would participate in the vertically integrated systems.

By law, the government and regional governments would regulate the electricity industry within their respective jurisdictions and through electricity regulatory authorities. The Electricity Law allows appointment of an electricity supply business area, cross-border electricity trading, as well as electricity tariffs to be differentiated by region for one certain business area (to allow for different costs of supply). Under the previous Electricity Law, Indonesia had a uniform electricity tariff regime and applied cross-subsidies between regions. At the time of writing, there was no ruling as to whether PLN will implement tariff differentiation over its extensive power systems across Indonesia.

As mandated by Law No. 30 Year 2009, the MEMR has issued three Government Regulations (GR), namely GR No. 14 Year 2012 regarding electricity supply businesses activity, GR No. 42 Year 2012 regarding the buying and selling of electricity across Indonesia's borders, and GR No. 62 Year 2012 regarding electricity support businesses.

The Ministry of Energy and Mineral Resources (MEMR) Regulation No. 22 Year 2012 regarding the Obligation of PLN to Purchase Electricity from Geothermal Power Plants and the Standard Purchase Price for Geothermal Power by PLN has been issued to replace the MEMR Regulation No. 2 Year 2011 and to set out how PLN purchases geothermal power. This regulation aims to accelerate the development of geothermal power as mandated by the Government Regulation No. 59 Year 2007 regarding Geothermal Business Activities as amended by the Government Regulation No. 70 Year 2010, particularly geothermal projects under the FTP2. The regulation sets the purchase price for geothermal power plant at 10 - 18.5 US cents/kWh depends on region and type of voltage transmission where geothermal power plants are connected to system. PLN will purchase geothermal power at that price without negotiable.

1.3.4 The Law on Geothermal

According to Law No. 27 Year 2003 regarding Geothermal Energy, there are 5 (five) stages in utilizing geothermal energy. The stages are preliminary survey, exploration, feasibility studies, exploitation and utilization. The government could only conduct the two early stages, preliminary survey and exploration whereas private party (business entity) could conduct all the five stages.

A business entity could initiate geothermal activities once obtaining Geothermal Business Permit (IUP) through Geothermal Working Area (GWA) tender. The authority to issue the permit is depending on the location where the GWA is located. If the GWA is located within a regent/city, IUP is issued by regent/city government. For GWA is located at across several regent/city areas, IUP is granted by provincial government. The central government (minister) is only giving IUP for GWA which lies across several provinces.

IUP period consist of:

a. An exploration period valid of 3 (three) years which can be extended 2 (two) times for a period of one year each.

b. A feasibility study valid for a maximum of 2 (two) years since the exploration time period is ended.

c. An exploitation period valid for a maximum period of 30 years after exploration has ceased and can be extended. Exploitation period may be extended at most of 20 (twenty)years for each extension

2. ENERGY SECTOR: STRUCTURE AND STAKEHOLDERS

2.1 Ministry of Energy and Mineral Resources

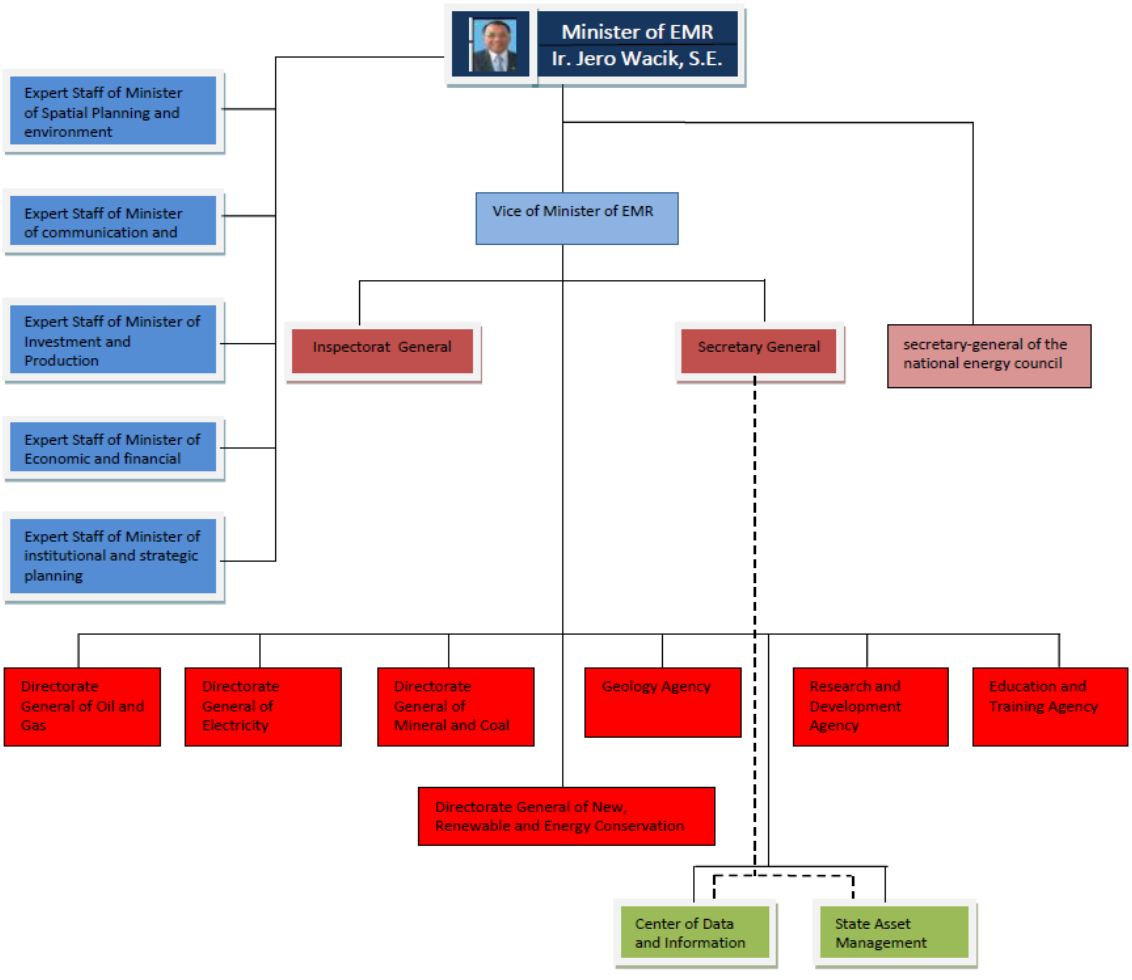


Figure 1. The Structure Organization of The Ministry of Energy and Mineral Resources

The Ministry of Energy and Mineral Resources (MEMR) has responsibilities to manage the part of government affairs in the fields of energy and mineral resources. MEMR has been divided into the following directorate generals and agencies, namely:

2.1.1 Directorate General of Oil and Gas

Directorate General of Oil and Gas has the duty to formulate and implement policies and technical standardizations in the fields of oil and gas. In order to perform her tasks, the Directorate General of Oil and Gas has the functions in preparing and implementing the policies in the fields of oil and gas, preparing the standards, norms, guidelines, criteria, and procedures in the fields of oil and gas, providing technical guidance and evaluation, and conducting the administration affairs of the Directorate General of Oil and Gas.

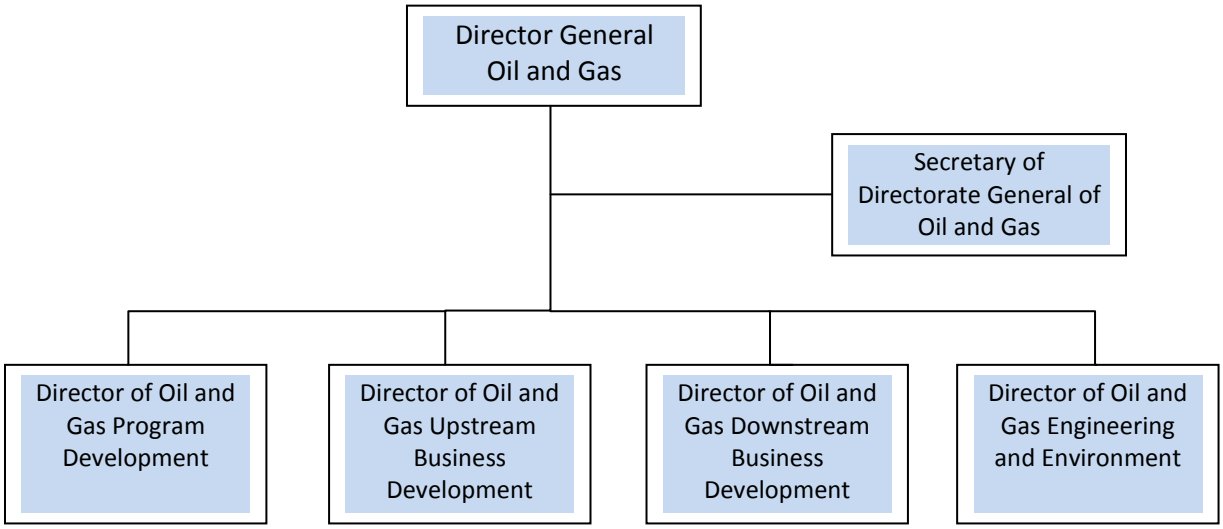


Figure 2. The Structure Organization of Directorate General of Oil and Gas

2.1.2 Directorate General of Electricity

Directorate General of Electricity has the duty to formulate and implement policies and technical standardizations in the fields of electricity. In order to perform her tasks, the Directorate General of Electricity has the functions in preparing and implementing the policies in the fields of electricity, preparing the standards, norms, guidelines, criteria, and procedures in the fields of electricity, providing technical guidance and evaluation, and the administration affairs of the Directorate General of Electricity.

There are three directorates and one secretariat under the Directorate General of Electricity which have different duty and function as shown in the organization chart below:

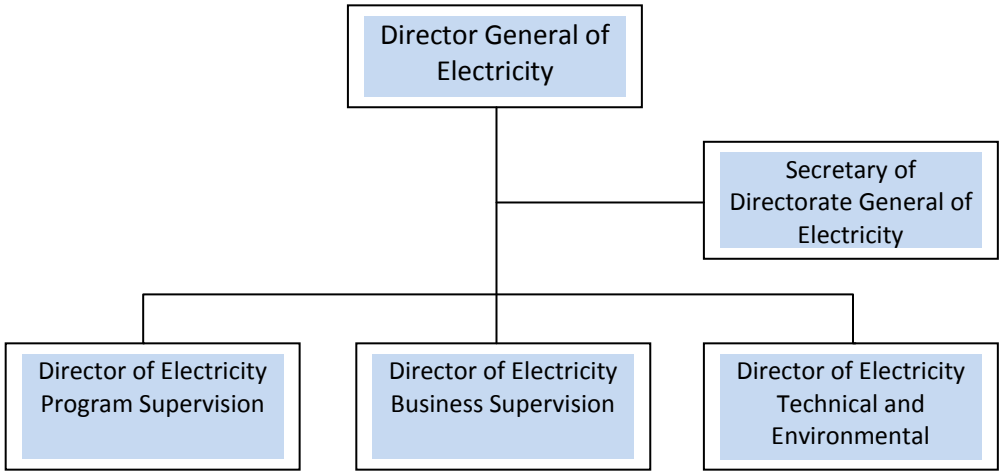


Figure 3. The Structure Organization of Directorate General of Electricity

2.1.3 Directorate General of Mineral and Coal

Directorate General of Mineral and Coal has the duty to formulate and implement policies and technical standardizations in the fields of mineral and coal. In order to perform her tasks, the Directorate General of Mineral and Coal has the functions in preparing and implementing the policies in the fields of mineral and coal, preparing the standards, norms, guidelines, criteria, and procedures in the fields of mineral and coal, providing technical guidance and evaluation, and conducting the administration affairs of the Directorate General of Mineral and Coal.

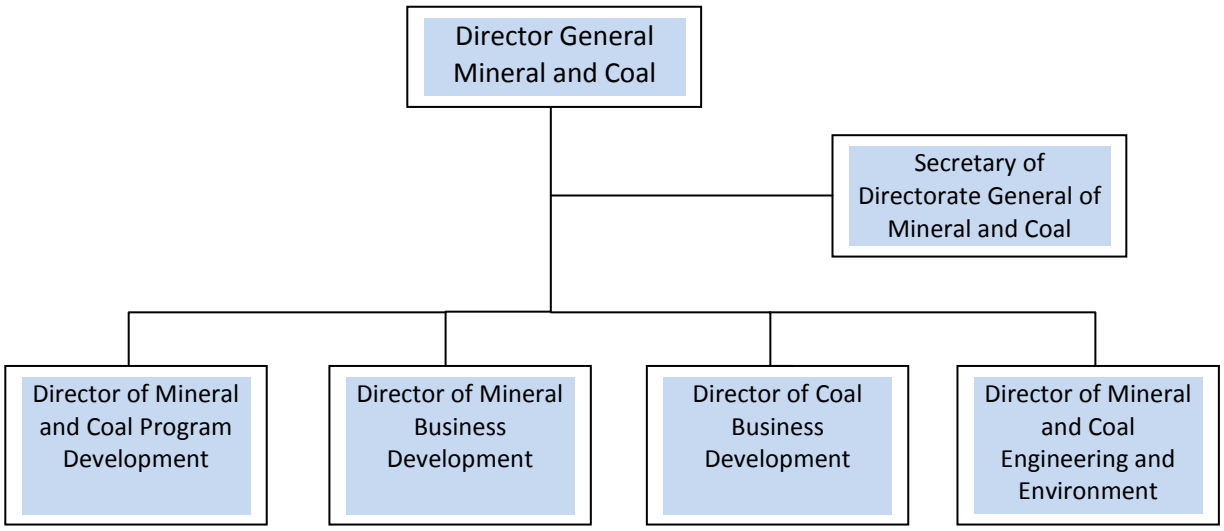


Figure 4. The Structure Organization of Directorate General of Mineral and Coal

2.1.4 Directorate General of New Renewable Energy and Energy Conservation (DGNREEC)

Directorate General of New Renewable Energy and Energy Conservation has the duty to formulate and implement policies and technical standardizations in the fields of new, renewable energy and energy conservation. In order to perform her tasks, the Directorate General of New Renewable Energy and Energy Conservation has the functions in preparing and implementing the policies in the fields of new, renewable energy and energy conservation, preparing the standards, norms, guidelines, criteria, and procedures in the fields of new, renewable energy and energy conservation, providing technical guidance and evaluation, and conducting the

administration affairs of the Directorate General of New Renewable Energy and Energy Conservation. There are four directorates and one secretariat under the Directorate General of New Renewable Energy and Energy Conservation which have different duty and function as shown in the organization chart below:

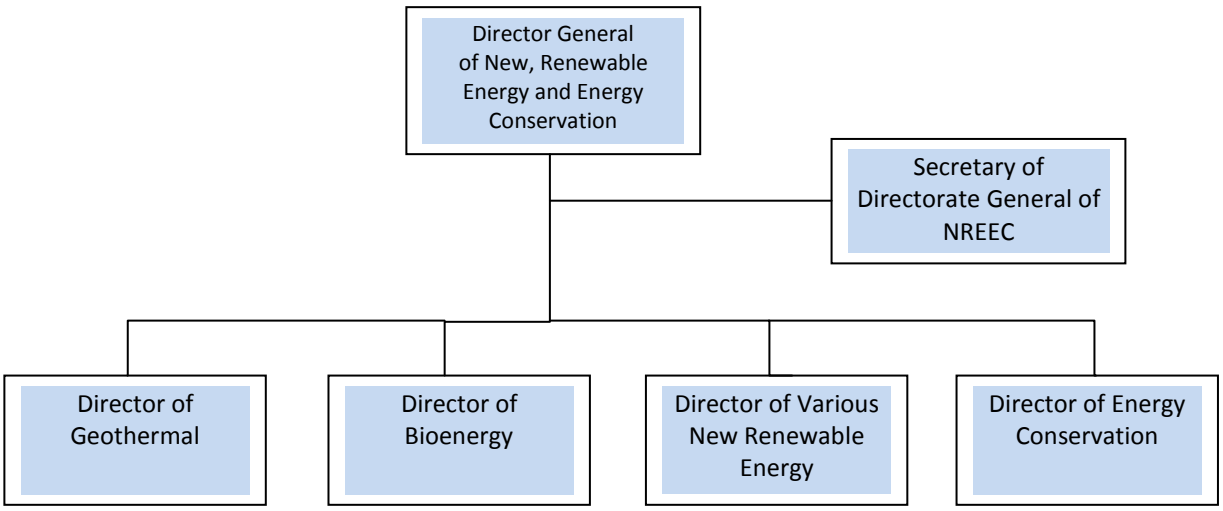


Figure 5. The Structure Organization of Directorate General of New, Renewable Energy and Energy Conservation

2.1.5 Geology Agency

Geology Agency has the duty to conduct research and service in the fields of geology. In order to perform her tasks, the Geology Agency has the functions in formulating policies in the fields of geology, formulating research and service plans and programs, fostering and implementing research and service, servicing in geological surveys, as well as researching and servicing in the fields of geology resources, volcanology and geological disaster mitigation and environmental geology, providing recommendation and presentation of information on the results of surveys, researches and services, evaluating the implementation of research and service in the fields of geology, and conducting the administration affairs of the Geology Agency.

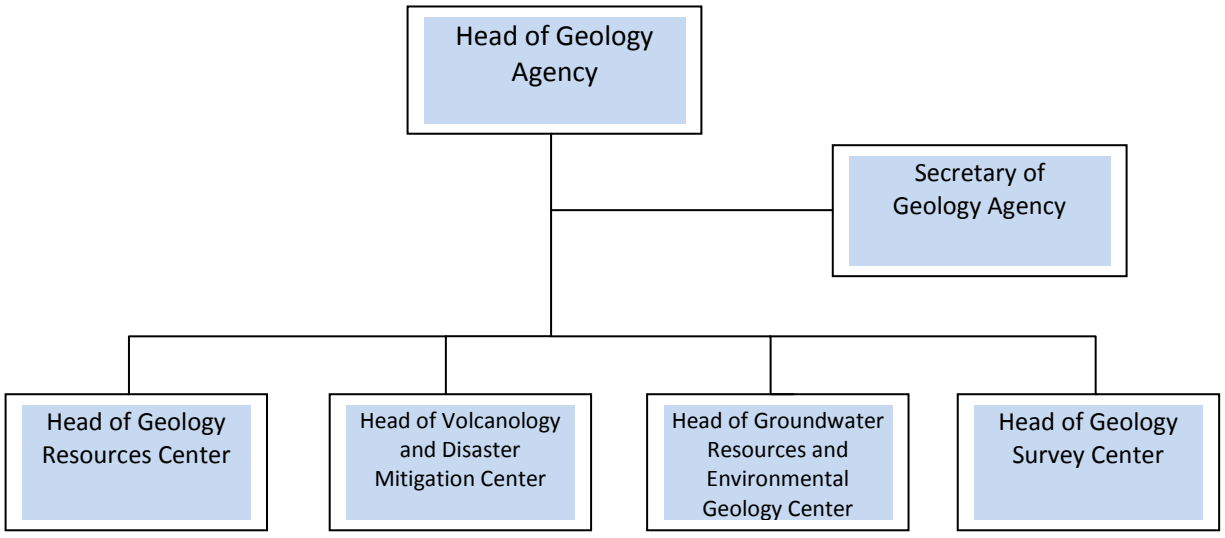


Figure 6. The Structure Organization of Geology Agency

2.1.6 Research and Development Agency of Mineral and Energy Resources

Research and Development Agency of Mineral and Energy Resources has the duty to conduct research and development in the fields of energy and mineral resources. In order to perform her tasks, the Research and Development Agency has the functions in preparing technical policies, plans and programs of research and development in the fields of energy and mineral resources, implementing research and development in the fields of energy and mineral resources, monitoring, evaluating and reporting the implementation of research and development in the fields of energy and mineral resources, and conducting the administration affairs of the Research and Development Agency.

