Report on the National Assessment Framework of Enabling Environment and Technology Innovation Eco-system for Making Sustainable Energy Options Affordable and Accessible

INDONESIA

Prepared by

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May 2014

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ABBREVIATIONS

BPPT	*Badan Pengkajian dan Penerapan Teknologi,* Agency for the Assessment and Application of Technology
CPO	Crude palm oil
LAPAN	*Lembaga Penerbangan dan Antariksa Nasional,* Institute of Aeronautics and Space Agency of Indonesia
LIPI	*Lembaga Ilmu Pengetahuan Indonesia,* Indonesian Institute of Sciences
MBOE	Million barrel oil equivalent
MEMR	Ministry of Energy and Mineral Resources
PLTA	*Pembangkit Listrik Tenaga Air,* Hydropower Electric Power Generation
PLTB	Pembangkit *Listrik Tenaga Bayu,* Wind Power Electric Power Generation
PLTD	*Pembangkit Listrik Tenaga Diesel,* Diesel Oil Electric Power Generation
PLTSa	*Pembangkit Listrik Tenaga Sampah,* Municipal Solid Waste Electric Power Generation
PLTS	*Pembangkit Listrik Tenaga Surya,* Solar Power Electric Power Generation
PLTGU	*Pembangkit Listrik Tenaga Gas dan Uap,* Gas and Steam Electric Power Generation
PLTU	*Pembangkit Listrik Tenaga Uap,* Steam Electric Power Generation
PLTM	*Pembangkit Listrik Tenaga Minihidro,* Mini-hydro Electric Power Generation
PLTG	*Pembangkit Listrik Tenaga Gas,* Gas Electric Power Generation

A. National Scenario for Sustainable Energy

General Information

With considerable economic, population growth and the resulting increase in energy demand and consumption, Indonesia has the interest to manage and use energy as effectively and as efficiently as possible. Indonesia's economic growth ranged from 6.2% in 2010, 6.5% in 2011, 6.2% in 2012, and 5.78% in 2013, while GDP per capita (PPP) in 2013 was US 5,180 [1]. The population growth was at 1.49%/year in last decade [2]. The increase in energy consumption was on average 7% per year [3].

Development and utilization of new and renewable energy become a priority in the energy development programme of Indonesia. Solar energy, biomass, wind, hydro power and geothermal are renewable energy resources that have been used to produce electricity to fulfill the increasing demand on electricity. Biomass, as raw material for production of biodiesel and bioethanol, to be utilized to substitute the fossil fuel, has become one of main concerns.

Various regulations and programmes have been launched to drive the investment, production and utilization of renewable energy for electricity power generation and for transportation. A list of laws and regulations related to sustainable energy and energy efficiency programme is shown in Appendix A.

There are four main sectors of energy users, namely household, commercial, industrial and transportation. In 2011, the largest energy user was the industrial sector with a share of 32.2%, and households 28% and transportation 24.5% [4]. Household energy consumption was tending to decrease, while energy for transportation was on the increase. Table 1 shows the progress of energy consumption by sectors in last five years.

The primary sources of energy still come from fossil fuels, namely 46.9% from oil, 26.4% from coal, and 21.9% from natural gas. The remainder is made up of hydro power and other renewable energy [5]. Hydro power and other renewable energies only make up about 4.8% from the total of utilized energy resources.

In the past, the government has put a lot of subsidies for fuel oil for transportation, gas for households, electricity, and fertilizers in order to support to support low income families and micro and home industries. Overall, subsidies for energy are the biggest proportion of government subsidies. For 2014, the government allocated energy subsidy could be as much as Rp 282.1 trillion (US $ 24.5 Billion, as the rate in March 2014 is around Rp 11,500/US $) [6]. Table 2 shows the government budget planning for energy subsidy for 2012 to 2014.

Table 1: Energy Consumption by Users

No	Sector	2008 (%)		2010 (%)		2011 (%)	
		(*)	(**)	(*)	(**)	(*)	(**)
1	Industrial	33.03	40.58	33.30	39.31	33.28	37.78
2	Transportation	21.71	31.30	23.95	32.19	24.09	33.73
3	Households	34.94	13.44	29.09	10.27	28.75	10.23
4	Commercial	3.22	4.43	3.10	4.00	3.05	3.91
5	Others	7.10	10.25	10.56	14.23	10.95	14.26
	Total (%)	100	100	100	100	100	100
	Total (MBOE)	906.8	628.97	1,067.5	793.94	1,114.76	834.72

Notes: Recalculated from Reference [4], pp 20-21.

MBOE (Million barrel oil equivalent); (*) Biomass included; (**): Biomass excluded.

Table 2: Government Subsidy for Energy

Year	Subsidy for energy (Rp, in trillion)			References
	Electricity	Fuel oil	Total	
2014	71.4	210.7	282.1	[6]
2013	80.9	193,8	274.7	[7]
2012	45	123.6	168.6	[8]

Note: [6], [7], [8], *APBN 2014, 2013, and 2012*. The Government Budget Planning for 2014, 2013 and 2012, respectively.

The government has taken necessary steps in anticipating and responding to a surge of energy needs, especially electrical energy. One of the first steps was to create a blueprint National Energy Management 2006-2025 (Presidential Decree, number 5 in 2006). There were two

kinds of approach to be conducted in stages until 2025, i.e. an increase in energy efficiency (savings) and utilization of new and renewable energy sources (energy diversification).
Given the electrification ratio was still relatively low at 63% in 2005 [9], 80.4% in 2013 [10] while Indonesia is targeting more than 95% electrification ratio in 2020, the discussion in this report would be on the promotion and utilization of alternative energy source for generating electricity, especially for rural areas.

Topology and Administrative

Indonesia is the largest archipelago country with more than 13,466 islands (islands with names), and the coastline is more than 99,000 km [11]. The length from east to west is around 5,150 km, width of 1,700 km, with a land area of 1.9 million square km and sea of 7.9 square km. The covered area of Indonesia is about 9,822,570 km^2. As a country within the *ring of fire*, there are more than 80 major active volcanoes scattered around the islands [12].

In 2013, Indonesia consisted of 34 provinces (see Figure 1). Each province is divided into several regions (*Kabupaten*) headed by *Bupati*, and Municipal/City (*Kota*) headed by *Walikota (*Mayor*)*. Currently, the number of *Kabupatens*is 410, and the number of *Kotas is* 98[13]. Each *Kabupaten* consists of several *Kecamatan,* headed by a *Camat*. The number of provinces and regions in near future might be increased. As of March 2014, the Indonesian Parliament is considering a number of proposals to establish new provinces and regions (DPR, *Dewan Perwakilan Rakyat*).

Figure 1: Names of Provinces of Indonesia

Population, Households and Electrification Rate

Population and Households

In 2010, the population was 237.5 million, and it is estimated that Indonesian population would be of 321 million in 2025 [14]. In the period of 2000 to 2010, population growth was 1.49% per year. In 2010, the ratio of men and women was of 119.5 million and of 118million respectively [15]. 54% of the population lives in urban areas, while 46% of the population lives in rural areas [16]. Java Island is the most populated island with more than 135 million people living on the island. The Figure of population density at each province is shown in Table 3.

In 2010, 34.4% of the population was at the productive age of 15-35 years. Dependency ratio was 51.3%, meaning that 100 productive people *have to take care of* 51.3 unproductive people. The dependency ratio is predicted to be 40% at year 2030[17].

Table 3: Population Density per Provinces of Indonesia [15]

No	Provinces	Population (in millions)
1	Aceh	4.48
2	North Sumatera	12.98
3	West Sumatera	4.84
4	Riau	5.54
5	Riau Islands	1.69
6	Jambi	3.09
7	South Sumatera	7.44
8	Bangka Belitung	1.22
9	Bengkulu	1.71
10	Lampung	7.59
11	Banten	10.54
12	DKI Jakarta	9.59
13	West Java	43.02
14	Central Java	32.38
15	DI Yogyakarta	3.45
16	East Java	37.47
17	Bali	3.89
18	NTB	4.49

19	NTT	4.68
20	West Kalimantan	4.39
21	Central Kalimantan	2.2
22	South Kalimantan	3.63
23	East Kalimantan	3.55
24	North Sulawesi	2.27
25	Gorontalo	1.04
26	Central Sulawesi	2.63
27	West Sulawesi	1.16
28	South Sulawesi	8.03
29	West-South Sulawesi	2.23
30	Maluku	1.53
31	North Maluku	1.03
32	West Papua	0.76
33	Papua	2.85
34	North Kalimantan	
	Total	237.6

In 2013, 28.5 million (11.47% of the population) people were living below the poverty line – 8.52 among the urban population and 14.42% among the rural population. According to BPS, the poverty line income was of Rp 308,000/capita/month in urban areas and Rp 275,800/capita/month in rural areas (18). The currency rate in early 2013 was Rp 9,500 to US$1.

Electrification Rate

Indonesia's economic development triggered a high growth in national electricity demand. Unfortunately supply could not fulfil the demand. As a result, Indonesia is facing electricity shortage in several areas. Several provinces have electrification rates less than 60% and thousands of islands are without access to the electricity grid [10]. Figure 2 shows electrification rate in each provinces of Indonesia.

In 2011, the electrification rate was 70.4% of the total number of households. The number of households in 2011 was 60,2million [19]. In 2013, this rose to 64 million [20]. In 2013, the electrification rate increased to 79.6%. PLN is targeting 96.8% electrification rate by 2020 [10].

The electrification rate of households varies from province to province. The highest electrification rate for urban areas is 99.91% (Jakarta), while the lowest is 96.42% (Papua). For rural areas, the highest electrification rate is 99.11% (West Java) while the lowest is 23.02% (Papua). In some areas, the electrification rate of households in urban areas is much higher than those in rural. In 2012 for example, in Riau province in urban areas the electrification rate was 94.88%, while in rural areas it was only 46%. In Papua province, the rate in urban areas was93.44%, whereas in rural areas was 12.53%. In more detail, the electrification rates of households in urban and rural areas are shown Table 4, while Figure 2 shows average electrification rate per provinces.

Table 4: Percentage of Households in Urban and Rural Received Electricity from PLN's Grid in year 2010-2012 [21]

No	Provinces	2010		2011		2012		
		Urban	Rural	Urban	Rural	Urban	Rural	Note
1	Aceh	96,57	88,81	98,79	92,59	98,68	93,86	
2	Sumatera Utara	97,07	81,71	98,50	84,22	98,98	86,93	
3	Sumatera Barat	94,79	78,45	95,41	81,57	98,34	85,55	
4	Riau	86,05	37,25	93,06	40,99	94,88	46,08	
5	Kepulauan Riau	91,29	59,86	95,93	48,73	95,30	46,06	Many islands
6	Jambi	90,95	67,30	94,42	67,94	95,97	74,89	
7	Sumatera Selatan	94,21	65,62	97,41	70,63	97,64	77,19	
8	Kepulauan Bangka Belitung	90,09	55,39	91,91	66,57	94,59	78,72	
9	Bengkulu	96,27	69,56	96,68	69,91	98,13	81,78	
10	Lampung	92,39	74,40	98,04	77,24	98,85	79,16	
11	DKI Jakarta	98,79	-	99,65	-	99,82		No rural
12	Jawa Barat	98,33	96,06	98,71	96,99	99,33	97,98	
13	Banten	98,15	91,57	99,03	96,16	99,16	98,16	
14	Jawa Tengah	98,59	97,95	99,32	98,18	99,72	98,96	
15	DI Yogyakarta	99,77	99,21	99,48	99,64	99,57	99,05	

16	Jawa Timur	98,42	96,49	98,79	96,57	99,63	97,92	
17	Bali	98,24	94,58	99,39	95,55	99,30	97,70	
18	Nusa Tenggara Barat	88,40	76,58	94,83	80,30	98,64	88,01	Many islands
19	Nusa Tenggara Timur	92,09	32,83	95,78	31,82	97,56	38,84	Many islands
20	Kalimantan Barat	96,27	56,74	96,21	60,68	96,82	64,55	
21	Kalimantan Tengah	90,43	48,02	94,19	51,41	96,93	54,50	
22	Kalimantan Selatan	97,12	84,46	98,30	83,32	99,04	88,03	
23	Kalimantan Timur	94,54	60,73	93,54	60,65	96,61	58,49	
24	Sulawesi Utara	95,73	90,62	97,72	89,66	98,29	92,56	
25	Gorontalo	91,49	60,89	95,01	62,63	95,15	64,23	
26	Sulawesi Tengah	91,87	61,04	96,06	64,58	97,13	71,14	
27	Sulawesi Selatan	97,41	82,37	98,57	81,05	98,57	84,75	
28	Sulawesi Barat	86,22	34,41	90,02	40,39	96,01	44,27	
29	Sulawesi Tenggara	93,64	59,07	95,91	67,86	96,05	72,67	
30	Maluku	93,07	61,94	91,93	58,08	94,96	61,35	
31	Maluku Utara	90,30	54,22	97,11	52,65	94,69	59,24	Many islands
32	Papua	86,29	14,58	92,65	12,47	93,44	12,53	
33	Papua Barat	86,54	49,25	96,18	48,33	98,39	49,78	
34	North Kalimantan	-	-	-	-	-	-	No data

Source: Ministry of Energy and Mineral Resources, 2012

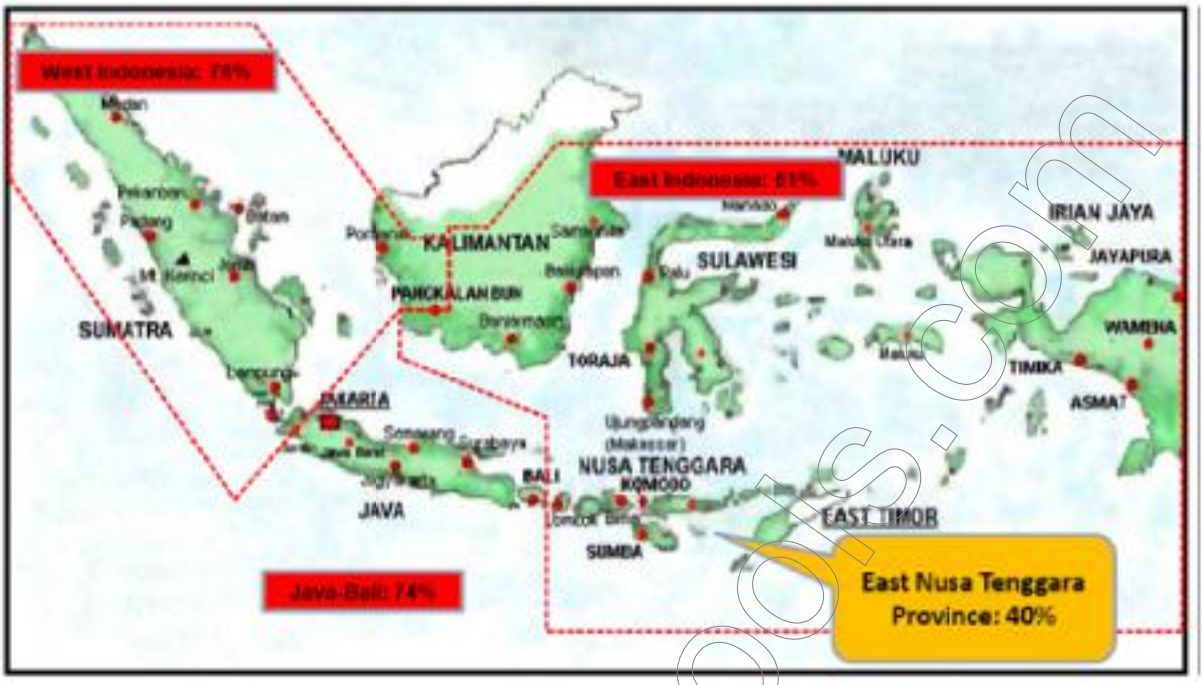
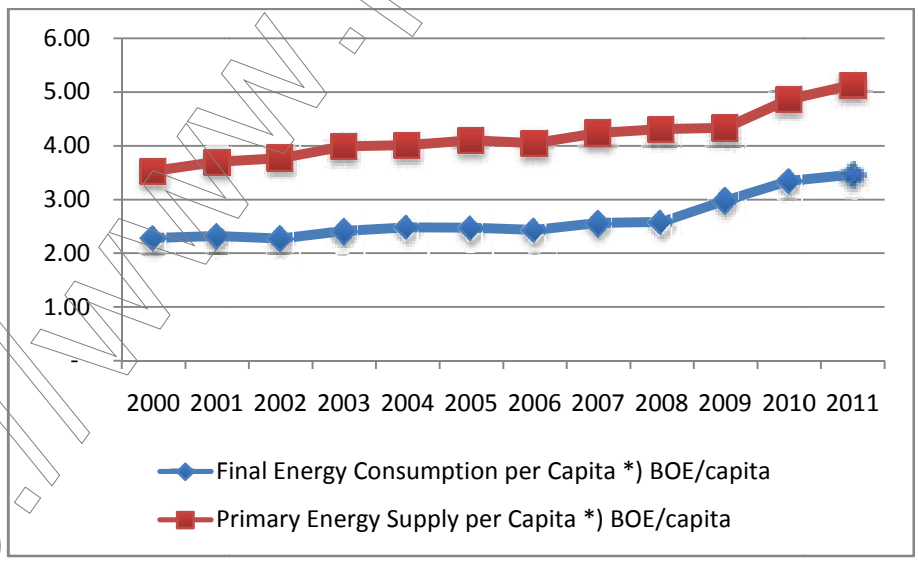


Figure 2: Electrification rate at each province in 2012

Energy Consumption per Capita

Energy consumption per capita was around 3.46 BOE/capita in 2011,which is very low compared to Japan which has an energy consumption of 29.8 BOE/capita [22] The consumption per capita was much lower than average world consumption. The trends of energy consumption per capita since 2000 are shown in Figure 3 [23].



(Note: Primary energy supply, excluded Biomass)

Figure 3: Trends of energy consumption per capita 2000-2011[24]

Electricity consumption in 2011 was 655 kWh/capita, and in 2013was 900 kWh. Data in 2010 showed that Indonesia electricity consumption per capita was lower than many other countries in ASEAN such as those in Malaysia of 3490, Thailand of 2079, and Vietnam 799kWh/capita [25]

Administrative set up for Energy Issues

The Ministry of Energy and Mineral Resources (MEMR) governs all energy issues nationally, included new and renewable energy resources. Since December 2013, regarding to sustainable energy, under new organizational structure of MEMR, there are three directors under the Director General of New, Renewable Energy and Energy Conservation namely Director for Geothermal, Directors for Bioenergy and Director for New and Renewable Energy.

The MEMR on behalf of the Government of Indonesia, proposes law to the DPR, define regulations, and determine national policies concerning energy, including energy subsidy. Besides that, the ministry also establishes and enforces standards and procedures on energy.

The *Dinas Energi dan Sumber Daya Mineral Propinsi (*Office of Energy and Mineral Resources of Province*,* an agency under Governor)engage with energy issues at the provincial level. The function of the office is to define provincial regulations, to determine cross regencies/cities management policies regarding energy issues. In reality, the office was just implementing the regulations and procedures determined by the ministry.

At the regency level, *Dinas Energi Kabupaten (*Office of Energy of Kabupaten*,* an agency under *Bupati*) works on energy issues at Kabupaten level. The office defines regency level regional regulations, provides guidance and supervision on regency endeavors and determines management policies within regency. It is important to be noted that in reality, the offices were just implementing the regulations and procedures determined by the ministry.

The Ministry of Finance provides funding to promote utilization of renewable energy, to support efforts for energy saving, etc. Banks and BRI provide loans to support utilization of renewable energy through *Kupedes*.

PLN is the only state owned company that produces electricity and distributes it to users nationwide. Private companies may produce electricity, and sell it to PLN to be distributed to users [10]. The electricity tariff calculated and proposed by PLN to the MEMR to be discussed to, and determined by the DPR (*Source: www.pln.go.id*).

In terms of investment, a local or foreign private company which plans to make an investment, including for energy businesses, should be applied to Badan *Koordinasi Penanaman Modal, BKPM,* (Investment Coordinating Board of Indonesia). BKPM is responsible for issuing approval for an investment (*Source: www.bkpm.go.id*).

Pertamina is a state own company which produces and distributes fuel oil in Indonesia. Before 2001, Pertamina was the only company which was allowed to distribute fuel oil, and establish fuel filling stations / fuel dispensers in Indonesia. Since then, private and foreign companies have been allowed to build fuel filling stations. Currently, companies such as Shell, Total, Petronas, etc. are operating in Indonesia.

Current Power Sector Set-up

Electricity Generation

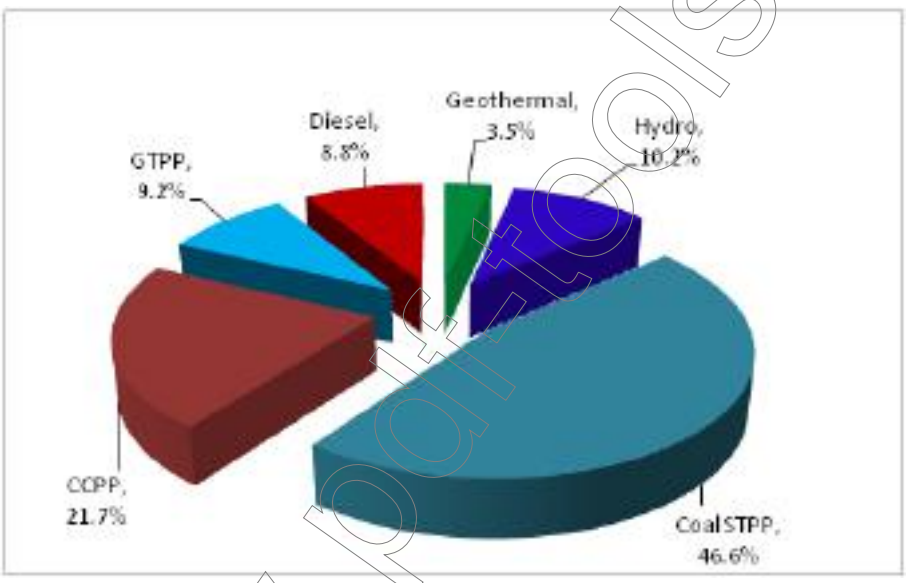
The electricity power generation in Indonesia is dominated by PLN. PLN controls approximately 35,000 MW of installed generating capacity, or over 85% of Indonesia's electricity power. Most of electricity (46.6%) is produced through burning coal. The role of sustainable energy in 2013 was still limited at 13.7%, predominantly through hydropower and geothermal. The distribution of energy sources is shown in Figure 4.

PLN owns and operates 1,267 generation plants, and the main purchaser of electricity from Independent Power Producers (IPPs). IPPs play a dominant role in generating electricity from geothermal energy in Indonesia. The role of IPPs compared to PLN's is shown in Figure 5.

Transmission and Distribution

PLN is the only provider of power transmission in Indonesia, it owns approximately 36,741 km of transmission lines, and 66,354 MVA of transmission transformer capacity. PLN is also sole distributor of electricity to end customers in Indonesia, with approximately 685,785 km of distribution lines and 36,430 MVA of transformer capacity. PLN serves approximately 46 million customers [10]. IPPs may produce electricity for themselves, or sell it to PLN. IPP's cannot sell it directly to users.

Figure 4: PLN's Power Plant Composition (Total 35,617 MW, 2012) [10]



Note: (CCPP = Combine Cycle Power Plant, GTPP = Gas Turbine Power Plant)

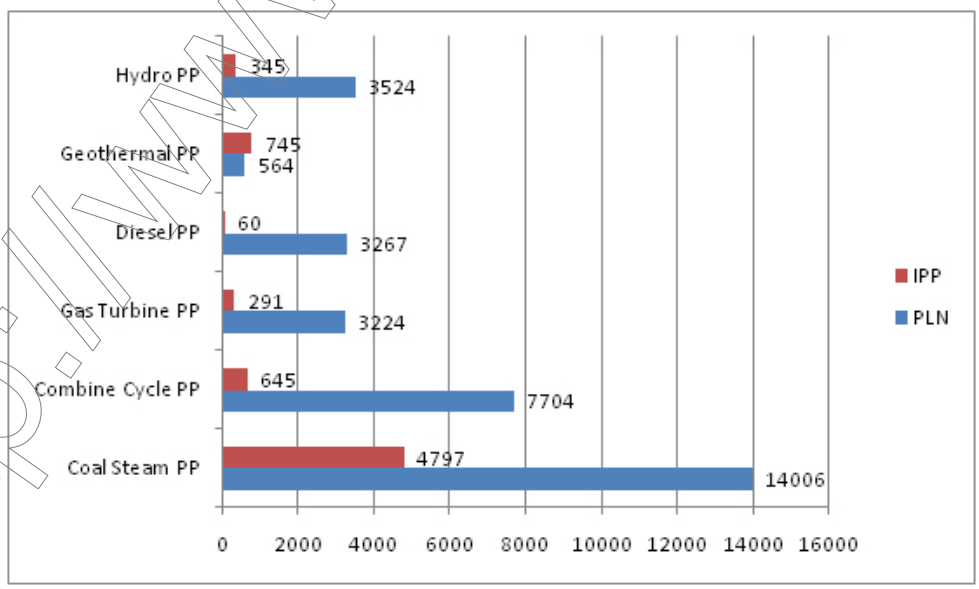


Figure 5: The role of IPPs compare to PLN, for electricity power generation (MW) [10]

Retail Tariff

PLN, under control of MEMR, arranges and proposes electricity retail tariff. The MEMR then proposes the tariff to the Parliament to be reviewed and approved. The tariffs are clustered into several clusters namely household, business, industry, social activities, and government. Each cluster is divided into several groups of electricity power limit. For example, the household cluster is divided into six groups. The lowest power limit for households is 450 VA. The tariff for each group in each cluster depends on the power limit and the magnitude of electricity used. Users pay to PLN for regular/monthly fee plus charge for utilization. Details of the tariff for households, commercial and industry clusters are shown in Appendix B.

Example of Suitability of Established Technology

PLN and IPPs produce electricity utilizing established technologies based on large hydropower, coal fired boiler, diesel fuel and geothermal power plant technologies. For remoteareas PLN generates power mostly utilizing diesel power plants. In several small cases, such as in Morotai Island, PLN also generates electricity utilizing PV based technology. A pilot project for a feasibility study in Bali, PLN is also producing electricity power utilizing wind power.

IPP and private industries are utilizing renewable material such as municipal solid waste, biomass, agricultural or forestry solid waste. These sources have been utilized to generate electricity at limited amount. Crude palm oil (CPO) processing industries, for example, utilize empty fruit bunches of oil palm to generate electricity in order to produce a supply of a few megawatts [26].

At Bantar Gebang, Bekasi, West Java, a private company generates electricity from Jakarta's municipal solid waste. Jakarta produces around 6000 tonnes per day of municipal solid waste. The waste is dumped to Bantar Gebang. The company taps landfill gas in the dumping area, and utilizes gas to generate electricity. Currently, it produces 10 MW electric power part of 26 MW their master plan [27].

Capital Cost Range

Appropriate data of capital cost range for electricity generation from various energy sources in Indonesia could not be found yet.

Resources Availability and Access

Percentage Share of Different Primary Sources

Indonesia is a country that has abundant energy resources, a variety of fossils such as petroleum, coal and natural gas, and new and renewable energy sources such as solar power, wind power, hydropower, geothermal, biomass, tidal and raw material for nuclear power. In addition, Indonesia has a potential for CBM, coal bed methane as well. Despite this potential, Indonesia is still not able to meet the energy needs within the country as a result of the significant increase in energy demand.

As shown in Table 1, the total energy consumption of Indonesia increased on average of around 7% /year. A study conducted by the Agency for Assessment and Application of Technology (*Badan Pengkajian dan Penerapan Teknologi*, BPPT) reported that based on energy intensity data, utilization of energy sources were not yet efficient enough. (BPPT 2012). Another study [25] stated that Indonesiais not a rich of fossil resources country. Unfortunately, most Indonesian people are not aware to the situation and not many efforts have been made to explain the existing condition. Tumiran [25] mentioned that Indonesia population is about 3.4% of the world population, whereas the fossil energy reserve in Indonesia is below 3.4%, meaning that Indonesia's fossil energy reserve per capita in insufficiently low. Fortunately, Indonesia has a huge potential of renewable energy resources which might play important role for future national energy mix.

Figure 6 shows the share of energy resources for electricity generation. From this we can see that coal is currently the major source for electricity generation in Indonesia [10]. The share of other resources is described in Figure 6.

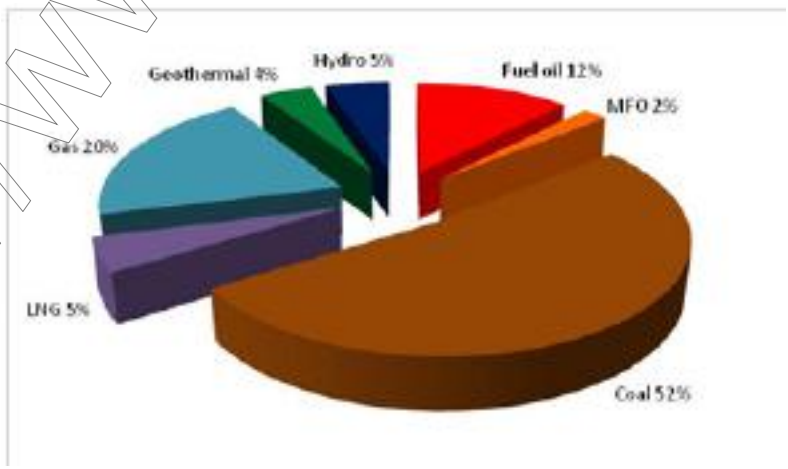


Figure 6: Energy Resources for Electricity Generation Share in 2013 [10]

Diversification of energy (the energy mix) is a concept / strategy that can be used as a tool to achieve economic and sustainable development. Energy mix policies have stressed that Indonesia should not only depend on fossil-based energy sources but also develop the use of renewable energy. Indonesia's energy mix policy needs be developed with a clear strategy, target utilization and national energy management, taking into account the potential energy, energy demand, energy infrastructure, and other factors such as energy prices, technology, taxes, investments and so on.

In 2005, the main sources of energy supply in Indonesia were petroleum (54.78%), followed by natural gas (22.24%), coal (16.77%), water (3.72%) and geothermal (2.46%). In 2011, the main energy supply was petroleum oil (46.39%), Gas (21.9%), Coal (26.38%) and NRE 4.79%) [31]. When we compare with Business As Usual Scenario (for 2011, Figure 7), it could be seen that dependency on oil was still high.

The government's goal in 2025 (as shown in Figure 8), is expected to realize optimal energy mix, namely: petroleum (<20%), natural gas (> 30%), coal (> 33%), biofuels (> 5%), geothermal (> 5%), renewable energy (> 5%) and liquefied coal (> 2%).

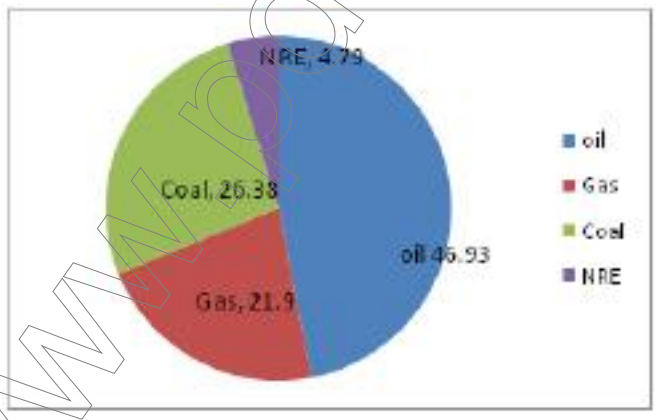


Figure 7: Energy Mix 2011 (Source: Hasrul, ESDM, 2012)

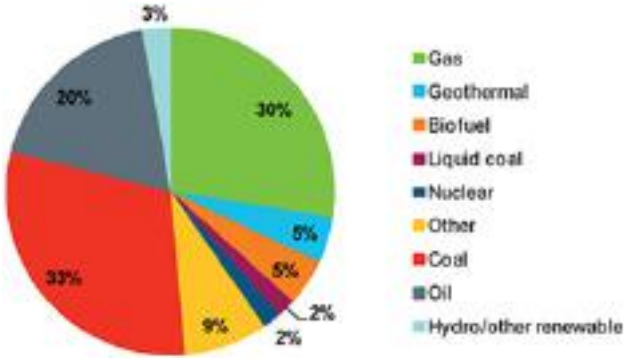


Figure 8: Target Energy Mix 2025 [32, 33]

Kerosene to - LPG Conversion Programme

Traditionally, wood and kerosene were primary energy sources for cooking and heating processes at households, micro and small industries and micro and small traders. Since 2005, the government has launched a programme to convert utilization of kerosene to LPG to be used by households, micro and small industries and micro and small traders.

Under the programme, the government supported low income households and micro and home industries by providing them with a suitable LPG gas stove, gas regulator, and a 3 kg LPG gas container for free. Beside that the government gives subsidy for the 3 kg LPG package utilized by those subsidy targets.

The programme was viewed as a successful programme since it could change traditional dependence on kerosene for cooking in most households and home industries in Indonesia. Currently most of households especially in Java, Bali, Madura (the most populated islands in Indonesia) and several provinces of Sumatera utilize LPG for cooking and heating processes. Recent data showed that in early 2014, LPG has been utilized by 48 million households [34] out of 64.06 million household in Indonesia at end of 2013 [35]. The programme is still continued to other provinces in Indonesia.

Potential and Install Capacity in Development of Renewable Energy

Renewable Energy Power Plant

In the last 10 years, world demand for renewable energy sources increased at a rate of nearly 25% per year. This increase was driven by: (i) increasing electrical energy requirements, (ii) increasing desire to use cleaner technologies, (iii) continued rising prices of fossil fuels, (iv) increased cost of construction of transmission lines, and (v) increased to increase assurance energy supply. To be able to increase the role of renewable energy quickly, the price and reliability of renewable energy-based electricity generation should be able to compete with conventional power [48].

In Indonesia, renewable energy sources have been utilized for electric power generation and for household purposes for many years. The potential and uses are shown in Table 5.