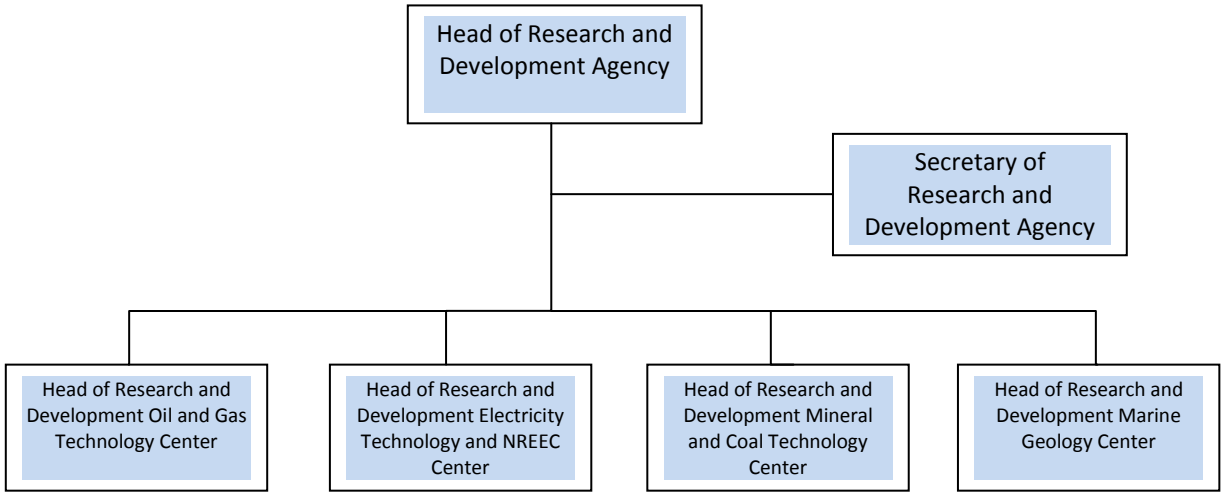


Figure 7. The Structure Organization of Research and Development Agency

2.1.7 Education and Training Agency of Mineral and Energy Resources

Education and Training Agency of Mineral and Energy Resources has the duty to conduct education and training in the fields of energy and mineral resources. In order to perform her tasks, the Education and Training Agency has the functions in preparing technical policies, plans and programs of education and training in the fields of energy and mineral resources, implementing education and training in the fields of energy and mineral resources, monitoring, evaluating and reporting the implementation of education and training in the fields of energy and mineral resources, and conducting the administration affairs of the Education and Training Agency.

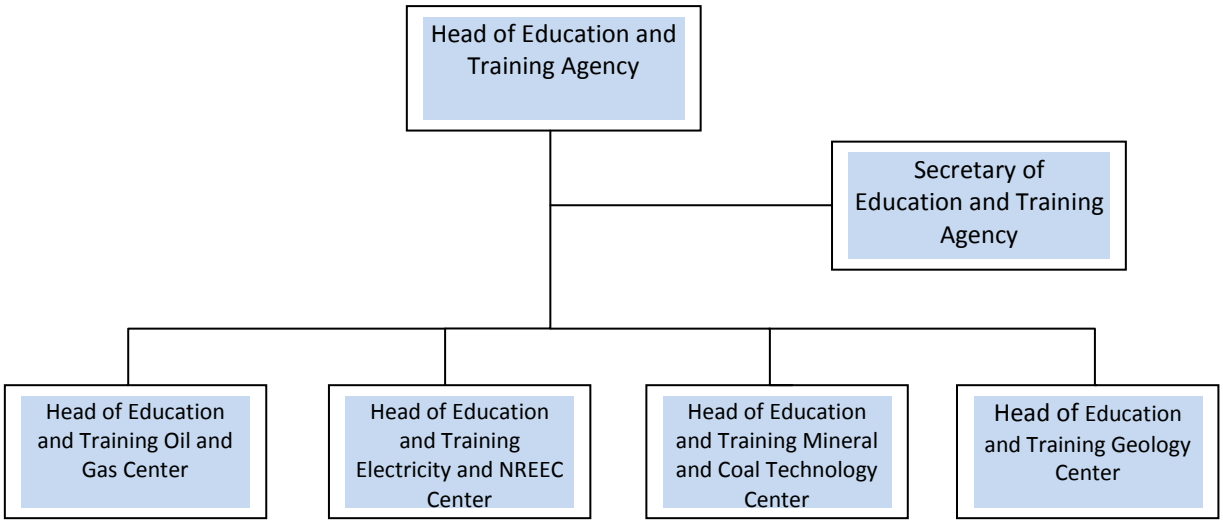


Figure 8. The Structure Organization of Education and Training Agency

2.2 Stakeholders

The successful implementation of policies and programs of the government in the energy sector is highly dependent on the support and cooperation of the stakeholders (associations, people, and public and private companies). Therefore, a good and clear communication, and transparency in policies and regulations making between government and stakeholders should be strengthened and expanded. The stakeholders who have had a good relationship and cooperation with the government in the energy sector are as shown in the table below.

Table 3. Stakeholders on New Renewable Energy

No	Stakeholders	
I	**STATE OWNED COMPANY**	
1	State Owned Electricity Company *PT Perusahaan Listrik Negara*	PLN
2	State Owned Oil and Natural Gas Mining Company *Perusahaan Pertambangan Minyak dan Gas Bumi*	Pertamina
3	State Owned Gas Company *PT Perusahaan Gas Negara*	PGN
II.	**NRE (New and Renewable Energy) CORE BUSINEESS ASSOCIATION**	
4	Indonesian Biofuel Producers Association *Asosiasi Produsen Biofuels Indonesia*	Aprobi
5	Indonesian Bioethanol Producers Association *Asosiasi Produsen Bioethanol Indonesia*	APBI
6	Indonesian Palm Oil Association *Gabungan Pengusaha Kelapa Sawit Indonesia*	Gapki
7	Indonesian Geothermal Association *Asosiasi Panas Bumi Indonesia*	API
8	Indonesian Minihidro Entrepreneur Association *Asosiasi Pengusaha Minihidro Indonesia*	APMI
9	Hydro Power Plant Entrepreneur Association *Asosiasi Pengusaha Pembangkit Listrik Tenaga Air*	-
10	Indonesian Ethanol and Spiritus Industry Association *Asosiasi Industri Ethanol dan Spiritus Indonesia*	Asendo
11	Indonesian Hydro Association *Asosiasi Hidro Indonesia*	AHI

No	Stakeholders	
12	Indonesia Solar Module Manufacturers Association *Asosiasi Pabrikan Modul Surya Indonesia*	Apamsi
13	Indonesian Ocean Energy Association *Asosiasi Energi Laut Indonesia*	ASELI
14	Indonesian Network Microhydro *Jejaring Mikrohidro Indonesia*	JMI
III.	**NRE BUSINESS ASSOCIATION SUPPORT**	
15	New Renewable Energy Support Business Association *Asosiasi Perusahaan Usaha Penunjang EBT Indonesia*	Appebti
16	Association of Indonesia Automotive Industries Indonesia *Gabungan Industri Kendaraan Indonesia*	Gaikindo
IV.	**NRE PROFESSIONAL ASSOCIATION**	
17	Indonesian Association of Bioenergy Scientist and Technologist *Ikatan Ahli Bioenergi Indonesia*	IKABI
18	Indonesian Biofuel Expert Association *Ikatan Ahli Bahan Bakar Indonesia*	IABI
19	Indonesian Biodiesel Forum *Forum Biodiesel Indonesia*	FBI
20	Indonesian Solar Energy Engineering Association *Ikatan Ahli Teknik Energi Surya Indonesia*	IATESI
21	Indonesian National Committee on Large Dams *Komite Nasional Indonesia Bendungan Besar*	KNI-BB
22	Nuclear Power Experts Association *Komisi Ahli Tenaga Nuklir*	KATN
V	**NRE COMMUNITY**	
23	Indonesian Renewable Energy Society *Masyarakat Energi Terbarukan Indonesia*	METI
24	Indonesian Wind Energy Society *Masyarakat Energi Angin Indonesia*	MEAI

No	Stakeholders	
25	Indonesian Palm Oil Board *Dewan Minyak Sawit Indonesia*	DMSI
26	Indonesian Biogas Community *Masyarakat Biogas Indonesia*	MBI
27	Community for Energy and Environment *Masyarakat Peduli Energi dan Lingkungan*	MPEL
VI	**ENERGY CONSERVATION BUSINESS ASSOCIATION SUPPORT OR CARBON SERVICE**	
28	Indonesian Association of Energy Conservation *Asosiasi Perusahaan Konservasi Energi Indonesia*	Apkenindo
29	Indonesian Lamp Manufacturers Association *Asosiasi Produsen Lampu Indonesia*	Aperlindo
30	Indonesian Electronics Association *Gabungan Elektronika Indonesia*	GABEL
31	Indonesian Electrical Industry Luminaries Association *Asosiasi Industri Luminer Kelistrikan Indonesia*	AILKI
VII.	**PROFESSIONAL ASSOCIATION OF ENERGY CONSERVATION OR CARBON SERVICE**	
32	Energy Conservation Expert *Himpunan Ahli Konservasi Energi*	HAKE
33	Indonesian Building Utility & Building Physics Engineers Association *Ikatan Ahli Fisika Bangunan Indonesia*	IAFBI
34	Indonesian Hotel Engineer Association *Asosiasi Ahli Tekhnik Hotel Indonesia*	ASATHI
35	Building Engineer Association	BEA
VIII	**ENERGY CONSERVATION COMMUNITY OR CARBON SERVICE**	
36	Energy Saving Society Forum *Forum Komunikasi Masyarakat Hemat Energi*	FKMHE
37	Green Building Council Indonesia	GBCI
38	Indonesian Business Council For Sustainable Development	IBCFSD

3. RENEWABLE ENERGY DEVELOPMENT IN INDONESIA

3.1 National Energy Policy and Regulations on Renewable Energy

In 2007, the Government of Indonesia issued the Energy law, which consists of two main policies on energy development as follow:

a. Energy Conservation
b. Energy Diversification

Until the time the National Energy Council (DEN) establishes a new National Energy Policy (KEN), the National Energy Policy of 2006 is in force. The aim of this policy is to:

- Achieve energy elasticity to GDP of less than one by year 2025
- Realise an optimum primary energy consumption mix in 2025, with shares as follows:
  - oil,—to become less than 20%
  - natural gas—to become greater than 30%
  - coal—to become greater than 33%
  - biofuels—to become greater than 5%
  - renewable energy and other energy including nuclear—to become greater than 10%
  - liquefied coal—to become greater than 2%.

The details of the energy programs and targets of the National Energy Policy are elaborated in the *Blue Print – National Energy Management 2005 to 2025* (ESDM, 2006).

Indonesia's 2006 energy policy expects the combined share of renewable energy and nuclear in the overall energy mix in 2025 to exceed 17%. The policy places special emphasis on enhancing the share of biofuels. Renewable energy and other energy including nuclear (as in the list above) is expected to be made up of at least a 5% share from geothermal and a combined share of biomass, hydropower, solar, wind and nuclear power to comprise the remainder of the 10% by 2025.

3.1.1 Current Renewable Energy Development

3.1.1.1 Geothermal Energy

Indonesia is a country with an abundant potential resources of geothermal energy that spread along the belt of active volcanoes from Sumatra, Java, Bali, Nusa Tenggara, Sulawesi, Maluku and West Papua. The data from the Geological Agency, the Ministry of Energy and Mineral Resources indicates that until 2012 had identified 299 locations with total potential capacity of 28 GWe for further development as shown in Table 4 below.

Table 4. Indonesia's Geothermal Potential, 2012

RESOURCES (MWe)		%	RESERVE (MWe)			%
Speculative	***Hypothetical***		***Possible***	***Probable***	***Proven***	
7,247	4,886	42.37%	13,391	823	2,288	57.63%
12,133			**16,502**			
28,635						

Until mid 2013, 58 Geothermal Working Areas (GWAs) had been determined by the government of which 19 GWAs were the existing GWAs that had been established before the enactment of Law No. 27 Year 2003 regarding Geothermal, whereas the rests were new GWAs as shown in Figure 9 below.

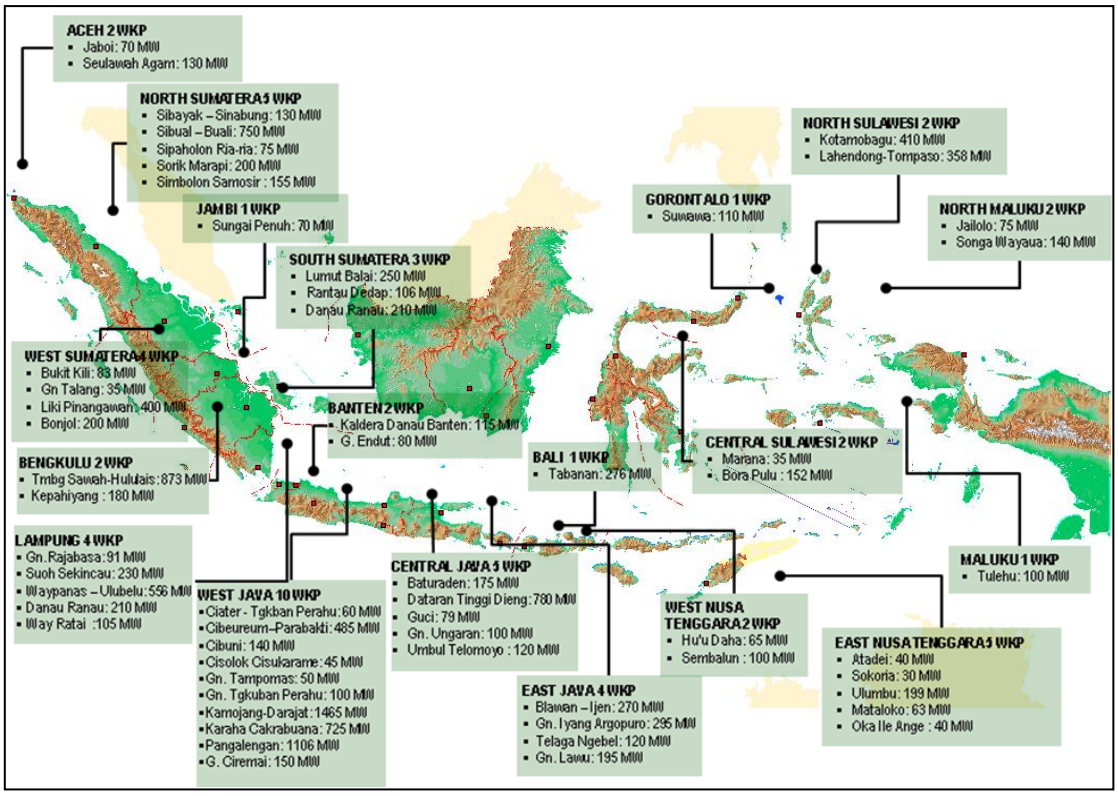


Figure 9. Distribution of Geothermal Working Area

However, the current indirect utilization of geothermal energy for electricity is only reached 1,341 MW or 5% of Indonesia's total potential. On the other hand, direct utilization of geothermal energy (for non-electricity purposes) has not been yet optimizing.

Based on the Presidential Regulation No. 5 Year 2006 regarding the National Energy Policy (KEN), the government has set a target of 9,500 MW electricity by 2025 or equal to 5% of total primary energy, as shown in Figure 10 below.

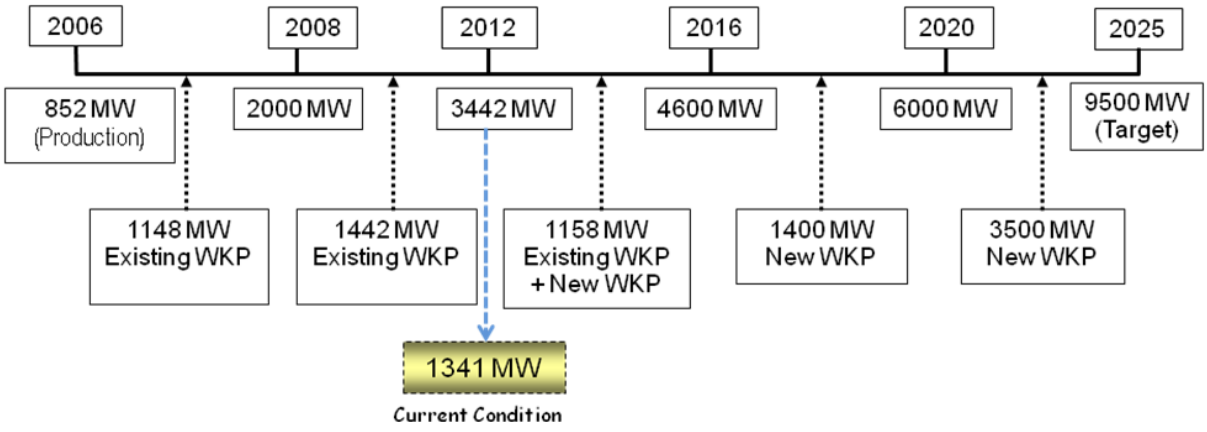


Figure 10. Road Map of Geothermal Development 2006 – 2025

In order to accelerate the geothermal utilization, the government issued the 10,000 MW Fast Track Program Phase 2 (FTP2), in which geothermal is targeted to contribute 4,965 MW of electricity.

In order to support the program, at least USD 15,000 million of investment is needed. This large amount of fund can not be borne entirely by the government. Thus stakeholder's participation and support from partners both within and outside the country, are strongly needed.

There are 2 ways for new investors for becoming a geothermal developers as shown in figure 5, as follows:

1. Preliminary Survey Assignment;
2. Obtaining Geothermal Business Permit (IUP), which awarded through GWA tender mechanism.

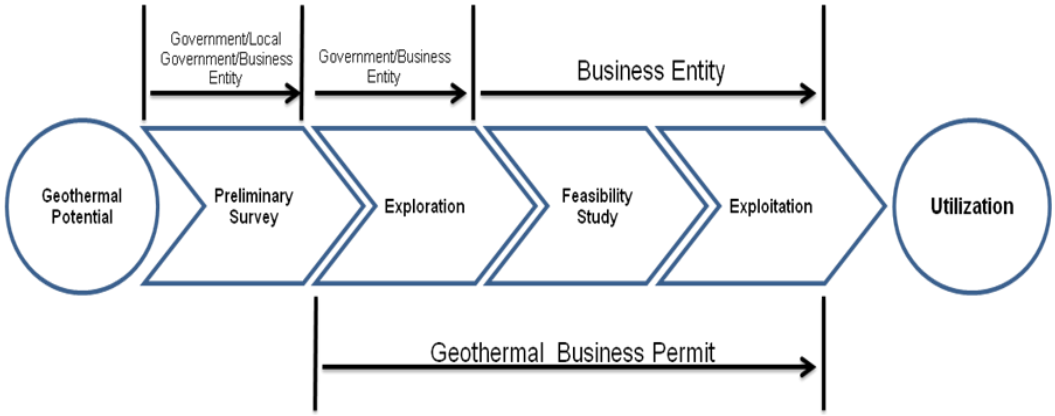


Figure 11. Geothermal Business Stages

In 2012, total steam production of geothermal energy was about 69,882,712 tonnes and total electricity production of geothermal energy was about 9,291,090 MWh as shown in Table 5.

Table 5. Steam and Electricity Production 2012

GWA	STEAM PROD (TONNES)	ELECTRICITY PROD (MWh)
Kamojang	10,878,385	1,455,258
Lahendong	3,261,670	446,809
Sibayak	160,361	15,960
Ulubelu	1,393,112	206,988
Salak	25,797,305	2,981,160
Darajat	14,174,881	2,189,644
Wayang Windu	13,169,817	1,845,674
Dieng	1,047,181	149,597
Total	**69,882,712**	**9,291,090**

3.1.1.2 Hydro Energy

Currently, Indonesia's total hydro energy potential resources was 75,670 MW which spreads across in many locations with the total installed capacity of 4,200 MW or 5.6% of the total hydro energy potential, as shown in Table 6.

In the regions with hydro potential, the central and local governments manage to build micro-hydro power plants (MHP) and after the projects completed it handed over to local people for management, operation and maintenance of MHP as efforts to provide electricity access to the community and to encourage community participation in managing its own energy.

Table 6. Potential and Installed Capacity of Hydro Energy

No.	Island	Large Scale (>10 MW)		Small Scale (<10 MW)		Total (MW)	
		Potential	Installed Capacity	Potential	Installed Capacity	Potential	Installed Capacity
1	Sumatera	16,100.00	1,154.00	281.76	83.44	16,381.76	1,237.44
2	Java	12,050.00	2,012.50	222.02	212.32	12,272.02	2,224.82
3	Kalimantan	5,999.50	30.00	277.75	31.27	6,277.25	61.27
4	Sulawesi	14,550.00	352.00	167.56	118.05	14,717.56	470.05
5	Bali-Nusa Tenggara	4,900.00	0.00	31.64	12.25	4,931.64	12.25
6	Maluku-Papua	21,057.00	23.00	32.78	4.67	21,089.78	27.67
Total		**74,656.50**	**3,571.50**	**1,013.51**	**462.00**	**75,670.01**	**4,033.50**

However, there are some challenges currently faced by the government in the development of hydro energy, as follows:

- Despite the good quality of local production turbines, the capacity of turbines are still below 1 MW. Therefore, it still needs support in research and development, as well as local manufacturing capabilities to produce turbines with capacity more than 500 kW;
- Hydro energy resources is generally located in forested areas where there are no adequate existing transportation infrastructure, thus its causing high investment cost;
- MHP often utilizes the resources of the state-controlled forests or indigenous people. MHP development is often hampered by the difficulty of obtaining permits from various parties. Therefore, it needs a mediation (clearing house); and
- MHP sustainability depends on the preservation of water resources, therefore the development of MHP should be protected by policies and regulations on water resources use and spatial planning to ensure water sustainability and availability.