Table 5: Potential and Installed Capacity of Renewable Energy (both Grid-connected and Off-grid) in Indonesia (up to 2011) [36]

No	Renewable Energy	Potential (MW)	Installed Capacity (MW)	Ratio (%)
1	**2**	**3**	**4**	**5 = 4/3**
1	Large hydro	75,670	5,705.29	7.54
2	Geothermal	29,038	1,189	4.00
3	Small hydro (Micro-hydro)	769.69	217.8 19	28.31
4	Biomass	49,810	1,618.40	3.25
5	Solar	4.80 kWh/m^2/day	13.5	-
6	Wind	3-6 m/s	1.96	-
7	Sea	43,000	-	-

Java Island is the most populated island in the country. However, the island has insufficient energy resources to fulfill the energy need. On the other hand, Sumatera and Kalimantan are much less densely populated, but the island possesses an abundance of energy resources. So, the distribution and transportation cost of fuel and electricity from island to island become a challenge for energy management in Indonesia. Table 6 shows the share of energy supply in major islands in the country.

Table 6: Primary energy supply share in Indonesia [37]

Regional	Oil (%)	Natural gas (%)	Coal (%)	Hydropower (%)	Geothermal (%)
Java	19	6	0	6	34
Sumatra	69	55	50	21	47
Kalimantan	9	14	50	29	0
Sulawesi	1	2	0	14	8
Others	2	24	0	31	10

Hydro Power

Hydropower is one of renewable energy technology that is commercially viable on large scale in Indonesia. Moreover, hydropower dams have made important and significant

contributions to economic and human development. Firstly, it is a renewable energy source and produces negligible amounts of greenhouse gases. In the long term, it produces large amounts of electricity at low cost and it can be adjusted to meet consumer demand. Furthermore, hydro dams are multipurpose and are built primarily for socio-economic developments such as irrigation, water supply, flood control, electric power and for tourism. Indonesia has a huge amount of hydropower resources. The potential of hydropower was estimated at about 75,000 MW, which ranks Indonesia fourth in Asia after China, the former Russian Federation and India. [37] However, only 34,000 MW of 75,000 MW is exploiTable. This is basically due to the high capital investment required to develop dams and the frequency of the emergence of socio-environment issues. In Indonesia, the development of a hydropower dam is overwhelmingly complex as the issues are not confined to the design, construction and operation of dams themselves but also involve issues of social, environmental and political dimensions. [37]

An advantage of hydropower is generally obvious from both economic and environmental aspects. Economically, hydropower apparently has a relatively low cost of production. As well as this, hydropower generally has a long life of approximately 50-100 years [49]. In terms of environmental issues, the reduction in carbon emissions from the use of clean energy sources such as water power is clearly a valuable contribution to the environment.

But there are also negative effects on the environment caused by the construction of hydropower dams. These large dams typically disrupt the ecological balance of rivers and lakes. Table 7 shows the installed capacity of hydropower stations in Indonesia.

Table 7: Installed capacity of hydropower station in Indonesia [37]

Station	**Installed capacity (MW)**	**Total**
1. Aceh		
PLTA Angkup	–	–
PLTA Peusangan	2 × 22.1 MW; 2 × 21.2 MW	86.6 MW
2. North Sumatra		
PLTA Sigura-gura	4 × 71.50 MW	286 MW

PLTA Tangga	4 × 79.25 MW	317 MW
PLTA Lau Renun	2 × 41 MW	82 MW
PLTA Sipan Sihaporas	2 × 25 MW	50 MW
PLTA Asahan I	2 × 90 MW	180 MW
3. West Sumatra		
PLTA Agam	3 × 3.5 MW	110.5 MW
PLTA Maninjau	4 × 17 MW	68 MW
PLTA Singkarak	4 × 43.75 MW	175 MW
4. Bengkulu		
PLTA Tes	4 × 4 MW	16 MW
PLTA Musi	3 × 70 MW	210 MW
5. Riau		
PLTA Koto Panjang	3 × 38 MW	114 MW
6. Lampung		
PLTA Besai	2 × 46.4 MW	90 MW
PLTA Batu Tegi	2 × 14 MW	28 MW
7. West Java		
PLTA Ubrug	2 × 10.80 MW; 1 × 6.30 MW	17.1 MW
PLTA Bengkok	3 × 3.15 MW; 1 × 0.70 MW	3.85 MW
PLTA Cibadak	–	–
PLTA Cikalong	3 × 6.40 MW	19.2 MW
PLTA Saguling	4 × 175 MW	700 MW
PLTA Cirata	8 × 126 MW	1.008 MW
PLTA Jatiluhur	7 × 25 MW	175 MW
PLTA Lamajan	3 × 6.40 MW	19.2 MW
PLTA Parakan Kondang	4 × 2.48 MW	9.92 MW
8. Central Java		
PLTA Jelok	4 × 5.12 MW	20.48 MW
PLTA Timo	4 × 3 MW	12 MW
PLTA Ketenger	2 × 3.52 MW	7 MW
PLTA Gajah Mungkur	1 × 12.4 MW	12.4 MW
PLTA Garung	2 × 13.2 MW	26.4 MW
PLTA Wadas Lintang	2 × 8.2 MW	16.4 MW
PLTA Mrica	3 × 61.5 MW	184.5 MW

PLTA Kedung Ombo	1 × 23 MW	23 MW
PLTA Sidorejo	1 × 1.4 MW	14 MW
PLTA Klambu	1 × 1.1 MW	1.1 MW
9. East Jawa		
PLTA Mendalan	3 × 5.8 MW	23 MW
PLTA Siman	3 × 3.6 MW	10.8 MW
PLTA Giringan	2 × 1.35 MW; 1 × 0.5 MW	3 MW
PLTA Selorejo	1 × 4.48 MW	4.48 MW
PLTA Karangkates	3 × 35 MW	105 MW
PLTA Wlingi	2 × 27 MW	54 MW
PLTA Lodoyo	1 × 4.5 MW	4.5 MW
PLTA Sengguruh	2 × 14.5 MW	29 MW
PLTA Tulung Agung	2 × 23 MW	46 MW
PLTA Tulis	2 × 7 MW	14 MW
10. South Kalimantan		
PLTA Riam Kanan	3 × 10 MW	30 MW
11. North Sulawesi		
PLTA Tonsea Lama	1 × 4.44 MW;	14.38 MW
	1 × 4.5 MW;	
	1 × 5.44 MW	
PLTA Tanggari I	1 × 17.2 MW	17.20 MW
PLTA Tanggari II	1 × 19 MW	19 MW
12. South Sulawesi		
PLTA Larona	3 × 55 MW	165 MW
PLTA Balambano	2 × 65 MW	130 MW
PLTA Karrebe	2 × 70 MW	140 MW
PLTA Bakaru	2 × 63 MW	126 MW
13. Cental Sulawesi		
PLTA Sulewana Poso I	4 × 40 MW	160 MW
PLTA Sulewana Poso II	3 × 60 MW	180 MW
PLTA Sulewana Poso III	5 × 80 MW	400 MW

Besides large hydropower, Indonesia also has potential for small hydropower across the country. The potential of micro hydro is estimated to be about 459.91 MW. Of this, 20.85

MW or 4.54%of the potential has been developed by the PLN for power generation in rural areas [37]. The potential sites are located in West Kalimantan, West Sumatra and Central Sulawesi, while the largest installed capacity of micro hydro can be found in North Sumatra, Central Java, West Java and Bengkulu. Indonesia, as a tropical country, possesses several large and many small rivers. As a result, it is highly possible that the development of micro and mini hydropower plants could play a prominent role for future energy mix of the country.

About 6000 plants of the mini hydropower range (300 kW to 5 MW) are economically feasible these days. Considering these potential small-scale of hydro are distributed evenly around the islands, small hydro power plants are seen as one option that may be used as local energy resource especially in remote areas for rural independent power generation. By exploring this potential intensively with involvement of private sector, it gives an excellent opportunity to develop energy sector as well as the policy. [37]

Solar Energy

Despite the fact that Indonesia is crossed by the equator, granting abundant amount of energy source with considerably high intensity (up to 4.8 kWh/ m^2/ day), the development and utilization of solar power has not yet been sufficiently intensive.

Several studies [28, 29, 30] showed that, considering solar intensity, Indonesia is suitable for the utilization of solar energy. In particular, the eastern part of Indonesia has the most potential for developing this system. However, considering the high humidity level, the most suitable technology should be searched. A study conducted by Irawan Rahardjo dan Ira Fitriana [28] and Budi [29] show that many islands of Indonesia received solar intensity at medium level (Figure 9).

The main problem for the use of solar energy is solar availability and variation of intensity. Solar energy is only available during the day. Therefore, solar power system should work with others system to store the energy in order to improve the reliability. Currently, a few research activities conducted by universities and research institutions in Indonesia are carrying out to get a suitable solar energy system for rural and urban area. Until 2012, the

largest solar cell system in country, at 600 kWp, was set up by PLN at Morotai Island. Figure 10 shows the PV solar power at Morotai Project.

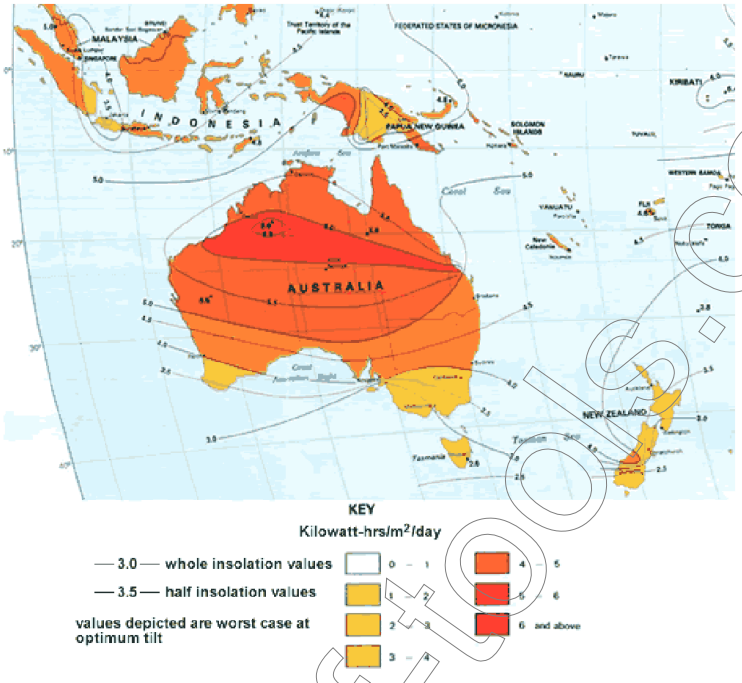


Figure 9: Intensity of Solar Radiation in Indonesia (kWh/ m2/ day) [29]

Another example of result of solar resource assessment for particular area is at Sumba Island. Currently 55% (4.45 MW) of Sumba Island electricity demand (8 MW) was supplied by solar energy and micro hydro power generation. In this island, PLN successfully developed and combined PLTMH and PLTS to fulfil local demand. Some examples of renewable energy power station in the island are:

1 x 40 kWh PLTMH at Kamanggih Area,
2 x 800 kWh PLTMH at Lapopu Area
1 x 150 kWp (peak)PLTS at Salura Area
1 x 450 kWp at Semau Area,
1 x 2, 3 MW PLTMH Lokomombo
1 x 480 kWp PLTS at Bilachenge,

The local government set a target of making Sumba Island iconic for its utilization of renewable energy technology by creating a target which aimed at 100% of locally available energy coming from renewable energy sources. [30]

Figure 10: Solar Cell Power Generation, PLTS at Morotai Island [50]

Currently, the government has put significant attention to driving utilization of Solar Power Electricity Generating System, *Pembangkit Listrik Tenaga Surya,* PLTS*,* as PLTS would be useful for the people of Indonesia who live in the off-grid rural areas and remote islands. In addition, PLTS is also hoped to support the programme for reduction of carbon dioxide (CO_2) emissions. A combination of PLTS and CO_2 reduction is a government programme. Utilization of solar power has the opportunity to eliminate more than 1 kg of CO_2 for every kWh of electricity it generates (compared to coal power plant) [50].

Currently, utilization of solar energy, especially solar water heaters in large houses or offices, has become a trend as it *improves the image* of the houses or the company. Unfortunately, the cost for installation is still considerably high for small houses, and for home and small industries. During this report preparation, it was impossible to find any studies relating to the assessment of potential of solar energy for water heating for households or industries in Indonesia could be found.

By 2025, the Indonesian government plans to install a number of solar power systems with a total capacity up to 1000 MW [51]. So, the solar power business opportunities in Indonesia, specifically utilization of solar cell, are going to be very large and increase rapidly. Unfortunately, competitive local technology is limited. There is no industry in Indonesia that produces solar cells.

The challenge in optimally utilizing solar power is the preparation of human resources, industry acceptance and energy subsidies. Barriers such as energy subsidies, as mentioned in Table 2 above, result in a reduction in the development and application of solar energy technologies. The government has recently been advised by a number of actors to reduce the size of subsidy given to oil in order to create a level playing field for renewable energies.

Wind Power

As Indonesia is located on the equator, the potential of the wind power plant is relatively small. However, based on available data, there are several areas in middle and east part Indonesia, for example NTB and NTT Islands, which have great potential. Most of the provinces in Indonesia have an average wind speed of about 4 m/s, except in the two provinces NTB and NTT. Therefore, a suitable Wind Power Electricity Generation (*Pembangkit Listrik Tenaga Bayu*, PLTB) developed in Indonesia is low speed turbine, and a power plant with a small capacity, below 100 kW [52].

The main challenge on utilization of PLTB is the low availability of wind. In order to cope with this problem, PLTB has to be operated in hybrid with other power sources. Electricity generation could be coupled with other alternative energy sources or with conventional plants. Although a PLTB usually generates power less than 100 kW, a dozen PLTBs have been built and operated in the region. [52]

On islands such as NTB and NTT, where all their energy needs must be *imported* from other islands of Indonesia, the presence of PLTB supports their energy independence. By utilizing PLTB the need for fossil fuels from other islands would be reduced. As well as this, the use of PLTB will increase the energy security of an area especially in off-grid rural areas. Again, utilization of PLTB supports the government programme to reduce CO_2 emission, as compared with diesel power plant (usually used to generate electricity at remote island of Indonesia), PLTB has the potential to reduce CO_2 emissions of 700 grams per kWh of electricity generated.

Utilization of wind power as an energy source in the country has a potential for further development, specifically at coastal areas where relative high speed wind is available. However, until now Indonesia has not had a comprehensive map of potential wind power yet.

Based on data collected by the Institute of Aeronautics and Space Agency of Indonesia (LAPAN) in 120 locations, areas that have wind speeds above 5 m/sec are at West Nusa Tenggara, East Nusa Tenggara, South Coast of Java and South Sulawesi. Example of Sumba's and West Timor's wind energy mapping is given in Figure 11 and Figure 12.

Considering the wind speeds are between2 and 6 m/s, the suitable wind power generators to be developed in Indonesia are small (10 kW) and medium scale power generations(10–100 kW). Indonesia has constructed 5 units of windmill generators across the country, each with a capacity of80 kW and 7 other units with the same capacity have been developed in four locations, North Sulawesi, the Pacific Islands, Selayar Island and Nusa Penida, Bali [37].

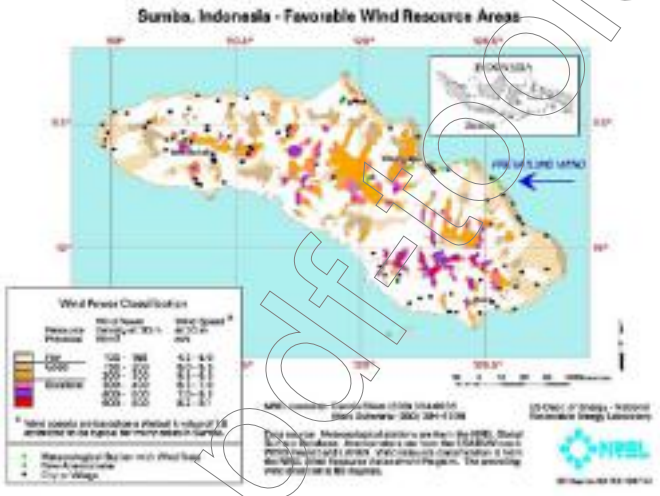


Figure 11: Sumba's wind energy mapping [37]

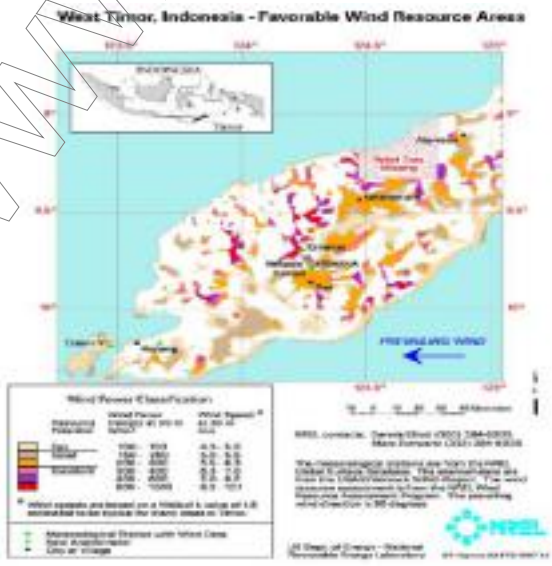


Figure 12: West Timor's wind energy mapping [37]

Biomass

Many doubted if bio-energy is a possible renewable energy solution, especially for bio-energy derived from agricultural and aquaculture. This is because a biomass can require very large land use and the production time is too long Moreover, it turns out the difference between output energy and fossil energy used in the process is not too significant. It is also worth noting that bio energy production also results in CO_2 emissions, however this is considerably less than that of fossil fuels. [37] So the challenge ahead is to determine whether or not biofuels could compete with other energy sources. The technical challenge is how to improve the efficiency of the process technology and how to accelerate the production of energy resources.

Utilization of biomass into biofuels in Indonesia can be grouped in three ways: (i) the combustion of solid biomass as traditionally used (ii) the production of fuel gas from biomass such as biogas, and (iii) the production of liquid fuels from biomass (biodiesel, bioethanol).

The first is direct burning of biomass, traditionally used for cooking, heating processes, and for steam generation for turbine applications. Until recently, small houses in rural or remote areas still used wood or agricultural waste for cooking purposes. Typically, they utilized waste material of forestry, agricultural processes such wood chips, coconut shells and branches of trees. Recently, utilization of municipal solid waste for electricity generation, Municipal Solid Waste Electric Power Generation (*Pembangkit Listrik Tenaga Sampah,* PLTSa) started to be realized, especially to tap the methane gas from landfill areas [38], or to burn the wastes.

Direct burning of biomass in this way has been generally discarded (except in PLTSa). Although the technology is simple, its efficiency is very low and produces a lot of CO_2. In Indonesia, Municipal Solid Waste Electric Power Generation (PLTSa) considered as an interesting solution to be developed, given the municipal waste production is increasing from year to year, and land for dumping is becoming limited. Local government programmes to build PLTSa are hindered due to rejection from the public who are concerned with environmental pollution, especially air pollution. Implementation of an environmentally sound technology for PLTSa is a challenge for future.

The second way to utilize biomass is the production of biogas from biomass. There are several reasons behind the development of this technology in Indonesia. The biogas can be

used for regular burning / heating at households. It can also be used as a fuel to generate electricity, and the solid waste could be utilized as fertilizer. Recently, many of biogas-to electricity plants have come up in small and large farms, schools (*Pesantren*), rural housing complexes, industrial estates, etc. [53]

The challenge for biogas production is that it requires certain initial investment to build the system. This is particularly true for small farms and low income people in rural areas. It is suggested that the government supports farmers on investment for construction of small biogas plant.

The potential of small biogas systems for applications in rural areas is somewhat encouraging. The waste from buffaloes, pigs and cows can be found in all provinces in Indonesia, though the quantities are in different amounts. Table 8 shows the summary of biogas energy potential by province in Indonesia and Table 9 shows major biomass energy potential as energy resources. Figure 13 shows typical small scale biogas digester in village or at home industries.

Table 8: Biogas Energy Potential in each Province [37]

Province	Biogas potential (MW)
East Java	125.9
Central Java	63
NTT	56.7
North Sumatra	46.8
Aceh	42.7
South Sulawesi	28.8
West Java	40.1
Bali	32
NTB	28.2
South Sumatra	26.8
West Sumatra	10–19
West Kalimantan, and Lampung,	-
Other provinces	<10

Table 9: Major biomass energy potential as energy resources [37]

Biomass	Main region	Production (million tons/ year)	Technical energy potential (GJ/year)	Remarks
Rubber wood	Sumatra, Kalimantan,	41 (replanting)	120	Small log < 10 cm medium and big logs are
	Java			used as fire wood in brick and roof tile industry
Logging residues	Sumatra, Kalimantan	4.5	19	
Sawn timber residues	Sumatra, Kalimantan	1.3	13	Residues of the factory often used as fire wood by local communities, residue available for free
Plywood and veneer	Kalimantan, Sumatra,	1.5	16	Residues are generally used yet
production residues	Java, Irian Jaya, Maluku			
Sugar residues	Java, Sumatra,	Bagasse: 10	78	Bagasse is generally used in sugar factories
	Sulawesi, Kalimantan,	Cane tops: 4		(90%), The use of cane leaf and tops need to be
	Bali/Nusa Tenggara	Cane leaf: 9.6		investigated
Rice residues	Java, Sumatra,	Husk: 12	150	Stalk and straw are generated at the field and
	Sulawesi, Kalimantan,	Bran: 2.5		generally burnt, in some areas used for feeding
	Bali/Nusa, Tenggara	Stalk: 2		or raw material for paper industry
		Straw: 49		Husks often burnt uncontrolled
Coconut residues	Sumatra, Java, Sulawesi	Husk: 12	7	Residues are used generated decentralized and
		Bran: 2.5		usually left on the plantation

				field. Largely
		Stalk: 2 Straw: 49		used as Firewood and for production charcoal
Palm oil residues	Sumatra, new areas:	Empty fruit	67	Palm cells and fiber are common fuel source,
	Kalimantan, Sulawesi,	Bunches: 3.4		EFB are generally incinerated
	Maluku, Nusa	Fibers: 3.6		
	Tenggara, Irian Jaya	Palm shells: 1.2		

Figure 13: A typical of biogas collector [39]

The third way is to produce liquid fuels from biomass. In Indonesia, the biggest focus on the development of biodiesel oil from fruit oil (palm oil, jatropha oil) and from cooking oil waste, and bio-ethanol molasses, tapioca starch, and other kind of starch. In last few years, many research institutes and universities attempt to utilize lignocellulosic agricultural and forestry waste material as raw material to produce bioethanol. The latter are mostly at lab or pilot scales. [42]

Utilization of bio-ethanol as fuel in Indonesia is that it reduces the use of gasoline as currently a blend of bio-ethanol (5%) into 95% gasoline (Pertamina Premium, RON 90) called as *bio premium*. Pertamina, the state-owned company that produces and distributes

gasoline in Indonesia, has wisely planned to increase the amount of bioethanol in *bio premium* to 10% and 15% steps.

Indonesia was known as the largest palm oil producer in the world after overtaking Malaysia in 2006. The country produce 21.6 million tons of palm oil, rise 3.8% from 2009. One of the factors leading to higher production is the expansion of palm oil plantation area by 6.7% to 5.73 million hectare in 2010. Most of the CPO (around 60%) that is exported to other countries is still in a raw form and is considered as a low value-added industry. Owing to the abundance of raw materials in the country, it has been utilized for biodiesel as an alternative fuel. Since 2013, 10% of biodiesel oil (derived from palm oil) mixed with 90% of diesel oil, *bio solar*, has been utilized. Currently Indonesia is the largest biodiesel producer in the Asia-Pacific.

Geothermal

In Indonesia, geothermal power plant is an increasingly significant source of renewable energy as deeply discussed. As a consequence of Indonesia's location in The Ring of Fire and its volcanic geology, the country is blessed with untapped potential of geothermal energy. It is estimated, the country has 28,000 MW of geothermal potential, corresponds to 40%of world's potential geothermal resource. The country constructed about 1200 MW of power plant from seven geothermal areas in North Sulawesi, North Sumatra, and Java. In 2009, geothermal energy represented 1.22% of the country's total energy supply and 3.6% of its electric power. The country also plans to develop nine other Geothermal Working Areas (GWA) such as GWA Seuwalah Agam (Aceh), GWA Soboi (Aceh), GWA Jailolo (North Maluku), GWA Telaga Ngebel (East Java), GWA Ungaran (Central Java), GWA Gunung Tampomas (West Java), GWA Cisolok-Cisukarame (WestJava), GWA Tangkuban Perahu (West Java), and GWA Sokoria[37]. Geothermal distribution potential in Indonesia by region is given in Table 10 and geothermal power plant capacity is presented in Table 11.

Table 10: Geothermal distribution potencies by region [37]

Area	Resource (MW) Speculative	Hypothetic	Reserve (MW) Probable	Possible	Proven
Sumatra	4975	2121	5845	15	380
Java	1960	1771	3265	885	1815

Bali-Nusa Tenggara	410	359	973	–	15
Sulawesi	1000	92	982	150	78
Maluku	595	37	327	–	–
Kalimantan	45	–	–	–	–
Papua	75	–	–	–	–
Total	9060	4380	11392	1050	2288

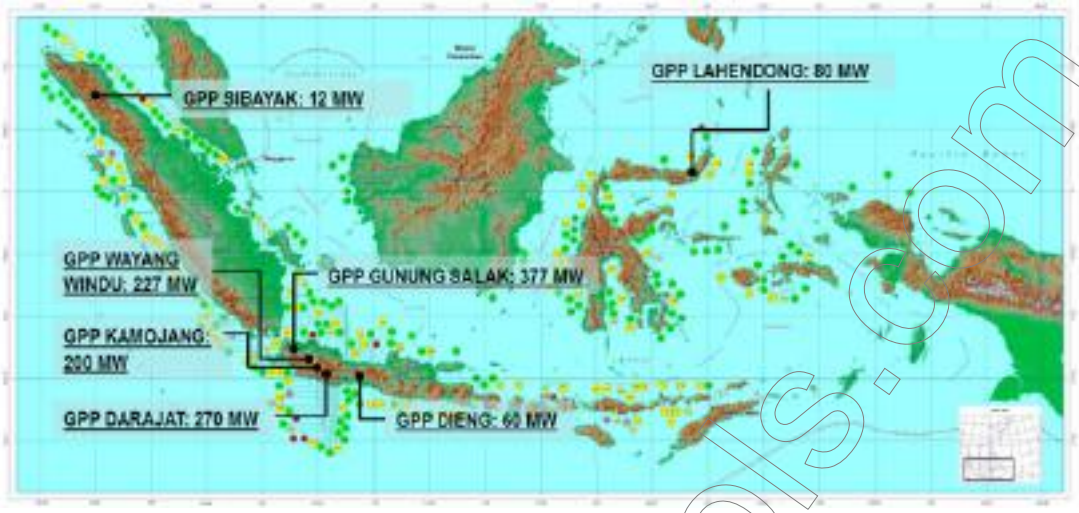
Table 11: Geothermal power plant capacity [37]

Working Area	**Location**	**Turbine capacity 1 × 30 MWe**	**Operator**	**Total capacity**
PLTP Kamojang	West Java	2 × 55 MWe 1 × 60 MWe	PLN	200 MW
PLTP Lahendong (Pertamina)	North Sulawesi	2 × 20 MWe 1 × 20 MWe	PLN	60 MW
PLTP Sibayak (Pertamina)	North Sumatra	1 × 12 MWe	Pertamina	12 MW
PLTP Salak (Chevron GS)	West Java	3 × 60 MWe 3 × 65 MWe	PLN CGS	375 MW
		1 × 55 MWe	PLN	
PLTP Darajat (Chevron GI)	West Java	1 × 90 MWe	CGI	255 MW
		1 × 110 MWe	CGI	
PLTP Wayang Windu	West Java	1 × 110MWe 1 × 117 MWe	SE	227 MW
PLTP Dieng (Geo Dipa Energi)	Central Java	1 × 60 MWe	GDE	60 MW
			Total	1189 MW

Source: M.H. Hasan et al. / Renewable and Sustainable Energy Reviews *16 (2012) 2316– 2328*

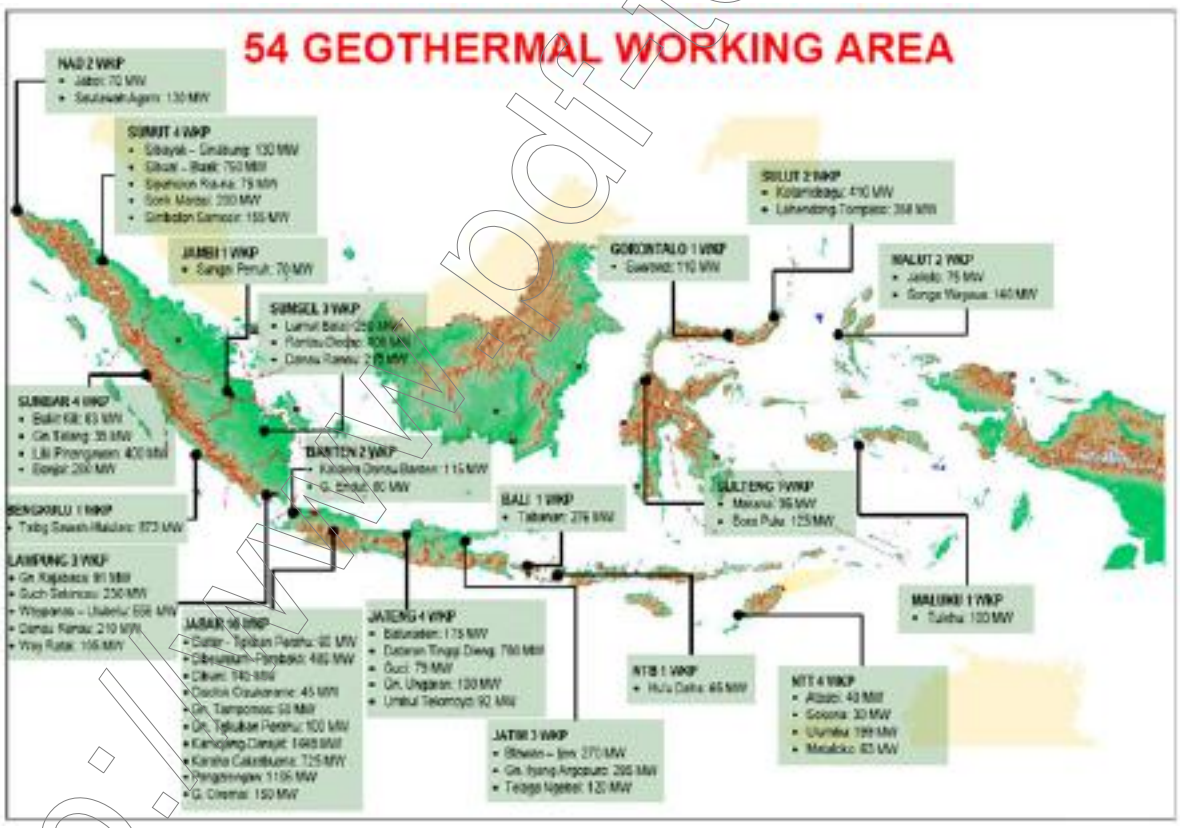
Figure 14 and Figure 15 show the existing installed geothermal power plant (GPP) and geothermal working area in Indonesia, respectively.

Figure 14: Installed Geothermal Power Plant (GPP) [43]



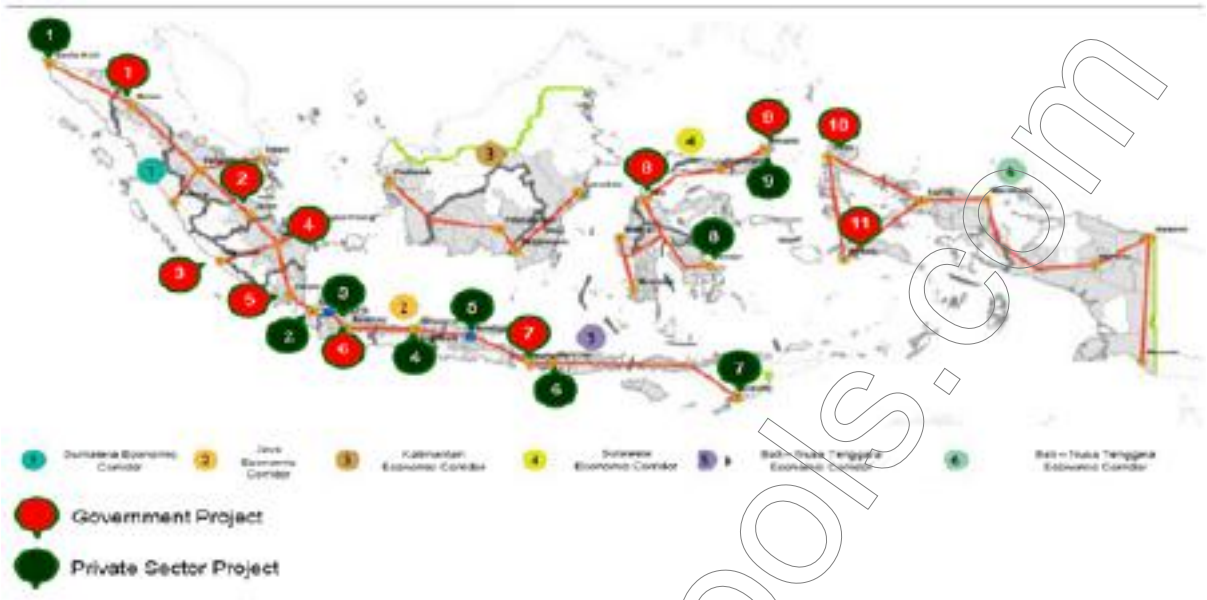
Source: Djadjang Sukarna (Energy Efficiency and Renewable Energy in Indonesia)

Figure 15: Geothermal working area in Indonesia [43]



In the Master Plan for Acceleration and Expansion of Indonesia Economic Development (MP3EI) 2011-2025) document, it was stated that development of geothermal as electricity generation plant is a priority programme. Figure 16 shows current geothermal project in Indonesia.