3.1.1.3 Solar Energy

Located in equator line, Indonesia has an abundant resources of solar energy which is suitable to use in small islands, remote areas, and border areas where there are no existing electricity installation. Very small scale electricity system in remote areas is currently planning to be supplied by solar power plants (SPP) in collaboration with the local government.

There are three alternatives of solar project implementation scheme, which are 1) Solar Photovoltaic (PV) or Solar Home System (SHS), 2) Centralized PV power plant, and 3) Hybrid System (using solar PV together with other existing resources, especially diesel power).

In 2009, Indonesia's total solar photovoltaic/solar home system installed capacity was 13.49 kW or increased by 55.6% from 2008 as shown in Table 7. The total installed capacity of solar photovoltaic/solar home system is still expected to increase in the near future due to the

government's electrification ratio program in small islands, remote areas and border areas will use solar photovoltaic/solar home system to electrify community.

Table 7. Installed Capacity of SPP/SHS

No.	Island	Capacity/Year (kW)				
		2005	2006	2007	2008	2009
1	Sumatera	0.33	0.78	1.69	2.65	4.28
2	Java	0.33	0.40	0.53	0.78	1.15
3	Kalimantan	0.16	0.38	0.71	1.11	1.93
4	Sulawesi	0.12	0.64	1.37	1.98	2.85
5	Bali, Nusa Tenggara	0.12	0.35	0.62	1.00	1.41
6	Maluku, Papua	0.16	0.36	0.71	1.15	1.87
Total		**1.22**	**2.91**	**5.63**	**8.67**	**13.49**

However, there are some challenges currently faced by the government in the development of solar energy, as follows:

- A strategy to encourage the capability of local solar panel industries increased and expanded as well as other components in developing SPP; and
- Changing people's image of SPP reliability. SPP devices are already widely trading in the market with vary of the quality that it has not been yet controlled by the government at the moment. So that there are many solar panels with low quality are selling in the market and making disappointed to consumers to use, thus damaging the image of SPP reliability.

In order to encourage the participation foreign companies in developing the solar industry in Indonesia as well as to boost utilization of solar energy, currently the government is finalizing the draft of the Ministerial Regulation regarding feed-in-tariff (FIT) in the field of solar energy. Through this FIT scheme, more incentives will be given to both local and foreign investors who can maximize the local content in their products. Based on the Presidential Regulation No. 54 Year 2010 regarding Procurement of Goods/Services in the Government, the minimum local content that has been set by the government is 40%.

Regarding PV development in Indonesia, there are 3 government programs that could be implemented, namely:

a. **Rural PV**: the aim is to increase electricity accessibility for rural community, especially in remote areas, small islands, and border areas using Solar Home System and Centralized PV System (off grid).

b. **Urban PV**: the aim is to provide electricity for own used to middle and high class households, real estates, office and commercial buildings, hotels and resorts, industries and other (off grid and on grid).

c. **On grid PV**: the aim is to offer business opportunity to Independent Power Producers (IPPs) in developing Solar Power Plant and selling the electricity to PLN.

3.1.1.4 Wind Energy

Since Indonesia is located on the equator line thus by nature the wind energy potential is relatively small. However, there are some areas have a good wind speeds as an effect of nozzle in the narrowing area between two islands or in the mountain slopes between two adjacent mountains.

On the other hand, in order to deal with intermittent characteristic of wind energy, application of wind power generation system with a special design is required for Indonesia.

Noting this situation and condition, the development of wind energy in Indonesia will be focused on or concentrated in the areas with wind potential, and the development of wind power plants in remote areas, small islands, and border areas is prioritized using hybrid systems together with existing diesel power plants.

In 2010, Indonesia's total installed capacity of wind power plant was 1,962.36 kW or increased by 5% from 2009 as shown in Table 8.

Table 8. Installed Capacity of Wind Power Plant

No.	Island	Capacity/Year (kW)					
		2005	2006	2007	2008	2009	2010
1	Sumatera	1.50	81.50	81.50	81.50	81.50	85.58
2	Java	285.75	285.75	285.75	285.75	285.75	300.04
3	Kalimantan	0.00	0.00	0.00	0.00	0.00	0.00
4	Sulawesi	148.70	228.70	388.70	588.70	588.70	618.14
5	Bali, Nusa Tenggara	591.05	591.05	911.05	911.05	911.05	956.60
6	Maluku, Papua	2.00	2.00	2.00	2.00	2.00	2.00
Total		**1,029.00**	**1,189.00**	**1,669.00**	**1,869.00**	**1,869.00**	**1,962.36**

However, there are some challenges currently faced by the government in the development of wind energy, as follows:

- There is not comprehensive data and maps of wind energy potential available.
- Investment cost of wind power plant is still relatively high (energy prices are still high) compared to other conventional power plant investments.
- There is no significant incentives available for industries in developing wind energy utilization.

3.1.1.5 Bioenergy

As agricultural based country, Indonesia has an abundant resources of bioenergy. The biggest bioenergy potential are coming from agro-industries and municipal wastes. It is estimated that the potential of bioenergy is about 49,810 MW. Similar with other renewable energy, bioenergy is also categorized as a clean energy, which not only could increase the national energy security but also give a good contribution to the environment.

The development of bioenergy in Indonesia is a part of green energy development under the program of the National Action of Greenhouse-gas Mitigation (*Program Rencana Aksi Nasional Gas Rumah Kaca*–RAN GRK). Bioenergy is also considered as local energy sources that considered as the most proper energy to improve the modern energy access to people in rural areas. Therefore, bioenergy development has become one of the priority energy development in Indonesia in order to increase the national energy security. Under the Presidential Regulation No. 5 Year 2006, bioenergy is expected to have a significant contribution in the national primary energy mix, with minimum share to 5% by 2025 or even the minimum share of bioenergy targets set higher to 8.9% by 2025 under the government's new vision, namely Vision 25/25.

In Indonesia, products of bioenergy are developed in the form of biofuel (liquid), biogas, bio-solid (bio-briquettes, pellets) and bio-electricity, as shown in Figure 12 below.

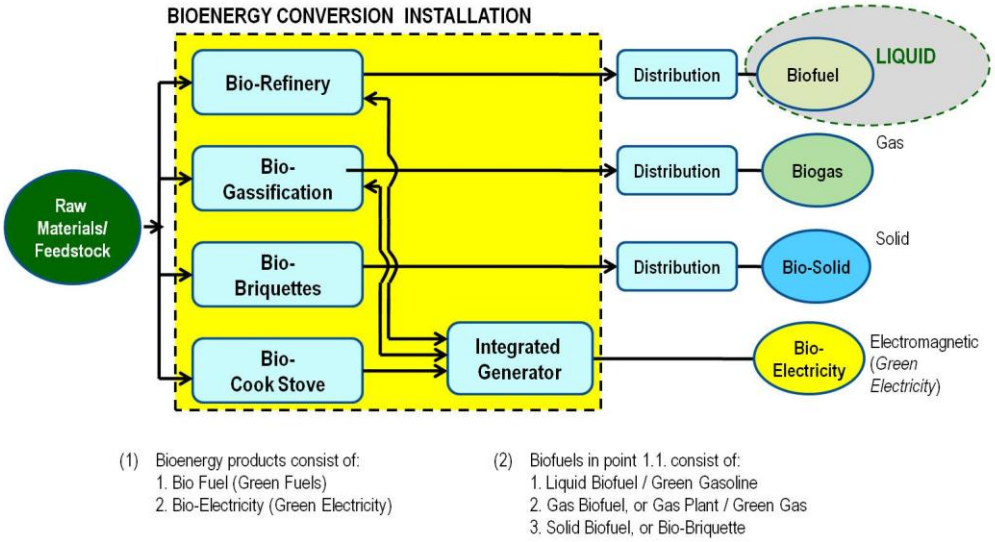


Figure 12. Bioenergy Conversion System

Even though Indonesia has a big potency of bioenergy, the utilization of bioenergy is still very low compared to its potency. It is estimated that the total bioenergy installed capacity has reached about 1,618.40 MW.

As mentioned above, the products of bioenergy are included bio-briquettes and pellets. Bio-briquettes and pellets are not a priority to be developed by the government currently, since its utilization can be replaced by the traditional biomass or simply by agricultural wastes. However, bio-briquettes and pellets are developed by some industries from some agro-industry wastes, and these products are exported to some countries.

A very different situation can be seen in the solid-biomass, the development of biogas currently is done in intensively manner, both for the domestic utilization (cooking and light), and also the electricity production. Biogas technology is considered as the grass-root technology where Indonesia is able to produce the technology. In Indonesia, the biogas development is carried out through 3 (three) following approaches, namely:

a. **Non-Commercial** (under government investment)

This scheme is addressed to increase the access on modern energy to rural people, especially for those who live in isolated areas. This approach also has aim to introduce the bioenergy technology to stimulate people's interest to utilize biogas system. Currently, under the Ministry of Energy and Mineral Resources budget, there are two programs using this scheme, namely the Biogas-Energy Self-sufficient Village (ESSV) program and the Special Allocation Fund Program (*Program Dana Alokasi Khusus*). The non-commercial approach for the biogas development is also conducted by other ministries, such as the Ministry of Agriculture, the Ministry of Cooperative and Small-Medium Enterprises, the Ministry of Environment, and the State Ministry for Development of Disadvantaged Regions.

b. **Semi Commercial** (under application of partial subsidies)

This approach has a mechanism where subsidy is applied to stimulate participation of people to use the biogas system and the involvement of private sectors and financial institutions. Currently, Indonesia has such program which is implemented under a bilateral cooperation between Indonesia and the Netherlands, namely the Domestic Biogas Program (*Program Biogas Rumah-Program BIRU*). The chosen area to implement this program is the area where there is credit available to the consumers/biogas users provided by financial institutions. The program provides Rp 2 million to each beneficiary to construct the biogas unit. Remaining cost of the

biogas unit construction is paid by the beneficiary, by cash or through the credit from the financial institution who involved this program.

c. **Commercial** (under Private Investment or Public-Private Partnership)

The scheme for commercial approached is under business-to-business (B to B) in where usually biogas is produced in large scales to produce electricity. What the government can do to encourage involvement of private sector in this scheme is to provide proper regulations and to improve the investment climate.

Further, Indonesia has also a priority to develop the biofuel (liquid), which consists of biodiesel, bioethanol and bio-oil. In 2008, the government issued the Ministerial Regulation No. 32 Year 2008 regarding Mandatory of Biofuel Utilization. This regulation mandates the utilization of biofuel in the transportation, industry as well as power plant sectors. Based on this regulation, the minimum of utilization of biodiesel is expected to become 20% and bioethanol to become 15% by 2025, as shown in Table 9 below.

Table 9. **MANDATORY ON BIOFUEL UTILIZATION**
(Ministerial Regulation No. 32 Year 2008)

BIODIESEL (Minimum)							
SECTOR		Year					
		2008	2009	2010	2015	2020	2025
Transportation, PSO*)		1%	1%	2.5%	5%	10%	20%
Transportation, Non PSO		-	1%	3%	7%	10%	20%
Industry		2.5%	2.5%	5%	10%	15%	20%
Electricity Generation		0.1%	0.25%	1%	10%	15%	20%
BIOETHANOL (Minimum)							
SECTOR		Year					
		2008	2009	2010	2015	2020	2025
Transportation, PSO		3%	1%	3%	5%	10%	15%
Transportation, Non PSO		5%	5%	7%	10%	12%	15%
Industry		-	5%	7%	10%	12%	15%
PURE PLANT OIL (Minimum)							
SECTOR		Year					
		2008	2009	2010	2015	2020	2025
Industry and transportation (low & medium speed engine)	Industry	-	-	1%	3%	5%	10%
	Marine	-	-	1%	3%	5%	10%
Electricity Generation		-	0.25%	1%	5%	7%	10%

**) PSO fuel: Public Service Obligation fuel means subsidized fuel*

Indonesia has various sources of raw material for both biodiesel and bioethanol. Biodiesel can be gained through the process of oil from diverse plants, such as from palm, coconut, *jarak pagar* (*Jatropha Curcas)*, *nyamplung* (*Callophylum*), and *kemiri sunan* (*Aleurites Trisperma*). However, the current raw material for the Indonesian's biodiesel production is crude palm oil (CPO), in where

Indonesia is the biggest producer of the CPO in the worlds. In 2011, the production of CPO was reached 23 million ton or increased about 5% compare 2010's production (Kemtan, 2013).

Similar with biodiesel, bioethanol also can be produced from various raw materials, such as from mollases from sugar industry, cassava, and sorghum.

Biodiesel industry is more advanced nowadays in Indonesia compared to bioethanol industry. It is estimated that Indonesia produces about 21 million ton per year of biodiesel. Currently, there are 23 biodiesel producers with the total installed capacity of around 4.5 million KL/year. For the bioethanol industry, it is identified that there are only 7 bioethanol producers which have commercial business licenses with the total installed capacity of about 286,686 KL/year. Some small industries have been identified in producing mitanol (kerosene from bioethanol) as a fuel for domestic purposes, for example for cooking and lighting. However, since mitanol is produced in small-scale industry, data and information related to this is limited.

Currently, under the mandatory regulation, the implementation of biodiesel mixed fuel in PSO transportation sector has achieved to 7.5%, in which 7.5% of biodiesel was mixed into the PSO diesel fuels, called as B-7.5. These fuels are distributed by Pertamina (State Owned Oil Company) as the off-taker. Furthermore, the government has a plan to mix 2.5% of biodiesel into the non-PSO diesel fuels, and it will be sold by other oil companies, such as Shell and Petronas.

In the national market, biofuel is sold based on the Market Price Index, which is regulated under the Ministerial Decree. In order to support the implementation of the mandatory regulation, the government provides subsidy but only for the biofuel which is mixed in PSO-fuel for transportation. Subsidy is defined as the difference between the Market Indeks Price of biofuel and the reference price of conventional fuels (solar/gasoline), which is currently taken from Means of Platss Singapore (MOPS). The figure of subsidy can be seen in Figure 13 below.

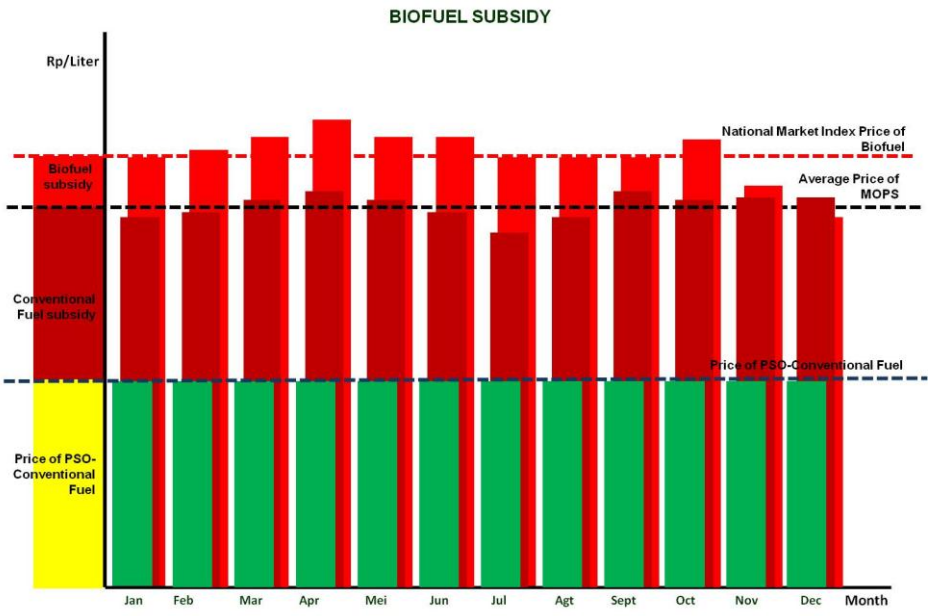


Figure 13. Calculation Biofuel Subsidy Simulation

In 2011, the subsidy was set by the government at the maximum of Rp 2,000,- per litre, both for biodiesel and bioethanol. In order to accelerate the utilization of biofuel, the government was allocated subsidy about Rp 2,937 billion in 2012, of which Rp 2,083 billion for biodiesel with quota to 694 thousand KL and Rp 854 billion for bioethanol with quota to 244 thousand KL.

With this figure, in 2012, the subsidy for biodiesel was became Rp 3,000,- per litre or increased Rp1,000,- per litre compared to 2011's subsidy and bioethanol became Rp. 3,500,- per litre or increased Rp1,500,- per litre compared to 2011's subsidy.

In 2012, there were 669 thousands KL of biofuels from blending biofuels and fossil fuels in Indonesia or increased almost doubling from 358 thousands KL in 2011. As of January 2013, the utilization of biodiesel was reached around 59 thousands KL.

A very different situation can be seen in the Indonesian bioethanol utilization, due to constraints on pricing, it is causing reluctances to supply bioethanol in Indonesia and as a result there was no utilization of bioethanol since 2010. To overcome this obstacle, the government under the Ministry of Energy and Mineral Resources has submitted a new proposal on biofuels price index revisions to the Ministry of Finance; however it has not yet been approved.

The Government of Indonesia always recaps and reviews progressing toward the achivement of government program and policy on biogas and biofuels development as an evaluation and annual monitoring. Until the end of year 2012, the government had been implemented several programs for accelerating biogas utilization. One of the programs was Desa Mandiri Energi (DME), which was utilizing the biogas for rural areas. The other program was cooperation between the government and Hivos (Non-Government agency from the Dutch Goverment) for providing biogas unit for households. Table 10 shows the several achievements of biogas program in Indonesia up to year 2012.

Table 10. Achivement for Biogas Program in Indonesia until the End of Year 2012

NO	IMPLEMENTOR	SPECIFICATION AND CAPACITY	TOTAL
1	Directorate General of New Renewable Energy and Energy Conservation, MEMR (Energy Rural Program/Program DME for Biogas Communal and Household)	▪ Household Biogas Digester: capacity of 4 - 6 M^3 , ▪ Communal: capacity of 20 - 30 M^3, and ▪ Waste of Tofu Industry: capacity of 40 - 136 M^3	▪ Capacity of 6 M^3 : 682 units, ▪ Capacity of 20 M^3 : 54 units ▪ Capacity of 40 M^3 : 1 unit ▪ Capacity of 90 M^3 : 4 units ▪ Capacity of 136 M^3 : 1 unit
2	Indonesia Domestic Biogas/ Program BIRU (Cooperation Between GOI-HIVOS)	Target 8,000 of biogas units for household (capacity of 4 - 6 M^3)	Realization: 7,432 units
3	PT Navigat Organic Energy Indonesia	Waste Power Plant from Municipal Solid Waste (Biogas), Capacity of 26 MW (COD in Sept. 2012 with total 8 MW of Biogas Landfill), on Grid	1 unit with capacity of 26 MW of electricity
4	PTPN V, Kebun Tandun	Waste Power Plant from Palm Oil Mill Effluent (POME), Capacity of 1 MW (COD in March 2012), off grid for own using in palm plantation	1 unit with capacity of 1 MW of electricity

For biofuel, both biodiesel and bioethanol, the realization of biodiesel utilization in Indonesia until the end of year 2012 was only 544,963 kL or 38.93% from 1,400,000 KL of the mandatory

regulation target, as shown in Figure 14 below. Therefore, to increase the utilization of biofuel and to achieve the mandatory regulation target, the government has increased the subsidy for biofuel in 2013.

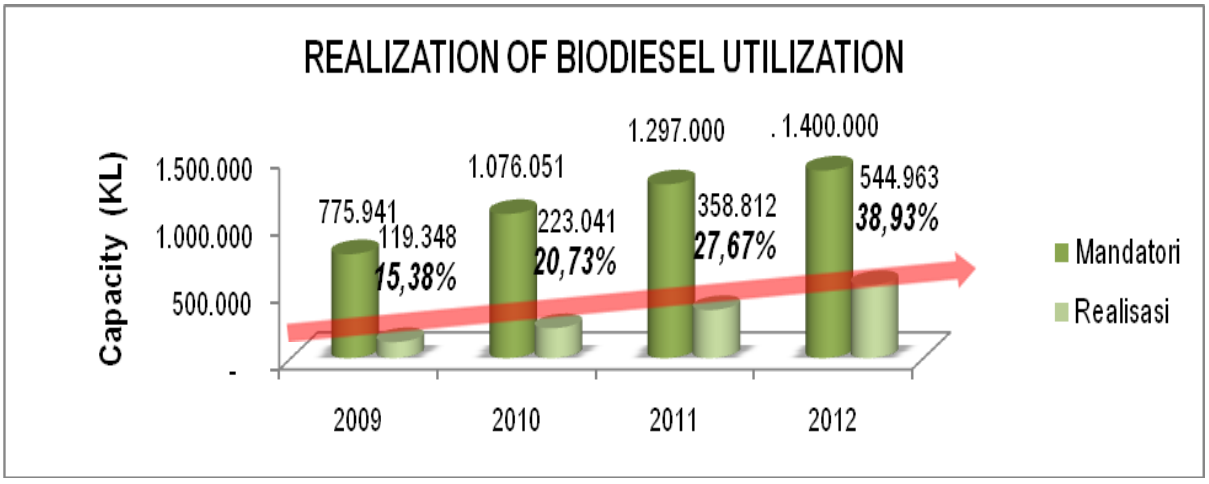


Figure 14. Realization of Biodiesel Utilization

3.1.2 Other New and Renewable Energy

3.1.2.1 Nuclear

Based on calculation conducted by PLN, nuclear power plant (NPP) cannot compete with other types of power plant, such as a of 1,000 MW supercritical coal power plant. The Fukushima Daichi NPP accident in March 2011, where thousands of residents who live near the plant must be evacuated to a safe area, has led to an escalation of opposition to develop nuclear energy for power generation. The decision to build a nuclear power plant is not based solely on economic and energy availability considerations, but also other considerations such as political, security, social, cultural and environmental. With those multi-dimensional aspects, the nuclear power plant construction program in Indonesia can only be decided by the government.

3.1.2.2 Liquefied Coal and Gasified Coal

As stated in the Government Regulation No. 5 Year 2006 regarding the National Energy Policy, the share of coal in primary energy consumption is expected to become greater than 33% in 2025. In Indonesia, coal has been projected as the main energy source to replace oil fuels until 2025, mainly for power generation. Therefore, in order to reduce CO_2 emission from coal fired power plant, it is necessary developing an environmental friendly power generation through clean coal technology implementation such as coal gasification and coal liquefaction.

Currently, Indonesia has reserves of about 60 billion tons of coal which found it throughout of Indonesia. Nearly 85% of the reserves are young coal (lignite) or in other words, low quality coal. It is because contains of 30% water content and has a low calorie with a low sale value. Lignite, also known as brown coal, in which could be developed as an alternative to petroleum.

In Indonesia, there are 2 potential locations for constructing a liquefied coal factory, one is in Banyuasin in South Sumatra, which has reserves of 2.9 billion tons of coal and the other is in Berau, East Kalimantan, which has reserves of 3 billion tons of coal. In addition, the large number of coal resources in Indonesia caused coal reserves can be utilized both as for gas fuel or power generation through coal gasification process.

3.1.2.3 Coal Bed Methane (CBM)

CBM resources in Indonesia reached 453.3 Trillion Cubic Feet (TCF) spreads in 11 areas of the coal basin at various locations in Indonesia, namely Sumatra, Java, Kalimantan and Sulawesi. Indonesia's CBM potential of 453.3 TCF includes proven reserves of 112.47 TCF and potential reserves of 57.60 TCF.

In 2015 Indonesia will be predicted to produce CBM up to 500 million cubic feet per day (MMSCFD) and this production can be increased to 900 MMSCFD in 2020. CBM production in Indonesia is expected to reach 1,500 MMSCFD by 2025.

3.1.2.4 Ocean Energy

Indonesia is a country in the world that has the largest maritime territory, with approximately two-thirds of its total area. Indonesia has the second longest beach in the world after Canada, where the length of the beach is about 80,000 km and the width of the ocean is about 52 million km^2.

Indonesia's ocean area along the southern coast of Java to Lombok is a location that has a large wave energy potential ranging from 10 to 20 kW per meter waves. Some studies have concluded that wave energy at some point in Indonesia could reach 70 kW per meter waves in some locations. The west coast of southern Sumatra island and the south coast of western Java have ocean wave energy potential about 40 kW per meter waves.

There are several alternative technologies that could be chosen for utilizing ocean wave energy. One of them that will be developed by Indonesia in the south coast of Java island is Tapered Channel Technology (Tapchan). However, until now the utilization of wave energy in Indonesia is still in the research stage with small capacity developed by the research and development institutions (BPPT-the Agency for the Assessment and Application Technology, PLN) and other educational institutions.

Indonesia has also tidal energy potential in some areas such as in Bagansiapiapi, Riau where the tidal high reaches 7 feet, in Palu Bay, Central Sulawesi where its geological structure enables the tidal phenomenon, in the Gulf of Bima in Sumbawa, Nusa Tenggara Barat, in West Kalimantan, in Papua, and in the south coast of Java where the tidal can reach more than 5 feet of high.

Not much different from tidal energy, ocean thermal energy in Indonesia also recently reached in the stage of research (potential data collection and feasibility study) conducted by several research institutions. As for ocean currents, current utilization for power generation has reached the implementation phase (pilot project) by T-files team from Bandung Institute of Technology (ITB) and Dr. Erwandi from Indonesia Hydrodynamics Laboratory, the Agency for The Assessment and Application of Technology (BPPT) and the Ministry of Marine Affairs and Fisheries.

3.2 Standardization

3.2.1 Standardization of Bioenergy Products

Like in any other countries, the development of bioenergy in Indonesia also considers the standards and safety aspects in order to protect the consumers from low quality products and to increase the competitiveness of the bioenergy producers. The development of standard is also one effort to make conducive business environment to the bioenergy producers with the guidelines. Some the following standards on bioenergy have been issued by the government, namely:

a. SNI 7826 : 2012 - Biogas producer unit with digester fixed dome type from concrete

b. SNI 7182 : 2012 - Biodiesel

c. SNI 7390 : 2012 - Denaturized bioethanol for gasohol

Some standards are under preparation, namely:

a. RSNI on Basic security system of hydrogen fuel

b. Biomass stove performance standard

3.2.2 Standardization of Hydro Power Plant

The development of hydro power plant in Indonesia also considers the standards and safety aspects in order to protect the consumers from low quality products and to increase the competitiveness of the hydro power plant industries. The development of standard is also one effort to make conducive business environment to the hydro power plant industries with the guidelines. Some the following standards on hydro power plant are under preparation, namely:

a. RSNI on Capacity design and lay-out of micro hydro power generation system with capacity up to 25 kW.

b. RSNI on Technical specifications of cross-flow turbines with capacity up to 35 kW.

3.2.3 Standardization of Solar Power Plant

The development of solar power plant in Indonesia also considers the standards and safety aspects in order to protect the consumers from low quality products and to increase the competitiveness of the solar power industries. The development of standard is also one effort to make conducive business environment to the solar power plant industries with the guidelines. Some the following standards on solar power plant are under preparation, namely:

a. RSNI on Characteristic parameters of stand-alone photovoltaic (PV) system

b. RSNI on Crystalline silicon terrestrial photovoltaic (PV) modules - design qualification and approval type

3.2.4 Standardization of Wind Power Plant

The development of wind power plant in Indonesia also considers the standards and safety aspects in order to protect the consumers from low quality products and to increase the competitiveness of the wind power industries. The development of standard is also one effort to make conducive business environment to the wind power plant industries with the guidelines. Some the following standards on wind power plant are under preparation, namely:

1. RSNI on Testing performance of electrical power produced by wind turbine

2. RSNI on Plan requirements of small scale wind turbine

3.3 Clean Energy Development

The Indonesian Government has commitment to support the development of clean energy, which is not only dedicated to maintain the environmental friendly, but also to secure the sustainability of energy supply for the nation. The development of new and renewable energy in Indonesia is a major part of clean energy development, a part from clean energy technology and energy efficiency implementation. With the growing concerns on climate change and reducing GHG emission from energy sector, new and renewable energy development obtains enourmous support in the clean energy development.

As a part of clean energy development, new and renewable energy also provides co-benefits to the country, as it supports the sustainable development both in local and national level.

3.3.1 National Mitigation Actions

In 2010, the President of Republic of Indonesia announced the Indonesia's voluntary commitment to reduce national GHG emission to 26% in 2020 from the business-as-usual scenario and it can be further reduce to 41% with the international support. This voluntary commitment is part of Indonesia's active participation to implement the Bali Action Plan that called for the developing countries to contribute in the global GHG emission reduction.

To achieve the voluntary commitment, the Presidential Regulation No. 61 Year 2011 regarding the National Action Plan on Greenhouse Gasses Emission Reduction (RAN-GRK) has been issued by the government. The RAN-GRK is not only enacted the national targets, but also mandated national mitigation actions to achieve the targets, instructed the implementation and evaluation of the actions plans by line ministries/institutions, and guided the development of the Local Action Plan on Greenhouse Gases Reduction (RAD-GRK) by the local governments.

The core activities (defines as the activities that directly reduce the GHG emission) are conducted in 5 main mitigation sectors:

- Agriculture;
- Forestry and peat land;
- Energy and trasnportation;
- Industry; and
- Waste management.

As defined in Table 11 below.

Table 11. Core Activities of the RAN-GRK

Sector	Emission Reduction (Giga Ton CO_2e)		Total	Mitigation Actions
	26%	15% (Total 41%)		
Forestry and Peatland	0.672	0.367	1.039	▪ Control on forest and peatland burning; ▪ Management of water supply & network system; ▪ Forest and land rehabilitation including Industrial forest and community forest; ▪ Removal of illegal logging; ▪ Preventing deforestation; ▪ Community emporwerment
Agriculture	0.008	0.003	0.011	▪ Introduction of low emission rice variety; ▪ Eficiency of irrigation water; ▪ Usage of organic fertilizer
Energy and Transportation	0.038	0.018	0.056	▪ Biofuel utilization; ▪ Utilization of high efficiency engine; ▪ Increasing quality of public transport and roads; ▪ Demand side management; ▪ Energy efficiency; ▪ **Renewable energy**

Sector	Emission Reduction (Giga Ton CO_2e)		Total	Mitigation Actions
	26%	15% (Total 41%)		
Industry	0.001	0.004	0.005	▪ Energy efficiency, ▪ **Renewable energy**
Waste	0.048	0.030	0.078	▪ Waste management with 3R (reduce, reuse, recycle); ▪ Integrated waste management in urban areas
Total (Gton)	**0.767**	**0.422**	**1.189**	

As stipulated in the Presidential Regulation No. 61 Year 2011, new renewable energy development, such as renewable energy-based power generation and bioenergy development (biogas and biofuel), is not only measured for its energy supplied, but also monitored and reported for its contribution on GHG emission reduction in national level.

As a part of the RAN-GRK, the Presidential Regulation also stipulated that the local governments must participate in reducing greenhouse gas emission in each respective provinces/regencies through the development of Local Action Plan on Greenhouse Gases Reduction (RAD-GRK). The RAD-GRK is defined as the workplan to implement activities that directly and indirectly reduce the GHGs emission reduction according to local development target and taking into account the RAN-GRK. The RAD-GRK will be legally binding policy for 1 (one) year after the issuance of the Presidential Regulation by Governor Decree (approximately by September 2012). The RAD-GRK will be reported to the Bappenas (the Ministry of National Development Planning) and the Minister of Interior.

In December 2012, the Bappenas and the Minister of Interior officially launched the 33 RAD-GRK developed and issued by the local governors in Indonesia.

3.3.2 Indonesia Carbon Market: Policy and Status

Indonesia participation in carbon market officially started in 2004, after the ratification of Kyoto Protocol under Law No. 17 Year 2004. The entry of Indonesia as part of the Kyoto Protocol enabled Indonesian project proponent to be involved in the flexible mechanism, namely Clean Development Mechanism (CDM). In order to answer the inquiry on the national approval of the CDM projects from the United Nations Framework Convention on Climate Change (UNFCCC), the Ministry of Environment had issued the Ministerial Decree No. 206 Year 2005 regarding the National Commission on CDM, which is mandating several representative of the ministries as the Committee members and appointing the Ministry of Environment as the authorities' institutions to manage the approval process. The 2005 decree was renewed by the Ministerial Decree No. 522 Year 2009, where the management of the approval process has been moved to the National Council on Climate Change (NCCC).

The first project of CDM conducted by the Indonesian project proponent was the solar cooker project in Province of Aceh, registered in the Executive Board of CDM in year 2006. Up to now, the National Committee on CDM has been reported that there are 240 CDM projects in Indonesia, in which 81 projects registered to the EB of CDM, including 4 Programmatics of CDM. Most of the projects are coming from energy sector related to energy supply, energy distribution and transmission, and energy efficiency in demand side. In Indonesia, proposing the energy projects as the CDM projects is perceived getting financial and political supports to the projects development. However, since the CDM windows are closed for the Indonesian stakeholders, with the EU—ETS as the main buyer of CER restricting the supply to the Least Developed Countries (LDCs).

Apart from CDM, the National Committee on CDM also processes and facilitates the national approval of voluntary carbon market. For anticipating new market mechanisms under the Post-Kyoto regimes, the National Council on Climate Change will explore and participate in international, regional and bilateral carbon market initiatives, such as new CDM, REDD+, crediting NAMAs, regional market, domestic market, joint credit mechanism (i.e with the Japanese Government), framework of various approaches (FVA), and others.

Those various initiatives and mechanisms on carbon markets can be classified into several carbon markets development strategies as follows:

- **Multilateral carbon market**: currently being negotiation; robust, and slightly complicated; environmental integrity and sustainable development criteria are not clearly defined yet;
- **Bilateral and regional carbon market**: directly between Indonesia and some developed countries; International carbon offset; Japan has already expressed their interests and it would be started soon; and
- **Domestic carbon market**: can be mandatory or voluntary basis; national boundary; simple and robust; can be used for NAMAs.

As for domestic carbon market, currently the NCCC develops the **Nusantara Carbon Scheme (SKN)** as the national appropriate carbon crediting mechanism. There are several considerations for the development of SKN, as follows:

1) as an alternative for the financial support in domestic mitigation actions;
2) as a catalyst for other new market mechanisms;
3) to maintain the momentum of Indonesia carbon market development; and
4) to ensure environmental integrity and sustainable development in Indonesia mitigation actions.

Currently, the NCCC has been developed at least 6 methodologies to the projects that could be divided into the afforestation and reforestation sector, biomass boiler utilization, composting, high-efficient boiler, biomass cookstove and mini/micro hydro power plant.

3.4 Policy on Incentives and Fiscal

In order to encourage and attract the participation of foreign and domestic investors as well as developers in developing new and renewable energy in Indonesia, the government has provided some initiatives on incentive and fiscal, as follows:

1. Increasing tariff/electricity selling price of new and renewable energy through feed in tariff (FIT)in which PLN is obliged to purchase renewable energy at a predetermined price (MEMR Regulation No. 04 Year 2012 (for Small and Medium Renewable Power Plant) and MEMR Regulation No. 17 Year 2013 (for Solar Photovoltaic Power Plant));
2. Giving fiscal incentive such as provision of corporate income tax relief or reduction facility (Regulation of the Minister of Finance (PMK) No. 130/PMK.011/2011). The government also gives tax breaks and customs (PMK No. 21/PMK.11/2010).
3. Incentive of funding;
4. Incentive of market support; and
5. Ease of licensing/finishing of overlapping the land.

APEC PEER REVIEW
ON LOW-CARBON POLICIES (PRLCE)

PART 2 : REVIEW TEAM REPORT

This part of the report presents the PRLCE Team's conclusions and recommendations about low carbon energy policies and programs in Indonesia.

1. INSTITUTIONAL CONTEXT

1.1 Critique

Indonesia has clearly established an overall legal framework for renewable energy by adopting Law No. 30 Year 2007 regarding Energy in order to realize its large potential of renewable energy. The Energy Law mandates the use of renewable energy sources be prioritized over non-renewable resources. It also defines the roles and responsibilities of the central government and local governments to prioritize renewable energy sources. In addition, a special legal framework for geothermal energy is supplied by the Geothermal Energy Law (Law No. 27 Year 2003).

In order to discharge the mandate of the Energy Law, the National Energy Council (DEN) was formed in 2008 with the tasks are drafting the National Energy Policy (KEN) and endorsement the National Energy Master Plan (RUEN). The assembly of the DEN members is chaired by the President of Indonesia. As an institution, the DEN is headed by the minister responsible for energy affairs. The DEN has 15 members: 7 ministers and high-ranking government officials responsible for the supply, transportation, distribution and use of energy and 8 stakeholder members from industry, academia, expert groups, environmental groups, and consumer groups. The selection and appointment of members of the DEN was finalized in late 2008. However, though the DEN is chaired by the President of Indonesia, policy formation and authorization occur slowly.

The Directorate General of New Renewable Energy and Energy Conservation (DGNREEC) was created within the Ministry of Energy and Mineral Resources (MEMR) in 2010 to focus on the implementation and regulation of renewable energy development. Other relevant government offices, including other directorate generals of MEMR, the Ministry of Environment, the state-owned electricity company, and state banks are also involved in policy implementation and regulation for renewable energy development. As renewable energy development inevitably entails many regulatory procedures at various governmental levels, the success of renewable energy implementation sometimes depends on the coordination between DGNREEC/MEMR and relevant offices not only within the central government but also local governments both at the provincial and municipal levels.

On the other hand, associations of renewable energy stakeholders, such as project developers, are organized for representing their interests to the society at large and especially to the government. However, based on consultation with a few renewable energy developers, in the discussion at the DEN, representative stakeholder members at the DEN are still not vocal enough to provide sufficient feedback based on the experience of energy businesses, especially renewable energy development in which the private sector plays an important role.

Incentive frameworks, such as feed in tariff (FIT), subsidies, and tax exemptions, have been established by the government to attract renewable energy investors and project developers.

1.2 Recommendations

Recommendation 1

In formulating the KEN and the RUEN, the National Energy Council (DEN) can play a pivotal role under the leadership of the chairman, the President of Indonesia. The DEN should be strengthened to set up basic policy guidelines on energy issues in timely manner.

Though the DEN is chaired by the President of Indonesia, policy formation and authorization could be accomplished more quickly. For example, the DEN finalized the Draft of KEN in March 2011 and has already submitted it to the Parliament to get the necessary approval before being enacted by the government. However, at the time of writing, the KEN has not yet been approved by the Parliament. As a consequence, the RUEN cannot yet be developed as well.

Recommendation 2

In the discussion at the DEN, its stakeholder members are recommended to increase feedback on the reality of energy businesses, especially renewable energy development in which the private sector plays an important role.

It is very important that representative stakeholder members at the DEN should become more vocal and provide increased feedback on the reality of renewable energy development during in the discussion within the DEN. This will ensure that the DEN adequately understands the real situation and condition of the private sector before making decisions on important policy that might impact the private sector.

Recommendation 3

As renewable energy development proceeds, an advisory body dedicated to renewable energy development might be needed as a formal channel between the government and renewable energy stakeholders. Such an advisory body can be a subcommittee of the DEN if the DEN expands its mandate to oversight of energy policy implementation or, if not, an independent advisory committee to the MEMR.

The DEN is in charge of energy policy in general, not only renewable energy but also fossil energy such as oil and natural gas. As renewable energy entails specific technical/technological issues, the DEN may face difficulty in formulating renewable energy policies due to the lack of technical/technological capacity. Thus the Advisory Body on renewable energy might be needed.

Recommendation 4

Further coordination between relevant government offices, not only in the central government but also among local (both provincial and municipal) governments, is recommended in regulatory or promotional procedures for renewable energy development.

Though the DGNREEC/MEMR is trying hard to coordinate relevant offices within not only the central government but also among local governments, both at provincial and municipal levels, it is almost natural to require further coordination among them, as renewable energy development inevitably entails many regulatory procedures at various level of government.

Recommendation 5

Incentives for promoting renewable energy development should be fully used for the sake of renewable energy development itself, regardless of the profitability of the renewable energy developers. Even if the profits of renewable energy developers increase thanks to renewable energy incentives, increased profit should not be considered as a target of "profit sharing" by the public sector, especially local governments.