Figure 16: Projects in geothermal power plant [43]



Government Policies to Scale Up Geothermal Development in Indonesia

The Government intends to accelerate and speed up the development of geothermal. In order to drive development of geothermal electricity power plant, the government launched strategies and policies such as:

- Presidential Regulation No. 04/2010 on Assignment to PT. PLN to Accelerate Power Plant Development Using Renewable Energy, Coal and Gas
- MEMR Regulation No. 01/2012 as revised of Ministerial Regulation No. 15/2010 on Projects List of Power Plant Accelerated Development using Renewable Energy, Coal and Gas as well as Related Transmission
- Target for Geothermal Power Plant Development on Crash Program 10.000 MW Phase II
    - Development for Production on Existing Field : 465 MW
    - Development for not yet in production on Existing Field : 1535 MW
    - New Development Geothermal Working Area : 2925 MW
    - Total of Geothermal Development 4925 MW

In order to enhance the investment climate for both existing developers as well as new entrants to the geothermal sector in Indonesia, the government launched:

1. Law No. 27/2003 on Geothermal and Government Regulations No. 59/2007 on Geothermal Business Activities jo Government Regulations No. 70/2010 are the basis of geothermal development Indonesia
2. Presidential Regulation No. 04/2010 jo Ministerial Regulation No. 01/2012 as revised of Ministerial Regulation No. 15/2010 (2nd Stage of 10,000 MW Crash Program) in order to speed up the development of geothermal power.
3. Pricing Policy
   - Ministerial Regulation of MEMR No. 02/2011 on geothermal price structure. The MR gives certainty on electricity price from geothermal power plant:
     - Electricity price as the result of a GWA tender, is represented as purchase price by PT PLN in the Power Purchase Agreement, which is final and non-negotiable
     - Ceiling price for geothermal energy: US$ 9.7 cents/kWh
     - If the price exceeds US$ 9.7 cents/kWh, negotiations between Parties are needed.
   - Fiscal incentives for geothermal development (based on Government Regulation No. 62/2008 jo No. 1/2007; MR of MoF No. 177/PMK.011/2007; and MR of MoF No. 22/PMK.011/2011) :
     - 30% of corporate income tax;
     - 10% of added-value tax paid by the GoI;
     - Custom duties exemption for geothermal developer;
     - 25% per year depreciation for 8 years with double declining balance method; and
     - Investment tax credit 5% per year for 6 years.
   - Currently the mechanism of Feed in Tariff for each GWA is being developed by the GoI in order to make geothermal business more attractive to investors.
4. Access to Potential Geothermal Resources for Investors
   - The Government offers a Preliminary Survey Assignment to third party (investor) which provides “first right refusal”.
   - The GoI establishes new GWAs and widely open opportunities for investors to participate in the geothermal business through GWAs tendering mechanism

5. In order to accelerate the tender process of new GWAs, the policies which regulate bidding process are being revised in order to make the tender more simple, transparent and bankable.
6. Coordinating with all relevant parties to accelerate and simplify the permit process.
7. Related to Forestry Issues, currently MEMR and Ministry of Forest have signed the MoU regarding the acceleration of geothermal utilization permit within production forest, protected forest, and conservation forest.
8. The government has issued a Presidential Decree that guarantees support for investment in Geothermal Infrastructure Project (PR No. 13/2010 jo PR No.67/2005 and PR 78/2010) and Ministry of Finance Regulation No. 139/2011 (PMK No. 139/2011) which guarantee the business feasibility of PT PLN for developing electricity from renewable energy, coal, and gas through cooperation with Independent Power Producers.

Need and Demand for Energy: Electrical Power Condition in Indonesia

Electricity demand forecast conducted by PLN is as shown in Table 12.

Table 12: Electricity Demand Projection and Target Electrification Ratio [10]

Year	Demand (TWh) (a)	Electrification ratio (%) (b)
2013	189	79.2
2014	208	82.6
2015	227	85.9
2016	246	88.9
2017	266	91.9
2018	286	93.7
2019	308	95.3
2020	332	96.8
2021	358	97.4
2022	387	97.8

Notes: (a) Based on average annual growth 8.4%.

(b) Targeted electrification ratio.

Installed Capacity

At the end of December 2011, PLN and subsidiary companies owned and operated 5,269 generating units with total installed capacity of 29,268.16 MW, of which 22,513.61 MW (76.9%) was installed in Java. The total installed capacity was up 8.82% compared to December 2010.The total generating plant capacity broken down by type of power plant as follows: Steam Turbine 12,053 MW (41.2%), Combined Cycle 7,834 MW (26.8%), Diesel 2,569 MW (8.8%), Hydro 3,511 MW (12%), Gas Turbine 2,839 MW (9.7%), and Geothermal 435 MW (1.5%). [54]

Energy Production and Purchase

The PLN electricity production (included rented, and purchase from utilities outside PLN) throughout 2011 was 183,421 GWh, up 8% over the previous year (2012 – 169,786 GWh). Of the energy production, 47.4% was produced by PT PLN (Persero) Holding, and 52.6% came from Subsidiary Companies, i.e. PT Indonesia Power, PT PJB, PT PLN Batam and PT PLN Tarakan. [54]

24.3% of this energy production was produced by natural gas, 41.5% was produced by coal fired, 31.6% by fossil oil, 7.8% by hydro and 2.6% came from geothermal. The share of oil, coal and geothermal used for electricity production increased over the previous year, while natural gas was constant relatively and hydro was decreased. [55]

Of this energy production, the energy purchased from other utilities outside PLN amount 40,681.87 GWh (22.2%). This was increased by 2,605.71 GWh or 6.8% over the previous year. From the total energy purchased the greater parts were 9,415 GWh (23.1%) from PT Paiton Energy Company and 8,162 GWh (20%) from PT Jawa Power. [55]

Market and Potential Services

Energy (Electricity) Sales

PLN's total energy sales in 2011 were 157,993 GWh, up 7.3% from the previous year. [54] Among groups of customers, energy was sold to:

a) Residential was the major share, consuming 65,111.57 GWh (41%),
b) Industry 54,725.82 GWh (35%),
c) Commercial 28,307.21 GWh (18%), and

d) Others (social, government office building, and public street lighting) 9,848.06 GWh (6%).

Electricity sold to Industry, Residential, Commercial and others group of customers increased by 7%, 9%, 4% and 6% over the previous year. Total number of customers was 45,895,145 at the end of December 2011. This was up 8% from the end of December 2010.

Sales of electric power in the last five years grew on average 8.5% per year, as shown in Table 13.

Table 13: PLN's Electricity Sales (TWh) [44]

Region	2007	2008	2009	2010	2011	Average
Indonesia	120.0	127.6	133.1	145.7	158	
Growth (%)	7.6	6.4	9.4	10.7	8.5	8.5
Java – Bali	95.6	100.8	104.1	113.4	120.8	
Growth (%)	7.4	5.4	3.3	8.9	6.5	6.3
Sumatera	14.7	16.4	17.6	19.7	21.5	
Growth (%)	7.9	11.9	7.2	11.6	9.3	9.6
Kalimantan	3.9	4.2	4.7	5.1	5.7	
Growth (%)	7.6	8.2	9.6	10.3	10.1	9.2
Sulawesi	3.9	4.2	4.6	5.1	5.6	
Growth (%)	10.2	7.3	8.8	10.7	11.0	9.6
Maluku, Papua and Nusa Tenggara	1.8	2.0	2.2	2.4	2.7	
Growth (%)	12.3	8.3	9.9	10.7	13.0	10.8

From Table 13, it can be seen that the average growth in electricity sales in Java, Bali (6.3% per year) is relatively lower than the average growth in Sumatra, Kalimantan, Sulawesi, Maluku, Papua and Nusa Tenggara. Lower sales growth in Java Bali in 2007 was due to the control of sales due to limited generation capacity in that year[1]. Furthermore, in 2008 the global financial crisis began until the end of 2009, which led to the sale of electric power in 2009 growing only by 3.3%. In 2010, growth in Java led to a recovery from the effects of the global financial crisis.

[1]No additional new plant in 2006 [55]

Sales of electric power in Sumatra grow much higher, at an average of 9.6% per year. This growth is not balanced by the addition of generation capacity that only grew an average of 5.2% per year, so that in many areas of chronic power crisis by 2009 and addressed to the rental power throughout 2010. [56]

Sales of electric power in Kalimantan grew by an average 9.2% per year, while the addition of generation capacity on average only 1% per year, so that in many areas there was a power crisis and limited sales.

Sales of electricity in Sulawesi grew by an average 9.6% per year, while the addition of generation capacity on average grew only 2.7% per year. This has resulted in electricity supply crisis until 2009, especially in the South Sulawesi. In 2010, this was partially resolved by the renting of generators.

The same thing happened in the other Eastern Indonesia, the Moluccas, Papua, and West Nusa Tenggara. Growth in Sumatra, Kalimantan, Sulawesi and East Indonesia is predicted to have the potential to rise further due to high waiting lists and due to limited supply and electrification ratio will be improved.

Electricity Sale Price

The sale price of electricity is controlled by the central government through the ministerial energy and mineral resources (MEMR). The price of electricity planned by the MEMR should be approved by the parliament.

The current price of electricity for major users is still under subsidy. As a result, the government is planning to reduce the level of subsidy wisely. Since 2013, the government gradually increased the sale price of electricity for certain groups of users, namely electricity for households which have a power allocation above 1300 VA and for industries in every three months (see Table 14). For a certain group of users, especially for small houses of low income people (households with allocated power of 450 VA and 900 VA), the price is still subsidized by the government.

In 2011, PLN's average power price per kWh was Rp 714.24 /kWh. It was increased compared to 2010 of Rp 699.1/kWh. The price for 2012 and 2013 is shown in Table 14.

Table 14: The electricity tariff for 2013 in each user category

A. Household	2012 Tariff	The first –three months	II-Three months	III -Three months	IV – Three months
a) 450 VA	Rp 410/Kwh	Same	Same	Same	Same (under subsidy)
b) 900 VA	Rp 585/Kwh	Same	Same	Same	Same (under subsidy)
c) 1.300 VA	Rp 790/Kwh	Rp 833/Kwh	Rp 879/Kwh	Rp 928/Kwh	Rp 979/kwh
d) 2.200 VA	Rp 795/Kwh	Rp 843/Kwh	Rp 893/Kwh	Rp 947/Kwh	Rp 1.004/Kwh
e) 3.500-5.500 VA	Rp 890/Kwh	Rp 948/Kwh	Rp 1.009/Kwh	Rp 1.975/Kwh	Rp 1.145/Kwh
f) Above 6.600 VA	Rp1.154/Kwh	Rp 1.195/Kwh	Rp 1.310/Kwh	Rp 1.340/Kwh	Rp1.362/Kwh (no subsidies)
B. Industries					
a) 450 VA	Rp476/Kwh	Same	Same	Same	Same (under subsidy)
b) 900 VA	Rp585/Kwh	Same	Same	Same	Same (under subsidy)
c) 1.3 kVA	Rp765/Kwh	Rp803/Kwh	Rp843/Kwh	Rp886/Kwh	Rp930/Kwh
d) 3.5- 14 kVA	Rp915/Kwh	Rp961/Kwh	Rp1.009/Kwh	Rp1.059/Kwh	Rp1.112/Kwh
e) 14-200 kVA	Rp870/Kwh	Rp914/Kwh	Rp959/Kwh	Rp1.007/Kwh	Rp1.057/Kwh
f) Above 200 kVA	Rp731/Kwh	Rp757/Kwh	Rp783/Kwh	Rp823/Kwh	Rp864/Kwh

PLN Business Area and Electrification Ratio

With the growth of total number of residential customers from 39,324,520 at the end of 2010 to 45,829,980 at the end of 2011, the electrification rate reached around 71.23% at the end of 2011. The rate in 2012 was 75.9%, and the target for 2016 is 83, 4%.

Electricity Supply Permit PLN has been determined by the Minister of Energy and Mineral Resources Decree No. 634-12/20/600.3/2011 dated 30 September 2011. The decree stipulates PLN Activity Region covering the entire territory of the Republic of Indonesia, except those

specified by the Government as Regional Enterprises for other State-Owned Enterprises, Regional Owned, privately owned companies or cooperatives.

For 2012 to 2021, the entire area of business PLN established by the Decree of the Minister of Energy and Mineral Resources in which the area of PLN business is divided into three operational areas, namely Bali, East Java, and the rest of Indonesia.

The development of the national electrification ratio from year to year has increased, from 64.3% in 2007 to 75.79% in 2012. In period of 2007-2011, the increase electrification ratio in areas of Java, Bali, Sumatra, Kalimantan, Sulawesi and other islands were as shown in Table 15.

Table 15: Electrification Ratio Growth (%) [44]

Wilayah	2007	2008	2009	2010	2011
Indonesia	60,8	62,3	65	67,5	71,23
Java-Bali	66,3	68	69,8	71,4	72,32
Sumatera	56,8	60,2	60,9	67,1	69,38
Kalimantan	54,5	53,9	55,1	62,3	64,25
Sulawesi	53,6	54,1	54,4	62,7	66,63
East Part of Indonesia	30,6	30,6	31,8	35,7	44,24

Table15 shows that growth occurs unevenly in each region. The main difficulty of PLN was the limited ability of plants and scattered geographical situation.

Number of Subscribers

The actual number of subscribers during the year 2007-2011 has increased from 37.2 million to 45.6 million. In other words, there has been a growth of 1.68 million people per year. The additional largest customers was in the household sector, which is an average of 1.6 million per year, followed by the business sector with an average of 87 thousand customers per year, public sector average of 45 thousand customers per year, and new industry in average 700 customers per year. Table 16shows the development of the number of customers by sector of PLN customers in five years.

Table 16: Subscribers Numbers Growth (Thousands) [44]

Customer Type	2007	2008	2009	2010	2011
Residential	34,508.1	35,835.1	36,897	39,108.5	42,348.3
Commercial	1,585.1	1,687.3	1,770.4	1,877.6	2,019.0
Public	988.8	1,052.2	1,164.7	1,147.8	1,213.7
Industrial	46.6	46.3	47.6	48.4	50.02
Total	**37,128.6**	**38,620.9**	**39,879.7**	**42,182.4**	**45,631.6**

Energy Sources of Power Generation

Regional Operations West and East Indonesia

For electricity generation, PLN utilizes several kinds of resources for their power generating systems, which spread in western and eastern Indonesia as shown in Table 17.

Table 17: Type of Installed Generating Capacity in Operation in Indonesia (MW) in 2011 [44]

Province	PLN (MW)						Total PLN	IPP (MW)			Total IPP	TOTAL
	PLTD	PLTG	PLTGU	PLTU	PLTA/M	PLTP		PLTU	PLTA/M	PLTP		
Aceh	217.5	0.0	0.0	0.0	1.8	0.0	219.0					219.0
Sumatera Utara	37.6	203.5	203.5	0.0	490.0	140.0	871.0			183.0	183.0	1,065.0
Sumatera Barat	32.8	54.0	817.9	200.0	254.2	0.0	1.359.0					1,359.0
Riau	86.7	59.7	59.7	0.0	0.0	114.0	260.0					260.0
Kep. Riau	81.6	0.0	0.0	0.0	0.0	0.0	82.0					82.0
Bengkulu	21.6	0.0	0.0	0.0	0.0	233.9	256.0					256.0
Sumatera Selatan	30.9	175.5	175.5	40.0	285.0	0.0	531.0	230.0	227.0		457	988.0
Jambi	49.4	78.0	78.0	0.0	0.0	0.0	127.0					127.0
Bangka Belitung	91.8	0.0	0.0	0.0	0.0	0.0	92.0					92.0
Lampung	65.8	18.0	18.0	0.0	200.0	119.6	403.0					403.0

Kalimantan Barat	194.8	34.0	34.0	0.0	0.0	1.6	230.0					230.0
Kalimantan Selatan	125.8	21.0	21.0	0.0	130.0	30.0	307.0					307.0
Kalimantan Tengah	78.1	0.0	0.0	0.0	0.0	0.0	78.0		11.0		11.0	89.0
Kalimantan Timur	223.9	38.4	38.4	60.0	0.0	0.0	322.0		45.0		45.0	367.0
Sulawesi Utara	73.3	0.0	0.0	0.0	10.0	55.4	199.0			3.0	3.0	202.0
Gorontalo	31.7	0.0	0.0	0.0	0.0	1.5	33.0					33.0
Sulawesi Tengah	110.2	0.0	0.0	0.0	30.0	8.6	149.0		27.0	3.0	30.0	179.0
Sulawesi Selatan	72.7	122.72	122.7	0.0	12.5	151.1	359.0	135.0		12.0	267.0	626.0
Sulawesi Barat	6.5	0.0	0.0	0.0	0.0	0.0	6.0					6.0
Sulawesi Tenggara	89.7	0.0	0.0	0.0	0.0	1.6	91.0					91.0
Maluku	134.6	0.0	0.0	0.0	0.0	0.0	135.0					135.0
Maluku Utara	62.0	0.0	0.0	0.0	0.0	0.0	62.0					62.0
Papua	89.6	0.0	0.0	0.0	0.0	2.0	92.0					92.0
Papua Barat	53.7	0.0	0.0	0.0	2.0	0.0	56.0					56.0
NTB	144.8	0.0	0.0	0.0	0.9	0.0	146.0					146.0
NTT	137.5	0.0	0.0	0.0	1.1	0.0	139.0					139.0
TOTAL	**2,344.5**	**804,9**	**917.9**	**1,357.5**	**1,119.2**	**60.0**	**6,604.0**	**310.0**	**201.0**	**11.0**	**1,007.0**	**7,611.0**

Note: IPP (Independent power producers) has PLTG = 60, PLTGU = 365 only at Sulawesi Selatan

Energy Source of Power Station in Java-Bali Region

The energy sources to produce electricity in Java and Bali Island are a bit different compared to other parts of Indonesia. As shown in Table 18, PLTGU and PLTA is major type of plant. Details of energy sources and the capacity of the Java-Bali power system as follows.

Table 18: Type of Plant and Its Capacity of Power System Java-Bali Year 2011 [44]

No	Power Plant Type	PLN	IPP	Total MW
1	PLTA	2,392	150	2,542
2	PLTU	107	3,012	3,119
3	PLTG	2,035	300	2,335
4	PLTGU	6,916	0	6,916
5	PLTP	375	685	1,060
5	PLTD	105	0	105

Note: IPP = Independent power producers

Indonesia Demand and Supply Gap

Electricity Demand and Supply Gap

The Electricity Demand and Supply Gap is shown in Table 19.

Table 19: Electricity Power Demand and Power Gap [45]

Provinces/Region	Peak Load At Year 2013	Power Demand At Year 2013	Committed Project	Power Needed/ Power Gap, up to 2013
Java, Bali and Madura	24,319	31,615	5,743	7,395
North Sumatera and Aceh	2,051	2,666	712	1,154
West and South Sumatera, Lampung and Riau	2,805	,3646	749	1,287
Bangka Belitung	130	176	2.5	103
West Kalimantan	326	440	125	19
Central and South Kalimantan	524	733	46	258
East Kalimantan	406	548	90	392
North and Central Sulawesi, and Gorontalo	509	712	251	150
South Sulawesi, and	885	1,195	305	436

South –West Sulawesi				
Maluku & North Maluku	110	153	34	44
Papua	157	228	42	42
Nusa Tenggara Barat	172	241	36	74
Nusa Tenggara Timur	109	152	26	30
Batam Island	332	432	-	572

Total Energy

Indonesia is the fourth most populous nation with 237.5 million people and ranks 13th in the primary energy use. Like many others developing countries, development and economic growth continue to affect the growing of energy consumption. Total primary energy supply had increased steadily over the past 19 years. It was about 1270.9 Mboe in 2009 which is more than200% increase from 1990. The trends of energy demand and supply are shown in Figure 17 and Figure 18.

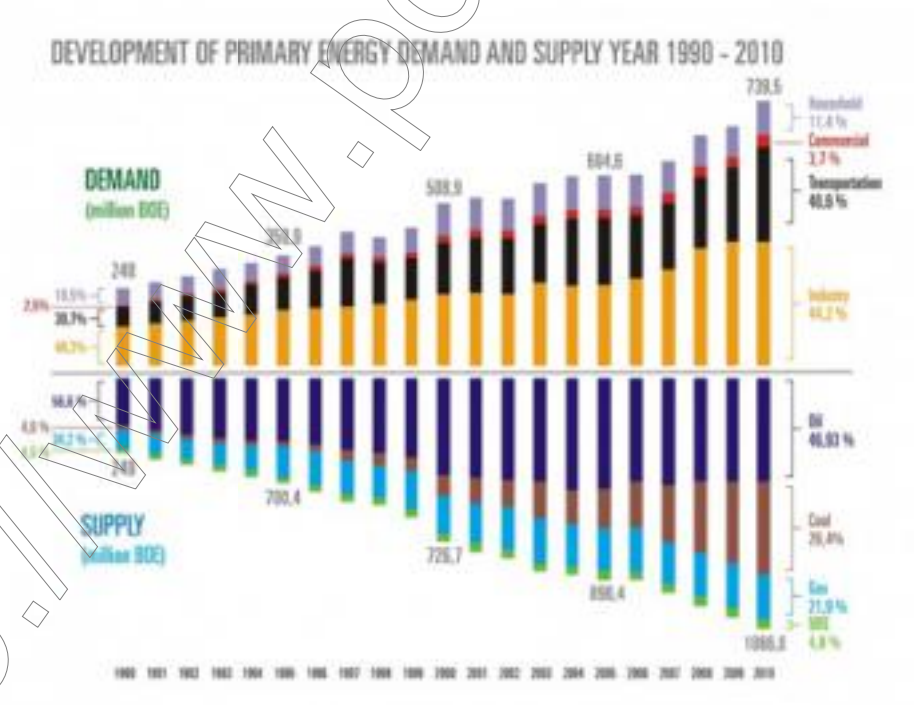


Figure 17: Trend of Energy Supply and demand in Indonesia [46]

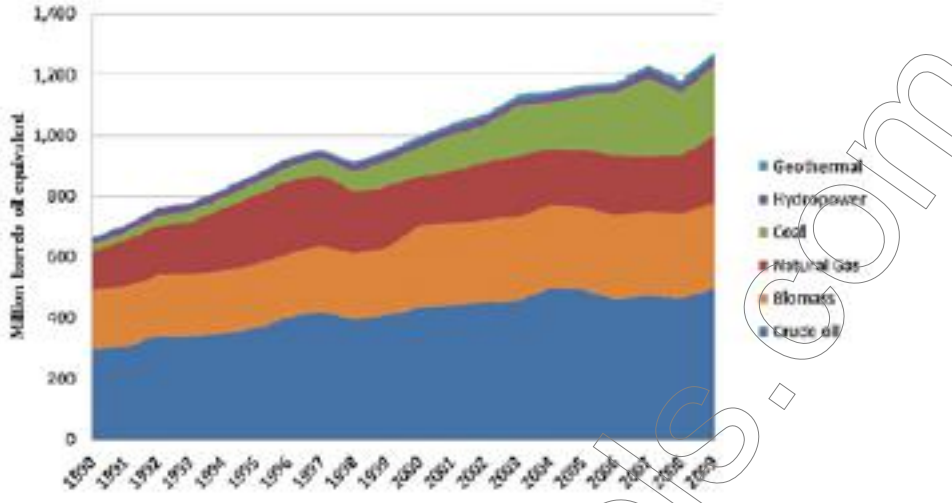


Figure 18: Trend of primary energy supply by fuel type in Indonesia [37]

Compare to the world's energy consumption, i.e.1.7 TOE per capita, Indonesia energy consumption is much lower i.e. 0.65 TOE per capita, with an average growth of primary energy about 7.7% in the past 20 years. [58] It is expected to continue to increase in the future as the demand for transportation fuel continues to increase. Apart from that, the final energy consumption increased drastically due to rapid urbanization and industrialization. Figure 19 shows the final energy consumption by sector in Indonesia from 1990 to 2009.

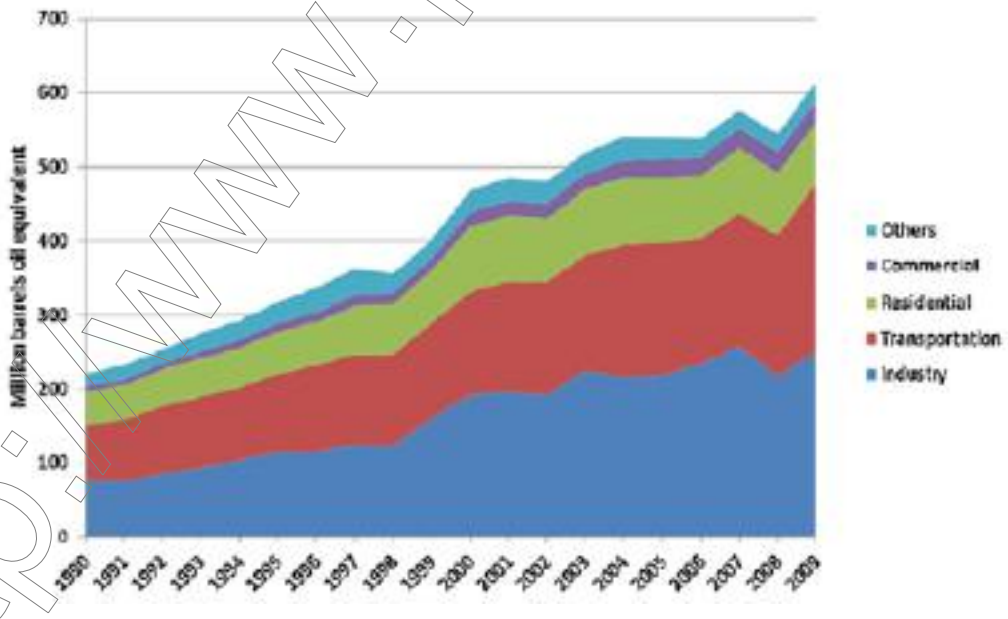


Figure 19: Trends of final energy consumption by sector in Indonesia [37]

Industrial sectors dominate energy consumption in Indonesia with its consumption is about 296 MBOE (41%) from total consumption of national energy in 2009 and followed closely by transportation sector which consumes 226.6 Mboe (37%). Residential and commercial sectors have also increased steadily. As shown in Table 6, most of the energy resources are located out of Java, but the demand of energy is concentrated in Java as can be seen from Figure 20, so energy transportation cost and facilities are important issues in Indonesia.

The energy consumption of transportation sector in the future will be an important factor for the future of energy demand supply projection and has potential to become the highest sector of energy consumption.

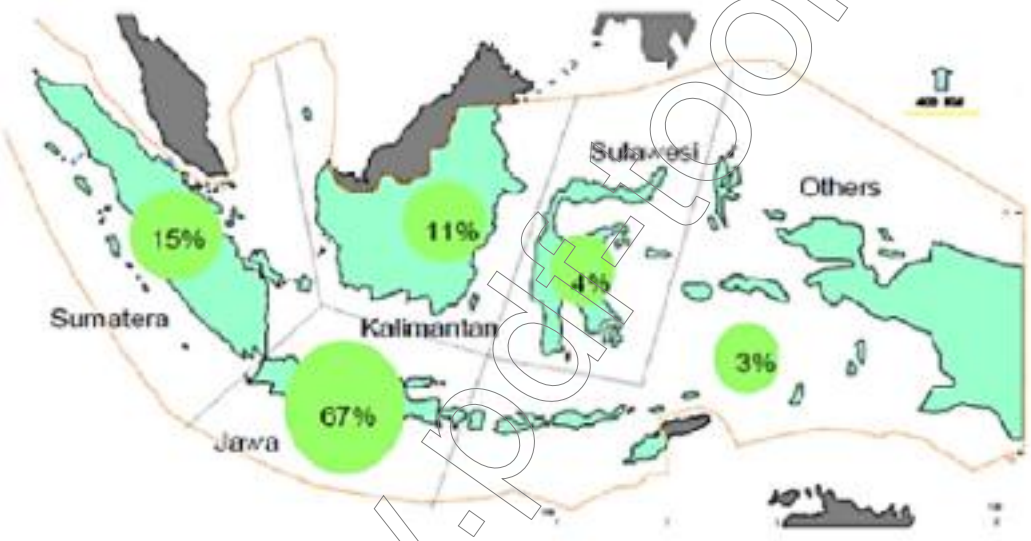


Figure 20: Distribution share of final energy consumption

In 2009, the final energy supply was dominated by non-renewable energy resources such as oil, gas and coal which contributed for 75% of the final energy consumption. This situation makes the government and the energy society worry as the fossil energy resources and supply will be diminished in the near future. On the other hand, the utilization of new and renewable energy resources has not been optimized due to its high production cost and by the subsidy policy on fossil energy. The contribution of crude oil in energy supply in Indonesia has decreased from 45% in 1990 to 39% in 2009, and increase again to 42% in 2013. On the other hand, the contribution of coal in energy supply has accelerated from 4% in1990 to 18% in 2009 which was mainly used in power generation and the cement industry. The primary energy supply share in 2009 is presented in Table 20. With increasing environmental issues,

the use of natural gas also is expected to grow at a steadily increasing pace. The contribution of the other energy resources such as hydropower, geothermal, wind, and solar were only 3% in 2009, which was very low in comparison to other countries. [52]

Table 20: Primary energy supply share in Indonesia [37]

Primary energy supply	Amount (kboe) 1990	2009	Share (%) 1990	2009
Crude oil	297,435	495,710	45	39
Biomass	193,191	279,251	29	22
Natural gas	127,604	220,930	29	18
Coal	24,390	231,351	4	18
Hydropower	21,678	28,688	3	2
Geothermal	2185	14,973	0	1

Note: Biomass was used in several ways such as on direct burning of wood at household at rural areas.

Indonesia Energy Efficiency

In 2009, total energy consumption per unit of GDP (primary energy intensity), measured at purchasing power parity is 16% higher than the world average which means that Indonesia is still not efficient enough in utilizing energy sources. It has decreased by 1.2%/year since 1990.

1) Objectives

Energy Efficiency in Indonesia has the following objectives (Sources: RIKEN (PP 70/2009, and APEC, 2012):

- Growth in energy consumption slower than GDP growth by 2025
- Industrial energy intensity reduction target of about 1% per year until 2025

The goal of the National Energy Conservation Master Plan, entitled RIKEN (PP 70/2009), is to achieve Indonesia's energy saving potential through energy efficiency and conservation (EE&C)measures, and so avoid wasteful energy use in Indonesia.

RIKEN identified the following sector energy saving potentials:

- 15-30% in industry,
- 25% in commercial buildings for electricity, and

- 10-30% in the households sector.

The National Energy Policy (2006) states that Indonesia's goal is to achieve an energy elasticity of less than 1 in 2025 (*Note: The energy elasticity is the rate of change of total primary energy supply over the rate of change of GDP*).

2) National programme

- To increase the share of renewable energies from 5% in 2005 to 10.6% by 2025 (3.8% of which would be from geothermal energy and 5% from biofuels). Geothermal plants will account for 39% of the second 10,000 MW crash programme launched in 2010, and hydroelectricity for 12%.
- Indonesia's goal under the National Energy Conservation Master Plan is to reduce energy intensity by around 1%/year, on average, until 2025. Fiscal incentives (tax deductions and soft loans) together with other instruments such as training and educational programmes as well as energy audits are used to implement that plan.

3) National Policy and Laws

- 2008 – The government implemented feed-in tariffs for electricity produced from renewables.
- 2011 – President Instruction No.13/2011 concerning Efficient Use of Energy and water Resources.
- 2012 – Ministry EMR Regulation on Efficient Use of Electricity Energy, *Kepmen* 13/2012.

4) Energy Efficiency Plan

- Book of Guidelines for Building Energy Efficiency, 2012, ESDM.
- Planning of Energy Efficiency and Elasticity 2012, BPPT.

5) Energy efficiency standard and labeling programmes

- (2011) Minister EMR no 06/2011 regarding the labeling and Sign of Energy Saving Lamp.

6) Awareness level of community to use energy efficient product

- Community: the role of *Dompet Dhuafa* in promoting RE.
- Power sector: The efficiency of the power sector tends to fluctuate and has decreased slightly since 1990. It stood at 38.5% in 2009, compared with 40% in 1990. The reduction of the share of hydroelectricity and the development of coal power plants explain the deterioration of that ratio. In 2009, thermal power plants had an efficiency rate of 35%; that rate has remained relatively stable since 1990. The limited development of more efficient technologies, such as gas combined cycles and cogeneration, did not permit an increase in the ratio for thermal power generation. [59]

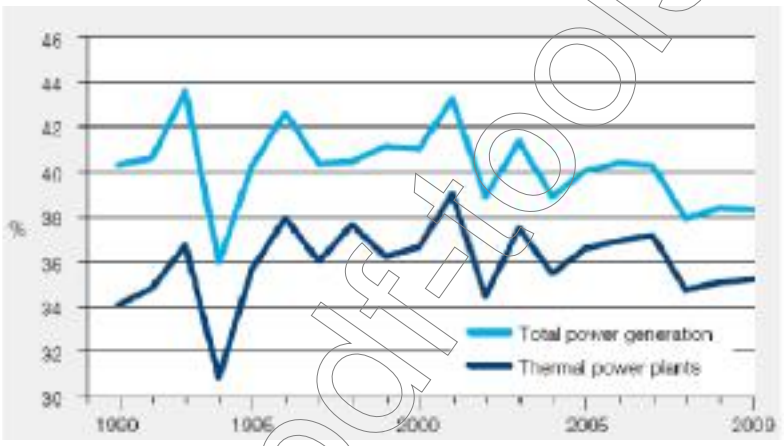


Figure 21: Efficiency of power generation and thermal power plants [59]

B. Technology Enabling Environment and Ecosystem

Government support for infrastructure

Separate to the initiatives around electricity, the Government has recently sought to encourage the development of infrastructure more generally. President Yudhoyono for instance has made infrastructure development a top Presidential priority by including it as a key element in Indonesia's medium term (2010-2014) development plan (or "RJPM") as prepared by the National Development Planning Board (or Bappenas).

The Government's working plan ("RKP") for 2010, as part of the RJPM, outlines 45 key infrastructure programmes including:

a. The development of facilities needed for energy processing (e.g. oil refineries, power generation), energy transmission and distribution (e.g. pipelines for gas and oil fuels) and energy storage (e.g. depots);
b. The utilization of alternative energy including renewables (e.g. geothermal, solar, water, wind and biomass); and
c. The completion of implementing regulations to Law No. 30 of 2007 on energy.