To attract investors and project developers to renewable energy development, incentive frameworks such as feed in tariff (FIT), subsidies, and tax exemptions are already established by the government. Those incentives, of course, tend to increase the profit of renewable energy developments. Otherwise those developers would not continue to develop renewable energy due to the lack of profitability. Even if the renewable energy developers become more profitable partly due to the incentives, their increased profit should be recognized as a legitimate reward for developing renewable energy. Therefore, it would not be appropriate for other stakeholders, including the public sector and especially local governments, to demand distribution of the increased profit as a target of "profit sharing." Such demand will discourage development of renewable energy in the long run, counteracting the intent of the incentive programs.

2. RENEWABLE ENERGY GOALS, TARGETS AND STRATEGY

2.1 Critique

Indonesia is evaluating options to diversify its energy sources in recognition of the fact that the cost of oil is increasing and excess reliance on this fuel source will likely result in lost economic opportunity. The planned diversification will also increase energy security and economic benefits for the country through increased use of domestic resources. The current energy mix, as of 2011, can be seen in Figure 15.

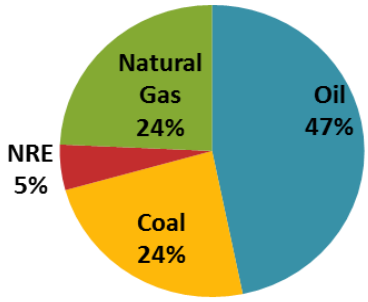


Figure 15. Energy Sources in 2011 (Tunggal, 2013)

Short- and long-term goals have historically shown to be key elements in achieving renewable energy targets. The PRLCE team received a comprehensive review of Indonesia's currently enacted energy goals in the 2006 National Energy Policy (2006 KEN) in which the Government of Indonesia has established clear targets for renewable energy generation. The 2006 KEN defines the goal of diversifying energy sources by increasing the share of renewable energy and nuclear to 17% by 2025 (Figure 16). Furthermore, the draft 2011 National Energy Policy (2011 KEN) increases the share of renewable energy to 23% by 2025 and 31% by 2050 (Figure 16). The 2011 KEN has not yet been approved. An important difference to note is that while the 2006 KEN includes nuclear and liquefied coal in the 17% by 2025 target, the 2011 KEN does not and requires the full 23% (and 31% by 2050) target to be met with renewable energy sources. This increases the proportion of energy from renewable sources substantially.

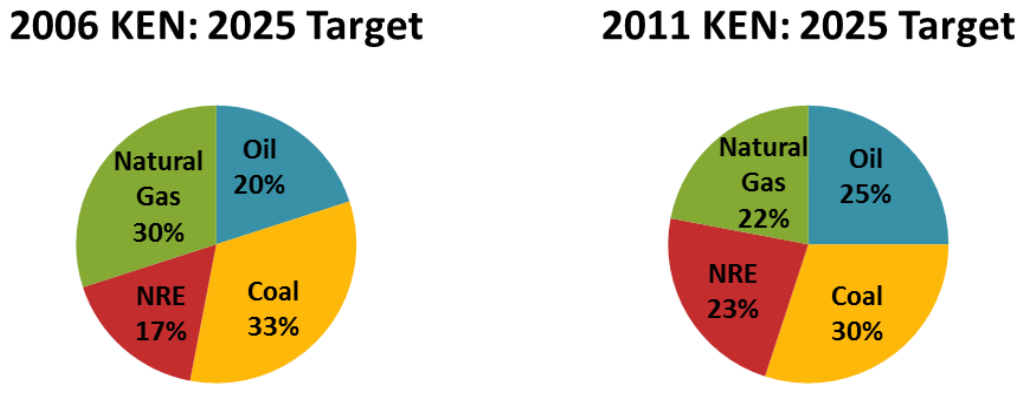


Figure 16. Energy Source Breakdown for 2006 KEN (Tunggal, 2013) and Draft 2011 KEN (Saleh, 2013)

During the PRLCE, a number of representatives from the government agencies highlighted the importance that the government is placing on increasing the domestic capacity for renewable energy. Private sector representatives also identified the need to increase capacity for renewable

energy. There is a clear interest in increasing local manufacturing of renewable energy technologies, particularly solar. As an example of the current efforts, the central government has established a renewable energy training program that provides training to approximately 1,500 local government officials each year.

While local capacity for many renewable energy technologies is limited, Indonesia does have a strong local capacity for small hydro. Local companies not only manufacture small hydro technologies for use in country, but also export these technologies to other countries in Asia and Africa. Local experts also provide small hydro training to other member countries of the Association of Southeast Asian Nations (ASEAN) (Faisal, 2013).

Indonesia has a long history of supporting the development of geothermal and hydroelectric generation and has, more recently, expanded support for bioenergy. For example, in 2010 Indonesia had the third highest installed capacity of geothermal power plants in the world (Holm et al., 2010). However, to achieve the renewable goals in the 2006 KEN or the draft 2011 KEN, the country will likely need to reduce market barriers to investments in other renewable energy technologies. Feed-in Tariffs (FITs) for solar and wind are currently under revision (see FIT section on page 53). Finalizing these support programs and addressing other non-technical barriers like improving transparency in the permitting process will be critical for achieving the diversification and renewable energy goals.

Regarding renewable generation, PLN is focused primarily on renewable resources that provide base-load generation and appears hesitant to develop other renewable resources that provide variable generation like solar and wind. PLN plans to increase the installed capacity of renewable energy over the next decade, but the focus is only on hydro and biomass. By 2020, PLN plans to have a total of 5.7 GW of hydro online and, between 2012 and 2021, the utility plans to bring 447 MW of biomass generation online (Anang, 2013).

The Indonesia's National Energy Master Plan (RUEN) requires local governments to develop a local energy master plan that aligns with the RUEN. This is important particularly because many local governments are involved in small-scale renewable energy projects such as micro-hydro. Furthermore, approximately 24% of the population lacked access to electricity in 2012 and encouraging local governments to develop an energy master plan may increase their participation in activities to improve electricity access within their communities.

The banking and private sectors are actively engaged in financing and developing renewable energy projects throughout the country. However, past experiences where renewable energy plants, particularly hydro and solar, have not performed as expected have caused financial institutions to treat them as "high risk" projects. Building the local capacity to ensure that projects are designed and constructed well, and that only quality technologies are used, will improve renewable energy performance and reduce the associated risk for financial institutions and investors.

Indonesia has successfully supported the development of hydro and geothermal electricity generation. However, supporting the development of generation from variable resources like solar and wind will allow the country to exploit additional renewable resources to meet the draft 2011 KEN targets and to provide electricity to more remote areas.

2.2 Recommendations

Recommendation 6

Finalize approval of the draft 2011 KEN quickly to provide clear market signals to the private sector, financial institutions, international investors, and PLN regarding the long-term demand for electricity generation from renewable energy.

The current new and renewable energy (NRE) target as outlined in the 2006 KEN is broken down in Table 12. The draft 2011 KEN increases the 2025 NRE target to 23%. Finalizing approval and implementing the draft 2011 KEN will provide a clear and long-term market signal for investment opportunities in renewable energy in Indonesia. Establishing a similar NRE resource-specific breakout in the 2011 KEN as occurs in the 2006 KEN will also provide greater certainty on which types of technologies will be supported under the new KEN over a specific time horizon. However, resource-specific breakouts can possibly limit investment in renewable technologies that may be more cost-effective in Indonesia. It is recommended that any breakout by resource establish a minimum for each resource that is in line with the government's goals, but also allows a high degree of flexibility so that the most cost-effective technologies can be utilized. For example, the target could be established with the minimum for each resource as outlined in the 2006 KEN leaving an additional 6% to be met by any of the renewable resources. If the goal for Indonesia is to have 23% of energy sources in 2025 be from renewable resources, it is recommended that any goals for nuclear and liquefied coal be stated in a separate category, as in the draft 2011 NEP that was presented to the PRLCE team, in order to clearly delineate renewable technologies from other low-carbon technologies.[1]

Table 12. 2006 KEN New and Renewable Energy Targets for 2025

Energy Source	Percentage of Total Energy Use
Biofuel	5%
Geothermal	5%
Nuclear, Hydro, Solar, Wind, and other NRE	5%
Liquefied Coal	2%

Recommendation 7

Evaluate the various energy support mechanisms (e.g. FITs, fossil-fuel subsidies) to ensure support for renewable energy is sustainable, coordinated, and complementary.

Indonesia has supported the development of renewable energy, particularly geothermal and hydroelectric, for many years. Broader support for other renewable energy technologies has more recently been developed (or is under development), particularly in the form of the various FITs. At the same time, Indonesia provides substantial financial subsidies for fossil fuels. While these are designed to ensure low income households can meet their basic energy needs, the financial support for fossil fuels and renewable energy are often contradictory and can be economically inefficient for the Indonesian society as a whole. To ensure the economic and political sustainability of support mechanisms, alternate approaches may want to be considered such as establishing a program to provide direct financial support to low income households rather than providing it through reduced fossil fuel prices. Alternate structures such as these may also help to identify more efficient ways to both meet the needs of low income households and support the growth of renewable energy in Indonesia over the long term.

Recommendation 8

Develop permitting checklists that clearly define the path and timeline for permitting each type of renewable energy technology and list separate paths for large-scale and small-scale projects.

The permitting or licensing process for renewable energy projects can be very complicated, and requires developers to meet various requirements established by multiple agencies. This

[1] *At the PRLCE, it was stated that nuclear is now considered only a last option as an energy source for Indonesia.*

process can pose a significant barrier to the development of renewable energy projects. For example, it takes a minimum of two years to acquire the necessary permits from the Ministry of Forestry for projects in forested areas. Developing a public checklist clearly cataloguing the permitting process for different types of renewable technologies will likely increase transparency in the process, clarify the roles for the various central government ministries and local government agencies, and likely help reduce the time required for approval. In the process of developing these checklists, the relevant ministries may identify areas of overlap or other opportunities to streamline the permitting process without sacrificing safety or environmental standards.

Separate checklists could be developed for each type of technology (e.g., photovoltaics, concentrating solar power, hydro, etc.) to assist developers in the permitting process of specific projects. Furthermore, it may be beneficial to separate the technology checklists into categories based on the size of the project as permitting requirements can vary greatly between residential-scale and utility-scale systems. For example, the photovoltaic category could include three checklists: large-scale utility projects (larger than 1 MW), medium-scale projects (10 kW – 1 MW), and small-scale residential and small-commercial projects (smaller than 10 kW). These numbers are examples; as the size of the systems in each tier should be determined by the system size at which a substantially different permitting process is triggered.

Recommendation 9

Increase local capacity for technical, financial, and project development across renewable energy technologies, particularly by providing students with the knowledge needed to pursue a career in renewable energy in Indonesia.

Indonesia is clearly focused on increasing renewable energy generation and has a definite understanding of the benefits to the economy of increasing the in-country technical, financial, and project development capacities. However, it can be challenging to develop a cohesive, integrated approach to building renewable energy capacity. It is recommended that the MEMR consider expanding existing renewable energy education programs, targeting both secondary and higher education institutions. Beginning education programs focused on renewables for younger students may encourage them to pursue a related degree at a university and, later, a related career. It may also be beneficial to establish a strong partnership between the renewable industry and these education institutions to ensure that the curriculum is developed in line with the needs of industry so that students are well prepared after graduation. These types of partnerships often also include an internship program so that students can get direct experience within the industry at an early stage. Through this framework, the industry partners benefit from the well-qualified work force and the students benefit by increasing their work experience and knowledge.

Indonesia could also benefit by establishing partnerships with other countries or international organizations that are involved in renewable energy trainings to leverage existing resources and broaden the knowledge base of the educators and participants in a capacity building program. Through such a program, Indonesia could offer hydro and geothermal training to representatives from other countries. In developing such an exchange program, the MEMR may choose to target specific technologies or skills such as photovoltaic (utility-scale and small-scale off-grid applications), large-scale wind, and renewable energy financing.

Building local entrepreneurial capacity and expertise related to renewable energy development can increase the opportunities for locally developed renewable energy projects and new sources of innovation. This can benefit the economy by providing the local population with the skills necessary to fill the positions that will be needed to meet Indonesia's long-term renewable energy goals. Furthermore, developing this capacity may increase the success of renewable energy projects as local developers may be able to rely on their knowledge of local conditions to better engage with communities in which renewable energy projects may be developed.

Recommendation 10

Adopt internationally recognized standards for renewable energy technologies to ensure only high-quality products are used in Indonesia. This is particularly important for small-scale, distributed generation technologies such as solar photovoltaics.

In some cases, poor quality renewable energy technologies in the market have resulted in investments in energy projects that failed within a short time after installation. This type of occurrence is not only costly to the investor, but can reflect poorly on the sector as a whole and hinder future investment in quality renewable technologies and projects. To protect consumers and investors alike, the MEMR can adopt internationally recognized standards as requirements that must be met for technologies to qualify for government funding. Furthermore, the MEMR can encourage financing institutions to adopt the same requirements. The government may want to consider establishing a certification body to certify technologies that meet minimum quality standards or partner with a credible international certification body. These types of activities will strongly incentivize the private sector to install only quality renewable technologies.

3. REGULATION AND INFRASTRUCTURE

3.1 Critique

Regulation

In order to give guidance for managing the national energy use and supply, including renewable energy development, the Indonesian Government has issued the National Energy Policy of 2006 under the Presidential Regulation No. 5 Year 2006. The 2006 Energy Policy expects the combined share of renewable energy and nuclear in the overall energy mix in 2025 to exceed 17%. Until the new National Energy Policy under Law No. 30 Year 2007 regarding Energy is adopted by the government, the National Energy Policy of 2006 is still in force.

Following the enactment of the Energy Law on 10 August 2007 and the formation of the National Energy Council (*Dewan Energi Nasional*, DEN) in 2008, the DEN drafted the new National Energy Policy in March 2011 with the aim to enhance energy self-reliance, strengthen R&D, increase electrification ratio to 100% by 2020, and secure strategic energy reserves (Saleh, 2013). Though Indonesia's 2011 Energy Policy is better than the Indonesia's 2006 Energy Policy in terms of renewable energy development aims, the Indonesia's 2011 Energy Policy cannot be enforced by the government until it receives approval from Parliament (*Dewan Perwakilan Rakyat*, DPR).

Despite this, the Indonesian Government still gives a priority and great attention to encourage the development of renewable energy by preparing and issuing of conducive regulations such as, ease of licensing/finishing of overlapping the land, incentives on tax and facilities, pricing, subsidies, funding, and the government guarantees.

In 2010, the government mandated the state-owned electricity company (*Perusahaan Listrik Negara*, PLN) to implement the 10,000 MW Fast Track Program Phase 2 (FTP2) under the Presidential Regulation No. 4 Year 2010. In this second phase, generating capacity is expected to rapidly increase not only to meet rising electricity demand but also to increase renewable energy utilization. In 2012, the Ministry of Energy and Mineral Resources (MEMR) announced the FTP 2 will add 10,002 MW capacity, of which 49% will be developed from geothermal, 17% from hydropower, and 1% from gassified coal. In order to ensure sustainability and energy security, the composition of the generation capacity mix for FTP2 is updated as required even though the validity period of the Presidential Regulation No. 4 Year 2010 will expire on 31 December 2014 (KESDM, 2012a).

Further, Indonesia also has a priority to expand the development of liquid biofuels (biodiesel, bioethanol and bio-oil). In 2008, the Government issued the Ministerial Regulation No. 32 Year 2008 regarding Mandatory Biofuel Utilization. This regulation mandates the utilization of biofuel in the transportation, industry and power plant sectors. In 2025, the minimum utilization in the power plant sector is expected to be only 20% biodiesel and 10% pure plant oil.

Infrastructure

Currently, the Java-Bali power system and the Sumatera power system are each well interconnected. Other power systems are either partially interconnected or isolated systems.

As of June 2013, the total installed capacity of power plants was about 44,661 MW, transmission line length was about 33,403 kms, and distribution line length was about 741,957 kms (see Figure 17). Most of the existing electricity infrastructure is located on the island of Java because the electricity demand is most concentrated on this island, followed by Sumatera, Sulawesi and Kalimantan islands. The electricity infrastructure on Nusa Tenggara, Maluku and Papua islands are less established due to the lower electricity demand and uneven distribution of population. These situations and conditions (less electricity demand and uneven distribution of population) in some regions are becoming challenges to the development of electricity infrastructure in Indonesia, and it seems the trend of electricity infrastructure development in the future will continue to be concentrated in Java-Bali and Sumatera.

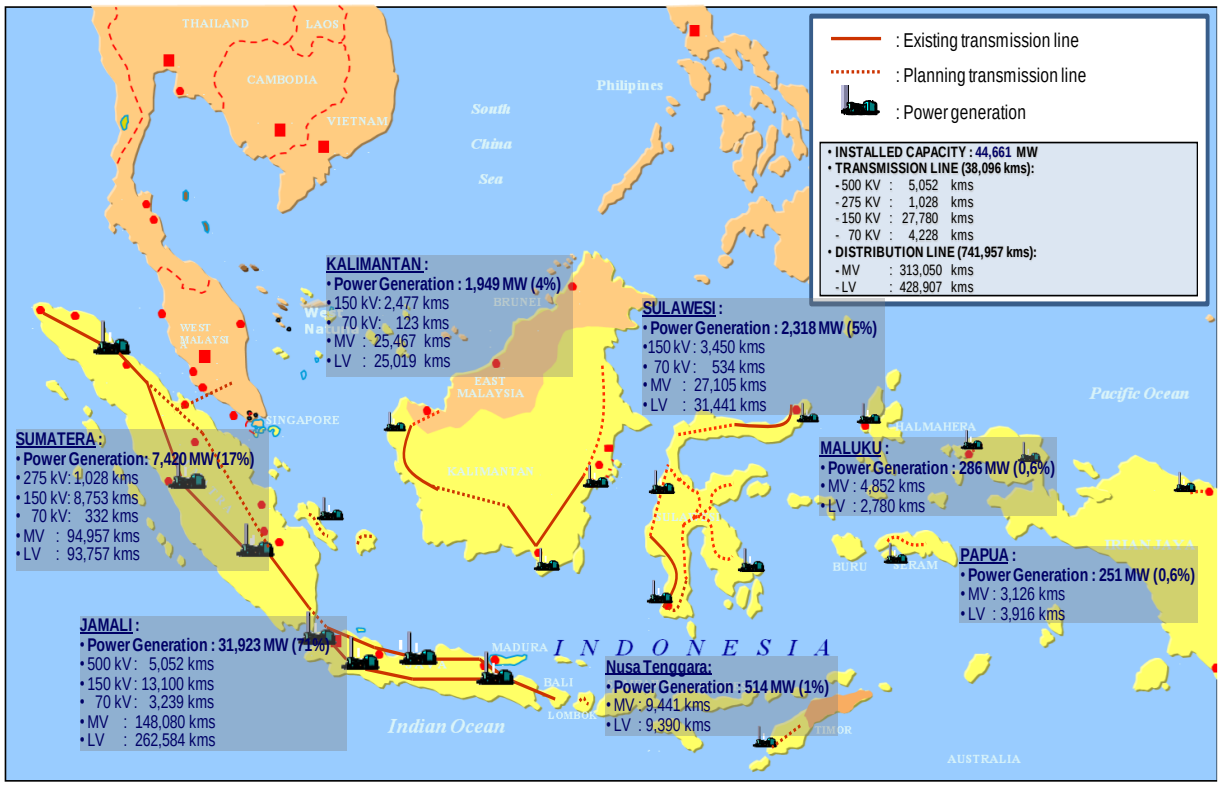
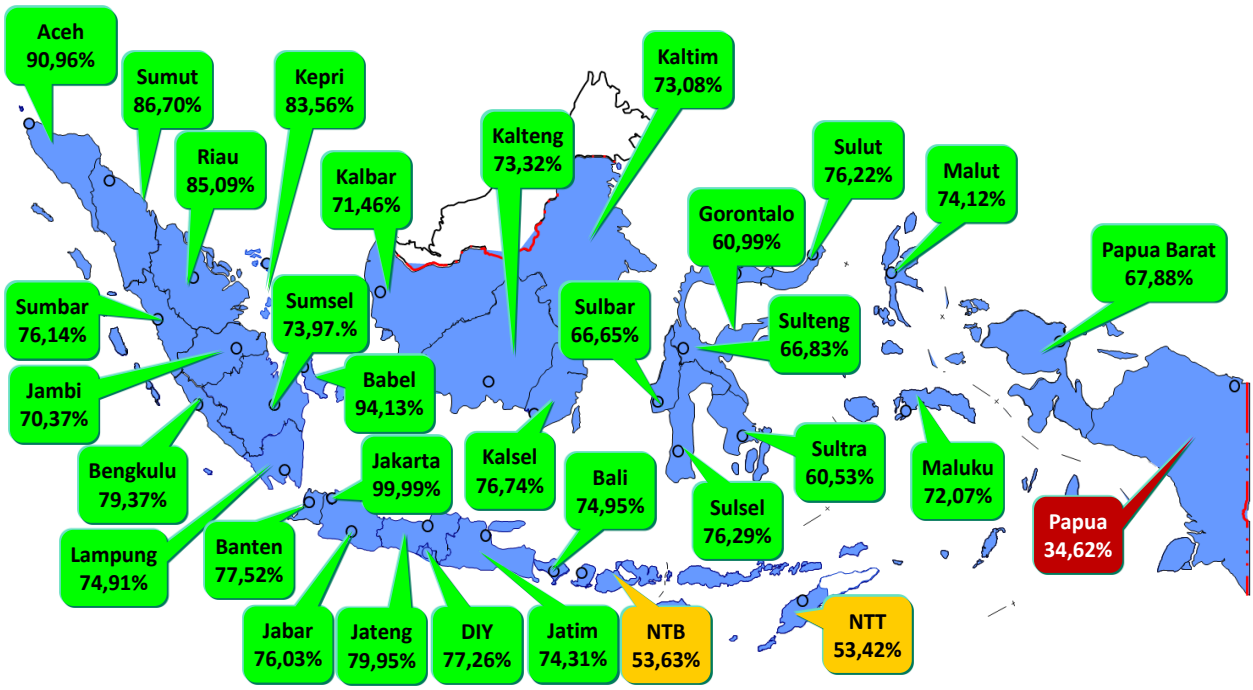


Figure 17. Indonesia Electricity Infrastructure (Hasril, 2013)

At the end of 2012, the electrification ratio was 76.56%, or 2.96% higher than the Midterm Development Plan target (*Rencana Pembangunan Jangka Menengah*, RPJM) and 3.61% higher than 2011 (Hasril, 2013). However, there were still 3 provinces, namely Nusa Tenggara Barat (NTB), Nusa Tenggara Timur (NTT) and especially Papua, with low electrification ratios as shown in Figure 18 below.



	REALIZATION							PLAN	
	2006	2007	2008	2009	2010	2011	2012	2013	2014
Electrification ratio	63.00%	64.34%	65.10%	65.79%	67.15%	72.95%	76.56%	79.30%	81.40%
Target of RPJM					*67.20%*	*70.40%*	*73.60%*	*76.80%*	*80.00%*

Figure 18. Realization of Electrification Ratio as of December 2012 (Hasril, 2013)

The Indonesian Government has established a fund for geothermal projects with an initial 1.126 trillion rupiah from the 2011 state budget (APBN) to encourage the promotion of development projects upstream under the government investment central unit called "Pusat Investasi Pemerintah, PIP" (BKF, 2012). This fund is intended to mitigate the high risks associated with the upstream stages of geothermal development. However, the magnitude of available geothermal funds depends largely on the allocation provided by the government in the APBN.

3.2 Recommendations

Regulation

Recommendation 11

Issue the National Energy Policy (KEN) as soon as possible so that the further implementation of this policy through the National Energy Master Plan (RUEN) and the Regional Energy Master Plan (RUED) can be developed.

It is important that the KEN be issued by the government as soon as possible after it receives approval from the parliament. This would ensure that the energy management plan under RUEN and RUED, which is to be developed under the KEN with the intent to meet energy needs throughout the country, will be developed soon.

In order to provide a strong legal framework to the KEN and the RUEN, the KEN should be stipulated by the government through government regulation or at least through presidential regulation. For the RUEN, it should be enacted through presidential regulation. And for the RUED, it is already clearly defined that it shall be stipulated through regional regulation.

If these three regulations can accommodate the current and future challenges of renewable energy development and have a strong legal framework to encourage the development of

renewable energy, the government's efforts to develop the Renewable Energy Law can be neglected. However, if evaluation of these three regulations leads to the results that the existing regulations are not sufficient to address the challenges faced by renewable energy development, then the Renewable Energy Law could be drafted by the government as the supreme law or regulation.

Recommendation 12

Produce mechanism to translate the renewable energy target from the National Energy Policy to state owned energy companies, such as through a Key Performance Index (KPI), to implement.

The KEN has clearly defined targets for diversifying energy sources from renewable energy, with the total share from renewables increasing from 23% by 2025 to 31% by 2050. Further details of the renewable energy targets will be translated and implemented into the RUEN and the RUED.

In order to assure these three regulations can be applied and implemented in a consistent and sustained way by all the state owned energy companies (such as PLN, Pertamina, etc.), the government should prepare a clear and transparent implementation mechanism to mandate the energy companies comply with everything that has been targeted by the government. One mechanism that can be used is a KPI or assignment to state owned energy companies under special regulation that contains a target to be achieved, sanctions and rewards, and reporting and monitoring mechanisms.

Recommendation 13

Harmonize the regulations between central government agencies, between central and local governments, and between local government agencies to prevent conflicting regulations that may hinder the development of renewable energy.

Since each central government agency, as well as local government agencies, have existing regulations based on their own laws and the central government delegates authority widely to local governments, the main important factor for driving successful renewable energy development is the creation of conducive and synergistic regulations at all levels of government. It is imperative to ensure that there are not conflicting regulations among the central government agencies itself, the central and local governments, and between the local government agencies.

Harmonization of regulations should be made in advance before the regulations are drafted or issued. For the regulations that have already been established and between which there are conflicts, a mutually positive approach could be carried out where the result of the understanding which has been agreed to by all parties may be embodied in the other regulations or an MoU.

Recommendation 14

Set up regulations that encourage and support the development of the domestic renewable energy industry to achieve self-reliance and to strengthen renewable energy standards.

Based on the KEN, renewable energy resources in Indonesia will be developed on a large-scale so that the share of renewables will become 23% in 2025 and 31% in 2050. This will be translated to increasing needs of renewable energy equipment, machineries and spare parts in the future. In order to minimize dependency on foreign products, regulations that encourage and support the development, self-reliance, and competitiveness of the domestic renewable energy industry should be set up in advance.

In addition, to avoid the entry of sub-standard equipment, machineries and spare parts as well as increasing the quality and reliability of the domestic products, strengthening equipment standards will be imperative.

Infrastructure

Recommendation 15

Give priority of the development of electricity infrastructure to the 3 provinces (NTB, NTT, & Papua) which have low electrification ratios by providing funding from the central and local governments.

The central and local governments in each province should allocate funds from the state budget (APBN) and the regional budget (*Anggaran Pendapatan Belanja Daerah*, APBD) for the development of electricity infrastructure in the three provinces, so that the electrification ratio in each of these 3 provinces reaches at least 60%[2].

The development of power plants in these 3 provinces should be prioritized using local and renewable energy sources. If diesel power plants must be developed, they should be developed as "hybrid system" with other renewable energy sources in all feasible situations.

The development of distributed generations or isolated systems in these 3 provinces should be prioritized if it meets economical and technical feasibility aspects.

Recommendation 16

Continue to support and expand the development of hybrid systems which use solar PV or wind turbines together with existing diesel power plants in the regions with renewable potential which can be economically implemented to reduce utilization of fossil fuels in power plants.

In 2011 the total capacity of existing diesel power plants belonging to PLN was 3,267 MW (Anang, 2013). In order to reduce utilization of fossil fuels in power plants as well as to encourage utilization of renewable energy, the hybrid systems which use solar PV or wind turbines together with existing diesel power plants should be strongly supported and expanded in locations in which they can be economically implemented. Hybrid systems can also increase the economic efficiency of diesel power plant.

Recommendation 17

Continue to develop and support distributed generation and isolated systems in the regions with renewable energy potential that can be economically developed.

Noting that Indonesia is a large archipelago economy consisting of 17,508 islands and also that most renewable energy sources are located far up in the mountains or in the forests (e.g. geothermal and hydro), electricity system development on the basis of distributed generation and isolated systems should continue to be developed and supported in regions with renewable energy potential that can be economically developed. A new electricity technology system that could be considered for development in regions with renewable energy potential is micro-grids.

Micro-grids are modern, small-scale versions of the centralized electricity system. They achieve specific local goals, such as reliability, carbon emission reduction, diversification of energy sources, and cost reduction, established by the community being served. Like the bulk power grid, smart micro-grids generate, distribute, and regulate the flow of electricity to consumers, but do so locally. Smart micro-grids are an ideal way to integrate renewable resources on the community level and allow for customer participation in the electricity enterprises (Galvin, 2013).

Recommendation 18

Continue to encourage dialogue between the government and investors and continue to improve the investment climate.

[2] *This value is the percentage of positive psychological figure*.

A key step in developing energy infrastructures is securing the necessary funds to develop reliable and efficient systems. Since it is sometimes difficult for the central and local governments to provide all funds, it is important that the central and local governments work with investors and seek to improve the investment climate where possible by providing and implementing conducive regulations or providing incentives/government guarantees to boost funding in this area.

Dialogue with investors should continue in order to get positive feedback for the improvement of the investment climate.

Recommendation 19

Strengthen cooperation with APEC economies as well as regional and international organizations in the fields of information exchange, technology transfer, human resources/capacity building, and financing.

One important factor in supporting the successful development of renewable energy is to strengthen cooperation with APEC economies and regional and international organizations that have extensive and successful renewable energy experiences, expertise and advanced technologies, as well as strong funding. The scope of cooperation may include information exchange, technology transfer, human resources/capacity building, and financing.

4. BIOFUELS AND BIOMASS ENERGY

4.1 Critique

Biofuel

Biofuels in Indonesia are derived from domestic resources. It is estimated that the annual CPO production is 23 million ton, where 6 million tons went to domestic use and 17 million tons were exported. This CPO is converted to biodiesel via 23 biodiesel producers with a total installed capacity of around 4.5 million KL/year. The biodiesel production in 2012 was estimated about 2 million KL, a 25% increase from 2011. However, the actual production is only about 45% of the installed production capacity. About 30% of biodiesel production is consumed domestically and the remaining biodiesel is exported.

The biodiesel is blended in subsidized fuel oil and is used in transportation (both PSO and non PSO), industry and for electricity generation. According to the mandate on biofuel utilization under the Ministerial Regulation No. 32 Year 2008, the percentage of blending in 2010-2015 varies depending on different uses. The biodiesel program in Indonesia became very successful. Therefore, the implementation on biodiesel mixed fuel transportation sector has increased from 5% to 7.5% on the PSO transportation sector in 2013.

Electricity

The bioenergy potential in Indonesia is large; however its use as fuel for power generation is rather limited. This is due to the fact that most of the resources are located in remote areas where there are no transmission lines available. Most of the installed biomass-based power plants use waste from the palm oil industry. In February 2011, the first and only MSW power plant was able to dispatch 12 MW to the grid. At the current stage, the total capacity of bioenergy-based on-grid generation was 75.5 MW in 2012.

Thermal

Biomass is used for heat in many households and several industries in the form of traditional biomass, bio-briquettes and pellets. However, the development of these technologies is not a priority for the government which is more focused on biogas production. The biogas development is carried out through the following three approaches, namely Non-Commercial

(government investment), Semi Commercial (application of partial subsidies), and Commercial (Private Investment, Public-Private Partnership). So far, more than 8,500 biogas digesters have been built. Most of them are small in scale (less than 6 m^2 reactor size).

Policy Instrument

A number of policies supporting bioenergy have been established in order to promote development such as the staging of mandatory biofuel utilization, tax exemption on VAT, investment tax incentives, direct subsidy on retail price for transportation sector, interest rate subsidy for biofuel feedstock plantation, simplifying the license procedure on biofuel business, priority for locally available bioenergy, and a FIT. However, most of the supports are available only for large scale projects.

4.2 Recommendations

Recommendation 20

Develop clear technical regulations for waste to energy activities in association with the 2008 Law on Waste Management.

Waste to energy activities is one of the activities that could significantly reduce the amount of waste. Thus, this activity should be incentivized based on Article 21 Clause (1) Law No. 18 Year 2008 regarding Waste Management that states "incentives to everyone who reduce waste" (KLH, 2013). However, since there is no clearly defined terminology of waste to energy and the technical details of this activity are not accommodated on this Law, this has caused different interpretations among the central government and local governments regarding the provision of incentives or fees.

In order to develop waste to energy more rapidly, clear technical regulations in association with the 2008 Law on Waste Management should be developed.

Recommendation 21

Create a suitable environment for small-scale projects (mostly for thermal projects using solid fuel and Biogas) in order to promote production of bioenergy in remote areas.

Even though higher efficiencies are typically achieved with larger capacities, sometimes large-scale projects are too costly to be implemented in remote areas where the demand is insufficient. Thus, in order to promote production of bioenergy in remote areas, small-scale projects could be created by developing some supporting efforts, such as:

- Develop financial supports such as incentives or FIT;
- Establish technical supports such as standards;
- Create markets and distribution infrastructure;
- Raise public awareness;
- Support distributed energy generation facilities.

Recommendation 22

Apply Key Performance Index (KPI) on bioenergy for large players in the energy business, especially state-owned energy companies such as Pertamina and PLN.

In order to assure the implementation of bioenergy utilization by the energy companies meets with the government target it is necessary to apply KPI to these companies, especially state-owned energy companies such as Pertamina and PLN.

The KPI should be evaluated yearly by the government to monitor progress toward the achievement of the targets by companies and it could include rewards and punishments to incentivize activities.

Recommendation 23

Promote human resource development and increase public awareness about the importance of bioenergy in every aspect (school, university, and public relation).

Promoting human resource development and increase public awareness about the importance of bioenergy will be necessary to achieve the long term bioenergy target. Currently, while the goals of bioenergy are well known throughout the central and local governments and within private sector organizations, there is a lack of understanding regarding the goals and the benefits of achieving these goals in the general public. It is recommended that the government develop an education campaign to inform the public about the bioenergy goals and the associated benefits. Such a campaign could be developed to target the public in general (for example, through something like public service announcements) and both school and university students through collaboration with the Ministry of Education and Culture.

If awareness from public increases and continues to grow, it eases the government's ability to promote and develop human resources development.

Recommendation 24

Establish clear goals for each bioenergy type in terms of primary energy or final energy (e.g. biofuel, thermal, power).

It is necessary for the government to establish clear goals for each bioenergy type in terms of primary energy or final energy so that the later implementation of bioenergy targets by energy companies could be determined clearly on the KPI. Perhaps, the detailing of the goals for each bioenergy type could be developed through the National Energy Master Plan (RUEN) and the Regional Energy Master Plan (RUED).

5. GEOTHERMAL, SOLAR AND WIND ENERGY

5.1 Critique

Geothermal

Since the issuance of law No. 27 Year 2003 regarding Geothermal, only few new public or private investments in the geothermal sector have occured. However, the potential for investment are promising as the following factors are expected to contribute. First, the increased volatility of fossil fuel prices has forced the government to provide an unexpected additional subsidy for electricity. Second, proposed the 10,000 MW Fast Track Programme Phase 2, in which geothermal is expected to produce 4,965 MW of electricity under this programme. Third, the considerable potential to reduce CO_2 emissions.

To increase the utilization of geothermal energy and attract investors, the government has made various efforts, related to legal certainly, improvement on geothermal energy price structure, providing various facilities and incentives, improvement of public facilities and infrastructure, coordinating with all relevant parties to accelerate and simplify permitting process.

Solar

Indonesia is a rich country in solar energy. Naturally, it is very important to increase the share of renewables from solar in energy mix. In fact, PLN has a strategy for solar PV development with the objective to replace diesel power plants or to reduce fossil fuel oil consumption, as well

as to increase the electrification ratio. Priority is given to regions with electrification rates below 60% and without access to other renewable energy sources, and to the systems have been electrified, it will not increase cost of existing electricity supplied. In 2012, PLN had developed solar PV with total capacity of 2.84 MW in 16 regions (Anang, 2013). Though Solar PV is still the most expensive option among renewable energy, it is competitive in some remote areas because of the high transportation cost of diesel fuel (the primary source of rural electrification is diesel generators).

It is good news that there are currently 6 manufactures of solar module in operation in Indonesia with a total capacity of about 110 MW per year (Dharman, 2012).

The application of solar energy is limited to the isolated area with lower electrification rate. In considering the increasing fossil fuel prices and decreasing prices of photovoltaics, solar PV can have bigger role in the future. Especially, it could be used to reduce peak demand in areas where peak demand in day time is a factor of increased cost. Because the solar power has the potential to reduce the peak in day time, it should be considered for the grid of large daytime peak.

Limited application of promotional measures such as FIT for PV will become very important for the purpose of peak cut, supply electricity in isolated areas, and replace diesel fuel for areas depend on diesel generation (see also FIT section on page 54).

Wind

Wind power potential in Indonesia is limited. Nonetheless, small wind energy systems have been constructed in several locations (Sulawesi, etc.) with a total installed capacity of 1,962.36 kW in 2010.

In Indonesia, development of wind energy systems in remote islands is prioritized using hybrid systems in combination with solar PV or interconnected with existing diesel power plants. Wind power is now becoming competitive with conventional energy scale as the size of wind turbines has increased. However, small wind energy systems are not yet competitive and need to compete with Solar PV. It is essential if it is to stay small, it has to compete with solar PV or it should find a location where a large system can be interconnected to the grid.

It should be noted that although the cost of the wind power is now becoming competitive with conventional energy scale, the cost of the wind power depends strongly on the local condition. However, the overall wind power potential in Indonesia is still limited. It is very important to find an appropriate location including the potential of off-shore as a long-term development options.

5.2 Recommendations

Recommendation 25

Periodically evaluate the most cost effective mix of renewables within the budget constraints and while taking into consideration other values like new industries, agricultural development, environmental impacts, and rural electrification.

Renewables are expensive; however, their costs are decreasing faster than those of conventional energies such as coal and oil products. This dynamic change in relative costs among energy options means that the best energy mix in terms of total costs can change significantly over time as the shares of renewables increase in the energy mix.

Table 13. Power Generation in the New Policies and 450 Scenarios: Different Learning Rates among Renewable Technologies (IEA, 2013)

Renewables Category	Plant Specification	Technological Learning (assumed future learning rates) 2010 to 2035
Biomass	Large-scale unit	5%
	Medium-scale CHP	5%
	Small-scale CHP	5%
	Biogas	5%
	Waste incineration	5%
	Cofiring	5%
Geothermal	Geothermal Electricity only	5%
	Geothermal CHP	5%
Hydropower	Large-scale unit	1%
	Small-scale unit	1%
Photovoltaic	Large-scale	17%
	Buildings	17%
Concentrating Solar Power		10%
Marine		14%
Wind Energy	Onshore	5%
	Offshore	9%

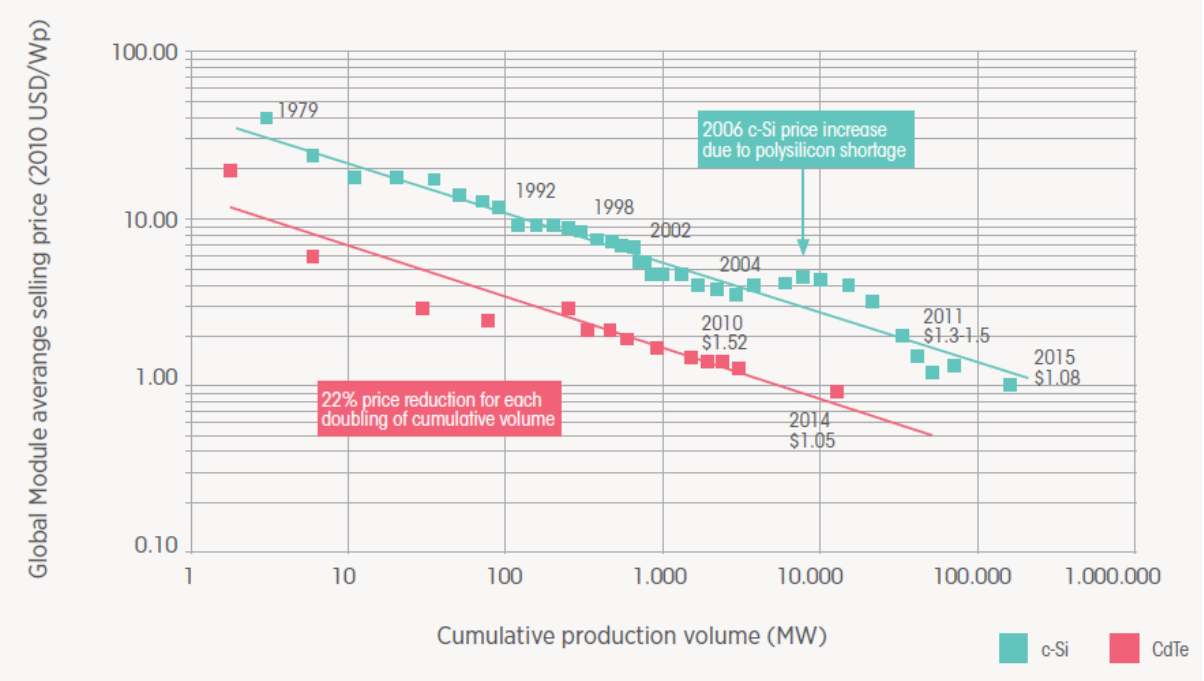


Figure 19. Trend of Solar PV Module Cost (Michael, 2012)

The above table of technological learning rates of renewables assumed in IEA's World Energy Outlook as important indicators of cost reduction. The rate shown that hydro is the lowest and the Photovoltaic is the highest. In fact, the cost of PV modules has been decreased by one tenth over the decade (see figure 19).