The Government has also sought to clarify "public private partnership" regulations with the passing of Presidential decree No.13/2010.

Attractive opportunities for IPPs

Overall Indonesia's economic fundamentals and its emerging regulatory framework are coming together to allow for renewed optimism within the electricity investment sector. The targeted GDP growth rates of 6.2% p.a. and an electrification ratio of 91% by 2019[i] should see electricity demand growing by 7% to 9% p.a. (and even 9.2% p.a. through to 2019) and take installed capacity to 81.6 GW by 2019. Accounting for retired capacity, this should equate to 54GW of new generating capacity or about 5GW per year[ii].

Massive capital investment will be required if these targets are to be met with the funding needs for the period 2010 to 2019 estimated at around US$66 billion or US$6.6 billion p.a. For the next five years the investment required is estimated at US$31.4 billion for 22 GW of

generating capacity, US$7.3 billion for some 17,000 km of transmission networks and US$5.3 billion for distribution, totaling around US$44 billion.

IPPs and other private investment in associated areas will be needed to help meet these capital demands. Whilst IPPs currently account for only 14% of generating capacity, the role of private investment in new capacity will surely grow. The second fast track programme alone will require an estimated US$16.4 billion in investment with approximately US$11.1 billion of this earmarked for the private sector. Overall, investors are potentially at the dawn of the most exciting electricity investment opportunities for at least a generation.

Legal and regulatory framework

The electricity sector is regulated by the Ministry of Energy and Mineral Resources ("MEMR") and its sub-agencies. These include the Directorate General of Electricity and Energy Utilization and the (newly created) Directorate General of Renewable Energy and Energy Conservation.

The current regulatory framework is provided by Electricity Law No.30/2009 (the "2009 Electricity Law").

The MEMR is responsible for developing the electricity master plan ("RUKN") which sets out, amongst other things, a ten year estimate of power demand and supply, the investment and funding policy, and the approach to the utilization of new and renewable energy resources. The RUKN also provides guidance to the central and regional Governments, and to potential investors, on energy contribution levels for renewable sources (to increase from 5% to 17% of Indonesia's total energy consumption by 2025). The RUKN is reviewed annually.

The Electrification Development Program 2013-2022 ("RUPTL") is based on the RUKN and constitutes an official ten year power development plan. The RUPTL is prepared by PLN, approved by the MEMR, and mandated by the current law and regulations. The RUPTL contains demand forecasts, future expansion plans, kWh production, and fuel requirements

and indicates which projects will be developed by PLN and IPP investors. The RUPTL is also reviewed annually.

The 2009 Electricity Law provides that regional Governments should also prepare a Regional General Plan of Electricity ("RUKD") based on the RUKN.

The 2009 Electricity Law

The 2009 Electricity Law divides the electricity business into two broad categories as follows:

a) Those activities involved in supplying electrical power such as:
   i. Electrical power generation (both for self-use and for sale to an off- grid captive consumer);
   ii. Electrical power transmission;
   iii. Electrical power distribution; and
   iv. The sale of electrical power.

b) Those activities involved in electrical power support such as:
   i. Consulting activities;
   ii. The construction and installation of electrical power equipment;
   iii. The operations and maintenance of electrical power equipment;
   iv. The development of electrical supporting equipment technology.

Generation

The power generation sector is dominated by PLN which controls around 86% (or 26.609 GW) of generation assets in Indonesia including through subsidiaries such as PT Indonesia Power, PT Pembangkit Jawa Bali, and PT PLN Batam.

Private sector partnership is allowed through Independent Power Producer ("IPP") arrangements (which continued to be sanctioned by the 2009 Electricity Law). IPP appointment is usually through competitive bidding except in certain circumstances (e.g. for renewable energy, mine-mouth, crisis, marginal gas, or expansion projects) in which case appointment can be direct. The structure involves the IPP signing an Energy Sales Agreements or Power Purchase Agreement with PLN to produce electric power and supply PLN electricity at an agreed price for an agreed period. Based on regulation of The Minister

of Energy And Mineral Resources of The Republic of Indonesia No. 4 Year 2012 and the Government Regulation No. 14 Year 2012, the bidding price could be higher than the feed-in tariff.

Of Indonesia's current installed capacity of 30.941GW, IPPs account for 4.269GW, or approx. 14%. Electricity generation licenses or "IUPTLs" can be offered to private entities (with up to 95% foreign shareholding) with PLN acting as the single buyer (see below).

Transmission, Distribution and Retailing

The 2009 Electricity Law provides PLN with priority rights to conduct these businesses throughout Indonesia. PLN, as the sole owner of transmission and distribution assets, also remains the only business entity in charge of transmitting and distributing electric power. Further, whilst the 2009 Electricity Law allows private participation in the supply of electricity for public use (which includes transmission and distribution), current private sector participation is still limited to the power generation sector.

Operations and Maintenance ("O&M")

O&M services for conventional electrical power can take the form of the following activities:

a) Consulting services for the installation of electricity power supply;
b) Construction and placement of electrical power supply installations;
c) Inspection and testing of electrical power installations;
d) Operation of electrical power installations; and
e) Maintenance of electrical power installations.

The provision of O&M services for geothermal activities is separately licensed under MoEMR Regulation No.5/2010.

Regulatory History of Electricity

History of Reforms

Early electricity arrangements in Indonesia were probably carried out pursuant to the 1890 Dutch Ordinance entitled the "Installation and Utilization of the Conductors for Electrical Lighting and Transferring Power via Electricity in Indonesia".

This ordinance was annulled in 1985 with the introduction of Electricity Law No.15/1985 (the "1985 Electricity Law"). The 1985 Electricity Law essentially commenced the modern era of electricity regulation in Indonesia.

The 1985 Electricity Law provided for a centralized system with a state-owned electricity company, being PLN, holding exclusive powers over the transmission, distribution and sale of electricity. Private companies were however allowed to generate electricity.

In 2002, the Government enacted Electricity Law No.20/2002 (the "2002 Electricity Law") which was aimed at liberalizing the electricity sector by allowing private investors to produce and sell power directly to customers in those areas designated as "competitive" areas.

However, in December 2004, Indonesia's Constitutional Court annulled the 2002 Electricity Law and re-enacted the 1985 Electricity Law. This was on the basis that the 2002 Electricity Law contravened Article 33 of the Indonesian Constitution. According to the Constitutional Court, electricity is a strategic commodity and its generation and distribution should remain under the exclusive control of the Government.

The 1985 Electricity Law was implemented through Government Regulation ("GR") No.10/1989 on the "provision and utilization of electricity" as amended by GR No.3/2005 and GR No.26/2006. Based on these regulations, IPPs were permitted to develop and supply power to "Electric Power Business License" holders ("PKUK" and "PIUKs") which was essentially limited to PLN. This was also with the approval of the MoEMR, Governors and heads of the regions/districts. Electricity development by IPPs was also required to be in-line with the prevailing RUPTL and RUKN [66].

Other important legislation includes:

a) Presidential decree No.67/2005 (since amended by Presidential decree No.13/2010) and MoF Regulation No.38/2006 which set rules and procedures for "public/private participation" arrangements;

b) Presidential decree No.42/2005 which outlined the inter-ministerial Committee for the Acceleration Program (KKPPI) responsible for coordinating policy related to the private provision of infrastructure;
c) MoEMR Reg No.44/2006 which allowed direct tender for the first fast track programmes (of coal-fired plants); Presidential decree No.71/2006 which launched the first fast track programme; Presidential decree No.4/2010 which launched the second fast track programme; and
d) MoEMR Reg No. 1/2006 (and its revisions via MoEMR Reg.No. 4/2007) on "electric power purchasing or rental transmission lines" which covered the appointment of IPPs.

Differences between the 2009 and 1985 Laws

As indicated, the 2009 Electricity Law replaced the 1985 Electricity Law (with effect from 23 September 2009). However, unlike the (intervening) 2002 Electricity Law, the 2009 Electricity Law does not eliminate the main role of PLN in the electricity supply business (as PLN is given "priority" rights to conduct this business throughout Indonesia). The 2009 Electricity Law also provides a greater role to the regional authorities in terms of licensing and in determining electricity tariffs.

For instance, under the 1985 Electricity Law, the electricity supply business in Indonesia was conducted by PLN as the holder of the Electricity Business Power license (or "PKUK"). Under the 2009 Electricity Law, electricity supply is still controlled by the State, but is conducted by the central and regional Governments through PLN and regionally owned entities.

To highlight the State's control in the sector, the 2009 Electricity Law also provides a first right of refusal to PLN to conduct an electricity supply business in an area before the central or regional government can offer the supply opportunity to regionally owned entities, private entities or cooperatives.

The 2009 Electricity Law also offers an improvement in the regulatory framework by providing a greater role for regional governments and other entities to participate in this

business. However, many of the finer points of the 2009 Electricity Law are to be stipulated in the 13 implementing regulations which, at the time of writing, were yet to issue (initially due within 1 year the effective date i.e. 23 September 2010).Some key differences between the 1985 and 2009 Laws are as follows (*source: Electricity in Indonesia – Investment and Taxation Guide, PWC, 2011*):

Table 21: Differences between the 1985 and 2009 Laws

Key Provisions	The 2009 Law	1985 Law
Electricity Supply Licensing	- PLN is merely the holder of an Electricity Generation Licence for Public Use ("IUPTL") - PLN has first right of refusal for unserviced areas which if not accepted can be assumed by the private sector - If the private sector does not take up a business opportunity, the Central Government must instruct PLN to supply the area	- PLN is the sole State agency involved in supplying electricity to the public (i.e. the sole holder of an Electricity Business Power Licence "IUKU") - If private developers wish to develop, they must demonstrate that PLN does not reliably service the area after which the Minister can grant the "business area" to an IPP
Role of regional autonomy	- The regional authorities are to prepare a Regional Electricity Plan or RUKD, based on the National Electricity Plan or RUKN - The Regional Electricity Development Plan must comply with the Regional Electricity Plan - The regional authorities can provide licences for power projects which are intra-regency and do not involve the sale of electricity to holders of a Central Government issued licence - The Central Government provides licences to PLN and to IPPs selling to PLN	- The National Electricity Plan is set by the Central Government - Electricity development must comply with the National Electricity Plan - Regional authorities can provide licences for power projects which are intra regency and non-Grid connected. - The Central Government regulates PLN and provides licences to Grid-connected IPPs.
Tariff	- The Central Government approves tariffs for Central Government issued licence holders (e.g. PLN and IPPs selling to PLN) - The regional authorities approve tariffs for IPPs selling to non-PLN utilities - Tariff variations, according to different business areas, are permitted - The authorities must consider the interests of the relevant business as well as the public - Tariffs must be approved by the Indonesian/ Regional House of Representatives	- The Central Government approves all tariffs to PLN - The regional authorities approve all tariffs of IPPs selling to non-PLN utilities - Tariffs to be uniform throughout Indonesia
Cross-border sale and purchase	Possible by the holder of an IUPTL from the Central Government. Purchase conditions include that there be a shortage of electricity supply. Sale conditions include that domestic electricity needs have been fulfilled.	Not regulated
Direct sale of electricity to public	No link between electricity licensing and whether the electricity facilities are connected to the National Transmission Network. The 2009 Law suggests that the holders of an IUPTL (which hold sale/ integrated licences) can sell directly to the public, when the projects are not connected to the National Transmission Network or are not inter-province projects.	For inter - province and National Transmission Network connected projects, the holders of electricity generation licences can generate power, but must sell the electricity first to PLN. Holders of an inter-province distribution licence (that is connected to the National Transmission Network) can sell electricity directly to the public.

Source: Law No.30/ 2009 and Law No.15/ 1985

Other Relevant Laws

The Geothermal Law

Geothermal energy utilization is conducted under a regime regulated by the following:

a) Presidential Decree No.76/2000;
b) Geothermal Law No.27/2003 (the "2003 Geothermal Law");
c) Government Regulation No.59/2007;
d) MEMR Regulation No.11/2009 (along with the 2009 Electricity Law for power generation activities); and
e) MEMR Regulation No.32/2009 which sets purchasing price arrangements for PLN.

The 2003 Geothermal Law only covers geothermal activities (i.e. the production of steam) while power generation actually falls under the 2009 Electricity Law. In other words, the new arrangements differentiate between geothermal activities and the actual power generation. This means there are two different regulatory and licensing requirements.

An integrated geothermal business therefore now requires an "IUP" (geothermal business license) and an IUPTL (electricity supply business license). Notwithstanding the requirement for two licenses, the geothermal and power operations can be carried out through a single Indonesian company.

This regime takes over from the (integrated) geothermal and power arrangements covered under the former Joint Operation Contract arrangements.

The Investment Law

Investment Law No.25/2007 (the "2007 Investment Law") is aimed at providing a one-stop investment framework for investors. This includes key investor guarantees such as the right to freely repatriate foreign currency, and key incentives such as exemptions from Import Duties and VAT otherwise due on the import of capital goods, machines or equipment for production needs.

Obligations for power plant investors under the 2007 Investment Law include:

a) Prioritizing the use of Indonesian manpower;
b) Ensuring a safe and healthy working environment;

c) Implementing a corporate social responsibility programme; and
d) Certain environmental conservation obligations.

Power plants must also fulfill a "local component level' which includes local services and goods under MEMR Regulation No. 48/2010.

The Capital Investment Coordination Board ("BKPM") is given the power to coordinate implementation of investment policy including that pursuant to the 2007 Investment Law.
Foreign investors wishing to participate in the electricity sector must first obtain a foreign investment license from BKPM pursuant to the 2007 Investment Law. To do this an Indonesian incorporated entity must be established and licensed as a PT PMA company (under the Investment Law No. 25/2007 and Company Law No.40/2007 - see below). A PT PMA can be licensed for both the geothermal and electricity sectors.

Once the PT PMA Company is established, the company must apply through the MoEMR for an IUPTL license and other licenses such as the permanent business license and principal license for investment facility through BKPM according to the prevailing regulations.

The Negative List

The "negative list", as set out in Presidential decree No.77/2007, 11/2007, and 36/2010 prescribe a set of business activities which are closed for investment or which have limitations on foreign participation.

The negative list generally limits foreign ownership to 95% for investments in the production, transmission and distribution of electricity (including for O&M of electrical power/geothermal installations). In recent changes, Presidential Regulation No.36/2010 extended foreign ownership as follows:

a) Small scale power plants (1-10MW) are now open to partnerships with small-medium businesses and cooperatives ("UMKK"); and
b) Geothermal support services such as O&M services may have a maximum foreign ownership of 90% and for drilling services a maximum of 95%.

As a result, foreign investors are generally limited to a 95% equity interest in companies producing electricity (conventional or geothermal based) and to 90% of an entity performing operations and maintenance service for geothermal energy.

Environment Issues

In October 2009, the Indonesian Parliament passed Environment Law No.32/2009 ("the 2009 Environment Law"). The 2009 Environment Law requires investors to comply with specific environmental practices and secure environmental permits before they begin operations. An environmental impact planning document ("AMDAL") is required for projects greater than 10MW capacity and an environmental management effort document ("UKL" or "UPL") is required for those less than 10MW. These documents are a prerequisite to obtaining a business license. Investors are also exposed to special environmental taxes.

Sanctions for non-compliance can include fines, revocation of operating permits and/or imprisonment. [source: Electricity in Indonesia – Investment and Taxation Guide, PWC, 2011].

The 2007 Company Law also imposes environmental obligations on companies undertaking business activities in the natural resources sector. The cost of these obligations is to be borne by the company. As this publication went to print; a Government Regulation providing details of these environmental responsibilities had not been issued. Whilst the obligations would seem to apply to geothermal and hydropower producers, they may ironically exclude IPPs using nonrenewable feed stocks.

Fast Track Programme II Expanded

On 6 August 2013, the Minister of Energy and Mineral Resources Regulation No. 21/2013 was issued providing an expanded list of power plants to be built by PLN and Independent Power Producers (IPPs) under the Fast Track Programme II (FTP II).

Rationale

The increasing demand for electricity needs significant additional investment. By allocating new projects to FTP II the Government hopes to attract more investors. FTP II projects come with a Government Guarantee through a Business Viability Guarantee Letter (BVGL). Procedure for providing BVGL regulated by Ministry of Finance Regulation No.139/PMK.011/2011. This regulation is generally applied and not related to the provision of subsidies. The guarantee covers PLN's payment obligations for the purchase of power during the operation period of a project only.

From 10,000 MW to 18,000 MW

The new target for FTP II is 17,918 MW up from 10,047 MW. PLN is tasked to build 5, 749 MW (up from 3,757 MW) while projects comprising a total of 12,169 MW are earmarked for IPPs (almost double the previous total of 6,290 MW).

Most of the new projects will be coal-fired and in Java with 2,000 MW to be built by PLN and 6,320 MW to be built by IPPs. The overall number of power plants to be built has been reduced from 97 to 76 with many small coal-fired and coal gasification projects in Kalimantan, Sulawesi, NTT and NTB being dropped from the list.

The number and total capacity of power plants using renewable energy (geothermal and hydropower) changes little except for a new 110 MW hydro power plant in West Java and a small 10 MW geothermal power plant in NTT. The following Table summarizes some of the existing policies and regulations related to the promotion of renewable energy in Indonesia

Table 22: Summary of some of the existing policies and regulations related to the promotion of renewable energy in Indonesia

No	Regulation	
1	Regulation of the Minister of Energy and Mineral Resources No. 002 Year 2006 on Concession Power Medium Scale Renewable Energy	Clause 2 (1): PKUK or PIUKU shall meet electricity demand in their respective business areas
		Clause 2 (2): In meeting the demand for electricity in the area of business as referred to in subsection (1), PKUK or

		PIUKU must purchase electricity from renewable energy power plant
		Clause 2 (3): Renewable energy power plant referred to in subsection (2) include: a. Renewable energy power plant with an installed capacity of over 1 (one) MW to 10 (ten) MW, or b. More power (excess power) which is above 1 (one) MW up to ten (10) MW of renewable energy power plant
		Clause 6 (1): PKUK or PIUKU in the process of purchasing the labor power of the offer cooperative or other entity attention to the rules of healthy and transparent business
2	Regulation of the Minister of Energy and Mineral Resources No. 10 Year 2012 About Implementing Physical Activity Energy Utilization of New and Renewable Energy	Clause 2: Physical activity utilization of new energy and renewable energy implemented in order to support sustainable national development to enhance national energy security
		Clause 3 (1): Physical activity energy utilization of new and renewable energy, as defined in Clause 2 of the form of development, procurement and / or installation of: (a) installation of electricity supply; (b) biofuels supply installation and / or (c) productive tools to support the business activities resulting from the utilization of new energy and renewable energy.

		Clause 3 (2): Physical activity referred to in subsection (1) aims to: (a) encourage the development of an energy independent country programme; (b) encourage the provision of energy from new energy sources and renewable energy; (c) promote growth and equitable development energy infrastructure in remote areas, lagging, borders, small islands and outermost, post-disaster, and / or post-conflict, and (d) pilot exploitation of new energy and renewable energy.
		Clause 4 (3): New Energy Management Program, Renewable and Energy Conservation as referred to in subsection (2) in place to support the accelerated development of new energy and renewable energy
		Clause 5: Directorate General shall: (a) made accountable for the implementation of physical activity utilization new energy and renewable energy; (b) monitoring and evaluation of the implementation of physical activity energy utilization of new and renewable energy; (c) reported the achievement of physical activity goals and objectives of the utilization of new energy and renewable energy to the Minister; (d) of monitoring, evaluation and outcomes management guidance and supervision of physical activity energy utilization of new and renewable energy; and

		(e) process and proposed outcomes of physical activity energy utilization of new and renewable energy as referred to in Clause 3 subsection (1) as a grant Ministry of Energy and Mineral Resources to Local Government.
		Clause 13 (1): Governor or regent / mayor in accordance with the authority set managers use the results of the physical implementation of new energy and renewable energy was delivered as referred to in Clause 12 subsection (2).
		Clause 13 (2): Business results of the implementation of physical activity referred to in subsection (1) include: (a) people directly or (b) management institutions to form joint venture group, cooperatives, associations, non-governmental organizations, or groups of peoples.
3	Government Regulation No. 70 Year 2009 on Energy Conservation	Clause 4: The government referred to in Clause 2 nationally responsible for: (a) formulate and determine policy, strategy, and energy conservation programmes; (b) develop qualified human resources in the field of energy conservation; (c) conduct a thorough and comprehensive socialization for the use of technology to implement energy conservation; (d) assess, develop and establish policies and allocate funds for the implementation of energy conservation programmes; (e) provide facilities and/or incentives for the

		implementation of energy conservation programmes; (f) undertake energy conservation technical assistance to employers, users of energy sources, dang energy users; (g) implement energy conservation programmes and activities that have been set, and (h) to guide and supervise the implementation of energy conservation programmes.
		Clause 18: Government and / or local government to provide incentives to: (a) energy users that use energy greater than or equal to 6,000 (six thousand) tons of oil equivalent per year, as referred to in Clause 12 subsection (2), and (b) energy-saving equipment manufacturers in the country, successfully implement energy conservation in a certain period.
4	Presidential Regulation No. 4 of 2010 On Assignment To the State Electricity Company (Limited) for Conducting Accelerated Development of Power Plant That Uses Renewable Energy, Coal and Gas.	Clause 1: Implementation construction acceleration of power plants that use renewable energy, coal, and gas through the assignment of the Government to the State Electricity Company (Limited), hereinafter referred to PT PLN (Limited) and through cooperation between PT PLN (Persero) and private power developer with power purchase scheme.
		Clause 2: Power plants that use renewable energy, coal and gas as referred to Clause 1 shall use environmentally friendly technology in accordance with the provisions of the legislation.

		Clause 3 (1): Government commissioned PT PLN (Persero) to organize the procurement of power plants that use renewable energy, coal, and gas.
		Clause 5: Funding the construction of the power plant and related transmission as referred to in Article 3 are from the State Budget (Budget), internal budget PT PLN (Persero), and other legitimate sources of funds in accordance with the provisions of the legislation.
5	Government Regulation No. 3 year 2005 on the Amendment of Government Regulation No. 10 year 1989 On the Provision and Utilization of Electricity	Clause 2 (4): To ensure the availability of primary energy to supply electricity for public use, priority use of local energy sources with liabilities prioritize the utilization of renewable energy sources
		Clause 6 (1): Does not damage the interests of the state, Electricity Business Permit granted to cooperatives and other business entities to conduct electricity supply business in the public interest or the electricity supply business for its own sake.
		Clause 6 (2): Other entity referred in subsection (1) to conduct the electricity supply business for public interest include regional-owned enterprises, private companies, government organizations and individuals.
		Clause 6 (3): Other entity referred to in subsection (1) to conduct the electricity supply business for its own cover-owned enterprise state-owned enterprises, private, non-governmental organizations, individuals or other state agencies.

6	Presidential Regulation No. 5 Year 2006 on National Energy Policy	Clause 2 (2): National Energy Policy Objectives are: (a) Achieving energy elasticity less than 1 (one) in 2025. (b) The realization of energy (primary) optimal mix in 2025, namely the role of each type of energy to the national energy consumption: 1) Petroleum to less than 20% (twenty percent); 2) Natural gas to more than 30% (thirty percent); 3) Coal to more than 33% (thirty three percent); 4) Biofuels (biofuels) to more than 5% (five percent); 5) Geothermal to more than 5% (five percent); 6) New energy and other renewable energy, especially biomass, nuclear, hydroelectric, solar, and wind power to more than 5% (five percent); and 7) Coal is liquefied (liquefied coal) to more than 2% (two percent)
		Clause 3 (3): Supporting policies referred to in subsection (1) include: (a) development of energy infrastructure including increased consumer access to energy; (b) partnership between government and the business community; (c) community empowerment; (d) development of research and development and education and training
		Clause 6 (1): Minister of Energy and Mineral Resources set certain alternative energy sources
		Clause 6 (2): Government can provide facilities and incentives to the energy conservation and development of

		alternative energy sources specified as mentioned in subsection (1)
		Clause 6 (3): Further provisions concerning the ease of administration and incentives referred to in subsection (2) is regulated by the relevant Minister in accordance with the authority of each
7	Presidential Instruction No. 1 Year 2006 concerning the Provision and Use of Biofuels (Biofuel) As material Other Fuels	Presidential Instruction To the Coordinating Minister for the Economy: coordinate the preparation of the supply and use of biofuels as an alternative fuel
		Presidential Instruction To the Minister of Energy and Mineral Resources: (a) establish and implement a policy provision and use of biofuels (biofuels) as an alternative fuel, which contain guarantees the availability of biofuels (biofuel) and guarantee the smooth and equitable distribution; (b) establish incentives and tariff policy package for the development of the supply and use of biofuels (biofuels) as an alternative fuel in coordination with relevant agencies; (c) set the standard and quality of biofuels (biofuels) as alternative fuel; (d) establish systems and procedures that are simple to test the quality of biofuels (biofuels) as an alternative fuel; (e) set of simple trading system from biofuels (biofuels) as an alternative fuel to the trade system of fuel oil; raw biofuel; (f) the dissemination of the use of biofuels (biofuels) as an alternative fuel; and

		(g) encourage companies engaged in the energy and mineral resources to utilize biofuels (biofuels) as an alternative fuel.
		Presidential Instruction To the Minister of Agriculture: (a) encourage the provision of feedstock crops for biofuels (biofuels), including seeds and seeds; (b) conduct outreach development (c) facilitate the provision of seeds and seedlings of raw materials for biofuels (biofuels); (d) integrate the development and post-harvest activities feedstock crops biofuels (biofuels).
		Presidential Instruction To the Minister of Forestry: authorize the use of forest land that is not productive for the development of feedstock for biofuels (biofuels) in accordance with the provisions of legislation.
		Presidential Instruction To the Minister of Industry: promote the development of domestic production of raw materials processing equipment for biofuels (biofuels) and encourage entrepreneurs in the developing biofuels industry.
		Presidential Instruction To the Minister of Trade: (a) encourage the supply and distribution of raw materials for biofuels (biofuels); (b) Ensure smooth supply and distribution components of the processing equipment and the use of biofuels.
		Presidential Instruction To the Minister of Transportation encourage increased use of biofuels (biofuels) as an alternative fuel in the transportation

		sector.
		Presidential Instruction To the Minister of Research and Technology: developing technology, applications suggest the use of technology and the provision of processing, distribution of raw materials and utilization of biofuels (biofuels) as an alternative fuel.
		Presidential Instruction To the Minister of Cooperatives and Small and Medium Enterprises:assist and encourage cooperatives and small and medium enterprises to participate in the development of plantfeedstock for biofuels (biofuels) as well as processing and commercial biofuels (biofuels) as an alternative fuel.
		Presidential Instruction To the Minister of State Owned Enterprises (SOEs): (a) encouraging state-owned agriculture, plantations and forestry to develop feedstock crops for biofuels (biofuels); (b) encouraging state-owned industry to develop biofuel processing industry (biofuels); (c) encourage BUM.N engineering to develop materials processing technology biofuels (biofuels); (d) encourage SOEs to harness the energy field of biofuels (biofuels) as alternative fuel.
		President instruction to the interior ministry: coordinate and facilitate local government and staff as well as the preparation of the community in the provision of land in their respective areas, especially critical lands for the cultivation of raw materials for biofuels (biofuels)

		Presidential Instruction To the Minister of Finance: reviewing laws and regulations in the financial sector in the context of the provision of incentives and fiscal relief for the supply of raw materials and the use of biofuels (biofuels) as an alternative fuel.
		Presidential Instruction To the Minister of the Environment: do socialization and communication to the public regarding the use of biofuels (biofuels) as alternative fuel is environmentally friendly.
		Presidential Instruction To Governors: (a) implement policies to increase the use of biofuels (biofuel as alternative fuel in the region in accordance with the authority; (b) the dissemination of the use of biofuels (biofuel) as an alternative fuel in the region; facilitate the provision of Lahari in each region according to its authority especially critical land for cultivation of biofuel feedstock (biofuel); (c) report the instruction execution to the Minister of the Interior.
		Presidential Instruction To the Regent/Mayor: (a) implement policies to increase the use of biofuels (biofuels) as an alternative fuel in the region in accordance with the authority; (b) perform socialization utilization of biofuels (biofuel) as alternative fuel in the region; (c) facilitate the provision of land in each region according to its authority especially critical land for cultivation of raw materials for biofuels (biofuels); (d) report on the implementation of the instruction to the Governor.

8	Regulation of the Minister of Industry Decree No. 04/M-IND/PER/1/2009 About Guidelines for Use of Domestic Production of Electricity Infrastructure	Clause 5: Any development of electricity infrastructure by state and or PIUKU executed by electric power construction services business, including Engineering, Procurement & Construction (EPC).
		Clause 7 (1):Construction of hydropower up to 100 MW per unit held and led by the National EPC company
		Clause 7 (2): Above 100 MW hydropower unit can be carried out by the EPC company shall cooperate with foreign and national EPC company. Any development of electricity infrastructure in the public interest or mandatory use of goods and services produced domestically.
	Incentives	
9	Insentif Riset Sistem Inovasi Nasional (National Innovation System Research Incentive)	Insentif Riset Sistem Inovasi Nasional (National Innovation System Research Incentive) is one of the policy instruments Ministry of Research and Technology to develop and optimize R& D resources, improving synergies between industry with research and development institution, and strengthen the capacity of science and technology between industry with research and development institution. The proposal of this research funding scheme must be derived from government agencies or institutions / Non-Government legal entities such as: LPNK - Research and Technology, Research and Development Ministry, the Regional Research and Development, Industrial (state or private), college (Public or Private), or R & D Foundation NGOs.

		There are 4 founding schemes: (a) Basic Research (RD) intended to pursue dropping mastery of science and technology (state of the art) and generate new qualified invention (breakthrough, Nobel Prize); (b) Applied Research (RT) which is intended to improve technology integration capabilities, especially in apply the results of basic research into proven technology; (c) System Science Research Capacity Production (KP) aimed to improving the technological capabilities in the production sector R & D institutions through research partnerships with industry; (d) Accelerating Diffusion and Utilization of Science and Technology (DF) were intended to improve the utilization of the results financing of R & D through the application of technology in the sector production, financing intermediary institutions that can applied R & D results in the production sector (performance based) and the stimulus for the growth of start-up company. The proposal title must be according to seven priority areas of science and technology: food technology; health and medicine technology; energy; transportation; information and communications; defense and security technology; and material technology.

10	Desa Mandiri Energi (Energy self-sufficient village)	There are two types of Desa Mandiri Energi:1. Desa Mandiri Energi non-fuel, such as using micro hydro, solar, and biogas; 2. Desa Mandiri Energi use of biofuels. There are seven departments that have developed and fund the Desa Mandiri Energi: 1. Ministry of Energy and Mineral Resources; 2. Ministry of Agriculture; 3. Ministry of Manpower and Transmigration; 4. Department of Internal Affairs; 5. State Minister for Acceleration Development Backward Regions; 6. State Minister for State Owned Enterprises; and 7. Ministry of Maritime Affairs and Fisheries
11	DIKTI Incentives	Encourage and increase the interest of Indonesian researchers to produce and publish their research results without exception in energy area

Source: Country Specific Information on Renewable Energy in Indonesia

Institutional, technical, financial, technology transfer support mechanisms[2]

Support mechanisms including institutional, technical, financial, technology transfer have been quite developed in Indonesia. The following Tables briefly describe most of the available support mechanism.

Table 23: Key R&D Institutions involved in the Development and Transfer of Renewable Energies [60]

No.	R&D Institutions
1	Ministry of Energy & Mineral resources republic of Indonesia (Kementrian Energi dan Sumber Daya Mineral) – ESDM. In charge of policy setting and national programme on Energy including renewable energy.
2	Ministry of Industry (MoI/Kementrian Perindustrian). Policy development to promote and strengthen national industry in the area of renewable energy.
3	State ministry for Science and Technology (KNRT/Kementrian Negara Riset dan Teknologi). Coordinating R&D Activities at major R&D Institutes and major research centers;

[2] More detail description on this support mechanism can be seen at Country Specific Information on Renewable Energi-INDONESIA by Dr. Syahrul Aiman and Manaek Simamora

	development of national strategic R&D.
4	Indonesian Institute of Sciences (LIPI). Conducting R&D including renewable energy.
5	Agency for Technology assessment and Application (BPPT). Conducting R&D including renewable energy.
6	National Nuclear Power Agency (BATAN/Badan Tenaga Atom Nasional). Conducting R&D including renewable energy.
7	National Institute of Aeronautics and Space (Lembaga Penerbangan dan Antariksa Nasional, LAPAN). Conducting R&D including renewable energy.
8	National Institute of Electronic (LEN/Lembaga Elektronika Nasional). A state owned enterprise producing products on electronics including supporting electronics for renewable energy companies.
9	PT. Pertamina (State Owned Enterprise). A major Indonesian major oil company currently includes renewable energy in its project development portfolio.
	Academic Institutions Offering Capacity Building Programmes in the Field of Renewable Energy (Including Undergraduate and Postgraduate Level Programmes in Renewable Energy)
10	Gadjahmada University (UGM, Universitas Gadjah Mada)
11	University of Indonesia (UI)
12	Bandung Institute of Technology (ITB)
13	Bogor Institute of Agriculture (IPB/Institute Pertanian Bogor)
14	Institute Technology Surabaya (ITS/Institute Technology Surabaya)
15	Universitas Tanjungpura (Tanjung Pura University) Pontianak
16	International Institute for Clean Energy and Climate Change
17	Politeknik Negeri (Technical Vocational Academy) Jember
18	Darma Persada University
19	Atmajaya University Yogyakarta
20	PoliteknikNegeri (Technical Vocational Academy) Sriwijaya
21	Politeknik Negeri (Technical Vocational Academy) Semarang (Polines)
22	Politeknik Negeri (Technical Vocational Academy) Bandung (Polban)
23	Politeknik Negeri (Technical Vocational Academy) Ujung Pandang
24	Universitas Hasanudin/Hasanuddin University (UNHAS)
	Other universities

Source: Country Specific Information on Renewable Energy in Indonesia [61]

Table 24: Key Indonesian Non-Governmental Organization in the field of Renewable Energy Sector

1	Name of Institution	Yayasan IBEKA (Institut Bisnis dan Ekonomi Kerakyatan) People Centered Business and Economic Institute
	Focus Area	Develop small hydropower project (5-400 kW) to electrify poor, rural communities across Indonesia in the scope of Citizen/Community Participation, Energy, and Income Generation.
	Contact	Director: Tri Mumpuni (Ashden Awards 2012) Yety Sofi Rahayu Administration and Finance Staff e-mail: ysroet@gmail.com Tel: +62-21-53661517
2	Name of Institution	IESR (Institute for Essential Services Reform)
	Focus Area	Power Sector Restructuring
	Address	Jl. Mampang Prapatan VIII (KomplexBappenas) No. R-13 Jakarta, 12790 Indonesia Tel: +62-21-7992945 Fax: +62-21-7996160 E-mail: iesr@iesr-indonesia.org
	Contact	Kharina Dewayani Administration and Finance Staff E-mail: kharina@iesr-indonesia.org Cut Rindayu Corporate Communication E-mail: rinda@iesr-indonesia.org Tel: +62-817823778
3	Name of Institution	EEP (Energy and Environmental Partnership) based on agreement between Finland and Indonesia

	Focus Area	Overall Objective of EEP Indonesia is the increased access to sustainable renewable energy and reduced growth rate of greenhouse gas (GHG) emissions in the participating provinces of IndonesiaActivities:- Capacity building/ training- Pilot and demonstration projects on renewable energy, energy efficiency and waste-to energy.- Pre-feasibility and feasibility studies on renewable energy, energy efficiency and waste to-energy, environmental impact assessments (EIA).- Strategic studies for renewable energy and energy efficiency development and biomass production and utilization for energy production.
	Contact	National Coordination Unit (NCU) Nasrullah (Eriell) Salim, National Coordinator E-mail: eriellsalim@eepindonesia.org Mobile: +62 815 825 2392; +62 821 1454 3407 Juhani Harkonen, Chief Technical Advisor Email: juhani.harkonen@eepindonesia.org Mobile: +62 821 2562 7013; +358 400 724025 EEP Indonesia Riau Office Mohammad Amin Email: eep.riau@eepindonesia.org Mobile: +62 813 7127 2767 EEP Indonesia Kalteng Office Ivi Anggraeni Email: eep.kalteng@eepindonesia.org Mobile: +62 813 6547 6347
4	Name of Institution	METI (Masyarakat Energi Terbarukan Indonesia) Indonesia Renewable Energy Society (IRES)
	Focus Area	Power Generation/Clean EnergyCommunication, consultancy and cooperation forum among Renewable Energy (RE) practitioner.METI establishes various Groups, each focusing on a particular Renewable Energy, including Solar PV, Geothermal, Micro Hydro, Biomass, and Other RE (such as Wind, Bio-Diesel,

		Bio-Ethanol, and Tidal Wave. Each Focus Group deals with concerns and prospects of maximum and effective use of RE available in Indonesia, and it strives toward continuous development, applications, promotion, advocacy and support for using RE on which it is focusing on. The outputs produced by each Focus Group will be compiled and used by METI for the government, legislators and other stakeholders on the effective sustainable use of RE in the country's strives to achieving the national long term energy security.Membership of each Focus Group is open for METI's members. Application for joining Focus Group activities is submitted to the Coordinator of each Focus Group via METI's Secretariat. METI, in addition to fulfilling its programme, also establishes various Working Teams, each dealing with particular issues including Environment, RE Technology and Education, Policies and Regulations, Socio-Economics, Model of Rural Area Development Utilizing RE, and Sustainable RE Business Development. The contributions of these Working Teams are providing basis for METI's advocacies on specific issues and advisory consultancy for rural and RE business developments.
	Address	Graha Niaga Lantai 9Jl. Jend. SudirmanKav. 58 Jakarta 12190 Indonesia Tel : +62-21 5291 2380-83Website: www.meti.or.idE-mail : meti.ires@yahoo.comMETI Secretariat c/o. PT. Makmur Wisesa Sejahtera Graha Irama 6th floor Jl. HR. Rasuna Said Block XI Kav.1-2Jakarta 12950Telp. +62 21 5790 3287Fax. +62 21 5790 3289Email. info@meti.or.id / meti.ires@gmail.com
	Contact	Sinta Public Relation and Communication Tel: +62-81280090080
5	Name of Institution	INOTEK (YayasanInovasiTeknologi Indonesia/Indonesia Technology Innovation Foundation)

	Focus Area	INOTEK Foundation ended 2011 by starting to work on a programme "Building Innovation Capacity in Clean Energy in Indonesia". This 2-year pilot programme until November 2013 is supported by the World Bank, wherein INOTEK is collaborating with GATD, APEX, Yayasan Gaia and Catapult Design to focus on supporting pro-poor clean energy design-driven innovation. The programme aims to identify technology challenges from target rural communities, create innovative design solutions that meet the challenges and needs, and involve entrepreneurs and private sector for sustainable dissemination of technologies.
	Contact	Jenggala street II, No. 9, Kebayoran Baru, DKI Jakarta, 12110 Indonesia. Tel: (+62-21) 7211179Fax: (62-21) 7223878

Source: Country Specific Information on Renewable Energy in Indonesia [61]

Table 25: Ministries and Government Agencies Involved in the Promotion of Renewable Energy

No	Institution	Focus Area
1	Ministry of Energy and Mineral Resources - Directorate General of New Renewable Energy and Energy Conservation (Kementerian EnergidanSumber Daya Mineral Direktorat Jenderal Energi Baru Terbarukan dan Konservasi Energi)	Develop, promote and applicants new energy (nuclear, hydrogen, coal bed methane, liquefied coal, gasified coal), renewable energy (geothermal, wind power, solar cell, micro-hydro, hydropower, bioenergy, ocean wave energy) and conservation energy at all region in Indonesia.
2	Indonesian Institute of Sciences (Lembaga Ilmu Pengetahuan Indonesia) LIPI	Renewable energy on biomass, micro hydro power, wind, solar, battery lithium, energy conservation, energy saving, etc.
3	Agency for The Assessment and Application of Technology (Badan Pengkajian dan Penerapan Teknologi) BPPT	a non-departmental government agency under the coordination of the Ministry of Research and Technology, which has the tasks of carrying out government duties in the field of assessment and application of energy resources and development technology

4	State Ministry of Research and Technology (Kementerian Risetdan Teknologi)	Increase productivity to meet the needs of the national R&D technology in the production sector and improve the competitiveness of productsnational and cultural innovation with focus on strengthening competencies in R&D areas of food security, energy, technology and transportation management, information technology and communications, defense and security technology, medical technology, and medicine, and advanced materials.
5	National Development and Planning Agency (Badan Perencanaan Pembangunan Nasional)-Bappenas	Coordination and synchronization of national development planning in the field of including in the area of, energy resources, minerals and mining, and the environment (clause 278)
6	Ministry of Cooperatives and Small and Medium Enterprises (Kementerian Koperasi dan Usaha Kecil dan Menengah)	Assist Ministry of Cooperatives and Small and Medium Enterprises in preparing policy formulation and coordination of policy implementation in the areas of production include the formulation, coordination, planning, policy development and implementation of technical functions KUMKM empowerment in the field of production.
7	Ministry of Industry (Kementerian Perindustrian)	1. Preparation of technical policies plans and programmes as well as research and study of macro planning industrial development of medium and long term 2. Implementation and assessment of research and development of macro planning medium and long-term industry, industry cluster development policy priorities as well as the climate and quality of industrial
8	Ministry of State Owned Enterprises (Kementerian BUMN)	1. Formulation and policy making in the field of construction of state-owned enterprises 2. coordination and synchronization of policy

		implementation in the field of construction of state-owned enterprises
9	PT PLN (Persero), state-owned enterprise	the provision of electricity nationally with fossil-based energy sources, new energy and renewable energy
10	PT. Indonesia Power (IP), state-owned enterprise	
11	PT. Pertamina, state-owned company	engaged in oil and gas and is currently undertaking the development of new energy-based energy and renewable energy

Source: Country Specific Information on Renewable Energy in Indonesia [61]

The government through the Ministry of Research and Technology has provided direction and stage of development of science and technology achievements in the field of new and renewable energy.

Indonesian Energy Sector Policy Research in Indonesia stated in the White Book (Buku putih) Research Development and Application of Science and Technology Field of New and Renewable Energy Sources to Support Security and Availability of Energy 2025. White book is a reference for the preparation of science and technology development strategies at the national, regional and community stages.

Road map of new and renewable energy that is contained in this white book has the following objectives:

a. The realization of the technology and the nation's energy infrastructure roles to support its own energy business.
b. The realization of research, development, and implementation roles to achieve the electrification ratio of household sector by 90%.
c. The realization of research, development, and implementation roles in increasing the share of renewable energy (other than geothermal) by at least 5%.
d. The application of the research, development, and application results in the utilization of nuclear energy with a share of about 4% of the national electricity production.

e. The application of the research, development, and application results of biofuels in the provision of the transport sector by 10%.
f. The application of the research, development, and application results in the use of gas for industrial and power generation sectors, transportation, and household.
g. The realization of research, development, and implementation roles in energy consumption per capita of 10 BOE.
h. The application of the research, development, and application results in support of the establishment of energy infrastructure that is able to maximize public access to and utilization of energy for export.
i. The application of the research, development, and application results to search for energy sources at home and abroad.
j. The application of the research, development, and application results of energy conservation to reduce energy elasticity is smaller than 1.

Table 26: R&D funding trend of new and renewable energy [62]

Category of Research	**2007**		**2008**		**2009**	
	Budget (IDR)x1M	**Number of Research**	**Budget (IDR)x1M**	**Number of Research**	**Budget (IDRp)x1M**	**Number of Research**
Basic Reseach	4,205	33	6,649	37	5,926	29
Applied Research	2,.790	34	6,201	30	2,102	9
Science & Technology Capacity	1,560	7	3,.515	15	5,502	16
Diffusion	570	7	NA	NA	1,113	4
Total	9,125	81	16,365	82	14,643	58

Table 27: Consulting Organizations/Consultants with Expertise in Renewable Energy Technology System Design, Application, and Transfer

1	Name of Institution	PT. Indoenergi Consultant
	Focus Area	The company is specialized in handling consultancy services in various fields particularly in relation to the energy sector, to serve the interests of corporations, governments, and individual independently
2	Name of Institution	Indonesia Environment Consultant
	Focus Area	An energy audit of the environmental management proactive targeting efficiency of energy use is used. Given the high cost of energy today, then perform an energy audit by a business unit is important. The benefits of an energy audit are to determine the level of energy efficiency that can raise the level of profit for the company as well as participating in environmental management. The method through action planning, feasibility analysis, implementation, monitoring and continuous improvement.
3	Name of Institution	Biogas Energi Persada (EP)
	Focus Area	Biogas Energy Persada (EP) is the developer, contractor and consultant biomass-based renewable energy using biogas technology.
4	Name of Institution	KAMASE
	Focus Area	Kamase Care is an organization engaged in research and consultancy in the field of renewable energy. Renewable energy is one of great potential in Indonesia, but its utility is less / minimum. Care Kamase formed as a manifestation of the desire to exploit the immense potential and develop it so that it becomes a source of energy that is widely used by the public. Founded in 2006, the main activity is to conduct studies and research on energy conservation and renewable energy, as well as providing consulting services for the community / service users who need it. The scope of our activities is an energy audit of buildings, Building Automation Systems, Solar Water Pump System, renewable energy consulting services, and Fire Protection Engineering.

		Some of the activities that have and are being done Kamase Care, in collaboration with Kamase is bio digester plant construction for the community and the farmers / ranchers and development of ground water lifter with renewable energy.
5	Name of Institution	Energi Management Indonesia
	Focus Area	Is a state-owned company engaged in the field of conservation and energy management. Assist the government, state enterprises and private sector in energy conservation, energy management and energy diversification. The implementations of our business activities carried out by trained specialists are professionals in their fields and supported by adequate equipment as needed. Our accumulated experiences in various sectors of society and in many industrial added values in the implementation of our business perform tasks of conservation, management and energy diversification.

Source: Country Specific Information on Renewable Energy in Indonesia [61]

Table 28: Technology Commercialization Agencies/Technology Business Incubators in the Renewable Energy

No	Name
1	Partnership and Business Incubator Directorate, University of Indonesia
2	Technology Incubator Division, Agency for the Assessment and Application of Technology (BPPT)
3	Technology Incubator, Centre for Innovation – LIPI
4	BPPT Engineering
5	Business and Industry Incubator, Bandung Technology Institute (ITB)
6	Business Innovation Centre (BIC)
7	Centre for Business Incubator and Entrepreneurship Development Kewirausahaan (P3K)-Bogor Agriculture Institute (IPB)
8	Business Incubator Centre (PusatInkubatorBisnisdanLayananMasyarakat), Brawijaya University
9	New Entrepreneur Incubator (INWUB) LPPM Soedirman University
10	R. Didiek Embriyakto, SE, ST, MM

11	Business Incubator, Gajah Mada University (UGM)
12	Business Incubator Centre (Pusat Inkubator Bisnis IKOPIN PIBI) Institut Manajemen Koperasi Indonesia IKOPIN Indonesia IKOPIN
13	Technology Business Incubator, North Sumatera University (USU)
14	Incubator Centre, Technology Institute of Sepuluh November (ITS)
15	Business Incubator-LPPM Pelita Harapan University
16	Agribusiness Incubator Jember University
17	Business Incubator Unit, Manufacturing Polytechnic, Polman Bandung
18	Business Incubator Centre, Padjadjaran University
19	Business Incubator-PPM, Atmajaya University

Source: Country Specific Information on Renewable Energy in Indonesia [61]

In general, the above technology and business incubators provide its services to new businesses including in the area of renewable energy. There is no special treatment for any area of business. However, the incubators can access several of support from various sources be it in private and government institution that provides financial support to renewable energy.

Table 29: Financial Institutions for Supporting Renewable Energy Development, Commercialization, Transfer and Adoption

No.	Name of Financial Institutions	Description and Contact Address
1	PT. Astra Mita Ventura	PT. Astra Mitra Ventura PT Astra Mitra Ventura (AMV) was established in 1991. Objective to provide financial facilities to medium & small enterprises (SMEs) to develop its business to be independent, modern and resilient, The company aims to assist SMEs through equity and training in order to develop management, technology, human resources and market opportunity. AMV participates through direct equity participation, convertible bond and profit sharing.

2	Dharma Bhakti Astra Foundation (YDBA)	In line with its philosophy, Astra established Yayasan Dharma Bhakti Astra (YDBA) in 1980 to generate potential, highly competent and competitive SMEs in national industrial structure. YDBA plays its role as an agent of development in empowering SMEs through building competency and capability of skilled manpower. YDBA main objective is to develop and to provide advocacy for SMEs. YDBA currently provides general assistance to SMEs in the range of: Education such as apprenticeships, comparison studies, technical assistance, plant visits and management training. The material of education and training is relevant with theories yet applicable. Financial resources access. Network development. Business development services for SMEs in Jakarta, Bandung, Tegal, Yogyakarta, Waru Sidoardjo, Lombok and Batam. Facilitate exhibitions and seminars.
3	Revolving Fund Management (Lembaga Pengelola Dana Bergulir - LPDB KUKM)-Ministry of Cooperative and SMEs	Provide loan to cooperatives and SMEs including green tech-based SMEs through its strategic partner institutions.
4	Government Investment Centre (Pusat Investasi Pemerintah-PIP) Ministry of Finance	Support financing of development of infrastructure in Indonesia including in the area of renewable energy at large scale
5	CSR Programmes, State-owned enterprises	State-owned enterprises provide funding for development of green-based economy including renewable energy programmes and businesses through partnership fund and for non-bankable SMEs

Source: Country Specific Information on Renewable Energy in Indonesia [61]

The example of revolving fund management is: PLN and LPDB-KUMKM has Signed the Memorandum of Understanding (MoU) about New and Renewable Energy Development. Utilization of new and renewable energy sources (renewable energy) to generate power in Indonesia is continue to be developed by the government , including involving the sector of Small and Medium Enterprises (SMEs). Regarding this, PT PLN (Persero) together with the Institute of Cooperative Revolving Fund Management, Micro, Small and Medium Enterprises (MSME - LPDB) agreed to collaborate in developing and improving the infrastructure facilities that utilize bioenergy sources of energy and new and renewable energy that exist in Indonesia.

Cooperation begins with the signing the MoU on August 28th between the President Director of PT PLN (Persero) and the Managing Director LPDB KUMKM. The period of is 1 (one) year after the signing of the MoU.

There are at least three points highlighted in this cooperation, namely to increase the knowledge, insight and cooperation in the field of new and renewable energy as well. Second, improvement and development of infrastructure in the fields of energy resources and new and renewable energy in Indonesia, as well as the development and utilization KUMKM. In this case the electric company is ready to provide technical support and assistance on the operation and maintenance of the plant to cooperatives and small entrepreneurs.

Table 30. Bank credit for energy sector

Name of Bank	Total loan (BillionIDR)	Energy sector loan (Billion IDR)
BRI	348.2	18.1
Mandiri	388.8	19.4
BNI	200.7	10.8
Total	937.7	48.4

Based on data from the financial statements of banks, especially state banks such as BRI, Bank Mandiri, and state-owned enterprises, the average bank lending is still about 5% of all outstanding loans. The major distribution is given to companies engaged in the oil & gas as well as coal mining.

The Indonesian government develops a programme to support energy security, including KKP-E (Credit Food Security and Energy). The real purpose is for the development of resilience of food derived from vegetable and it is expected that the derivatives can be used as energy.

In the same boat with the KKPE programme, the banks are still not considering the renewable energy field as the main business. The banks programmes related to renewable energy is still limited to the company CSR as a social responsibility to the community.

The low bank lending to the energy industry can be caused by several things as follows:

1. For a loan to the corporate, the bank has a credit limit on a business field for the spread of risk.
2. High dependence on fossil fuels, therefore the utilization of renewable energy is very limited
3. Banks have difficulties in selecting viable borrowers.
4. Related KKPE, the bank has several limitations including its distribution should be through farmer groups / businesses.

Table 31: Potential Renewable Energy in Indonesia

Energy source	Installed capacity	Resource potential	Undeveloped potential (%)
Hydropower	4,264.0 MW	75,670 MW	94
Geothermal	1,052.0 MW	27,510 MW	96
Mini-hydropower	86.1 MW	500 MW	83
Biomass	446.0 MW	49,810 MW	99
Solar	12.2 MW	4.8 kWh/m^2/day	-
Wind	1.1 MW	9,190 MW	99
Ocean	0.0 MW	35 MW	100

Source: PLN presentation to the US Energy Association

The Foreign Investment Law regulates Direct Foreign Investment (FDI) by granting a right of entry to foreign businesses through a government licensing procedure principally controlled by Indonesian Capital Investment Coordinating Board (BKPM). Foreigners are permitted to invest with no restriction on the maximum size of the investment, the source of funds or the destination market of the products. This is except in an industry sector which is listed as

closed to foreign investment on the Investment Negative List ("Negative List") which attaches to the Foreign Investment Law under Presidential Regulation. (Source: Investing in Indonesia, kpmg.com/id)

The latest 2010 Negative List set out in Presidential Regulation No.36/2010 contains 20 nominated industries or fields of business that are closed to foreign investment. The rest are open if certain conditions are fulfilled. The revision of Indonesia's Negative Investment List of Indonesia has been conducted in order to attract more foreign investment in Southeast Asia's largest economy by making the country more competitive. Basically the revised Negative Investment List will be grouped in 5 (five) categories. First, business sectors which will be more open for foreign investment; Second, business sectors which will be more restricted for foreign investment; Third, business sectors that adopt the harmonization of the simplification of the foreign capital ownership; Fourth, business sectors which have relationship with the public private partnership (PPP) (kerjasama pemerintah swasta/KPS); and Fifth, business sectors which have to be inline with the prevailing laws and regulations. Energy sector is included in the fourth category. Energy and mineral resources sectors specifically on the power industry whereby for the transmission and distribution of the power supply, during the concession period, allowing foreign investors to hold 100% for PPP/KPS and maximum of 95% for non-PPP/KPS, power plant with small scale of 1-10 MW limits the foreign investment at the maximum of 49% for PPP/KPS as well as non-PPP/KPS, and for power plant above 10MW scale 100% for PPP/KPS and 95% for non-PPP/KPS maximum ownership for foreign investors. (*Source: http://www.hprplawyers.com/indonesian-negative-list-for-investment-will-be-issued-soon/*)

Table 32: Negative Investment List in Indonesia

Sector Heading	Sub-sector Heading	Regulation of PDI
Energy and Mineral Resources	• Less than 1 MW power plant	• Reserved for UMKMK
	• Small scale power plant (1-10 MW)	• Requires a partnership with small enterprise
	• Drilling services of geothermal and oil & gas off/ on-shore; Geothermal nuclear, and more than 100MW of power plants; Power plant transmission and electricity distribution; Operation and maintenance services of oil & gas facility and power plant installation; Technology development of electricity supplied equipment; EPC and electricity consultancy	• Maximum 95% foreign shareholding
	• Radioactive mineral mining	• Requires a recommendation from National Nuclear Energy Agency ("BATAN")

Since 2008, the government has offered tax incentives for foreign investment, including investors in renewable energy. Incentives include a 30 percent net income tax reduction for six years, free repatriation of investments and profits, and dispute settlement.

In addition, Indonesia's National Energy Policy of 2006 amended several policies and regulations to support renewable energy deployment. The law codified the targets for renewable energy production by 2025 set by Presidential Decree No. 5 and strengthened the position of cooperatives, private companies, and community organizations in PPA negotiation.

The regulations that support investment in renewable energy are:

1. PMK 117.PMK.06/2006 (credit for bioenergy development)
2. Gov.Regulation No 1/2007 (income tax for investment) refurbished by Gov. Regulation No.62/2008
3. Presidential Regulation No 8/2007 (biofuel fund)
4. Government Regulation No. 8/2007 on the establishment of the Government Investment Board may also support biofuel projects, by facilitating investment.
5. Presidential Regulation No.4 /2010 Exemption of import duty for fast-track stage 2

Incentives for Renewable Energy Generation

There are a number of tax incentives which may be applicable for renewable energy projects, particularly geothermal powered projects. These include:

a) Income Tax incentives under GR No.1 (as lastly amended by GR No. 62/2008) which currently applies to the "conversion" of geothermal energy into electric power. GR No.1 concessions include:

   i) An "investment credit" @30% of the qualifying capital investment (i.e. as an uplift in deductions at five percent p.a. each year from commercial production);

   ii) An extended tax loss carry forward period of up to 10 years;

   iii) Accelerated depreciation rates (essentially at double the general rates);

   iv) A maximum dividend Withholding Tax ("WHT") of 10%.

Implementing regulations to GR No.1 indicate that:

i) BKPM is to recommend the granting of any tax incentives to the MoF (i.e. the initial application will be through BKPM). The DGT will issue a decision on behalf of the MoF;

ii) The tax incentives are to take effect from the beginning of commercial production;

iii) The tax loss carry forward period is extended incrementally to a maximum of 10 years (i.e. an extension to between 5 and 10 years is a possible outcome);

iv) The DGT determines the beginning of the commercial production and the tax loss carry forward period (separately) and after tax audit (i.e. entitlement to these concessions may not be known in advance).

b) For electricity generation driven by renewable energy, MoF regulation No. 21/PMK.011/2010 may also provide tax and customs incentives similar to those available under GR No.1.

c) Minister of Finance ("MoF") Regulation No.177/2007 (for geothermal operations) and MoF Regulations No.154/2008 and No.176/2009 (for power operations) may provide a separate Import Duty exemption;

d) an Import Duty exemption (specifically for projects under the 2nd fast track programme) may alternatively be available under Presidential Regulation No.4/2010 (to be further regulated under MoF Decree yet to issue);

e) An Import VAT "borne by the Government" facility is available under MoF Regulation No.24/2010 (for geothermal projects in exploration phase). This facility is subject to annual renewal; and

f) For imports of capital goods during the development/construction phase, import VAT may be exempted under MoF Regulation No.31/2008.

Table 33: Tax Incentives - Comparison for Conventional and Renewable Power Plants

	Conventional				Renewable Energy			
Facility	**Income Tax**	**VAT**	**Article 22**	**Import Duty**	**Income Tax**	**VAT**	**Article 22**	**Import Duty**
GR 1/2007 (as amended by GR 62/2008) regarding incentives for specified business categories or regions	No	-	-	-	Geothermal only	-	-	-
					Facilities provided are investment allowance deduction of 30% (over 6 years), accelerated depreciation and amortisation, reduced dividend WHT on dividends paid to non-residents and up to 5 additional years tax loss carry forward. Currently applies to Geothermal activities, however the list of applicable industries is currently being revised (Nov 2010).			
GR 12/2001 (as amended by GR 31/2007 and as implemented by MoF Reg 21/2008) regarding VAT facilities in relation to certain 'strategic goods'	-	Yes, however only available to VAT-able entrepreneurs (electricity is generally VAT exempt). Applies to capital goods (machines, tools and factory equipment) only; excludes spare parts	-	-	-	Yes, however only available to VAT-able entrepreneurs (electricity is generally VAT exempt). Applies to capital goods (machines, tools and factory equipment) only; excludes spare parts	-	-
	To utilise this exemption it is necessary to register as a VAT-able entrepreneur despite the fact that electricity is generally not subject to VAT. The drafting of GR12/2001 is unclear as far as providing a VAT exemption for goods to produce electricity. GR31/2007 also now omits some commentary which was in the elucidation of GR12/2001							
MoF Reg No. 176/ PMK.011/2009	-	-	-	Provides an import duty exemption on import of machines/ goods & materials for the establishment and development of facilities that produce certain goods (assumed to include electricity) and limited services (including mining and construction services); but appears to require the involvement of BKPM, which does not license IPP's, other than captive plants.	-	-	-	Provides an import duty exemption on import of machines/ goods & materials for the establishment and development of facilities produce that certain goods (assumed to include electricity) and limited services (including mining and construction services); but appears to require the involvement of BKPM, which does not license IPP's, other than captive plants.
	The exemption is provided on the machines, goods and materials which have: a) not been produced in Indonesia; b) been produced in Indonesia but do not meet the required specifications; or c) produced in Indonesia in insufficient quantity as determined by Ministry/official.							

	Conventional				Renewable Energy			
Facility	Income Tax	VAT	Article 22	Import Duty	Income Tax	VAT	Article 22	Import Duty
MoF Reg No. 177/ PMK.011/2007	-	-	-	-	-	-	-	Geothermal investments attract an exemptions from import duty, on goods used in geothermal business activities (requires a working area or license for a survey or geothermal mining business license). Effective 16 July 2007; but was due to be reviewed 28 December 2009.
					The exemption is provided on the machines, goods and materials which have: a) not been produced in Indonesia; b) been produced in Indonesia but do not meet the required specifications; or c) produced in Indonesia in insufficient quantity as determined by Ministry/official.			
MoF Reg No. 21/ PMK.011/2010 (Renewable Energy Regulation)	-	-	-	-	Yes, but refers to GR1/2007 for procedures	Yes for capital goods (not parts or material), but refers to GR 12/2001 for procedures	Automatic exemption for capital goods (not parts or materials), although unclear how to prove eligibility	Yes, but refers to PMK 154/2008 for procedures
					The application of this regulation is uncertain due to the linkage back to the existing regulations for the application procedure. Query whether this facility provides a de-facto extension of the industries listed in GR 62/2008.			
MoF Reg No.24/ PMK.011/2010 regarding government borne VAT for upstream oil & gas, and geothermal exploration (PMK 24)	-	-	-	-	-	Geothermal only & only in exploration stage This exemption is granted annually (e.g. PMK 24 expires 31 December 2010)	-	-
MoF Reg No.154/ PMK.011/2008 regarding import duty exemption for electricity production under a PPA with PLN (public use power plant sector)	-	-	-	For suppliers to PLN under a PPA. Capital goods only (defined as machines, equipment and tools); excludes spare parts	-	-	-	For suppliers to PLN under a PPA. Capital goods only(defined as machines, equipment and tools); excludes spare parts

Source: Eletricity in Indonesia – Investment and Taxation Guide, PWC, 2011

C. Business Enabling Environment and Ecosystem

Feed-In-Tariff (FIT) Policies

A Feed-In Tariff (FIT, standard offer contract advanced renewable tariff or renewable energy payments) is a policy mechanism designed to accelerate investment in renewable energy technologies. It achieves this by offering long-term contracts to renewable energy producers, typically based on the cost of generation of each technology. Technologies such as wind power, for instance, are awarded a lower per-kWh price, while technologies such as solar PV and tidal power are offered a higher price, reflecting higher costs.

In addition, feed-in tariffs often include "tariff depression", a mechanism according to which the price (or tariff) ratchets down over time. This is done in order to track and encourage technological cost reductions. The goal of feed-in tariffs is to offer cost-based compensation to renewable energy producers, providing the price certainty and long-term contracts that help finance renewable energy investments.

Renewable Energy Push

In recent years the Indonesian government has shown an increasing interest in renewable energy (RE) as a means to address the growing energy demand in the archipelago. Presidential Regulation No.5/2006 on National Energy Policy and the creation of the Directorate General of New & Renewable Energy and Energy Conservation (EBTKE) in 2011 both stressed the importance of RE as an avenue to increase electrification of the country and to meet the energy needs of an expanding economy whilst minimizing the environmental impact. Indonesia has an ambitious target to increase new and renewable energy to 17% of total energy use by 2025 (2010: 4.4%).

In the past few months the Ministry of Energy and Mineral Resources has issued new feed-in tariffs (FITs) for solar PV power stations and waste-based power stations (see page 11 and 12 for further details) and is expected to announce new FITs for geothermal power stations. At the New and Renewable Energy and Energy Conservation Conference (ETBKE Conex 2013) in August speakers highlighted Indonesia's potential for the use of RE as well as the current under- utilization of these resources.

In September, PwC was a content partner for a Solar PV trade mission and conference hosted by Solar Plaza. The 20 trade mission delegates were in Jakarta to hear more about the upcoming tender for 140 MW of solar PV power stations. The location and capacity quota of the PV power stations to be tendered out are detailed in the decision of the Director-General of New and Renewable Energy and Energy Conservation No.979 K/29DJE/2013. Further details on the tender schedule are expected by the end of 2013.

Feed-in Tariff for Solar Power

On 12 June 2013, the Minister of Energy and Mineral Resources Regulation No.17/2013 was issued which stipulates a feed-in tariff (FIT) that PLN must pay for electricity generated from privately owned PV solar power plants.

The capacity quota and location of 140 MW of PV Power Plants to be tendered in 2013 are listed in the EBTKE Director General Decision No. 979 K/29DJE/2013.
The details:

- FIT: The price of electricity to be purchased by PLN has been increased to a maximum of US$0.25 per kWh and includes all interconnection costs from the PV solar power plant to the electricity network of PLN. Investors sourcing 40% or more of components domestically would enjoy higher prices.

Table 34: Feed-in Tariff for Solar Power

FIT (<40% domestic components)	FIT (≥40% domestic components)	Comments
US$ 0.25/kWh	US$0.30/kWh	EBTKE Director General will verify that 40% threshold has been met and enforce tender rules.

Source: Indonesian Electricity – Investment and Taxation Guide, PWC, 2011

- Tender process: The government will retain its competitive bidding process for new solar power facilities, so the final purchase price paid by PLN to the winning bidder may be lower than US$0.25/kWh. The tender winner must deposit 20% of construction cost within 15 days of being announced as tender winner, and register a Tax ID.

- 20 year contract: The power sale and purchase agreement is valid for 20 years, and may be extended.
- Timeframe: Construction of the solar power plant must commence within three months of Agreement execution, with the plant reaching commercial operability within 18 months of Agreement execution. An extension of 12 months may be granted with the following penalties imposed in the form of a reduction in the purchase price of power.

Table 35: FIT for timeframe of construction of solar power

Delay in commercial operability (in months)	Price Reduction
≤3 months	3%
3 months ≤6 months	5%
>6 months ≤12 months	8%
> 12 months	N/A – Agreement is terminated

Source: Indonesian Electricity – Investment and Taxation Guide, PWC, 2011

Feed-in-Tariff (FIT) for Renewable Energy Sources

A Feed-In Tariff (FIT, standard offer contract advanced renewable tariff or renewable energy payments) is a policy mechanism designed to accelerate investment in renewable energy technologies. It achieves this by offering long-term contracts to renewable energy producers, typically based on the cost of generation of each technology. Technologies such as wind power, for instance, are awarded a lower per-kWh price, while technologies such as solar PV and tidal power are offered a higher price, reflecting higher costs.

In addition, feed-in tariffs often include "tariff digression", a mechanism according to which the price (or tariff) ratchets down over time. This is done in order to track and encourage technological cost reductions. The goal of feed-in tariffs is to offer cost-based compensation to renewable energy producers, providing the price certainty and long-term contracts that help finance renewable energy investments.

Electricity Purchasing of Small Scale and Medium Scale Renewable Energy Power Plant or Excess Power by PLN

Based on the Regulation of the Minister of Energy and Mineral Resources of the Republic of Indonesia Number 04 Year 2012 on Power Purchase Price by PT. PLN (Persero) From Power Plants Using Renewable Energy Small And Medium Scale Or Excess Power, PT PLN (Persero) is required to purchase electricity from power plants that use renewable energy in small and medium scale with a capacity up to 10 MW or excess electric power (excess power) of state-owned enterprises, regional-owned enterprises, private enterprises, cooperatives and NGOs in order to strengthen the local electricity supply system. To attract investment in power generation projects based on renewable energy, the Government through the Minister of Energy and Mineral Resources Regulation No. 19 of 2013 increased the purchase price of electricity by PLN from municipal waste-based power generation.