Moreover, energy access is closely connected to the development of industry, agriculture, rural areas and environmental sustainability. Also, the development of renewables is essentially based on distributed system; therefore it can contribute to the local development and industries related to geothermal, wind and solar energies. Nevertheless, the budget for renewables is mostly paid by subsidies through PLN and/or the central government. This budget is closely linked to the price level of electric power, indicating that the best mix of renewables could change depending on the level of the electric power price.

Regarding this situation and condition, periodical evaluation of the budget allocation becomes more important and is recommended to improve the cost efficient mix of renewables in consideration of decreasing costs of renewables, contribution to creation of new industries, rural development and environmental sustainability. The evaluation should consider the following points:

a. Which renewables have the most potential?
b. Which renewables can generate more energy (kWh)?
c. Which renewables are the most cost efficient in terms of levelized cost (Rp/kWh)?
d. What is the contribution to local community? Is it just connecting to grid or supplying electricity to the local community? Is there an opportunity to promote local industries? Can unused lands be utilized?
e. Feed-In-Tariff or Subsidies (to PLN or direct), which can contribute to the local community (FIT or subsidies)?

Recommendation 26

Solar, wind, and micro hydro are important for rural electrification and for the reduction of diesel consumption. One can consider such measures like special support for the introduction of those renewable energies under "Rural Electrification with Renewables".

The mission of rural electrification is very important for Indonesia as tens of millions of rural residents do not have access to electricity. There are two categories in current status of rural electrification in Indonesia. One is a local grid or off-grid system using diesel generators with limited supply. Another is a rural area without electricity. The problem with the former is the high cost of the fuel and supply being limited to times of high demand such as mornings and evenings. The problem of the latter is the high cost of grid connection. Currently grid extension through PLN is the primary measure for this purpose. In the past, solar PV and wind power was not an option for rural electrification because of high costs. The significant reduction of costs of these options in recent years has made it possible to use solar and wind power as sources of rural electrification.

Indonesia is a country of islands. The cost advantages of using renewables for distributed generation systems in comparison to an over- or under-water extension of transmission lines across islands increasingly larger. Grid connection from one island to another is costly. As such, the utilization of solar and wind power for electrification in locations where grid connections is difficult emerges as a cost-effective option, particularly with the cost reductions of solar and wind in combination of diesel generator.

Also important is the characteristics of resources and the technologies to use them. A geothermal power plant provides baseload generation and can take advantage of economies of

scale. Wind power can also take advantage of economies of scale, but it provides intermittent generation based on the wind resource available. Solar PV is most expensive and also an intermittent energy source, but can more easily be applied from the small scale to large scale depending on the availability of land and solar resource.

In this context, in locations with access to the grid where there is sufficient wind potential, wind power can be cost effective compared to Solar PV. In remote areas, a micro grid system can also be an option to reduce the utilization of diesel generators.

Recommendation 27

Periodically evaluate the cost/effectiveness of off-grid vs. grid extension for the promotion of renewable energy. For the case of off-grid systems, local governmental initiatives should also be encouraged.

Local energy supply is the responsibility of the local government. The energy needs in local areas can be better understood by the local authorities. This is particularly the case for renewables, such as geothermal, solar and wind, where resource potential and land availability are essential for effective use.

To increase the share of renewables, there are two options in Indonesia. One is to connect to grid and extend the grid. Another is utilization of renewables as a part of off-grid system. For the case of the former, such measures like feed-in-tariff and/or renewables portfolio standards are popular support mechanisms. But for the latter case, involvement of the local government will be helpful by encouraging them to design and implement rural electrification using locally available renewables to achieve higher cost effectiveness. It is important that the evaluation should consider the dynamic changes of comparable costs, namely that 1) solar and wind power are relatively expensive, but their costs are decreasing fast and they can contribute to remote areas where geothermal, biomass and hydro are relatively difficult to develop, and the 2) differences between the costs for grid extension and the costs of solar-wind-diesel generation based off-grid system.

Recommendation 28

Prepare tools for facilitating better communication considering that the transition of authority has shifted from the central to local level making the issues of financing (ex. Taxes), level of experiences, and rules (ex. Land use) more complex.

The transition of authority from the central government to local government has increased the importance of local rules. Local involvement is also important for renewables because the availability of lands is one of the most important factors for renewables such as geothermal, solar and wind power. Especially because geothermal resources can be distributed across more than one province and the different jurisdictions can delay the administrative process and increase the cost of management. The complexities include differences of taxes, land use regulations, and transmission of electricity across the local borders.

6 HYDRO POWER ENERGY

6.1 Critique

Indonesia has an abundant potential of hydro resources which is estimated to be to support 75,670 MW capacity. The hydro resources exist in many locations throughout the country. In order to develop hydro energy potential, PLN, as a State Owned Electricity Company, has been developing a detailed roadmap for development of hydro power under the PLN's Electricity Supply Business Plan 2011-2020 (RUPTL). Based on the RUPTL, it is expected that 5.7 GW

capacity of hydro power will be developed by 2020 (Anang, 2013). However, the additional capacity of hydro power development only accounts for 7.5% of total hydro energy potential.

Indonesia has extensive experience with and technical knowledge of hydro power projects. The first turbine was installed in 1885 in West Java, one of the main tea regions in Indonesia. At this time, the turbines only rotated the shaft of tea rollers and other machinery in the tea factory; it was not used to directly rotate a generator. Later, with advances in turbine and generator technologies, hydro power plants were built. In 1910, 40 private tea plantations owned hydro power plants, and 15 years later there were already 400 hydro power plants in operation with a total capacity of approximately 12.5 MW (Faisal, 2013). It is therefore no wonder that the promotion and development of hydro energy in Indonesia is already farther along compared to other renewable energy in terms of total installed capacity, local capability development and the domestic existence of industries and manufacturing capabilities.

In order to protect the consumers from low quality products and to increase the competitiveness of the hydro power plant industries, the Indonesian Government is currently in the process of establishing standardization for hydro power plants, namely RSNI on Capacity design and lay-out of micro hydro power generation system with capacity up to 25 kW, and RSNI on Technical specifications of cross-flow turbines with capacity up to 35 kW.

Indonesia has the local capability to produce turbines (Francis turbine up to 1 MW, cross-flow turbine T15 up to 400 kW, vertical axis propeller turbine up to 60 kW, and tubular propeller turbine up to 200 kW) which cover a wide range of suitable sizes for a variety of projects such as stand-alone, captive, and grid connected projects. In 2005, the first locally manufactured T15 cross flow turbine with a runner diameter of 500 mm was commissioned and began selling power to the grid. Currently, more than 10 turbine manufacturers are in operation in Indonesia in which 3 of them have already exported their products to ASEAN, African and European countries. Besides that, the local manufacturers in Indonesia can also produce other hydro power equipment such as Electronic Load Controller (ELC), Induction Generator Controller (IGC), Digital Turbine Controller (DTC), and Flow Control System (Faisal, 2013). However, most of the equipment produced by local industries is still for small-scale systems.

In the last 20 years, Indonesia has accumulated a lot of knowledge about micro hydro power (MHP) with a capacity up to 250 kW. Currently, there are 400 people qualified for building and operating MHP with a capacity up to 1 MW. This figure represents an experience of 4,000 man per-years (Faisal, 2013). In order to dispatch and disseminate the experts' MHP project development knowledge and experience to public and private institutions and organizations in Indonesia as well as ASEAN region, a regional learning center for MHP has been established in Bandung.

In order to increase hydro energy development, a FIT for grid-connected hydro power has been established by the government. Besides that, the government also provides some funding through the state budget (APBN) for developing micro hydro in remote areas, small islands, and border areas with hydro energy potential. Positively, the financial sector supports hydro power projects as long as meet their financing schemes.

6.2 Recommendations

Recommendation 29

Encourage further R&D on hydro technology to reduce costs.

In order to promote the application of different scale hydro power projects in remote areas, small islands, and border areas, the initial cost of hydro power should be reduced through further R&D by the governments, institutes, and/or private sectors.

Recommendation 30

Improve the local manufacturing capabilities to produce turbines with capacity greater than 500 kW.

The bigger the capacity, the higher efficiency is. In the regions with a large hydro energy potential, turbines with capacity greater than 500 kW will be needed in order to optimally utilize the hydro resource, which will be more cost-effective even though the initial cost is higher than the small ones. In this case, supporting R&D as well as improving the local manufacturing capabilities to produce turbines with capacity greater than 500 kW is needed.

Recommendation 31

Review and redesign the subsidy structure for hydro power projects depending on the scale and remoteness of a system.

The government should reconsider the subsidy structures for hydro power projects to incorporate the scale, region and period of the projects into each type of subsidy structure. For example, the subsidy for hydro power projects in remote areas should be much higher than those projects in the main islands. Also, the subsidy for small-scale projects should be much higher than those for large-scale projects.

Recommendation 32

Establish stricter environmental compliance monitoring for hydro power projects, even for mini hydro power plants.

Most of hydro power plants are generally located in forested areas thus the environmental assessment should be carried out not only before the projects has begun construction, but should also be conducted while the project is in operation.

Recommendation 33

Accelerate the process of contract approval through better coordination among relevant government agencies and institutions.

Most areas suitable for hydro power projects with run of river schemes are within forested areas. None of the regulations has made licensing simpler, though some have included a rhetorical statement mentioning that this is "a strategic industry." Based on the forestry regulations, processing of the forestry license requires two years before it issued without any dispensation. Therefore, it is necessary to educate the policy makers from the Ministry of Forestry that hydro power projects with run-of river schemes are environmentally beneficial. Thus mediation action is needed to facilitate faster permitting processes for the various parties.

Recommendation 34

Improve awareness and participation of local residents on the development of hydro power projects.

In order to continue hydro power project development, it is necessary to improve the awareness and encourage an active participation of the people around the project and educating them about the benefits of the project for them. The awareness and participation of the people not only could mitigate rejection of the project from the local residents but could also influence the residents to save the energy and to protect the environment surrounding the power plant.

Recommendation 35

Increase training of technical personnel to ensure sufficient support for the operation and maintenance of hydro power plants in remote areas and on small islands.

Though there are more than 400 people qualified to build and operate MHP plants to date with more than 4,000 man per-years' experience, more technical personnel are still needed. The technical personnel could be obtained through training conducted not only by the central or local governments but also institutes or other private sector entities.

7 POWER SUPPLY SYSTEM-FIT, SMART GRID AND PRIVATE PARTICIPATION

7.1 Critique

On 23 December 2009, the Indonesian Government enacted Law No. 30 Year 2009 regarding Electricity. The new Electricity Law was drafted to replace Law No. 15 Year 1985 which the Constitutional Court had reinstated in December 2004 as a provisional law upon annulment of Law No. 20 Year 2002. The main difference between Law No. 30 Year 2009 and Law No. 15 Year 1985 is the absence of a Holder of Electricity Business Authority (Pemegang Kuasa Usaha Ketenagalistrikan, PKUK). Under Law No. 15 Year 1985, PLN was the sole PKUK and thus was responsible for providing electricity to all parts of Indonesia.

To prevent a monopolistic industry for the electricity sector, the new Electricity Law allows the electricity industry to be made up of electricity business entities that will be able to obtain electricity supply business licenses. Subsequent to the Electricity Law, the Feed-In Tariff (FIT) mechanism was implemented based on the Minister of Energy and Mineral Resources Regulation. Under the FIT mechanism, PLN is obliged to purchase renewable energy at a pre-determined price. Currently, the geothermal pricing mechanism is under revision. The aim of revision of geothermal pricing mechanism is to formulate the best geothermal energy structure to increase the bankability of geothermal business activity. The existing FIT tariffs for others renewable energy in Indonesia, except for geothermal are as follows:

Table 14. FIT Rates in Indonesia (Tunggal, 2013)

Hydro Power, Solar and Wind Power Electricity Price
(MEMR Regulation No. 04 Year 2012)

No.	Region	Price (Rp/kWh)	
		High Voltage	Medium Voltage
1	Java and Bali	656	1,004
2	Sumatera and Sulawesi	787	1,205
3	Kalimantan, West and East Nusa Tenggara	853	1,305
4	Maluku and Papua	984	1,506

Electricity Ceiling Price is still subject to be revised

- Mini and Micro Hydro will be increased from Rp 656/kWh to **Rp 975 – 1,050/kWh.**
- Solar will be increased from **Rp 1,880 – 3,135/kWh**.

Biomass, Biogas, and Municipal Solid Waste Electricity Price
(MEMR Regulation No. 04 Year 2012)

No.	Energy	Capacity	Electricity Buying Price	Notes
Medium Voltage				
1	Biomass	up to 10 MW	Rp 975/kWh x F	
2	Biogas	up to 10 MW	Rp 975/kWh x F	Non MSW
3	Municipal Solid Waste (MSW)	up to 10 MW	Rp 1,050/kWh x F	Zero Waste
4	Municipal Solid Waste (MSW)	up to 10 MW	Rp 850/kWh x F	Landfill

Low Voltage				
1	Biomass	up to 10 MW	Rp 1,325/kWh x F	
2	Biogas	up to 10 MW	Rp 1,325/kWh x F	Non MSW
3	Municipal Solid Waste (MSW)	up to 10 MW	Rp 1,398/kWh x F	Zero Waste
4	Municipal Solid Waste (MSW)	up to 10 MW	Rp 1,198/kWh x F	Landfill

Incentive Factor (F)

- Java, Bali, Sumatera : F = 1
- Kalimantan, Sulawesi, West and East Nusa Tenggara : F = 1.2
- Maluku and Papua : F = 1.3

Since the development of new and renewable energy is still at its infancy, the government requires more participation from the private sector. To increase participation from the private sector in terms of renewable energy development, the Indonesian Government has initiated fiscal incentives in the form of reduction in corporate income tax (PMK No. 130/PMK.011/2011) and also custom duty and tax "breaks" (PMK No.21/PMK.11/2010).

Based on consultation with a few renewable energy developers, it seems that they are happy with the interaction between them and the related government agencies. However, it was also noted that they have highlighted the following complaints:

- The cap on power plant capacity of 10 MW to be eligible for FIT (hydro, biomass, biogas and MSW) limits the development of larger-scale projects which may be more cost-effective.
- The lack of financial support from banks makes it difficult to obtain financing.
- It is difficult to obtain competitive financing rates (current interest rates ~12%).
- There is insufficient compensation/support for developers who were the first movers in the industry.
- There is a perception of lack of action by PLN to find alternatives to diesel plants in rural populated islands.
- Bankability of the PPA especially for geothermal where there is a need for a cost pass through mechanism in the case of cost increase not due to the developer after PPA signing.

7.2 Recommendations

Feed-In Tariff (FIT)

Recommendation 36

Price structure – On top of the base rate, bonuses could be added to existing tariff to promote local content and also to encourage the renewable energy developer to choose the right and reliable technology for sustainable system performance.

Proven technologies: Enhancing energy performance and sustaining the energy generation can be one of the key criteria in securing the energy supply. The selection of appropriate technology may add value in solving the economy's problems by, for example, using indigenous sources like municipal solid waste (MSW) as fuel which not only generates electricity but also provides a solution to dispose waste. Giving incentives to renewable energy developers for using high efficiency equipment can prevent waste and ultimately allow more power production with the

same amount of fuel (biomass, biogas feedstock) in comparison with using lower efficiency but cheaper equipment.

Local content: This is to encourage the local expert, for example scientists, industry players, financiers and relevant beneficiaries, to take part in sharing their knowledge and grasp the opportunities to increase economic growth. Giving more incentives to projects using local content will help stimulate the whole value chain of renewable energy development from local equipment manufacturers to raw material suppliers and will also support services such as logistic companies and downstream markets such as local contractors and entrepreneurs. More job creation means reducing unemployment and government liability for social issues. Currently, incentives for local content are being proposed for solar PV. At the same time, those incentives should also be extended to other renewable energy resources.

Recommendation 37

FIT for plant capacity > 10MW for small hydro and biomass (include biogas and MSW) – Certain project sites may have resources that can produce more than 10 MW of electricity. Economies of scale may mean greater production of energy but with a lower FIT rate (e.g. a win-win situation).

In project development, economies of scale are the cost advantages that developers obtain due to size, with cost per unit of output generally decreasing as fixed costs are spread out over more units of output. The Ministry of Energy and Mineral Resources should leverage this and allow renewable energy developers, especially small hydro and biomass (incl. biogas and MSW), with generation potential greater than 10 MW to enjoy the benefits of FIT albeit with a lower FIT rate. This generates a win-win situation whereby the renewable energy developers enjoy better returns of investment and the government will be able to tap in to additional clean energy production at a lower cost.

Recommendation 38

Yearly FIT rate review - Sustainability of the FIT mechanism should be reviewed yearly in terms of achievements, tariff rate and funds required for the mechanism.

A sustainable program is a program that meets the needs of the present without compromising the ability of future generation to meet their own needs. The same should be reflected in the FIT mechanism for Indonesia. Current tariffs under the FIT mechanism are subsidized from the government's budget. Frequent reviews (yearly, half-yearly review) should be done to ensure that the program is on track in terms of achieving the goals and targets of the National Energy Policy, and also the impact of achieving those targets to the funds required to subsidize the tariffs under the mechanism. Yearly review of the FIT tariff is necessary to ensure that the tariffs are set according to the current market prices for renewable energy technologies and also to allow reasonable returns to the renewable energy developers. Ultimately, the government should start identifying more sustainable means of funding the FIT mechanism to ensure continuity of renewable energy development.

Recommendation 39

FIT for Small PV systems – Current proposed FIT rates are for solar farm size projects. For capacity building, FIT for rooftop system (<12kW) should be encouraged to boost expertise of local players.

The proposed FIT mechanism for solar PV seems to lean towards large-scale solar farm size projects. However, solar farm projects require huge land areas and not many local contractors have the capability and expertise to construct plants of that size. In terms of capacity building, encouraging the growth of smaller rooftop systems can boost the expertise of local players in terms of technology familiarization and system installation. Encouraging rooftop programs will also enable utilization of existing free space on rooftops and thus prevent the usage of agriculture land or green areas for solar farm construction.

Smart Grid

Recommendation 40

To get smart grids in place as soon as possible – 1,000 islands project requires proper monitoring in terms of system stability, supply and demand patterns, asset utilisation and operating efficiency. Smart grid could be the solution. Sumba Island is a good start.

The smart grid represents the merging of multiple technologies into a system that provides reliable and cost-effective energy. The smart grid has extensive communications capabilities that enable smart metering, as well as remote monitoring and data gathering devices. Operationally, the smart grid provides increased reliability, more effective asset and energy management and reduction of CO_2 while integrating systems and devices on the distribution grid. In Indonesia's case, the number of populated island that are not connected to the main grid makes distributed generation more appealing than transmitting electricity from island to island. Having a smart grid could be a solution in managing possible bidirectional energy flows from distributed generation such as from solar farms, wind turbines, mini hydro and other sources. Sumba Island is a good start but an acceleration program should be implemented to go hand in hand with the 1,000 islands project.

Recommendation 41

Capacity building – to be actively involved in APEC related activities on smart grid.

It is important that there is capacity building in the area of smart grids. Currently there are a number of projects on smart grid technology in the APEC region. It will be beneficial to Indonesia in the planning and implementation stages to coordinate with its neighbors in the APEC region and learn from similar examples within the APEC region to work together to bring the most effective and efficient results for their economy.