Feed-In-Tariff, Terms & Conditions

Terms and purchase price of electricity is regulated by the Regulation of the Minister of Energy and Mineral Resources is determined by the following factors:

- Power plant location
- Interconnection type to grid network
- Power plant type

Table 36: Feed-In-Tariff (FIT) Schemes in Indonesia

Feed-In-Tariff (FIT) Schemes (*)		**Grid Interconnection Type**	
		Medium Voltage Lines (Rp/kWh)	**Low Voltage Lines (Rp/kWh)**
Renewable Energy other than Biogas/Biomass and Municipal Waste			
Location	**F**		
Jawa and Bali	**1**	**656**	**1,004**
Sumatera and Sulawesi	**1.2**	**787.2**	**1,204.8**
Kalimantan, Nusa Tenggara Barat and Nusa Tenggara Timur	**1.3**	**852.8**	**1,305.2**
Maluku and Papua	**1.5**	**984**	**1,506**

Biogas/Biomass					
Location	**F**				
Jawa, Madura, Bali and Sumatera	**1**	**975**		**1,325**	
Sulawesi, Kalimantan, Nusa Tenggara Timur and Nusa Tenggara Barat	**1.2**	**1,170**		**1,590**	
Maluku and Papua	**1.3**	**1,267.5**		**1,722.5**	
Municipal Waste - Zero Waste Technology					
		MoEMR 4/2012	**MoEMR 19/2013**	**MoEMR 4/2012**	**MoEMR 19/2013**
Location	**F**				
Jawa, Madura, Bali and Sumatera	**1**	**1,050**	**1,450**	**1,398**	**1,798**
Sulawesi, Kalimantan, Nusa Tenggara Timur and Nusa Tenggara Barat	**1.2**	**1,260**	**1,740**	**1,677.6**	**2,157.6**
Maluku and Papua	**1.3**	**1,365**	**1,885**	**1,817.4**	**2,337.4**
Municipal Waste – Sanitary Landfill					
Location	**F**				
Jawa, Madura, Bali and Sumatera	**1**	**850**	**1,250**	**1,198**	**1,598**
Sulawesi, Kalimantan, Nusa Tenggara Timur and Nusa Tenggara Barat	**1.2**	**1,020**	**1,500**	**1,437.6**	**1,917.6**
Maluku and Papua	**1.3**	**1,105**	**1,625**	**1,557.4**	**2,077.4**

Notes: F: factor incentive based on power plant location

Medium Voltage Lines: 1 kV - 35 kV (e.g. 6 kV, 7 kV, 12 – 20 kV)

Low Voltage Lines: 100 V – 1 kV (e.g. 220 V, 380 V)

*Differences feed in tarrif of 2012 and 2013 showed that the government encourages investment in new and renewable energy

Source: Ministry of Energy and Mineral Resource Regulation No.4/2012 and No.19/2013

Zero waste is a waste management technology resulting in a significant reduction in waste volume through a specific process or incinerator integrated gasification and anaerobic. Sanitary landfill is a waste treatment technology in a particular area isolated until it is safe for the environment.

The purchase price of electricity in the Table above are used in a power purchase contract from power plants and from excess power (excess power) that uses renewable energy in small

and medium scale without price negotiating and price approval from the Minister of Energy and Mineral Resources. Power purchasing is based on the Self-Estimated Price (HPS) by PT. PLN (Persero) and must obtain approval from the Minister of Energy and Mineral Resources.PT. PLN (Persero) purchases electricity from power plants that use renewable energy and small and medium scale biomass-based power plants, biogas and municipal waste from state-owned enterprises, regional-owned enterprises, private enterprises, cooperatives and non-government at a price exceeding the price of the Table (higher than FIT). In the event of a crisis condition of electricity supply and limited numbers of consumers, PT PLN (Persero) also will purchase excess electricity (excess power) at a price higher than the price set forth in the Table (FIT). However such prices must be approved by the MoEMR. PLN can also purchase excess power during conditions of electricity supply crises with a higher price based on PLN estimates. Article 4 of regulation of MoEMR No. 4 Year 2012 allows PLN to buy the power at the higher price or in excess of the amounts specified in the regulation, subject to the agreement by the parties and based on PLN's own estimates and approved by the Minister, suggesting the possibility of revising the existing pricing through negotiations.

Purchase of electricity at the same price or higher than the Base Supply (BPP) power must be approved by the provincial Director General of Electricity on behalf of the Minister of Energy and Mineral Resources. The legal basis of price escalation is accommodated in the article 39 of the Government Regulation No. 14 Year 2012, which stipulates that the price of electricity as approved by the Minister, governor or regent/city mayor, in accordance with their respective authority, can be adjusted due to certain changes of cost elements on the basis of mutual agreement which should be stated in the PPA.

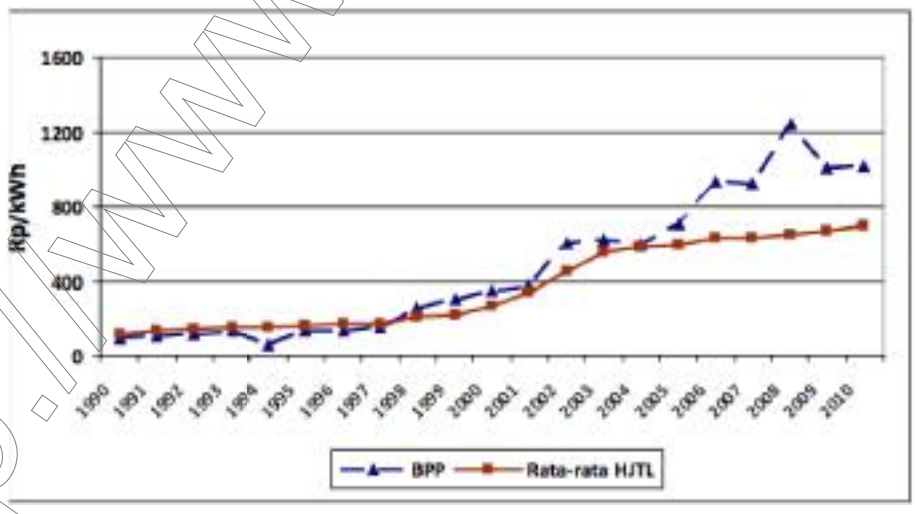
Provincial Basic Allocation Expense of electricity prepared by the Board of Directors of PT. PLN (Persero) and submitted to the Director General of Electricity every 3 (three) months.
Duration of the contract of purchase excess electricity (excess power) a maximum of 1 (one) year and may be extended. Directors of PT. PLN (Persero) must report the purchase of excess electricity (excess power) to the Director General of Electricity every 3 (three) months.

Average Generation Cost & Electricity Subsidy

Removing the corresponding electricity price market mechanism is not possible government amid the still high level of poverty. Based on data from the Central Statistics Agency (BPS), in 2010 the number of poor people in Indonesia reached 31.02 million people, or 13:33 per cent of the 237 million population. Moreover, Article 33 UUD 1945 clearly states that the production branch that controls the lives of many people controlled by the state, as well as the earth, water and natural riches contained therein shall be controlled by the state and used in the best interests of the people. So the electricity supply business must be provided by the state and spread evenly and affordable by all levels of society. Therefore, government intervention is necessary to encourage the production and distribution of electric power is more evenly distributed at an affordable price.

One of the government interventions in the power sector is the involvement in the determination of electricity tariff. The electricity tariff policy is closely associated with the policy of subsidies. This is because since 1998 the government set electricity rates is always lower than the cost of electricity supply (Figure 22). This caused the company a loss of electric power providers. So as to compensate for the determination of the selling price of electricity, the government pays the difference in price to the company providing electric power in the form of electricity subsidies.

Figure 22: Basic Allocation Expenses (BPP) and Average Selling Price of Electricity 1990-2010



Source: PLN Statistics 2011

Putting in force the presidential instructions mentioned above influences PLN electricity sales as well as the size of government subsidies. The Government of the Republic of Indonesia

provides consumer subsidies through the company. The method for calculation of and remittance for the electricity subsidy in the 2010 and 2011 Budget used Republic of Indonesia Finance Ministry Regulation (PMK) No. 111/PMK.02/2007 dated 14 September 2007, which was amended by Regulation No. 162/PMK.02/2007 dated 17 December 2007.
The electricity subsidy and the negative difference between the average sales price of electric energy (IDR/kWh) from each tariff category minus Basic Allocation Expenses (BPP) for electric energy (IDR/kWh) depending on the electrical current for each tariff category is multiplied by sales volume (kWh) for each tariff category. BPP for electric energy is calculated based on this formula, and incorporates allowance for network, transmission and distribution leakages as determined by the Energy and Mineral Resource Ministry c.q. Directorate General of Electricity.

Based on that formula, on year BPP can be projected by Average Selling Price of Electricity by Type of Customer on previous year, as well as Province's BPP.

Table 37: Average Selling Price of Electricity by Type of Customer and by Province (2011)

PLN Operational Unit/Province	Residential	Industrial	Business	Social	Gov. Office Building	Publ. Street Lighting	Total
Region of NAD	552.76	813.79	891.30	606.86	1,034.03	819.79	658.16
Region of North Sumatera	587.19	726.24	929.69	663.12	1,027.00	819.91	700.63
Region of West Sumatera	582.12	625.43	949.35	615.10	1,064.28	830.24	667.50
Region of Riau	663.62	753.08	954.85	670.93	1,049.30	819.34	761.02
-Riau	654.49	744.81	942.92	760.60	1,036.24	819.45	755.00
-Riau Archipelago	706.87	798.80	1,012.86	61.33	1,099.81	818.69	790.38
Region of South Sumatera, Jambi & Bengkulu	613.78	737.92	941.62	634.73	1,015.84	796.62	704.64
-South Sumatera	599.79	736.09	927.87	634.12	1,003.58	789.81	697.74
-Jambi	659.47	747.24	970.70	644.60	1,020.25	810.18	739.91
-Bengkulu	590.49	751.53	955.62	620.33	1,058.29	819.62	670.71
Region of Bangka Belitung	623.16	828.54	1,007.66	639.14	1,050.79	819.58	710.45
Region of Lampung	608.47	737.83	909.67	632.37	1,032.17	818.74	688.35
East Sulawesi	586.31	790.00	796.20	554.83	997.72	818.72	659.70
Region of S & C Kalimantan	561.46	753.25	988.04	615.93	1,063.63	819.97	678.83
-South Kalimantan	544.25	754.40	998.36	610.30	1,081.23	819.97	6,669.06
-Central Kalimantan	598.27	745.04	967.33	627.38	1,042.20	820.00	700.88
Region of East Kalimantan	615.76	772.40	987.26	661.41	1,010.57	819.93	737.34
Region of N, C Sulawesi & Gorontalo	592.56	792.84	986.55	612.78	1,062.40	823.92	703.28
-North Sulawesi	607.85	773.76	1,008.98	637.73	1,038.79	800.13	720.69
-Gorontalo	558.82	784.77	915.01	619.08	1,057.41	828.85	663.64
-Central Sulawesi	583.48	883.59	952.65	621.42	1,087.04	846.73	689.71

Region of S, SE & W Sulawesi	580.00	688.51	941.22	645.82	1,023.69	815.94	696.04
-South Sulawesi	571.49	684.23	933.23	648.94	1,014.16	815.26	692.21
-Southeast Sulawesi	617.08	792.42	1,011.05	620.64	1,049.19	820.00	722.72
-West Sulawesi	605.53	871.84	927.64	637.21	1,078.98	819.98	700.43
Region of Maluku & North Maluku	573.94	819.43	946.40	627.13	1,108.05	819.75	699.36
-Maluku	565.99	805.18	987.89	619.37	862.94	890.02	693.96
-North Maluku	586.12	866.33	859.15	641.38	1,500.48	758.63	708.24
Region of Papua	700.53	792.13	975.53	689.71	1,036.09	851.88	813.46
-Papua	765.34	901.11	1,061.25	741.54	1,088.45	930.21	888.63
-West Papua	595.21	742.54	818.99	600.43	898.19	752.93	684.64
Distribution of Bali	640.33	815.46	991.26	653.03	1,063.31	820.13	821.86
Region of West Nusa Tenggara	531.14	828.78	985.52	574.99	1,022.50	819.42	690.33
Region of East Nusa Tenggara	603.60	873.31	992.59	664.15	1,040.25	823.50	740.01
PT PLN Batam	835.74	1,085.77	1,383.34	775.15	1,421.05	1,347.14	1,118.32
PT PLN Tarakan	744.52	-	1,578.80	928.12	2,668.58	-	942.66
Outside Java	605.68	744.43	980.09	617.36	1,063.18	820.63	728.57
Dist. Of East Java	576.73	708.71	986.96	651.73	1,040.35	819.58	697.09
Dist. Of East Central Java & Yogyakarta	536.29	724.28	996.66	651.10	1,021.50	826.77	669.92
-Central Java	525.84	723.12	993.73	636.09	1,027.38	827.56	662.63
-D.I. Yogyakarta	608.92	755.57	1,009.38	701.74	998.69	820.00	729.66
Dist. Of West Java & Banten	533.48	699.88	963.03	620.36	933.82	818.58	669.55
-West Java	533.77	716.50	957.95	625.80	920.25	818.42	674.21
-Banten	530.18	651.18	1,031.62	558.22	1,063.31	819.96	647.73
Dist. Of Jakarta Raya & Tangerang	765.44	728.00	943.81	757.60	874.07	819.78	812.21
Java	608.20	710.25	959.81	681.85	922.21	821.60	717.76
Indonesia	617.95	695.46	951.05	646.36	939.80	791.52	714.24

Source: PLN Statistic 2011[55]

Based upon the Budget Implementation Authorization Form letter (DIPA), the subsidy ceiling for electricity in budget year 2011 is set at IDR 40,700 billion, including an 8% margin above primary expenses for electricity supply. On 23 December 2011, the government raised the subsidy ceiling for electricity in 2011 to IDR 86,245 billion.

Based upon the DIPA, the top ceiling for the electricity subsidy in the 2010 budget was set to IDR 35,300 billion, including an 8% margin above primary expenses for electricity supply. In accordance with the revised 2010 state budget, the government raised the 2010 electricity

subsidy ceiling to IDR 51, 106 billion. On 29 December 2010, the government raised the electricity subsidy ceiling to IDR 3,606 billion.

Table 38: Average Generation Cost by Type of Power Plants (IDR/kWh) 2006-2011

Year	Hydro	Steam	Diesel	Gas	Geothermal	Combined Cycle	Average
2006	143.19	389.48	1,631.36	1,999.15	579.74	889.33	705.96
2007	118.80	405.91	2,438.47	2,155.67	615.10	873.80	706.62
2008	131.60	597.26	3,578.25	3,298.03	746.61	1,278.79	1,051.84
2009	139.48	598.31	2,696.52	1,422.71	639.87	739.79	767.79
2010	98.02	559.22	2,043.71	1,594.93	701.39	788.46	795.59
2011	155.79	588.47	2,536.85	2,260.96	792.61	960.58	1,051.14

Source: PLN Statistics 2011 [55]

Table 39: Average Selling Price of Electricity (HJTL) by Type of Customers (IDR/kWh) 2003-2011

Year	Residential	Industrial	Business	Social	Gov. Office Building	Publ. Street Lighting	Total
2003	522.48	530.32	661.41	538.09	725.90	594.98	550.74
2004	557.76	559.15	682.32	568.65	712.47	638.99	581.75
2005	563.05	569.87	694.71	569.90	730.32	628.72	590.91
2006	571.12	624.23	764.25	585.30	755.53	644.87	628.14
2007	571.76	621.32	772.51	574.08	743.40	647.73	629.18
2008	588.01	622.04	850.56	580.89	847.15	665.11	653.00
2009	589.33	644.34	890.90	577.77	870.38	663.33	670.02
2010	615.92	660.99	934.32	623.76	953.03	745.77	699.09
2011	617.95	695.46	951.05	646.36	939.80	791.52	714.24

Source: PLN Statistics 2012

It was agreed in the proposed electricity subsidy in 2013, among others, about the increase in electricity tariffs by 15% in 2013 gradually, electricity sales growth of 9% and sales volume of 182.3 TWh of electricity. Basic allocation expense for electricity shrinkage of 8.5% and

Basic Electricity Allocation Expense IDR 212.07 trillion or IDR 1,163 per kWh, so total BPP in 2013 was IDR 1,261 per kWh.

In addition to adjustments in electricity tariffs, the government encourages the generation of electric energy from new and renewable energy. This effort will reduce the share of fossil energy in electricity generation such as diesel and gas respectively burdensome costs of power generation per kWh of IDR 2,536.85 and IDR 2,260.96 is far above the average selling price of electricity (HJTL) IDR 714.24 (2011). With the increasing portion of electricity generation from non-fossil energy, it will reduce the Average Generation Cost and Expenses Basic Allocation (BPP), thus reducing the burden on the state budget electricity subsidy.

Basic Electricity Tariffs (TDL)

Ministry of Energy and Mineral Resources (MoEMR) Regulation No.30/2012 has determined Basic Electricity Tariffs (TDL) 2013 as shown as Tables below (for Residential, Commercial and Industrial type of customer). In every 3 months, Basic Electricity Tariffs proposed by PT.PLN (Persero) to get approved by MoEMR. Based on RAPBN 2013, the tariffs will be increase 15% gradually in a year.

Table 40: The Latest Basic Electricity Tariff (TDL) for Residential Use Q4 2013

No	Group Rates	Power Limit	Regular		Pre-Paid
			Price (IDR/kVA/month)	Usage Fee (IDR/kWh)	
1	R-1/TR	until 450 VA	11,000	Block I : 0-30 kWh : 169 Block II: > 30 – 60 kWh: 360 Block III: >60 kWh : 495	415
2	R-1/TR	900 VA	20,000	Block I : 0-20 kWh : 275 Block II: > 20 – 60 kWh: 445 Block III: >60 kWh : 495	605

3	R-1/TR	1,300 VA	*)	979	979
4	R-1/TR	2,200 VA	*)	1,004	1,004
5	R-2/TR	3,500-5,500 VA	*)	1,145	1,145
6	R-3/TR	6,600 VA above	*)	1,352	1,352

Source: MoEMR Regulation No.30/2012

Table 41: The Latest Basic Electricity Tariff (TDL) for Commercial Use Q4 2013

No	Group Rates	Power Limit	Regular		Pre-Paid
			Price (IDR/kVA/month)	Usage Fee (IDR/kWh)	
1	B-1/TR	450 VA	23,500	Block I : 0-30 kWh : 254 Block II: > 30 : 420	535
2	B-1/TR	900 VA	26,500	Block I : 0-108 kWh : 420 Block II: > 108 kWh: 465	630
3	B-1/TR	1,300 VA	*)	966	966
4	B-1/TR	2,200 VA – 5,500 VA	*)	1,100	1,100
5	B-2/TR	6,600-200 kVA	**)	1,352	1,352
6	B-3/TM	> 200 kVA	***)	Block WBP = K x 1,020 Block LWBP = 1,020 kVArh = 1,117 ***)	-

Source: MoEMR Regulation No.30/2012

Table 42: The Latest Basic Electricity Tariff (TDL) for Industrial Use Q4 2013

No	Group Rates	Power Limit	Regular		Pre-Paid
			Price (IDR/kVA/month)	Usage Fee (IDR/kWh)	
1	I-1/TR	450 VA	26,000	Block I : 0-30 kWh : 160 Block II: > 30 : 395	485
2	I-1/TR	900 VA	31,500	Block I : 0-72 kWh : 315 Block II: >72 kWh: 405	600
3	I-1/TR	1,300 VA	*)	930	930
4	I-1/TR	2,200 VA	*)	960	960
5	I-1/TR	3,500-14 kVA	*)	1,112	1,112
6	I-2/TR	>14 - 200 kVA	**)	Block WBP = K x 972 Block LWBP = 972 kVArh = 1,057 ***)	-
7	I-3/TM	> 200 kVA	**)	Block WBP = K x 803 Block LWBP = 803 kVArh = 864 ***)	-
8	I-4/TT	>30,000 kVA	***)	Block WBP and LWBP = 723 kVArh = 723 ***)	-

Source: MoEMR Regulation No.30/2012

The price of electricity on average in 2012 amounted to IDR 782 per kWh (Persero), with a gradual increase in TDL 15% during 2013, the price of electricity on average in 2013 is estimated at about Rp. 899.30 per kWh. With an estimated value of the Basic Allocation Expenses (BPP) in 2013 amounted to IDR 1,261 per kWh, the electricity subsidy to be borne by the state budget is around IDR 361 per kWh.

Law No. 30/2009: PLN is no longer an Authorized Agency in The Electrical Power Business, but a State-owned Enterprise assigned the duty of supplying electricity to meet public needs. The 2009 Electricity Law provides PLN with priority rights to conduct these businesses throughout Indonesia. PLN, as the sole owner of transmission and distribution assets, also

remains the only business entity in charge of transmitting and distributing electric power. Further, whilst the 2009 Electricity Law allows private participation in the supply of electricity for public use (which includes transmission and distribution), current private sector participation is still limited to the power generation sector.

MEMR Regulation No.28/2012 Clause/Article 2 stated that Electricity distribution business, the sale of electricity, and integrated electricity supply business for public interest in the Business Area implemented. In one region there is only one Business Enterprises. The region defined in the terms of existing business enterprises which has inaccessibility and inability to meet quality and reliability in the terms of generation and distribution of electricity. It is good opportunities but face many challenges. Weaker fossil fuel prices of late have undermined the attractiveness of investments in renewable energy technology. Many renewable-electricity generated projects tend to be small scale and typically have high unit capital costs. This means that they often rely on price protection especially with regard to their tariff. They may also face grid connection and land acquisition/use problems. If they have to develop their distribution lines, it will need more funds, resulting in higher risk investment. Moreover, PLN required buying electricity from renewable energy. Therefore, electricity generation in Indonesia will be distributed mostly on-grid connection, located in the area which PLN have already have distribution and transmission lines. Finally, financing can be an issue as there is little early stage risk equity available in Indonesia with investors typically looking for more mature projects driven off conventional power sources.

Government encourages "Go Green" not by financial assistant but through policies which encourage state-owned enterprises and large companies to support "Go Green" projects.

Table 43: Summary of PVES sustainability dimensions for Case Study (Lampung, West Java and NTT)

Institutional dimension: Benefits & *Issues*		
- The establishment of organic, informal PVES market institution has facilitated the PVES horizontal network for information sharing	- Institutional capacity building for providers (market facilitation, technical assistance, increased capacity for manufacturing and	- Dual objectives on GHG reduction credit & SRD, delivered using top down and bottom up approach

	exporting BOS component)	consolidated the differing interests of the investor and host community
- Institutional skill: autonomy in the selection of the form of electricity supply (PVES or grid), in the PVES transaction (payment terms, PVES configuration)	- Rural outlets were established in the project areas to approach customers, *however many outlets were forced to close down due to declining sales following the project closure*	- Institutional capacity building: the establishment of PLD, KUEP and KUPD, exercise in defining the rule of the game resulting in users high commitment to the continued operation of PLD
	- *The vertical network did not allow users to be active participants*	- The PM training allowed local people, who managed PLD, to handle the plant operation and management
		- Involvement of local community and local capable institution (NGO) to act as facilitator was instrumental in achieving a successful project outcome
		- The rural electrification project was accompanied by rural economy empowerment, made explicit in the contractual document
Financial dimension: Benefits & *Issues*		
- Affordability for users as new module is still perceived too expensive	- Increased accessibility for providers and users (limited to wealthier households) during project life (Section 3.4.3.b)	- A full capital investment is required for the less commercial market segment (grants, or fully funded externally, in this case)
- Saving from cost and effort to obtain fossil fuel, dry cell batteries and battery charging	- Saving from cost and effort to obtain fossil fuel, dry cell batteries and battery charging	- Users pay monthly fee to cover PLD operation, and the revenue was deposited in a bank account, authority from

		PLD & village head were required for the withdrawal
- More earning from longer *warung* (shop) operation	- More earning from longer *warung* (shop) operation	- Saving from purchase and effort to obtain fossil fuel and dry cell batteries, monthly payment at PLD office saved operational cost for collection
- Cheaper electricity compared to the available diesel electricity grid, and improved compatible with users' seasonal income, although initial capital investment was perceived to be expensive	- *Continued dependency on subsidy to maintain financial accessibility and market operation upon project closure*	- The reserve power was unavailable as the connection material became unaffordable
- Profitability for providers (the OM entrepreneurs)		
- Issues: *shortage of second hand PV module*		
Technological dimension: Benefits & *Issues*		
- Continued PVES service with the availability of local capable agent who made business out of the after sales service infrastructure, creating users confidence in the SHS providers	- Enaction of SHS standards, certification and establishment of testing facilities allowed domestic manufacturers to enter international SHS market exporting BOS components	- Equipment was supplied from overseas (PV module, wind turbine, diesel engine) creating continuing dependency on outsourced repair
- Innovation related to the use of SHS without BCR	- *Maintenance of testing facilities poses challenges in resource availability (cost and personnel)*	- IEC, ISO were used combined with the safety law and standards
- PVES technological capacity (rebuilding SHS package, simple I-V testing procedure, operation, maintenance, energy management)	- After sales technical support: provided by the rural outlets during the project life, *however the outlets closing could pose issues related to*	- OM manuals provided for users

	continued after sales service	
- Confidence in PVES service which, given the right utilization, was more reliable than the grid	- Degree of users familiarity with SHS varied, *in some cases resulting in users disappointment from overselling*	- Technician and spare parts were available at PLD office
- The SHS power is limited but to many users is found to suit their energy demand	- *The reduction in energy level in the battery (within 6 months after installation) resulted in users deciding to bypass the BCR*	- At the end of the hybrid technical life, SHS would be preferred
Social dimension: Benefits &*Issues*		
- PVES meets the low energy demand of some end users, those who require more capacity also own portable diesel engine, many of those who decided to connect to the grid have kept their SHS as a backup supply	- Job creation, economic activities facilitated	- Economic activities: The accompanying community empowerment programme, allowed users to tap into electrical and non-electrical economic activities, based on the pre-existing local economy, enabling them to pay for the electricity regularly
- Facilitate night gathering, share SHS use with neighbors, share TV watching	- Healthier lifestyle (more house cleaning)	- Significant revenue was generated, *but not sufficient to refinance a similar investment. The expensive overseas repair of overseas made electronic components could drain the revenue generated*
- Less dispute in the family, save children from the hazardous risk of preparing kerosene lamps	- Better quality of lighting for study and longer shop operation at night	- Initial local skepticism towards PVES was overcome by technical demonstration and meetings in the village
- Close connectedness between	- Increased security feeling	- Better quality of lighting

providers and users based on trust and reciprocity		for study, longer shop operation at night, handicraft making in the evening, avoid fire risk, respiratory problems from indoor pollution
- SHS use has evolved to power CD player to play recorded swallow's twitter for swallow bird farming; and to charge mobile phones	- Facilitate night gathering and TV watching	- Increased feeling of security facilitated night-time gatherings
- Expect further PVES-based equipment use for economic activities: carpentry equipment (*sugu*, portable drilling machine), tailoring machine	- Many users perceived the SHS capacity insufficient to fulfill their energy need, many decided to purchase more SHS, others remained interested to connect to the grid, others purchased SHS as a back up to the grid	- Isolation reduced by access to infotainment, use of rural telephone and TV watching which also facilitated people gathering
	- Portable solar powered radio expected	- Social prestige, *strengthened social hierarchy (women's domestic task reinforced)*
	- Reduced isolation due to access to infotainment and use of mobile phones	
	- *Villagers were not familiar with a banking system*	
	- *Lamps too bright for sleeping at night*	
	- *Fear that brighter light provoked observation by thieves*	
	- *Strengthened social hierarchy (women's domestic task reinforced)*	
Ecological dimension: Benefits & *Issues*		

- Less use of fossil fuel (kerosene and diesel)	- Less use of fossil fuel (kerosene and diesel)	- Less use of fossil fuel (kerosene and diesel)
- Waste disposal: the custom for used battery compartments was either reuse or resale, other PVES wastes were dumped in the yard	- Waste disposal: the custom for used battery compartments was either reuse or resale,	- Waste disposal: *PVES wastes were dumped in the yard*
	other PVES wastes were dumped in the yard	- Corrosion was a serious issue as the metallic equipment could not stand the harsh natural environment of the Oeledo location

Source: Enhancing the Sustainability of Off-Grid Photovoltaic Energy Service Delivery in Indonesia, School of Electrical Engineering and Telecommunications, University of New South Wales, Sydney, Australia 2007

There is no difference between RE and non-RE sector in Indonesia for priority sector in lending or soft loans. Also currently, there is no regulation related with options for end user financing for adoption of off-grid solutions in Indonesia

D. Business Models for SET Delivery

Electricity Generation

Power generation development in Indonesia from 2006-2011 was still dominated by fossil-based sources. There is an increasing trend on the use of non-fossil based energy such as geothermal, hydro power, wind power, and solar power (mora details, see Table 16-26). It is interesting to note that the use of these non fossil-based sources of energy is still insignificant compared to toral energy sources. Specifically the use of non fossil energy sources such as mini hydro, micro hydro, wind, and solar is still very insiginifcant; while its potential especially geothermal, for example, is very huge (approx. 40% of world reserve is Indonesia).

The use of non fossil energy sources such as wind and solar is also not encouraging due to different causes. Wind power is not well developed due to local charasteristics of wind velocity (mostly low speed). This make the energy efficiency on this source very low. In other words, it requires much higher investment level to generate the same unit of energy. Policy implication of this situation is that this source of energy would only be used widely if there is significant incentives to boost its utilizaiton. Solar energy source has a high energy pontential. However, its use has not been widely used due to low energy effiency. As such, source of energy can be widely utilized if it is supported with related incentives and policy. And also this source of energy can be used for specific purposes such as electrification in the remote areas, telecommunication infrastructures, lighting of public road, etc.

Table 44: PLN's Electricity Supply Facilities (2006-2011)

No	Description		2006	2007	2008	2009	2010	2011
1	**POWER PLANT**	MW	23,354.69	23,664.48	24,031.37	24,366.16	26,337.81	30,528.63
	Steam PP	MW	6,900	7,114	7,344	7,644	8,031.50	10,177.50
	Gas Turbine PP	MW	2,727.23	2,743,626	2,496.69	2,563.59	3,223.68	3,391.93
	Combuned Cycle PP	MW	7,021.00	7,061.00	7,371.00	7,371.00	6,951.30	7,841.97
	Machine-Gas	MW	-	-	9.8	14.00	26.8	80.54
	Diesel PP	MW	2,782.40	2,829.20	2,829.30	2,829.10	4,142.60	5,020.73
	Hydro PP	MW	3,529.10	3,501.50	3,504.30	3,508.50	3,522.60	3,488.71
	Mini Hydro PP	MW	-	-	-	-	-	27.23
	Micro Hydro PP	MW	-	-	-	-	-	2.55
	Geothermal PP	MW	395	395	415	435.00	438.8	455.00
	Wind Power	MW	-	-	0.3	1.10	0.3	0.34
	Solar	MW	-	-	-	-	0.2	1.13
	Coal Gasification	MW	-	-	-	-	-	41.00
2	**TRANSMISSION LINES**	km	32,916.63	33,162.87	34,183.85	40,041.14	48,563,63	41,771.74
	500 kV TL (EHVTL)	km	5,047.78	5,047.78	5,092.00	5,092.00	4,923.00	5,052.00
	25-150 kV TL(HVTL)	km	27,869.05	28,115.09	29,091.85	34,949.14	43,640.63	36,719.74
	SUB STATUION							
	Transformer Capacity	MVA	54,527.00	58,713.00	59,508.00	81,875.00	85,169.00	94,614.50
	Units	unit	1,101	1,136	1,144	1,220	1,228	1,280
3	**DISTRIBUTION LINES**	km	573,049.44	598,497.69	614,925.20	639,517.23	661,762.35	679,424.50
	Medium Voltages (6-20 kV)	km	246,775.43	253,908.02	261,163.20	268,611.87	275,613.31	288,719.36
	Low Voltage (<6 kV)	km	326,274.01	344,589.67	353,762.00	370,905.36	406,149.04	390,704.94
	DISTRIBUTION							

	SUBSTATION							
	Transformer Capacity	MVA	32,873.70	33,826.37	32,244.40	34,724.80	35,701.36	39,211.11
	Units	unit	259,444	279,454	276,549	286,724	298,357	318,107.00

Source: PLN Statistic 2011

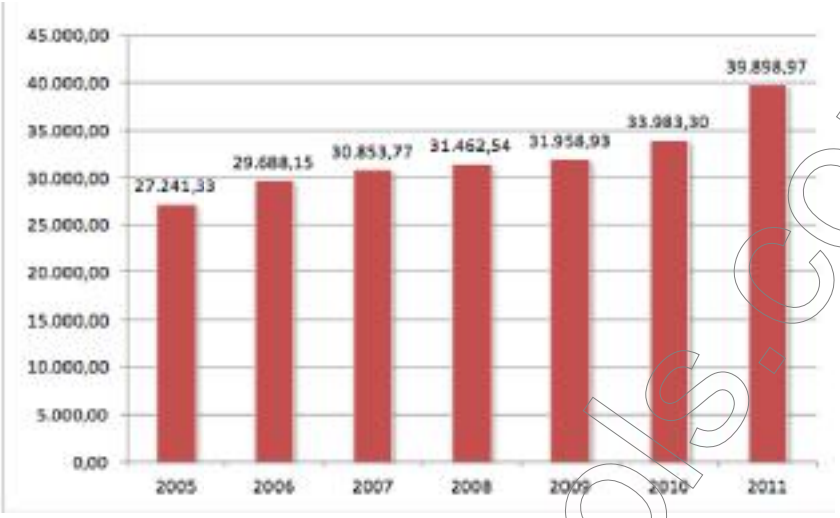
Table 45: National's Installed Capacity of Power Plant by Type (MW) (2006-2011)

Year	Steam PP	Gas PP	Combined Cycle PP	Engine PP	Diesel PP	Hydro PP	Mini Hydro PP	Micro Hydro PP	Geothermal PP
2006	11,170.00	3,102.95	7,659.97	21.00	3,165.05	3,715.61	3.03	0.55	850.00
2007	12,014.00	3,220.18	7,699.97	33.00	3,211.91	3,688.04	6.03	0.55	980.00
2008	12,294.00	3,068.97	8,009.97	66.84	3,272.98	3,690.80	6.03	0.69	1,052.00
2009	12,594.00	3,135.88	8,009.97	71.00	3,256.36	3,694.95	6.03	0.69	1,189.00
2010	12,981.50	3,821.57	7,590.32	92.84	4,569.89	3,719.69	13.53	0.69	1,192.75
2011	16,318.00	4,236.02	8,480.97	169.54	5,471.93	3,880.83	57.66	5.93	1,209.00

Wind Power PP	Solar PP	Coal Gasification PP	Waste PP	Total
0.00	0.00	0.00	0.00	29,688.15
0.10	0.00	0.00	0.00	30,853.77
0.26	0.00	0.00	0.00	31,462.54
1.06	0.00	0.00	0.00	31,958.93
0.34	0.19	0.00	0.00	33,983.30
0.93	1.16	41.00	26.00	39,898.97

Source: *Handbook of Energy & Economic Statistics of Indonesia 2012*

Figure 23: National's Installed Capacity of Power Plant by Type (MW) (2005-2011)



Source: PLN Statistic 2011

Table 46: PLN's Installed Capacity of Power Plant by Type (MW) (2006-2011)

Year	Steam PP	Gas PP*	Combined Cycle PP*	Gas Engine PP*	Diesel PP*	Hydro PP	Mini Hydro PP
2006	6,900.00	2,727.20	7,021.00	0.00	2,782.40	3,529.10	-
2007	7,114.00	2,743.60	7,061.00	0.00	2,829.20	3,501.50	-
2008	7,344.00	2,496.70	7,371.00	9.80	2,890.30	3,504.30	-
2009	7,644.00	2,563.60	7,371.00	14.00	2,829.10	3,508.50	-
2010	8,031.50	3,223.70	7,371.00	26.80	4,142.60	3,522.60	-
2011	10,177.50	3,391.90	7,842.00	80.50	5,020.70	3,488.70	27.20

Micro Hydro PP	Geothermal PP	Wind Power PP	Solar PP	Coal Gasification PP	Total
-	395.00	-	-	-	23,354.69
-	415.00	0.10	-	-	23,664.48
-	415.00	0.30	-	-	24,031.37
-	435.00	1.10	-	-	24,366.16
-	438.80	0.30	0.20	-	26,337.81
2.60	455.00	0.30	1.10	41.00	30,528.63

*2011 includes power plant rented (Source: *Handbook of Energy & Economic Statistics of Indonesia 2012)*

Table 47: PLN's Installed Capacity of Power Plant by Type and by Region (MW) (2011)

No	Region/Province	PLTU/Steam PP	PLTG/Gas PP	PLTGU/Combined Cycle PP	PLTMG/Gas Engine PP	PLTD/Diesel PP
1	Nanggroe Aceh Darussalam	-	-	-	-	200.68
2	North Sumatera	490.00	223.29	817.88	-	41.42
3	West Sumatera	200.00	64.05	-	-	32.79
4	Riau	-	64.80	-	-	89.02
5	Riau Island	-	-	-	-	81.64
6	Bengkulu	-	-	-	-	20.04
7	Jambi	-	61.77	-	-	44.12
8	South Sumatera	285.00	174.85	40.00	-	32.69
9	Bangka Belitung	-	-	-	-	91.78
10	Lampung	200.00	-	-	-	81.52
11	Banten	4,940.00	-	740.00	-	-
12	DKI Jakarta	500.00	52.00	2,441.58	-	16.08
13	West Java	990.00	1,148.00	660.00	-	0.20
14	Central Java	930.00	135.26	1,033.90	-	-
15	D. I. Yogyakarta	-	-	-	-	-
16	East java	1,500.00	342.45	2,040.61	-	8.83
17	Bali	-	356.85	-	-	79.40
18	West Kalimantan	-	34.00	-	-	194.84
19	Central Kalimantan	-	-	-	-	78.05
20	South Kalimantan	130.00	21.00	-	-	125.82
21	East Kalimantan	-	38.40	60.00	13.94	223.99
22	North Sulawesi	-	-	-	-	103.56
23	Gorontalo	-	-	-	-	31.70
24	Central Sulawesi	-	-	-	-	118.84
25	West Sulawesi	-	-	-	-	6.49
26	South Sulawesi	12.50	122.72	-	-	72.69
27	South East Sulawesi	-	-	-	-	89.70
28	West Nusa Tenggara	-	-	-	-	144.82

29	East Nusa Tenggara	-	-	-	-	137.50
30	Maluku	-	-	-	-	154.04
31	North Maluku	-	-	-	-	42.55
32	Papua	-	-	-	-	91.60
33	Papua Barat	-	-	-	-	51.67
	INDONESIA	**10,177.50**	**2,839.44**	**7,833.97**	**13.94**	**2,488.10**

Source: PLN Statistic 2011

Table 48: PLN's Installed Capacity Rented by Type of Power Plant and by Region (MW) (2011)

No	Region/Province	PLTG/Gas Turbine PP	PLTGU/Combined Cycle PP	PLTMG / Gas Engine PP	PLTD/Diesel PP	PLTGB /Coal Gas	Total
1	Nanggroe Aceh Darussalam	-	-	-	246.00	-	246.00
2	North Sumatera	-	-	-	117.00	-	117.00
3	West Sumatera	-	-	-	80.15	-	80.15
4	Riau	58.50	8.00	-	194.75	-	261.25
5	Riau Island	-	-	-	61.95	-	61.95
6	Bengkulu	-	-	-	17.00	-	17.00
7	Jambi	120.00	-	17.50	5.00	-	142.50
8	South Sumatera	354.00	-	33.00	-	-	387.00
9	Bangka Belitung	-	-	-	116.04	-	116.04
10	Lampung	-	-	-	158.94	-	158.94
11	Banten	-	-	-	-	-	-
12	DKI Jakarta	-	-	-	-	-	-
13	West Java	-	-	-	-	-	-
14	Central Java	-	-	-	-	-	-
15	D. I. Yogyakarta	-	-	-	-	-	-
16	East java	-	-	-	-	-	-
17	Bali	-	-	-	126.00	-	126.00
18	West Kalimantan	-	-	-	202.50	33.00	235.50
19	Central Kalimantan	-	-	-	58.10	-	58.10
20	South Kalimantan	-	-	-	119.00	-	119.00

21	East Kalimantan	20.00	-	16.10	150.35	8.00	194.45
22	North Sulawesi	-	-	-	79.00	-	79.00
23	Gorontalo	-	-	-	29.00	-	29.00
24	Central Sulawesi	-	-	-	63.00	-	63.00
25	West Sulawesi	-	-	-	-	-	-
26	South Sulawesi	-	-	-	255.00	-	255.00
27	South East Sulawesi	-	-	-	84.00	-	84.00
28	West Nusa Tenggara	-	-	-	142.50	-	142.50
29	East Nusa Tenggara	-	-	-	50.85	-	50.85
30	Maluku	-	-	-	62.00	-	62.00
31	North Maluku	-	-	-	26.00	-	26.00
32	Papua	-	-	-	66.50	-	66.50
33	Papua Barat	-	-	-	22.00	-	22.00
	INDONESIA	**552.50**	**8.00**	**66.60**	**2,532.63**	**41.00**	**3,200.73**

Source: *Handbook of Energy & Economic Statistics of Indonesia 2012*

Table 49: Private (IPP & PPU)'s Installed Capacity by Type of Power Plant and by Region (MW) (2011)

No	Region/ Province	Classification	PLTU	PLTG	PLTGU	PLTMG	PLTD	PLTA	PLTM	PLTMH	PLTP	PLTB	PLTS	PLTSa	Total
1	Nanggroe Aceh Darussalam	IPP	15							0.09					15.09
2	North Sumatera	IPP	30					187.5	7.5		12				237
3	West Sumatera	IPP								0.33					0.33
4	Riau	IPP													
5	Riau Island	IPP	22	262.087		58	289.959								632.046
6	Jambi	IPP	6			19				0.22					25.22
7	South Sumatera	IPP	312	112	150										574
8	Bangka Belitung	IPP	7				5								12
9	Lampung	IPP													

10	Banten	IPP													400
11	DKI Jakarta	IPP													
12	West Java	IPP			150			186.5	0.5	1.67	682			26	1,046.67
		PPU		386	204										590
13	Central Java	IPP	2,745							0.14	60				2,805.14
14	East Java	IPP	2,450						0.025						2,460.03
15	Bali	IPP								0.025		0.395	0.03		0.45
16	West Kalimantan	IPP								0.4					0.40
17	Central Kalimantan	IPP	28												20.00
18	South Kalimantan	IPP	14												14.00
19	East Kalimantan	IPP	71.5				44.6								116.10
		PPU	7	24		12	38.687								81.67
20	North Sulawesi	IPP							3						3.00
21	Central Sulawesi	IPP	30						9.3						39.30
22	South Sulawesi	IPP	3	60	135		62.22	8.12	10.1	0.29		0.2			278.93
23	West Nusa Tenggara	IPP								0.2					0.20
24	East Nusa Tenggara	IPP								0.015					0.02

25	Papua	IPP					305								3.05
26	West Papua	IPP					7.7								7.70
Indonesia			**6,140.50**	**844.087**	**639**	**89**	**451.2**	**392.12**	**30.4.25**	**3.38**	**754**	**0.595**	**0.03**	**26**	**9.370.34**

Source: *Handbook of Energy & Economic Statistics of Indonesia 2012*

Table 50: Rated Capacity of Power Plant (MW) (2011)

Year	Hydro PP	Steam PP	Gas Turbine PP	Combine Cycle PP	Geothermal PP	Diesel PP	Gas Engine PP	Solar PP	Wind Power PP	Total
2006	3,283.24	7,608.16	2,323.48	6,493.77	373.71	1.937.27	-	-	-	22,019.63
2007	3,409.12	7,748.73	2,455.87	6,165.33	388	1,885.56	-	-	-	22,052.61
2008	3,397.87	7,406.12	2,173.79	6,399.79	394	1,808.53	-	-	0.26	21,580.36
2009	33,418.62	7,976.65	2,236.66	6,340.60	394	1,669.11	-	-	1.06	22,036.70
2010	3,433.79	8,652.01	2,792.87	6,139.72	415.8	2,071.90	34.6	0.17	-	23,540.86
2011	3,430.11	10,844.21	2,357.43	6,817.82	434	1,555.20	10	1.15	-	25,.449.92

Source: *Handbook of Energy & Economic Statistics of Indonesia 2012*

Table 51: Rated Capacity of Power Plant by Type and by Region (MW) (2011)

No	Region/Province	Hydro PP	Steam PP	Gas Turbine PP
1	Nanggroe Aceh Darussalam	0.8	-	-
2	North Sumatera	-	-	-
3	West Sumatera	0.4	-	-
4	Riau	-	-	-
5	Riau Island	-	-	-
6	South Sumatera	-	121	-
7	Jambi	-	-	-
8	Bengkulu	1.2	-	-
9	Bangka Belitung	-	-	-
10	Lampung	-	-	-
11	West Kalimantan	1.58	-	30
12	South Kalimantan	30	-	18

13	Central Kalimantan	-	-	-
14	East Kalimantan	-	-	32
15	North Sulawesi	50.3	-	-
16	Gorontalo	1.2	-	-
17	Central Sulawesi	5.45	10	-
18	South Sulawesi	147.37	-	72
19	South East Sulawesi	4	-	-
20	West Sulawesi	-	-	-
21	Maluku	-	-	-
22	North Maluku	-	-	-
23	Papua	1.85	-	-
24	West Papua	1.6	-	-
25	Dist. Bali	-	-	-
26	West Nusa Tenggara	0.62	-	-
27	East Nusa Tenggara	1.03	-	-
28	PT PLN Batam	-	-	-
29	PT PLN Tarakan	-	-	-
30	Kit Sumbagut	252.26	263.87	217.58
31	Kit Sumbagsel	604.41	375.25	247.96
32	P3B Sumatera	-	-	-
Outside Java		**1,104.07**	**770.12**	**617.74**
33	Dist. East Java	1.8	-	-
34	Dist. Central Java	0.38	-	-
35	D.I Yogyakarta	0.1	-	-
36	West Java	-	-	-
37	Banten	-	-	-
38	Dist. Jakarta Raya and Tangerang	-	-	-
39	PT Indonesia Power	1,100.88	3,599.59	728.69
40	PT PJB	1,222.88	1,617.00	171
41	P3B Jawa Bali	-	-	-
42	Pembangkit Muara Tawar	-	-	840
43	Pembangkit Cilegon	-	587.5	-
44	Pembangkit Tanjung Jati B	-	2,840	-

45	Lontar	-	560	-
46	Indramayu	-	870	-
Java		**2,326.04**	**10,074.09**	**1,739.69**
Indonesia		**3,340.11**	**10,844.21**	**2,357.43**

Source: Annual Report PLN 2011

Table 52: Rated Capacity of Power Plant by Type (MW) (2011) [63]

PLTGU Combined Cycle PP	PLTP Geothermal PP	PLTD Diesel PP	PLTM-G/Gas Engine PP	PLTS/Solar PP	PLT Bayu/Wind Power PP	Total	%
-	-	88.4	-	-	-	89.2	0.35
-	-	7.91	-	-	-	7.91	0.03
-	-	19.02	-	-	-	19.42	0.08
-	-	49.33	-	-	-	49.33	0.19
-	-	52.93	-	-	-	52.93	0.21
-	-	4.3	-	-	-	4.3	0.02
-	-	9.32	-	-	-	9.32	0.04
-	-	12.64	-	-	-	13.84	0.05
-	-	56.07	-	-	-	56.07	0.22
-	-	2.04	-	-	-	2.04	0.01
-	-	142.81	-	-	-	174.45	0.69
-	-	55.96	-	-	-	224.96	0.88
-	-	53.67	-	-	-	224.96	0.21
58.3	-	109.76	-	-	-	200.35	0.79
-	80	64.36	-	-	-	195	0.77
-	-	18.3	-	-	-	19.5	0.08
-	-	-	-	-	-	84.01	0.33
-	-	47.17	-	-	-	266.54	1.05
-	-	65.77	-	-	-	69.77	0.27
-	-	4.9	-	-	-	4.9	0.02
-	-	60.77	-	0.1	-	60.87	0.24
-	-	29.32	-	-	-	29.32	0.12
-	-	56.96	-	-	-	58.81	0.23
-	-	40.4	-	-	-	42	0.17

-	-	2.23	-	-	-	2.23	0.01
-	-	81.3	-	0.21	-	82.13	0.32
-	-	92.1	-	0.35	-	93.48	0.37
-	-	47.52	-	-	-	47.52	0.19
-	-	10.8	10	-	-	20.8	0.08
673	-	48.2	-	-	-	1,454.91	5.72
36	-	86.97	-	-	-	1,350.59	5.31
-	-	-	-	-	-		
-	-	6.74	-	-	-	8.54	0.03
-	-	-	-	-	-	0.38	0
-	-	-	-	-	-	0.1	0
-	-	-	-	-	-	-	-
-	-	0.16	-	-	-	0.16	0
-	-	58	-	-	-	-	-
2,320.52	354	58.51	-	-	-	8,162.19	32.07
2,315.00	-	-	-	-	-	5,325.88	20.93
-	-	-	-	-	-	-	-
-	-	-	-	-	-	840	3.3
1,415.00	-	-	-	-	-	2,002.50	7.87
-	-	-	-	-	-	2,840.00	11.16
-	-	-	-	-	-	560	2.2
-	-	-	-	-	-	870	-
6,050.52	354	65.41	-	-	-	20,609.75	80.98
6,817.82	434	1,555.20	10	1.15	-	25,449.92	100

Table 53: Rated Capacity of Power Plant by Type (MW) (2011) Continued [63]

PLTA/Hydro PP	PLTM/Mini Hydro PP	PLTMH/Micro Hydro PP	PLTP/Geothermal PP	PLTB/Wind Power	PLTS/Solar PP	Total
1.75	-	-	-	-	-	202.43
132.00	7.50	-	-	-	-	1,712.09
254.16	-	-	-	-	-	551.00
114.00	-	-	-	-	-	267.82
-	-	-	-	-	-	81.64

236.04	-	-	-	-	-	256.08
-	-	-	-	-	-	105.89
-	-	-	-	-	-	532.54
-	-	-	-	-	-	91.78
118.00	-	-	-	-	-	399.52
-	-	-	-	-	-	5,680.00
-	-	-	-	-	-	3,009.66
1,805.36	-	-	375.00	-	-	4,978.56
306.82	2.80	-	-	-	-	2,408.78
0.32	-	-	-	-	-	0.32
283.03	-	-	-	-	-	4,174.92
-	-	-	-	0.26	-	436.51
1.60	-	-	-	-	0.07	230.51
-	-	-	-	-	-	78.05
30.00	-	-	-	-	-	306.82
-	-	-	-	0.09	-	336.42
51.38	5.00	-	80.00	0.08	0.34	240.36
-	1.50	-	-	-	-	33.20
-	8.55	-	-	-	-	127.39
-	-	-	-	-	-	6.49
148.50	-	-	-	-	-	356.41
1.60	-	2.55	-	-	-	93.85
-	0.92	-	-	-	0.26	146.00
0.12	0.96	-	-	-	0.37	138.95
-	-	-	-	-	-	154.04
-	-	-	-	-	-	42.55
2.04	-	-	-	-	-	93.64
2.00	-	-	-	-	-	53.67
3,488.72	27.23	2.55	455.00	0.43	1.04	27,327.92

Fast Track Programme 10.000 MW Phase 1

Based on Republic of Indonesia presidential Regulation no. 71 Year 2006 dated 5 July 2006, which was replaced by Republic of Indonesia presidential Regulation no. 59 Year 2009 dated 23 December 2009, the government assigned the company to develop coal-fired steam power

plants (PLTU) at 42 locations in Indonesia, including 10 with total capacity of 7,490 MW for Java – Bali and 32 with 2,769 MW off Java – Bali. The projects are expected to operate in 2012-2014.

Project Finance

From the finance perspective, the Fast track programme of 10,000 MW has already experienced a significant progress. For the projects related to generation, financing needed from foreign currency already secured total of uS$5.1 billion, while financing from local currency has been secured to the amount of Rp21.6 trillion. For the related transmission project, the foreign currency of uS$346 million and local currency of Rp12.17 trillion has been secured. Some 85% of the total required financing the Fast track programme development comes from credit that is guaranteed by the government of Indonesia

In accordance with Presidential Regulation (PP) No.91 Year 2007, this replaced PP No. 86 Year 2006 on Government Guarantee for development of coal generated electric power. The remaining 15% will be covered by internal PLN's financing.

As of 31 December 2011, the company had already paid a down payment of uS$872 million and Rp.4, 750,379 million for 36 EPC contracts, or around 15% of the total value of the contracts that were classified as construction in progress. The down payments were funded by the issued guaranteed notes and withdrawals of credit facilities for the fast track programme.

In 2011, the company signed 131 contracts for upgrading and constructing new transmission and sub stations both in Java and outside Java. These projects are financed by own funds and withdrawal of credit facilities from bank. Construction signed for additional power plants and own funds and other external funding through offshore loans grants and investment projects from the State budget finance development regular of transmission and distribution network.

Development of 10,000 MW Phase 1

In 2011, PLN signed 36 Engineering, Procurement and Construction (EPC) contracts, which consist of 10 electricity power plants with aggregate capacity of 7,490 MW for Java-Bali and 26 electric power plants with aggregate capacity of 2.4 GW outside Java and Bali. Based on

these EPC contracts, the company was required to pay the contractor down payment approximately 15% of contract value upfront while the remaining 85% will be funded through credit facilities from banks.

In 2011 additional capacity of 3,274 MW for the 10,000 MW Fast Track Program Phase I was added by PLTU 3 Banten - Lontar 3x315 MW, PLTU 1 Banten - Suralaya 1x625 MW, PLTU 1 JABAR - Indramayu 3x330 MW, PLTU 1 Jateng – Rembang 2x315 MW, PLTU Kep.Riau - Tanjung. Balai Karimun 2x7 MW, PLTU 2 Sulut - Amurang 2x25 MW, PLTU Sultra - Kendari 2x10 MW.

Table 54: Rated Capacity of Power Plant by Type (MW) (2011) Continued [63]

No	Project	Capacity (MW)	Unit	COD Contract	COD Est./Realization
Jawa-Bali					
1	Steam Power Plant 1 Banten-Suralaya	1x625	1	12-Mar-10	22 Ags 2011
2	Steam Power Plant 2 Banten-Labuan	2x300	1 2	12 Sep 2009 12 Des 2009	29 Oct 2009 15 Apr 2010
3	Steam Power Plant 3 Banten-Lontar	3x315	1 2 3	7 Apr 2010 7 Jun 2010 7 Aug 2010	Des 2011 Feb 2012 Mar 2012
4	Steam Power Plant 1 Jabar-Indramayu	3x330	1 2 3	12 Sep 2009 12 Dec 2009 12 Mar 2010	29 Jan 2011 19 Mey 2011 Des 2011
5	Steam Power Plant 2 Jabar-Pelabuhan	3x350	1 2 3	Agt 2012 Nov 2012 Feb 2013	Agt 2012 Nov 2012 Feb 2013
6	Steam Power Plant 1 Jateng-Rembang	2x315	1 2	21 Sep 2009 21 Dec 2009	10 Des 2011 10 Des 2011
7	Steam Power Plant 2 Adipala-Cilacap	1x660	1	22-Apr-12	May-14
8	Steam Power Plant 1 Jatim-Pacitan	2x315	1 2	7 Feb 2010 7 May 2010	Jun 2012 Sep 2012
9	Steam Power Plant 2 Jatim-Paiton	1x660	1	12-Mar-10	Apr-12

10	Steam Power Plant 3 Jatim-Tj Awar-awar	2x350	1 2	25 Oct 2010 25 Jan 2011	Sep 2013 des 2013
	Total FTP-1 Jawa-Bali	**7,490**			
West Indonesia					
11	Steam Power Plant NAD-Meulaboh	2x110	1 2	6 Jan 2011 6 Apr 2011	Oct 2012 Des 2012
12	Steam Power Plant 2 Sumut-Pangkalan Susu	2x220	1 2	11 Aug 2011 11 Nov 2011	Jun 213 Oct 2013
13	Steam Power Plant 1 Riau-Bengkalis	2x10	1 2	9 Oct 2010 9 Dec 2010	Nov 2013 Des 2013
14	Steam Power Plant 2 Riau-Selat Panjang	2x7	1 2	19 Aug 2010 19 Oct 2010	Apr 2012 Jun 2012
15	Steam Power Plant Riau-Tenayan	2x110	1 2	- -	Jan 2014 Apr 2014
16	Steam Power Plant Kep. Riau-Tj Balai Karimun	2x7	1 2	16 May 2010 16 May 2010	Nov 2011 Des 2011
17	Steam Power Plant Sumbar-Teluk Sirih	2x112	1 2	17 Apr 2010 17 Jul 2010	Oct 2012 Des 2012
18	Steam Power Plant 3 Babel-Bangka Baru	2x300	1 2	10 Nov 2010 10 Jan 2011	Mar 2012 Apr 2012
19	Steam Power Plant 4 Babel-Belitung	2x16.5	1	02 Nov 2010 02 Jan 2011	Mar-12
20	Steam Power Plant Lampung-Tarahan Baru	2x100	1 2	29 Apr 2010 29 Jul 2010	Mar 2012 Apr 2012
21	Steam Power Plant 1 Kalbar-Parit Baru	2x50	1 2	28 Dec 2011 28 Feb 2012	Sep 2013 Nov 2013
22	Steam Power Plant 2 Kalbar-Bengkayang	2x27.5	1 2	Mar 2012 May 2012	Sep 2013 Des 2013
	Total FTP-1 West Indonesia	1,600			
East Indonesia					
23	Steam Power Plant Kalsel-Asam-Asam	2x65	3 4	20 Aug 2010 20 Oct 2010	Feb 2012 May 2012
24	Steam Power Plant 1 Kalteng-Pulau Pisau	2x60	1 2	19 Dec 2012 19 Feb 2013	Feb 2013 Apr 2013

Fast Track Programme 10,000 MW Phase 2

Development of Fast Track Program Phase 2 of the 10,000 MW development project is based on Presidential Decree No.4/2010, which was later amended by Presidential Decree No.48/2011, under which a mandate was given to PLN to establish a 9.522 MW power plant using gas and coal as fuel. This was later revised by ESDM Ministry Instruction No. 1/2012 to increase power generation to a supply capacity of 10.047 MW.

The goal of implementing FTP 2 is to meet Indonesia's electricity requirements that extend beyond the capacity of FTP 1 in accordance with Finance Ministry Instruction no. 139/2011 regarding government preparedness for guarantee for the said IPP's and PLN obligations to the IPP's to purchase electric energy in accordance with the PPA.

Within FTP 2, the IPP has more dominant role in developing more than half of the total FTP 2 capacity with responsibility for 5.023 MW, with a composition of 17.5% hydropower, 3% from gas, 49% geothermal and 30.7% from coal.

Construction for the FTP 2 project has largely already begun with coal based generator development at 4 (four) locations with total capacity of 154 MW, some of which is included in the EPC contract. Financially, the FTP 2 is financed in two steps loans, the company budget, bank loans and the capital market.

Electrical Power Provider

PT. PLN (Persero)

In the late 19th century, electricity development in Indonesia was intensified by a number of Dutch companies operating sugar and tea factories that developed power plants for their own needs. Between 1942 and 1945, there was a shift in management from Dutch companies to Japanese after the Dutch surrendered to the Japanese troops at the beginning of World War II.

A shift occurred once more at the end of World War II in August 1945, when the Japanese surrendered to the Allied Forces. The youths and electricity workers took advantage of this shift and a delegation of Electricity and Gas laborers/Employees along with the leaders of the KNL took the initiative to meet president Soekarno to request the handover of these

companies to the Government of the Republic of Indonesia. On 27 October 1945, president Soekarno established the Electricity and Gas Bureau under the Department of Public Work and Energy with a total power generation capacity of 157.5 MW.

On 1 January 1961, the Electricity and Gas Bureau was renamed BPU-PLN (Board of General Administration of the State Electricity Company) working in the fields of electricity, gas and coke. On 1 January 1965, BPU-PLN was disbanded and inaugurated as 2 (two) state-owned enterprises, State. Electricity Company (PLN) to manage electrical power and State Gas Company (PGN) to manage gas.

In 1972, in accordance with Government Regulation no.17, the status of the State-owned Electricity Company (PLN) was defined as a General State-owned Electricity Company and as Authorized Agency for Electrical Power Business (PKUK) assigned the duty of providing electricity to meet public needs. In line with a Government policy to provide electricity provision opportunities to the private sector, since 1994 until the present day the status of PLN has been amended from a General Company to Corporation (Persero) and also as the PKUK supplying electricity to meet public needs.

Furthermore, with the issuance of law number 30/2009, PLN is no longer an authorized agency in the electrical power business (PKUK), but a State-owned Enterprise assigned the duty of supplying electricity to meet public needs.

Field of Business PT. PLN

The Company's fields of business cover various activities as referred to in Law No.30/2009, as well as the Company's Articles of Association, including:

1. Provision Of Electrical Power:
   - Generation of electricity
   - Supply of electricity
   - Distribution of electricity
   - Planning and constructing facilities to supply electrical power
   - Development of electricity supply
   - Sales of electric power

2. Electricity Support:
    - Electricity consultation
    - Construction and installation of electrical power equipment
    - Maintenance of electrical power equipment
    - Developing technology to support electricity supply
3. Other Activities:
    - Managing utilization of natural resources and other energy sources in the interests of electrical power
    - Operating and dispatching services for generation, supply, distribution and retail sales of electrical power.
    - Industrial activity related to electrical power hardware and software and other equipment related to electrical power
    - Cooperation with other parties and institutions related to electrical power, both domestically and abroad in the fields of development, operations, telecommunications and other information related to electrical power
    - Electricity services
    - The company's business activities are divided into a number of categories:

Planning

Covers planning development of electric power facilities (generation, transmission and distribution) and supporting activities: budgeting, business development, organization development and human resources. Planning activities related to network distribution and electricity in rural areas will be implemented by the Head office, while lower levels of planning will be carried out by district organization units or distributors.

Development

Covers construction of power generating facilities, transmission and substations, which are under the organization construction unit of the main construction agency. Meanwhile, construction of distribution networks is implemented by each district organization unit and distribution units. Rural development of electricity projects funded from the State Budget is the responsibility of the Government and run through the Directorate General for Electricity.

Corporate / Operational Activities

Activities related to the production of electricity are the responsibility of electrical power generation units consisting of various kinds of power plants, Steam power plants (PLTU) fired by coal, natural gas or oil (BBM); Hydroelectric power plants (PLTA) fired by water powered turbines; Gas power plants (LTG-gas turbine) fired by natural gas or oil; Geothermal power plants (PLTP) fired by steam within our planet; and Diesel power plants (PLTD) fired by oil.

Further, the Company also purchases electrical power produced by private power plants (IPP), which also use various kinds of power generation. Electrical power generated by power plants is distributed to the main substation through a transmission network with varying voltage levels: extra high voltage (500 kV), high voltage (150 and 70 kV) and medium voltage (20 kV). The greater the voltage being transmitted along transmission lines of the same measurement, the greater the voltage required. The voltage levels at substations with capacities of 500 kV or 150 kV are reduced for distribution to customers.

PLN main customers are served by high voltage networks of 150 and 70 kV and medium networks of 20 kV, while our customers with smaller electrical requirements are sourced from substations distributing medium voltage of 20 kV; subsequently, voltage at the distribution substation is reduced to the level of 380/220 volts for further distribution through low voltage networks to home connections.

All the above services are conducted by PLN through its business units distributed across the entire Indonesian archipelago. A list of all PLN business units is presented in following Table.

Independent Power Producer

Before the year 1997, the company established sales agreements (PPA and ESC) for preparation of large-scale private electricity supply (IPP). In 1999, the company carried out renegotiations of the PPA and ESC through the Special PLN Working Contract Renegotiation team under the government. The renegotiations included, among other aspects, rebalancing

the conditions of contracts, including price legitimacy and price disparities between the actual sales price of electricity and the PLN sales price.

Within agreement with specific IPP's, it had been agreed that for the length of the arrangement, PLN had the option to buy the selling rights, ownership rights and interest in specified contracts. The Table below shows IPPs that are already in operation and those that are not operating.

Table 55: IPP's Power Plants [65]

No.	Company	Project	Fuel	Capacity (MW)	AF B) (%)	Period
1	PT Cikarang Listrindo	Cikarang, West Java	Gas	300	72	1998-2018
2	PT Energy Sengkang	Sengkang, South Sulawesi	Gas	255	85	1999-2028
3	Chevron Geothermal Salak, Ltd	Salak, West Java	Geothermal	165	90	1997-2027
4	PT Makassar Power	Pare-Pare, South Sulawesi	MFO	60	80	1998-2013
5	PT Paiton Energy	Paiton I, East Java	Coal	1,230	85	2000-2040
6	PT Jawa Power	Paiton II, East Java	Coal	1,220	83	2000-2030
7	Chevron Geothermal Indonesia, Ltd	Drajat, West Java	Geothermal	180	95	2000-2030
8	Star Energy Geothermal (Wayang Windu) Ltd. (d/h/formerly Magma Nusantara Limited)	Wayang Windu, West Java	Geothermal	220	90	2000-2042
9	PT Geo Dipa Energi	Dieng, Central Java	Geothermal	60	85	2002-2044
10	PT Asrigita Prasarana	Palembang, South Sumatera	Gas	150	85	2004-2024
11	PT Sumber Segara Primadaya	Cilacap, Central Java	Coal	562	80	2007-2037

12	PT Dalle Energy Batam	Panaran, Batam Island	Gas	55	80	2005-2016
13	PT Mitra Energi Batam	Panaran, Batam Island	Gas	55	84	2005-2016
14	PT Indo Matra Power	Kawasan Industri Kabil, Batam Island	Gas	17	90	2005-2017
15	PT Jembo Energindo	Panaran, Batam Island	Gas	24	65	2008-2011
16	PT Metaepsi Pejebe Power Generation	Gunung Megang, South Sumatera	Gas	80	80	2005-2025
17	PT Pusaka Jaya Palu Power	Palu, Central Sulawesi	Coal	27	80	2007-2032
18	PT Pertamina Geothermal Energi	Kamojang, West Java	Geothermal	60	90	2008-2038
19	PT Cahaya Fajar Kaltim	Embalut, East Kalimantan	Coal	45	72	2008-2038
20	PT Dizamatra Powerindo	Sebayak, North Sumatera	Geothermal	11	90	2008-2038
21	PT Bajradaya Sentranusa	Asahan, North Sumatera	Hidro	180	90	2010-2010
22	PT Cipta Daya Nusantara	Mobuya, North Sumatera	Hidro	3	80	2007-2027
23	Perum Jasa Tirta	Purwakarta, West Java	Hidro	150	-	2012
24	Aggreko International Project, Ltd	Batam Island	Gas	30	80	2008-2011
25	PT Fajar Futura Energy Luwu	Luwu, South Sulawesi	Hidro	2	-	2010-2035
26	PT Sulawesi Mini Hydro Power	Sinjai, South Sulawesi	Hidro	10	-	2011-2036
27	PT Guo Hua Energi Musi Makmur	Muara Enim, South Sumatera	Coal	227	80	2011-2041
28	PT Eksploitasi Energi Indonesia	Pangkalan Bun, Central Kalimantan	Coal	11	80	2011-2036
Total				**5,389**		

Table 56: IPP's Power Plants Will be Operated [64]

No.	Company	Project	Fuel	Capacity (MW)	AF B) (%)	Period	Status
1	PT Paiton Energy	Paiton Expansion, East Java	Coal	815	80	2012-2042	d)
2	PT Cirebon Electric Power	Cirebon, West Java	Coal	660	80		d)
3	PT General Energy Bali	Celukan Bawang, Bali	Coal	380	85		d)
4	Sarulla Operations Ltd	Sarulla, North Sumatera	Geothermal	330	90		e)
5	PT Ranyza Energi	Kuala Tanjung, North Sumatera	Coal	225	94		e)
6	PT Priamanaya Power Energi	Baturaja, South Sumatera	Coal	225	80		e)
7	PT Bukit Pembangkit Innovative	Banjarsari, South Sumatera	Coal	220	80		d)
8	PT Bosowa Energy	Jeneponto, South Sulawesi	Coal	200	80		d)
9	PT Poso Energy	Poso, Central Sulawesi	Hidro	195	846GWh/th		d)
10	PT Geo Dipa Energi	Patuha, West Java	Geothermal	180	90		e)
11	Bali Energi Ltd	Bedugul, Bali	Geothermal	175	95		e)
12	PT TJK Power	Batam Island	Coal	110	85		e)
13	PT Geo Dipa Energi	Dieng, Central Java	Geothermal	60	85		e)
14	PT Equator Manunggal Power	Pontianak, West Kalimantan	Geothermal	54	85		d)
15	PT Indo Ridatama	Samboja, East Kalimantan	Coal	55	80		e)
16	Others		Coal				
Total				**4,110**			

a) The agreements are effective from the date of signing and buy and sell of electricity is valid between 19 to 30 years starting from the commercial operation date.
b) AF = power supply factor which should be absorbed by the Company.
c) Represent contracts with 27 Ipps, consisting of 20 Ipps under construction and 7 Ipps in financing stage, which are located in several areas of Indonesia and are generated by coal, geothermal and mini hydro each with power plant's capacity of less than 50 MW.
d) Under-construction.
e) Financing stage.