Private Participation

Recommendation 42

Higher local equity participation - To encourage local investors to participate in renewable energy projects under the FIT so that they will get the most benefit from the project.

Usually, local equity participation is used by companies operating in emerging economies in which the local governments want to reap the rewards brought on by development. For Indonesia's case, the government should look into policies or incentives that encourage local investors to participate in renewable energy projects. Criteria such requiring a minimum threshold of local equity participation are necessary to prevent a major outflow of government subsidies out of Indonesia. Moreover, local share ownership also allows locals to have a say in company decisions.

Recommendation 43

Green Financing Schemes/Loan_– Proper support mechanism in terms of "Green Loans" to be provided to renewable energy developers to encourage more participation from new players.

Green financing describes a broad range of funding for environment-oriented technologies, projects, industries or businesses. Green industries and technologies are all at different levels of maturity, thus, requiring different levels of funding from different sources of capital. Green finance is a core part of low carbon green growth because it connects the financial industry, environmental improvement and economic growth. Since lack of financing is one of the most common barriers in developing renewable energy projects, private sector participation can be enhanced through a proper support mechanism and financing incentives such as a Green

Technology Financing Scheme whereby the industry players will benefit from 2% interest rate absorption that will be covered by the government.

Recommendation 44

Standardization of PPA(s) for projects under FIT – Standard template of PPA(s) should be in place for projects to be awarded through FIT mechanism to reduce negotiation time for PPA signing.

The key contract document for any IPP project is the Power Purchase Agreement (PPA) between the developers and the off-taker. However, the most time consuming activity for any power projects is to negotiate and execute the PPA documents. Standardized PPA contracts for all the renewable energy sources under the FIT mechanism will reduce time and costs for investors/developers and off-takers and allow for more efficient analysis by the rating agencies and capital market investors.

Recommendation 45

Establish standard operating procedures and timeframe – To ensure efficiency in renewable energy project implementation by private investors, standard operating procedures and timeframe should be established in terms of project award time, approval from ministries (Ministry of Finance), PPA signing, etc.

Standard Operating Procedures (SOP) are detailed instructions to achieve uniformity of the performance of a specific function. A proper SOP should be established to determine the requirements and timeframe for a project to be awarded under the FIT mechanism. A transparent process will give comfort to lenders and ultimately ensure efficiency in renewable energy project implementation. Commitment from all parties are required to ensure the successful implementation of the FIT mechanism and compliance to the establish SOP.

Recommendation 46

Need to educate the financing parties – Most financiers are risk adverse and not willing to finance new technology or new markets which have not matured. Therefore, there is a need to consistently have dialogues/consultation/workshop between the regulators and the financiers to allay the worries of financial institution.

Most financiers are risk adverse and will not venture into new markets which are still not matured. This causes problems to the renewable energy developers in terms of getting financing and also being able to obtain competitive interests rates. Financiers need to be educated on the importance and benefits of green technology so that they are more willing to provide financing and categorize renewable energy developments as low risk and bankable projects. Consistent stakeholder consultation between the government agencies, manufacturers, developers and financiers should be held so that all parties are comfortable to be part of the renewable energy industry.

8 GREEN HOUSE GAS MANAGEMENT

8.1 Critique

The energy sector is the fastest growing sector in terms of greenhouse gas (GHG) emissions and could equal forestry sector emissions by 2030. Indonesia has demonstrated its leadership among non-Annex I countries in regards to GHG mitigation by setting the goal to reduce GHG emissions by 26% from the projected baseline by 2020. Further, the government has set the target of reducing emissions by an additional 15% if international support, particularly financing, is made available. These goals, listed in Table 15, were enacted in 2011 in the National Action Plan on Greenhouse Gases Emission Reduction (RAN-GRK). The RAN-GRK also mandated the implementation of mitigation activities and developed the process for engaging local

governments in addressing climate change in the Local Action Plan on Greenhouse Gases Reduction (RAD-GRK). The major activities identified in the Energy and Transportation sector include increasing the use of biofuels, increasing the use of high efficiency engines, improving the quality of public transportation, increasing utilization of demand side management, improving energy efficiency, and increasing generation from renewable energy. Renewable energy was also designated as an activity in the industrial sector. Under RAN-GRK and RAD-GRK, the Government of Indonesia is moving away from a project-based approach and is increasing the focus on developing nationally appropriate mitigation actions.

Table 15. RAN-GRK Goals for GHG Reduction from 2020 Projected Baseline, by Sector

Sector	GHG Reduction Goal (Gigatons of CO_2e)	
	26% Target	Additional 15%
Forestry and Peatland	0.672	0.367
Waste	0.048	0.030
Energy and Transportation	0.038	0.018
Agriculture	0.008	0.003
Industry	0.001	0.004
TOTAL	**0.767**	**0.422**

Under the RAD-GRK, each province is mandated to develop plans that include a GHG inventory and baseline, a selection of mitigation actions, and mitigation scenarios with prioritized actions. The RAN-GRK Secretariat is designed to support the local governments as they develop these plans, but local capacity is very limited. The Secretariat, which was launched in December 2012, is led by the Ministry of National Development Planning (BAPPENAS) in partnership with international agencies.

In addition to the RAN-GRK Secretariat, the Government of Indonesia has established two other notable organizations dedicated to climate change. The National Council on Climate Change (DNPI), established by the Presidential Regulation No. 46 Year 2008, and the Indonesia Climate Change Trust Fund (ICCTF). The DNPI is a multi-ministerial organization focused primarily on climate change adaptation but also responsible for managing the Nusantara Carbon Scheme. The scheme is a voluntary carbon trading program in Indonesia and is currently under development. The ICCTF was established to coordinate and harmonize donor and private sector funds and activities targeting climate change mitigation activities to ensure that these activities are aligned with national plans.

The Presidential Regulation No. 61 Year 2011 stipulates that new renewable energy generation and bioenergy development activities must monitor and report on GHG emission reductions.

The first commitment period under the Kyoto Protocol concluded in December 2012 and the second commitment period will run from 2013 through 2020. The Clean Development Mechanism (CDM), a market mechanism established to increase investment in clean energy in developing countries and reduce global GHG emissions, faces much uncertainty due to the reduced participation in the second commitment period and the very low prices for certified emission reduction (CER) credits.[3] Through 2012, Indonesia had 137 projects registered with the

[3] *At the time of this writing, CERs were valued below $1 USD.*

Clean Development Mechanism (CDM) Executive Board, 75 of which were in energy or energy-related sectors (UNFCCC, 2013). It is unclear what role CDM, the nascent Nusantara Carbon Scheme, or other carbon trading schemes will play in the future of renewable energy development in Indonesia.

Regardless of the existence of carbon trading mechanisms, Indonesia will need to closely measure GHG emissions in order to demonstrate achievement of the 26% reduction goal by 2020. The government is in the process of establishing measurement and verification methodologies and protocols for GHG emissions. The DNPI and the Ministry of Environment are collaborating on this initiative and do not expect that emissions from the energy sector will be difficult to measure.

8.2 Recommendations

Recommendation 46

Build capacity among developers, banks, local governments, and other stakeholders for measuring GHG emissions and reporting to the central government.

Indonesia will need to methodically track GHG emissions across all sectors in order to demonstrate compliance with the President's goal of reducing GHG emissions 26% by 2020. Besides developing capacity within the government for the Nusantara Carbon Scheme, it will be imperative for the country to build capacity within the non-governmental sector, particularly among financing institutions, local governments, renewable energy developers, and other stakeholders. Doing so will ensure accurate reporting to the central government for renewable energy-related GHG emissions savings. The government can begin by providing trainings to the non-governmental sector in the methodologies that will be used in the Nusantara Carbon Scheme. The government may also consider partnering with climate change non-governmental organizations (NGOs) that can provide additional technical training and lessons learned from experiences in measuring GHG emissions in other countries.

Recommendation 47

Expand the education program targeting the general public regarding the national GHG emissions goals and the benefits of achieving these goals.

Public support for GHG reduction initiatives will be necessary to achieve the long-term GHG emissions reduction goals established by the government. Currently, while the goals are well known throughout the central government and within private sector organizations focused on climate change and renewable energy, there is less of an understanding regarding the goals and the benefits of achieving these goals in the general public. The DNPI's Communication, Information and Education Division has conducted an education program; however, a lack of awareness of the GHG reduction initiatives and benefits still persists. It is recommended that the DNPI, expand the education campaign to inform the population about the national goals and the associated benefits. Such a campaign could be developed to target the public in general (for example, through something like public service announcements) and both primary and secondary students through collaboration with the Ministry of Education and Culture.

Recommendation 48

Ensure the GHG emission reductions targets are aligned with and incorporated into the national energy plan and the national electrification plan.

The Indonesian government has multiple national plans that relate to renewable energy and, therefore, GHG emissions. The 2006 KEN, the one that is in force until the draft 2011 KEN is approved, calls for a substantial increase in the use of coal for electricity generation by 2025, which may impede Indonesia's ability to meet the GHG targets. Efforts should be taken to

ensure that the 2011 KEN and the National Electricity General Plan (RUKN) are complementary to the GHG emissions reductions targets.

Recommendation 49

Establish a clear policy regarding allocation of GHG savings for renewable energy projects such that they are allocated to the project owner and not to an associated ministry for CDM or other carbon market purposes.

The sale of carbon credits can contribute to the financing of a renewable energy project if a carbon market and viable price signal for credits exists. While the future of the CDM is less certain, Indonesia's development of the Nusantara Carbon Scheme and other new market mechanisms may lead to a revived carbon market in the country. Accordingly, it is imperative that there are clear rules regarding the allocation of carbon credits for renewable energy projects. For example, under the CDM, mini-hydro project developers were unable to obtain carbon credits for the reduced GHG emissions associated with their projects because the Ministry of Forestry maintained that any carbon credits should belong to the ministry. Allowing the developer to maintain ownership of the credits increases the incentives for renewable energy development. The developer may choose to sell the carbon credits at market value and the entity that purchases the carbon credits can use them toward offsetting their own GHG emissions. Providing certainty that the developer will have ownership of the GHG savings allows the developer to incorporate the potential sale of the carbon credits as a revenue stream when financing the project. The ability to access this future revenue stream can also make it easier for projects to attract investment and be financed when the market value for carbon credits is strong.

APPENDIX A: PEER REVIEW TEAM MEMBERS

The report was produced by the Asia Pacific Energy Research Centre (APERC) for the Asia-Pacific Economic Cooperation (APEC). The Peer Review Team was made up of the following experts from APEC economies as well as APERC, with each contributing to specific sections:

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3. Dr. Li KUISHAN, Director of Design and Research Team No. 1, East China Architectural Design & Research Institute Co. Ltd, (ECADI), China (Part II, Section #6)
4. Dr. Kaoru YAMAGUCHI, Senior Researcher, New and Renewable Energy Group, New and Renewable Energy and International Cooperation Unit, The Institute of Energy Economics, Japan (IEEJ), Japan (Part II, Section #5)
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6. Dr. Chatchawan CHAICHANA, Head of Energy Technology for Environment Research Centre (ETE), Faculty of Engineering, Chiang Mai University, Thailand (Part II, Section #4)
7. Ms. Sarah BUSCHE, Policy Analyst, the Strategic Energy Analysis Center, National Renewable Energy Lab (NREL), United States of America (Part II, Section #2 and #8 as well as editor for Part II)
8. Mr. Chrisnawan ANDITYA, Researcher, Asia Pacific Energy Research Centre (APERC), Japan (Part II, Section #3)

APPENDIX B: ORGANISATIONS AND OFFICIALS CONSULTED

GOVERNMENT OFFICIALS

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Mr. Rida Mulyana, Director General

Mr. Tunggal, Secretary of DGNREEC

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Mrs. Maritje Hutapea, Director of Energy Conservation

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The National Energy Council (NEC)

Mr. Saleh Abdurrahman, Head, Bureau for Facilitation of Energy Crisis Response and Energy Supervision, Secretariat General of NEC

Directorat General of Electricity (DGE)

Mr. Hasril Nuzahar, Director of Electricity Program Supervision

Research and Development Center of Technology for Electricity, Renewable Energy and Energy Conservation

Mr. Didi Sukaryadi, Coordinator Group of Research and Development Implementing for Techno Economic, Energy and Environmental Conservation of Electricity

ENERGY COMPANIES

State Owned Electricity Company (PLN)

Mr. Anang Yahmadi, Senior Manager of Geothermal, New and Renewable Energy Division

PT. Navigat Organic Energy Indonesia

Ms. Cynthia Hendrayani, Vice President, Project Development & Environmental Finance

PT. Bumi Invesco Energi

Mr. Riza Husni, Head of Hydro Power Business Association

PT. Chevron Geothermal Salak

Ms. Ferry Shaza, PGPA Operation Support Team Manager, Chevron Geothermal & Power Operation

ACADEMIA

Center for Research on Energy Policy, Bandung Institute of Technology (ITB)

Dr. Retno Gumilang, Head of Center for Research on Energy Policy

Dr. Ucok Siagian, Senior Researcher and Expert

ENERGY ASSOCIATIONS

Indonesia Renewable Energy Society (METI-IRES)

Dr. Surya Darma, Expert Member of METI

Indonesia Geothermal Association (API-INAGA)

Mr. Abadi Poernomo, Chairman of INAGA

The Indonesian Association of Bioenergy Scientists and Technologists (IKABI-IABEST)

Mr. Tatang H. Soerawidjaja, President of IABEST

The Indonesian Solar Module Manufacturer Association (APAMSI)

Mr. Dharman Mangaparna, Chairman of APAMSI

Bandung Hydro Association (AHB)

Mr. Faisal Rahadian, Chairman of AHB

The Indonesia Wind Energy Society (MEAI-IWES)

Mr. Sahat Pakpahan, Head of MEAI

Mr. Soeripto MS, Secretariat Member of MEAI

FINANCIAL INSTITUTION

Bank Negara Indonesia (BNI)

Mr. Andi F. Rahmawan, Local Corporate & Multinational Company I Division

APPENDIX C: REFERENCES

Anang Yahmadi (2013). Senior Manager of Geothermal, New and Renewable Energy Division, PT PLN (Persero). "New and Renewable Projects in Indonesia", Presented on APEC Peer Review on Low Carbon Energy Policy (PRLCE), Jakarta, 13 May 2013.

BKF (Fiscal Policy Agency – *Badan Kebijakan Fiskal, Kementerian Keuangan*) (2012). "*Dukungan Kementerian Keuangan dalam Program Efisiensi Energi di Indonesia",* Jakarta, 31 January 2012. http://www.iesr.or.id/wp-content/uploads/Kemenkeu.pdf

BPS (Indonesia Statistics Agency – *Badan Pusat Statistik*) (2012). "*Berita Resmi Statistik No.13/02/Th.XV"*, 6 February 2012. www.bps.go.id/brs_file/pdb_banner1.pdf

Dharman Mangaparna (2013). Chairman of APAMSI. "Potential and Challenge in The Indonesian Solar Development", Presented on APEC Peer Review on Low Carbon Energy Policy (PRLCE), Jakarta, 14 May 2013.

Faisal Rahadian (2013). Small Hydro Power Association. "Indonesian Small Hydro Power Development: Potential and Challenges", Presented on APEC Peer Review on Low Carbon Energy Policy (PRLCE), Jakarta, 14 May 2013.

Galvin Electricity Initiative (2013). "What are Smart Microgrids?". http://galvinpower.org/microgrids. Accessed June 2013

Hasril Nuzahar (2013). Director of Electricity Program Supervision, Directorate General of Electricity. "Overview of Indonesia Electricity Policy", Presented on APEC Peer Review on Low Carbon Energy Policy (PRLCE), Jakarta 13 May 2013.

Holm, A.; Blodgett, L.; Jennejohn, D.; Gawell, K. (2010). Geothermal Energy Association. "Geothermal Energy: International Market Update." http://www.geo-energy.org/pdf/reports/GEA_International_Market_Report_Final_May_2010.pdf.

IEA (International Energy Agency) (2013). World energy Outlook: Investment Costs of Power Generation. Assumed Investment Costs, Operation and Maintenance Costs and Efficiencies. http://www.iea.org/publications/worldenergyoutlook/weomodel/investmentscosts/. Accessed June 2013.

Kemenkeu (Ministry of Finance) (2010). "Nota Keuangan dan APBN 2010". www.anggaran.depkeu.go.id/Content/10-01-06,NKAPBN2010.pdf

Kemtan (Ministry of Agriculture - Kementerian Pertanian) (2013). "Basis Data Statistik Pertanian, Sub Sektor Perkebunan, Komoditi Kelapa Sawit, Level Nasional, Status Angka Angka Tetap, Tahun 2010-2019". Accessed July 2013. http://aplikasi.deptan.go.id/bdsp/hasil_ind.asp

KESDM (Ministry of Energy and Mineral Resources – Kementerian Energi dan Sumber Daya Mineral) (2006). "Blueprint Pengelolaan Energi Nasional 2006-2025". www.esdm.go.id/publikasi/lainlain/doc_download/714-blue-print-pengelolaan-energi-nasional-

KESDM (Ministry of Energy and Mineral Resources – *Kementerian Energi dan Sumber Daya Mineral*) (2012). "Handbook of Energy and Economic Statistics of Indonesia 2012". http://prokum.esdm.go.id/Publikasi/Handbook%20of%20Energy%20&%20Economic%20Statistics%20of%20Indonesia%20/Handbook%20of%20Energy%20&%20Economic%20Statistics%20ind%202012.pdf

KESDM (Ministry of Energy and Mineral Resources – Kementerian Energi dan Sumber Daya Mineral) (2013a). "Peraturan Presiden No. 4 Tahun 2010 tentang Penugasan kepada PT PLN (Persero) untuk Melakukan Percepatan Pembangunan Pembangkit Tenaga Listrik yang Menggunakan Energi Terbarukan, Batubara dan Gas". Accessed June 2013. http://prokum.esdm.go.id/perpres/2010/Perpres%204%202010.pdf

KESDM (Ministry of Energy and Mineral Resources – *Kementerian Energi dan Sumber Daya Mineral*) (2013b). "Undang-Undang No. 27 Tahun 2003 tentang Panas Bumi". Accessed June 2013. http://prokum.esdm.go.id/uu/2003/uu-27-2003.pdf

KLH (Ministry of Environment – *Kementerian Lingkungan Hidup*) (2013). "Undang-Undang No. 18 Tahun 2008 tentang Pengelolaan Sampah". Accessed June 2013. http://www.menlh.go.id/DATA/UU18-2008.pdf

Michael Taylor (2012). IRENA Innovation and Technology Centre. "The Renewable Revolution: Power Generation Costs". 26 October 2012. http://iea-retd.org/wp-content/uploads/2012/10/1-1-TAYLOR_costing-IRENA-IEA-RETD-Oct-26-Version-3.pdf

Saleh Abdurrahman (2013). Deputy Secretary General, National Energy Council. "National Energy Policy: Towards Sustainable Energy Future", Presented on APEC Peer Review on Low Carbon Energy Policy (PRLCE), Jakarta, 13 May 2013.

Sjaiful Ruchijat (2013). Head of Sub-Directorate of Investation and Coopertaion on Geothermal. "Up-Date on Geothermal Energy Development and Utilization in Indonesia", Presented on APEC Peer Review on Low Carbon Energy Policy (PRLCE), Jakarta, 13 May 2013

Tunggal (2013). Secretary Directorate General of New Renewable Energy and Energy Conservation. "Policies and Strategies for the Development of New Renewable Energy", Presented on APEC Peer Review on Low Carbon Energy Policy (PRLCE), Jakarta, 13 May 2013

UNFCCC (2013). "Clean Development Mechanism." http://cdm.unfccc.int/Projects/projsearch.html. Accessed June 2013.

APPENDIX D: USEFUL LINKS

Bank Negara Indonesia (BNI) – www.bni.co.id

Center for Research on Energy Policy, ITB – www.crep.itb.ac.id

Directorate General of New Renewable Energy and Energy Conservation (DJEBTKE) – www.ebtke.esdm.go.id

Directorate General of Electricity (DJK) – www.djlpe.esdm.go.id

Indonesian Geothermal Association (API) – www.inaga.org

Indonesia Renewable Energy Society (METI) – www.meti.or.id

Ministry of Energy and Mineral Resources (KESDM) – www.esdm.go.id

National Energy Council (DEN) – www.den.go.id

PT PLN (Persero) – www.pln.co.id

PT Navigat Organic Energy Indonesia – www.noei.co.id

Research and Development Center of Technology for Electricity, Renewable Energy and Energy Conservation – www.p3tkebt.esdm.go.id

The Indonesian Solar Module Manufacturer Association (APAMSI) – www.apamsi.org