The price of gas, MFO and coal generated electric power per kWh was determined based upon specific formulas considering agreements on, among other things, the cost of capital,

payment of operational and maintenance expenses, fuel expenses and payment of variable operational and maintenance expenses. For power generation using geothermal resources, the price of electricity was determined by a specific formula as formalized in the Energy Charge and Capacity Charge agreement, among other things.

Business Development for Renewable Energy (Case: Geothermal)

The private sector can play an important role in developing the energy, especially at a time when the global economy is increasingly unclear, leading to reluctance from parties to invest. One company that has set its commitment is PT Pertamina Geothermal Energy (PGE).

PGE will focus on their own to make electricity from geothermal energy began in 2012. The goal is to augment electricity supply in Indonesia with minimal pollution. Until the year 2011, PGE has been explored as much as 1,560 MW of geothermal energy.

According to the Director of PGE it still continues to do the development of a number of plants. Among plants Hulu Lais 2 x 55 megawatts, Kotamobagu 2 x 20 megawatts and Karaha is expected to generate approximately 60 megawatts of electricity.

PGE plans to invest more than $ 2 billion to add to the development of geothermal capacity 1,050 MW in the period 2011-2015. In the development of geothermal energy using PGE has three business models.

First, the company produces steam which is then sold to PLN to be converted into electrical energy. Second, PGE also produces electricity and steam at the same time supply to PLN through a transmission that is in the area of operations and Sibayak Kamojang each with a capacity of 60 MW and 2 MW. The third business model is collaboration with independent power producers (IPP) with the Joint Operation Agreement (JOA) system, which was implemented in operational areas Salak, Darajat, Wayang Windu, Sarulla and Bedugul (Bali).

The government is targeting the development of geothermal energy could reach 12,300 MW by 2025. Indonesia is expected to utilize geothermal energy to become the largest in the world.

In 2014, the development is expected to already be approaching 3500 MW, which will operate its own PGE of 3,000 MW. Indonesia itself has touted prospect geothermal generated from ring volcano in Sumatra, Java, Bali, Nusa Tenggara and Sulawesi until potentially 250,150 volcanoes have been identified.

Other companies such as PT Wijaya Karya (Persero) Tbk continue to strengthen its investment in the field of energy and electricity. Wika plans in 2012 to invest for a power plant Siak 28 MW with a contract value of Rp 350 billion and investment cooperation micro-hydro power plant (MHP) 13 MW West Java Rp 300 billion.

In February 2011, Wika has completed the first investment project in the field of energy, namely diesel Pesanggaran Bali 3x18 MW system using Build-Operate-Transfer (BOT) system. Wika also was carrying 3 investment projects generating 25 MW namely Ambon diesel, diesel Forms 60 MW and 20 MW power plant Rengat. Target total sales per year from 2012 to 2019 from four investment projects is Rp 469.99 billion with a total profit of Rp 46.99 billion per year.

Other companies such as Zug Industry Indonesia instead create a new plant as an extension of a previous building. The company is engaged in the business of design engineers and power system plan. The electricity company also continues to develop many innovations for electricity in the country.

But admittedly the development of electricity in the country is still constrained by infrastructure problems. National Development Planning Agency (Bappenas) assess the problem of electricity infrastructure in the country is still a barrier to the growth rate of the overall electricity investment. The provision of electricity infrastructure is not optimal due to the lack of funding is judged.

Previous surveys by the World Bank doing business in 2012 downgraded the climate of doing business (investment) in Indonesia from position 126 to 129 due to the lack of electricity infrastructure.

But of course there remains optimism. The Government through the PLN continues to meet the needs of electricity. PLN targets the number of customers using pre-paid electricity to more than 5 million customers in 2012, up 6% from the current postpaid subscribers has reached 3.5 million subscribers. In addition, the government encourages the development of independent power plants (private) or IPP in order to supply more electricity to PLN. Good cooperation between the government and companies engaged in the field of electricity and energy will certainly make optimism the development of electricity during 2012.

All projects include RE/SET project or service will follow the applicable procedures, need approvals required from concerned authorities and there is no ease of getting such approvals. In addition to the lack of clarity Bantar Gebang landfill project, also occurs misperceptions among the public Bantar Gebang and Bekasi City Government regarding the compensation fund. For Bantar Gebang's community, the compensation funds should be distributed to those affected by the presence of TPA Bantar Gebang. However, Bekasi municipal government, the compensation fund should be entered into the budget first and then channeled into projects that are according to the study. Damage to the environment, facilities and infrastructure that may be caused by the presence of the project needs to be a concern for the projecy management and the government, which appears to reduce the cost of the socio-economic impact, both for municipal solid waste power generation projects and geothermal power.

E. Social-Economic Factors

Social Factor

Like other Asian countries, traditionally Indonesian rural communities get used to utilize renewable energy technology to fulfill their energy needs especially for agricultural production processes. A traditional hydropower rice milling and a simple solar power rice dryer are examples of the technologies. Besides that, since early 70s, biogas from animal manure has been utilized by rural communities for household cooking. Socially, a simple wind power propeller to drive "a bird strike" at rice field is another example.

Unfortunately, these are now becoming obsolete, and many are switching to the use of fossil fuels to drive a variety of motors and machines.

The government efforts to promote RE

In order to promote utilization of renewable energy resources the government, through MEMR, have introduced and implemented the following measures:

a) Facilitate and give incentives for industry which use biodiesel.

b) Field Advisor and Award Pioneer.

   In 2010, Ministry of Mineral and Energy Resources launched a programme to train field advisors for energy related matters (*Petugas Penyuluh Lapangan, PPL, Energi*) to support and help communities in order to utilize energy resources efficiently. In addition, the ministry has also launched a programme to give awards and grant for people who showed pioneering activities in energy. The idea is to drive and support urban communities to utilize energy resource efficiently and drive rural communities to utilize locally available renewable energy resources to fulfil their energy needs and to utilize resources efficiently. (Source: www.esdm.go.id, Arsip Berita/Pemerintah Luncurkan Program PPL Energi, Agustus 2010). Example of the activities are to train or advise on how to use 3 kg LPG system during the conversion of kerosene to LPG for household cooking. Another example is a Renewable Energy Initiator Program (*Program Kepioneeran Bidang Energi*), which provides rewards and prizes for people who showed pioneering activities in energy saving and utilizing renewable energy technology related to micro hydro, biogas, biomass, and efficiently used energy

resources. The Program is conducted jointly with religious communities and schools. The training for the advisor is conducted by MEMR's training centres.

c) Local governments through Province Education Offices (*Dinas Pendidikan Propinsi*) provide students (preliminary and junior high school, at certain provinces or regions) with knowledge on solar energy, by building demo facilities, Smart Education Park (*Taman Pintar*) at recreation and at tourism objects at certain cities (in Jakarta, Yogyakarta, Surabaya, Makasar cities) to show RET to student.

d) Almost at all the governmental R&D Institution and many public and private universities promote renewable energy technology. Several universities, such as University of Muhammadiah Yogyakarta (UMY) and Darma Persada University, have special curricula for renewable energy development, and renewable energy technology. UMY for example just received Indonesia Green Award 2014 for its achievement in renewable energy conservation education programme (Source: www.kompas.com, 22 April 2014). Darma Persada University has Master Programme for Renewable Energy (www.unsada.ac.id/?page_id=3663). Bakrie University, Politeknik Jember, Surabaya University, Jenderal Sudirman University are several university which has curricula concerning renewable energy in their education programme. These education programmes indicate that universities in Indonesia are aware the important of development renewable energy for future energy mix in this country.

e) ESDM give award for energy efficient for commercial buildings.

National and Societies Openness to Technology Innovations

Technology innovations, including renewable technology innovations, are the concerns of the government and society. To enhance local technology innovations, the ministry of science and technology built Business Innovation Centre (BIC) to drive innovation, including renewable energy. The centre is designed to drive, collect information on technology innovations resulted by public and private universities, research institution, and promote them to community especially to related industries.

a) Implement code of conduct for research scientists
b) Certain Media (TV and Newspaper) offers innovation award related to Green Tech.
c) National championship on Energy Saving.

Example of Community involvement in developing RE

Involvement and enthusiasm of Indonesian communities in developing and promoting renewable energy could be seen throughout a number of societies and their activities in RET. In this report only several examples of societies and communities activities are reviewed as follows.

a) Indonesia Renewable Energy Society (*Masyarakat Energy Terbarukan Indonesia,* METI) is a society of scholars who are concerned with RE development. The member consists of industries, research scientists, lecturers, businessmen and women, and government official. The society is media for people for communication, consultancy, or develop cooperation among members. Regularly, the society conducts national or international activities such as seminar, workshop, focus group discussion related to renewable energy (www.meti.or.id)

b) APEBTI (Asosiasi Perusahaan Penunjang Energi Baru Terbarukan Indonesia) *The Association Of Indonesian Renewable Energy Supporting Companies (AIRESCO)"* (www.apebti.com). APEBTI's members are company which deals with new and renewable energy activities. Their objectives are to support and enhance Indonesian business and economy in the areas of new and renewable energies. The association is a media for members to exchange information, discuss their activities and challenges, to give training for members, etc. Numerous activities of APEBTI may be learned from their website.

c) Association of Indonesian Bioethanol Producers (*Asosiasi Pengusaha Bioethanol Indonesia,* APBI). The association was founded on November 2008 by members. The association's member is restricted.

d) Association of Indonesian Biofuels Producers (Asosiasi Produsen Biofuels Indonesia (APROBI) is an association of biodiesel oil and others biofuels.

e) Indonesian NGO "*Yayasan Rumah Energi*" (Energy House Foundation) collaborated with HIVOS, an NGO from the Netherlands, support the utilization of biogas in rural areas (www.biru.or.id). Their activities has supported construction of more than 11,000 biogas digester system for farmers in nine provinces and providing access to biogas for more than 17,700 people at rural areas. About 550 biogas digesters have been built in West Java provinces only (*source: bisnis-jabar.com*). Their support is

especially for small scale biogas digester construction, at size of the biogas digesters between 4 m^3 (for one house) and 12 m^3 (for three houses).

f) Indonesia Wind Power Society (IWES), (*Masyarakat Energi Angin Indonesia*, MEAI) is a society of experts, scientists, industry and business people who has interest in conducting research and developing wind power technology and businesses in Indonesia. The mission are to develop and utilize wind power, to support the government programme on providing electricity for rural areas, especially for remote areas by utility wind power, and to enhance human resources capability in wind power technology.

g) Indonesia Geothermal Association, INAGA (*Asosiasi Panasbumi Indonesia*, API) (wwww.inaga.org) is a society of industries expert, scientist, business people, and other community members who has interest to develop and enhance utilization of geothermal in Indonesia. The association was founded in 1991. Their mission is to proactively position geothermal energy at competitive edge because of its renewable, environmentally sound, economically attractive options to meet increasing demand of Indonesia's energy market.

h) GreenRadio.fm is a radio broadcaster which has regular programme to promote *green and eco technology for people* with a tag "eco-lifestyle".

Example of women involvement in RE

Example of women involvement in renewable energy at rural areas has been studied by AbuBakar Lubis (Lubis, A, 2004). He studied and showed how role of women at rural households especially at villages which have operated solar PV for lighting. Operation and maintenance of the system is mostly conducted by women because of their husbands are out for works. The study showed number of positive impacts of the renewable energy to economy and social issues of household such as a better sanitation and better standard of living, give a chance for women to understand and operate the system, provide job opportunities, etc. The study also showed the negative impacts, such as creating 'tension' between husband and wife and a pressure on schools and teachers to provide more and better infrastructure for student.

Ms. Tri Mumpuni in 2013 received an award from Islamic Development Bank (IDB) during an event with theme "Women Management of Natural Resources for Development" for her innovative works on renewable energy for remote and rural areas in Indonesia (*Source: antaranews.com: 6 March 2013: www.antaranews.com/berita/361750, access 21 April 2014*). Ms. Tri Mumpuni has developed of micro hydro power generation PLTMH for more than 60 remote area and villages which had no grid connection. Her innovative approaches are not only to build the electricity power generation, but also teach people how to keep water catchment area, at least 30 km^2 naturally, so that the river or water flow to supply the hydropower station could be kept in good condition.

Assistance from Local Community Group in Promoting SET/RET

- Role of local community, *Karang Taruna*, in promoting RE through informal education and edu-tourism (education and recreation).
- Activities of *Dian Desa* Foundation (*Light of Village* foundation) in RE

Affordability and Accessibility

Conventional Energy Being Use and Unit Price

Tariff for conventional energy in Indonesia is shown in Appendix B for electricity and Table 21 for fuel oil.

Table 57: Retail Price of Fuel Oil (as per April 2014)

No	Fuel Oil	Price (Rp/liter)	Note
1	Pertamina Premium (RON 90)	6,500	(subsidized)
2	Pertamina Pertamax (RON 95)	10,500	(nonsubsidized)
3	Biodiesel	5,500	(subsidized)
4	Kerosene :	3,500	(subsidized), At areas where LPG 3 kg does not available. (price depend on province)
5	Kerosene	10,000	(nonsubsidized) At areas where LPG 3 kg are available
6	Cooking : LPG –	16.000/ 3 kg	(Subsidies).

		package	
7	Cooking LPG	90.000/12 kg package.	(Nonsubsidized)

Average Monthly Spending on Use of Conventional Energy

During this report preparation, there is no study or survey which showed monthly spending of a household in Indonesia. BPS as the agency of statistic published that there was a trend of reduction of family spending for food from 51.4% of family income in 2010 to 47.7% in Sep 2012. The rest was spending for nonfood, included for electricity, transportation, etc. (*BPS 2013, Statistik Pendapatan dan Pengeluaran, www.bps.go.id*). Merdeka.com a newspaper of Indonesia, on Jan 2, 2014 published that in Jakarta average living cost of low income households, with 4 people in a family in 2012, was Rp 7.500.700 a month, 35% of the spending was for food. Another source mentioned that average low- and middle-income households spend Rp 100,000 (about US$10) for cooking gas LPG for a month. It should be noted here that LPG gas for low income family is subsidized by the government.

The Government Subsidy for Conventional Fuels

As mentioned earlier that the government of Indonesia provides several type of subsidy for energy. The allocated government budget for total energy subsidy for 2014 is Rp 282 trillion or about US$24.50, with exchange rate per April 2014. The subsidy is for diesel fuel and gasoline (i.e. Premium Pertamina, RON 90) for transportation and for LPG (3 kg package) designed for low income households and micro or home industries. The subsidy is also for electricity for small houses/ low income families. The amount of subsidy per type of fuel is shown in Table 20.

Table 58: The subsidy of non-conventional energy per type of fuel

No	Type of Non-Conventional Energy	Retail Price (Rp/unit)	Subsidized (Rp/unit)	Note
1	Gasoline :Pertamina Premium (RON 90)	6,500 / liter	2,300/liter	2013 (Source : www.pertamina.com/news)

2	LPG : package 3 kg.	16,000/3 kg	5,500/kg	Data: Jan 2014. Source : www.pertamina.com/news-room/siaran-pers/sesuaikan-harga- elpiji
3	Bio Solar (biodiesel fuel oil)	5,500/litre (current retail price)	3,900/litre	The amount of subsidy based on exchange value in 2012 (US $ 1/Rp 9000). (Source : www.finance.detik.com, Date : Data on March 29/2012)
4	Electricity	a) For consumer with 450 VA and 900 VA	396 /kWh (average subsidy)	Source: ("Tanya Jawab seputar pengurangan subsidy : Kenaikan tariff listrik 2013", www.pln.go.id/

Financing Scheme for purchasing RE

- In 2004-2006, in collaboration with Yayasan Dian Desa Kupedes BRI through the programme, helping the villagers build solar energy.
- Kupedes, micro loans (up to US$25 M) also helps in the renewable energy business. KUPEDES initially be general rural credit (general credit / loan for rural areas / villages), but lately Kupedes name used for a variety of micro-credit BRI.
- A programme from BRI Bank to support solar energy (BRI - Kupedes - PLTS).

F. South-South Co-operation

In order to enhance development and utilization of new and renewable energy resources, the government of Indonesia signed agreements with several countries. The following is a short list of cooperation in the field.

a) Cooperation among Indonesia-India- South Africa on development of renewable energy.
b) Cooperation between Indonesia and South Korea to develop and enhance utilization of renewable energy in Indonesia as decided by the President of two countries on October 2013 (Source: Energy Today)
c) Cooperation between Indonesia and Philippine signed in June 2013 concerning development renewable energy in two countries.
d) Cooperation between Indonesia and Hungary, June 2011, concerning renewable energy.
e) Cooperation between Indonesia and New Zealand, Dec 2011, to develop wind energy and micro hydro power to be implemented at east part Indonesia.
f) Indonesia Thailand Energy Forum (ITEF). During their meeting in Bali, 2013, and at meeting in Feb 2014, the forum agreed to develop renewable energy, especially bio-fuels.
g) Cooperation between Indonesia and Finland in the frame of EEP – Energy and Environment Program, April 2010. The cooperation was agreed to support capacity building, especially for Central Kalimantan and Riau Provinces.
h) ASEAN – MERCOSUR (*Mercado Comun Del Sur*/ Common Market of the South), in their meeting in Bali, Nov 2008, agreed to cooperate in field of renewable energy development to reduce on fossil oil dependency.

Cooperation among Indonesia-India-South Africa on Development of Renewable Energy

Background

Both Indonesia and South Africa are at a stage where national policies on climate change mitigation have been formulated, and there is scope for cities to begin taking concrete action. ICLEI, an international association of local governments committed to sustainable development, has developed a local renewable (LR) initiative which steers city governments

through the integration of increased energy efficiency (EE) and RE generation into all city activities.

Purpose of Cooperation

To develop two model local renewables initiatives, one in Ekurhuleni Municipality in South Africa, and the other in Yogyakarta city in Indonesia while providing both with guidance from a city in India, and to facilitate the adoption of similar initiatives in other South African and Indonesian cities

Main Activities

- Make the final selection of the project cities, currently slated to be Yogyakarta and Ekurhuleni, and designate one Indian city as a resource city to provide process guidance
- Assess each project city's carbon emissions inventory to identify priority interventions
- Develop action plan for each city adopting EE and RE initiatives in line with national policy, involving a multi-tier stakeholder committee.
- Identify financial sources for implementation, and relevant demonstration projects
- Implement a pilot project in each city and showcase the process and results to observer cities, disseminate via country workshops
- Develop a local RE resource centre for each city showcasing local initiatives and products
- Develop a country-specific Solar Cities Guidebook to actively promote renewable energy

Expected Impact

- Starting impetus provided for major cities in South Africa and Indonesia to work towards national and international EE and emission reduction goals
- Long term action plans in place following an analysis of reduced energy use and emissions
- Potentials identified for RE and EE to improve delivery of municipal services
- Shortened learning curve for cities through the South-South exchange of experiences

- Communities catalyzed into adopting RE and EE initiatives at household level thanks to resource centers showcasing case studies
- Potential for project cities to transform into "Solar Cities" as was the case in India
- Strengthened ICLEI regional capacity to roll out this programme on a wider scale
- Related News
- Coimbatore hosts launch workshop for ICLEI Local Renewables project

Project Information

- Programmed sector: RE & EE (Policy& Regulation)
- Stage of project: Ongoing
- Location: IN/India, ZA/South Africa, ID/Indonesia
- Duration: 2011 - 2013
- Budget: € 150,326 including co-funding from Co- funding from Ekurhuleni and Yogyakarta project cities

Indonesia-Republic of Korea Cooperation

Both countries agreed to develop renewable energy. Several activities have been conducted. One of the implementing projects is development of pilot-scale system for production of bioethanol from palm oil industry solid waste (a lignocellulose material). The facilities were based on Korean technology, while the process condition based on Indonesian research results. The Republic of Korea (through KOICA) funded the project for construction the pilot scale facilities, laboratory analytical equipment and for training, while Indonesia funded for operational of the facilities.

Indonesia-Thailand Energy Forum ITEF

Indonesia-Thailand Energy Forum (ITEF) was result from a meeting between the President of Indonesia and Prime Minister of Thailand on October 2006. In December 2007 in Bangkok, the two ministers for energy affair from both countries signed an agreement to form the Energy Forum. On the first ITEF meeting July 11-12 2008 in Bangkok, both countries agreed to collaborate in the field of energy sector, for R&D, electricity, Petroleum and Gas, and coal.

In the 4th meeting in 2013 in Bali, the collaboration has been expanded to cover new and renewable energy such as biofuels, CBM. (Source: http://www.esdm.go.id/agenda/)

Summary

This report describes the relevant information to sustainable energy technology innovation eco-system in Indonesia. This includes current national sustainable energy policies and programmes, including support mechanisms (regulatory, institutional, technical, financial, etc.) that compliments and supplements promotion of affordable and accessible sustainable energy options. It also identifies South-South cooperation opportunities to import/adopt sustainable energy technologies in such areas as solar energy and geothermal, etc.

In terms of regulatory supporting mechanism, Indonesia has launched a number of policies and regulations in attempts to promote the use of renewable energy so as to accelerate the fulfillment of energy mix target. The policies and regulation is also aimed at developing and strengthening technology innovation ecosystem on sustainable energy in Indonesia. A more consistent enforcement of those policies and regulation will have a positive impact to concretely promote a wider energy options for various stakeholders in Indonesia. It is also necessary for Indonesia to create policy and regulation that encouraging the strengthened sustainable energy technology innovation ecosystem amongst the South-South Cooperation and also in the Asia and the Pacific region.

Indonesia has also participated in South-South Cooperation on sustainable energy such as with India, South Africa, and other countries. Given the energy potential of geothermal, biomass, hydro power in Indonesia, it is necessary Indonesia to strengthen its innovation technological capacity in these important areas and develop collaboration with other countries in the region that have same energy potential to participate.

Challenges in Indonesia

The biggest challenge to promote utilization of RE and to drive '*energy saving concern*' are: a) very limited support for those who need fund /investment for a change in their energy system to be a more efficient one, because they need to change or upgrade (apparatus, equipment, etc.), and b) people of Indonesia get use on low cost of energy due to the huge

subsidy from government. For 2014 the government allocated Rp 210 trillion and Rp 71.4 Trillion for fuel and electricity subsidy respectively.

Suggestion

Due to environmental consequences of burning fossil fuels like greenhouse gas emission and the fact that fossil fuel like greenhouse gas emission will be depleted one day, the dependency of Indonesian energy scenario to fossil fuels will have an adverse effect on the economy in Indonesia. Therefore, action toward using renewable energy source should be put as priority by the government. Some of successful implementation of renewable energy programmes from developed and developing countries that can be adopted by Indonesian government.

Urgent Problems

Pressing issues currently faced by PLN are a) to meet the need of areas that lack of electricity and b) replace the fossil oil-fired power plant with other type fuel and c) provide electricity for areas that do not have power, including border areas and remote areas, both in the short term and long term.

In several major islands, such as Sumatra, Kalimantan, etc. experiencing power shortages. The fulfillment of the electricity demand is a major challenge, and utilization of renewable energy to fulfill local need should be considered.

Case Study

Development of Local Technology for Geothermal Electric Power Generation to Increase Electricity Power Generation Utilizing Renewable Energy in Indonesia

Introduction

In order to accelerate economic development of Indonesia, the government launched a development programme called MP3EI, *Master Plan Percepatan Pembangunan Ekonomi Indonesia* (2011-2025),the Master Plan for Acceleration and Expansion of Indonesia Economic Development. The document mentioned that the government plan to build 10,000 MW (at each step) power plan infrastructure and facilities in several potential provinces of Indonesia to support industries development in those selected provinces[3].

Development geothermal electricity power generation plant is a priority in the programme, as the huge sources of geothermal in Indonesia (See Figure 14 and 15 on Page 31). As a consequence of Indonesia's location in The Ring of Fire and its volcanic geology, the country is blessed with untapped potential of geothermal energy. It is estimated that the country has 29,000 MW of geothermal potential, corresponding to 40% of world's potential geothermal resource (Table 59). So far, it is only less than 10% of the potential that has been utilized (Table 60).

Table 59: The potency of geothermal in Indonesia (Anang, H , PLN 2014)

RESOURCE (MW)		%	RESERVE (MW)			%
Speculative	*Hypothetical*		*Possible*	*Probable*	*Proven*	
8.780	4.391	45.36%	12.756	823	2.288	54.64%
13.171			15.867			
29.038						

[3] *Nenny Saptadji (2008):* Strategi dan Langkah-langkah dibidang: ENERGI PANAS BUMIJune, ITB.

Table 60: Geothermal power plant capacity [37]

Working Area	Location	Turbine capacity 1 × 30 MWe	Operator	Total capacity
PLTP Kamojang	West Java	2 × 55 MWe 1 × 60 MWe	PLN	200 MW
PLTP Lahendong (Pertamina)	North Sulawesi	2 × 20 MWe 1 × 20 MWe	PLN	60 MW
PLTP Sibayak (Pertamina)	North Sumatra	1 × 12 MWe	Pertamina	12 MW
PLTP Salak (Chevron GS)	West Java	3 × 60 MWe 3 × 65 MWe	PLN CGS	375 MW
		1 × 55 MWe	PLN	
PLTP Darajat (Chevron GI)	West Java	1 × 90 MWe	CGI	255 MW
		1 × 110 MWe	CGI	
PLTP Wayang Windu	West Java	1 × 110MWe 1 × 117 MWe	SE	227 MW
PLTP Dieng (Geo Dipa Energi)	Central Java	1 × 60 MWe	GDE	60 MW
			Total	1,189 W

I. Programme: Target and Road Map of Geothermal Power Plant Development

Table 61: The government's target in the "Energy Mix" is to realize 9500 MWe operated by year 2025

Year	Total Capacity (MWe)	Increasing Capacity (MWe)
2008	2000	1193
2012	3442	1442
2016	4600	1158
2020	6000	1400
2025	9500	3500

Government Strategy

1. Increase gradually the existing capacity of geothermal power plants;
2. Develop Mining Working Areas (WKP) for geothermal drilling in proven areas;
3. Conduct exploration drilling at WKPs that have been explored in detail and then develop these fields for power generation;
4. Conduct WKP geothermal energy exploration where rights management has been handed over to Pertamina and PLN; and
5. Auction new WKP for geothermal energy exploration.

Government Efforts

1. Increase gradually the existing capacity of geothermal power plants at the moment (existing) in accordance with the potential reserves, which cover Kamojang, Darajat, Awibengkok - Mount Salak, Wayang Windu, Lahendong, Dieng and Sibayak.
2. Developing Mining Working Area (WKP) Geothermal who has proven through drilling, the field Bedugul (Bali), Patuha (West Java), Sarula (North Sumatra), Cibuni (West Java), Ulumbu (East Nusa Tenggara) and Karaha Bodas (West Java).
3. Conducting exploration drilling at the WKP few have been explored in detail and then develop these fields for power generation. These fields include Moss Hall (South Sumatra), field Ulubelu (Lampung), and the PT PLN, i.e. Mataloko Field (Ambon).
4. Doing WKP Geothermal Exploration in the rights management has been handed over to Pertamina and PLN, ie Tulehu field (Ambon), Kotamubagu (North Sulawesi), I-Argopuro (East Java), Full River (Jambi) and Hulu Lais (Bengkulu).
5. Auction Geothermal new WKP with priority WKP ex Pertamina.

Development Problems

- Dieng and Patuha : There is still no certainty about the settlement of related issues:
  - Elimination / release inbreng assets Pertamina and PT PLN.
  - Status former HCE assets / PPL (OPIC).
- At the time of high oil prices, Rig (drilling tower) is difficult to obtain fierce competition and price plans delayed drilling rig rental services increased.

- Price agreement between PLN and business communities is difficult to achieve / require considerable time (Kompas News: sdh no agreement PLN and Pertamina Geothermal power price related).
- There are provisions in the Forestry Act prohibits any activity in the nature reserve forests and national parks for non-forestry activities Bedugul: Permits the use of forests for geothermal development and denial of Balinese society (socio-cultural).
- Geothermal areas are in remote locations, where infrastructure facilities are generally less supportive (minimal).
- Availability of experts in the field of geothermal energy to support geothermal development is still very limited.

Efforts for Achieving Energy Targets Mix

Now the target geothermal has missed 50% of the Plan 2008.

STRATEGY

- Geothermal Road Map should be 'revised'
- Must be have a commitment from all parties, namely the Central and Local Government, DESDM, Dept. of Finance, Dept. Forestry, DLPE, PT PLN, and businesses to resolve problems in the fields of Dieng, Patuha, Bedugul, Kamojang (Unit-5) and another field.
- Formed "EXPERT TEAM" and assigned special responsibility in monitoring the achievement of targets set in the "ENERGY MIX".
- The government needs to dedicate Rig-rig (drilling tower) for drilling geothermal wells, as is done in Iceland.
- Intensify the development of small -scale geothermal power plants in remote areas, such as NTT, Maluku and Sulawesi

REGULATORY ASPECTS

1. Provisions on forestry land use needs to be revisited by providing an exception for geothermal development (not equated with open pit).
2. Policy Price: least cost concept is not adopted PLN applied to renewable energy.

3. Government regulation governing geothermal direct use should be published soon

EDUCATIONASPECTS

Accelerating the provision of skilled professionals in geothermal development in Indonesia

AppliedAcademicMaster Program(S2)
"Geothermal Engineering" beganat the ITB

TECHNICAL ASPECTS

1. Optimizing Geothermal Power Plant existing and to be built , with :
   - Utilizing brine (water of separation in the separator) to generate electricity with a flash binary cycle or cycle.
   - Utilizing the condenser heat to generate electricity with binary cycle.
   - Utilize excess fluid pressure before entering into the turbine.
2. Improvements in technology and methodologies in use today , with the goal of reducing uncertainty in the assessment of resources (resource assessment) , improving efficiency , reducing the risk of exploration and development as well as minimizing the impact of development on the environment.
3. Assessment technical and economic feasibility of developing a geothermal field in Java and Sumatra.

Intensify research to solve problems of silica, so that very high geothermal temperatures (> 300^{o}C) can be utilized.

ASPECTS OF CAPACITY BUILDING

(Improve Ability of Nation)

- To date the use of goods, services, technology, and engineering and design capabilities in the country is still very limited. As per the spirit of Law. 27/2003 on Geothermal, Article 32 (h) the use of goods, services, technology, and engineering and design capabilities in the country needs to be improved. Should begin upaya2 komponen2 equipment manufacture in the country (for example, to manufacture small capacity turbines).
- Software development (software) for applications in the field of Geothermal continues to be implemented.
- Update software for the analysis of technical feasibility and economics of geothermal projects that have been developed ITB.

Efforts To Speed UpThe Geothermal Development In Indonesia

Development of Local Technology (BPPT-2014)

1. Until 2012, all power plants used foreign technology.
2. BPPT is appointed by the government to develop national technology, in cooperation with local industries.
3. Improving and harmonizing regulations in geothermal business, including a revision of the Geothermal Law to allow the geothermal development in conservation forest.
4. Pricing regulation with comprehensive treatment.
5. Fiscal incentives for geothermal development.

Local Content RegulationFor Geothermal Power Plant

Table 62: Industrial Minister Regulation No. 54/2012

CAPACITY	LOCAL CONTENT		
	EQUIPMENT*	SERVICE**	COMBINATION
≤ 5 MW	31,30%	89,18%	42,00%
> 5 MW - 10 MW	21,00%	82,30%	40,45%
>10 MW - 60 MW	15,70%	74,10%	33,24%
> 60 MW - 110 MW	16,30%	60,10%	29,21%
> 110 MW	16,00%	58,40%	28,95%

Notes: *) Equipment: Equipment consists of steam turbine, boiler, generator, electrical, instrument and control, balance of plant and/or civil and steel structure.

**) Service: Consultancy service (feasibility study), integrated construction service (engineering, procurement, and construction), inspection, test, certification and/or supporting services.

Development of Small-Scale Geothermal Power Plant

Noting that the technology of geothermal power plants all from abroad, BPPT as government research institutions, along with some of the local industry, build local technology to design and create a geothermal power plant. Currently the system is being test d (commissioning).

Goals:

To accelerate the development small scale geothermal power plants by domestic human resources and national industries.

1. It is a national priority programme stated in the Presidential Regulation No. 05/2010 regarding the National Medium-Term Development Plan 2010 – 2014.
2. Output :
   - Condensing Turbine Technology of 3 MW GeoPP.

   → Ready for operation in Kamojang Geothermal Field
   - Binary Cycle Technology of 100 kW GeoPP.

   → Under construction in Wayang Windu Field

Figure 24: Local players are producing 3 MW geothermal equipment

Figure 25: Pilot plant for geothermal energy

Table 63: Local Industries which get involved in Geothermal Power Plan Development in Indonesia

No	Component of System	Industries/Institution	Note
1	Engineering Design	BPPT	A government RD Institution.
2	Production well, Hot Well Pump, Reejection Well.	PT. PGE	
3	Demister, Condensor, Jet Ejector, After Condenser,	PT.BBI	
4	Turbine	PT.NTP	
5	Generator	PT.PINDAD	A state owned company.
6	Vacuum Pump, ACW Pump	PT.TGE	
7	Cooling Tower	PT. Hamon	

(Source: Unggul BPPT, 2014)

Future Challenges and Opportunity

1. The Geothermal Power Plant operates at its3MW scale, the challenge ahead is to build GPP on a bigger scale with the technology of the country, so that the utilization of geothermal energy as a source of electricity from renewable energy materials can be optimized.
2. How this technology can be co-operated with many countries in Asia which have the potential for geothermal energy.

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