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Analysis exploiting of resource energy alternative as new energy to Support Substitute BBM

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ABSTRACT

Energy represent requirement of human being base, what increasing in line with its life storey;level. Oil fuel / fossil energy represent one of the source energy having the character of do not newly (non sources energy renewable) which during the time representing pledge to fulfill requirement of energy in all activity sector. Properties of resource of energy in Indonesia, that is Hydropower, hot earth, earth gas, coal, peat, biomassa, biogas, wind, sea energy, sun and other can be exploited as alternative energy, replacing depended to oil fuel, what limited progressively goodness sum up and its reserve. Oil fuel hold very dominant position in accomplishment requirement of energy in country. Have to realize in this time Indonesia have imported crude oil and also oil fuel to ful fill requirement. crisis of Energy which knock over world affect, world crude oil price height, having an effect on direct to activity of economics. Properties of resource energy, specially the source of new and new energy which we have, require to difikirkan to be exploited as alternative energy, replacing and lessening role of oil fuel in consumption of energi in Indonesia. On that pattern, Body Research and Development of University of wijaya Putra doing research with activity of Analysis Exploiting Of Resource of Energy Alternative Is Ready of Energy Society in Indonesia, upon which policy of management of exploiting of resource of energy existing. Renewable energy To support BBM subtitute.

Introduction

Energy represent the elementary requirement of human being, what increasing in line with its life storey;level. Oil fuel (BBM) hold the very position dominant in accomplishment of requirement of energy national. Composition consume the energy national in this time BBM : 52,50%; Gas : 19,04%; Coal : 21,52%; Water : 3,73%; Earth Heat : 3,01%; and New Energy : 0,2%. Condition that way happened in consequence of policy subsidize the past to oil fuel in effort race the acceleration of undeniable growth ekonomi. A fact that production of Indonesia petroleum experience of the degradation of effect [is existence of degradation naturally and progressively attenuate [it] reserve. Product decrease our crude oil and height of price of crude oil [of] world very having an effect on to ability of development budget. During the time oil fuel in Indonesia still be subsidized by state (passing APBN), so that become the very heavy burden for government.For lessen the the subsidy burden governmental try to lessen the depending to energy of oil fuel, with searching and developing source energy other;dissimilar cheap and easy to got. Have to realize that in this time Indonesia have imported crude oil and also of BBM to fulfill requirement of domestic consumption. Till in this time the source of petroleum energi still become the source of especial energi in its use especially in the field o electricity , industrial and transportation. Middle crisis of energy in this time arise idea for the multifarious of energy (diversified energy) by developing the source of other energy as alternative energy. to is ready consumption of domestic energy. Indonesia have resource Multifarious of energy, like gas and oil, hot [of] earth (geothermal), coal, peat, water energy, biogas,biomassa, sun, wind, waving sea etc.. Resource potency of energy the spread over in all area in Indonesia according to karekteristik and condition of its geology . In general in usage / consume energy in Indonesia still rely on and base on resource of energy petroleum. Condition of real indicate that resource of energy petroleum will finished and have limitation of supply goodness in the form of its reserve. Other side request resource of energy the progressively mount to cause oil price excelsior so that have high exporting market potency. Ought to petroleum can be pledged as source of inclusion to national income and only as energy for certain which technological have to use oil fuel..

Electrics Energy as sekunder energy very [is] popular used in all activity sector. PT. Company Of Electrics State (Persero) as body of[is effort property of state duty negara, carrying out. conduct ready and service of electric power, in awakening electric power still using many resource of energy petroleum. A condition of that, growth of technology indicate that almost entire/all equipments of household, white colars, and hotel of equipments. other use electrics energy which all the the base onoil fuel. Whereas technology convert energy for power station have found many with various capacities and scale like energy of[is source of water energy (PLTA), nuclear resource energy (PLTN), hot resource energy earth (Geothermal), biodisel energy and is other exploiting as him. Depended to this petroleum cannot be let, because requirement of energy increasing in line with growth of resident amount, the increasing of industrialization and

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growth of recent and sophisticated all technology like at the of this time. Composition usage of energy which too leaning. oil fuel have to immediately difikirkan by way of Multifarious usage of resource of energy (diversified energy) being based on requirement and potency exist in in this time. In the effort it is important to know besaran usage of energy persektor of activity, resource type energy able to be used, exploiting type and usage of energy, technological usage of energy, location / spreading of activity of usage of energy Exploiting of source of energy new and new require to be developed to remember price and role of BBM increasing and bounce up high in the place of for the supply of continual energy. Various means conducted to knowing resource potency of energy able to be developed in Indonesia, one of them by conducting data. Pursuant to obtained data can be determined by step and also strategy in management and exploiting entire/all potency is source of natural resources especially resource of energy existing to is ready requirement of energy certain region and activity type, so that can be specified its exploiting strategy . Multifarious usage of energy by exploiting resource of energy local, expected can lessendepend on resource of energy petroleum, so that in exploiting and management of resource of energy petroleum have to really to which is requiring of it especially becoming priority scale. But implementation of[is source of new energy of vital importance to immediately started. Under this studied in a word various source of new energy. Why new energy? :Renewable energy have to immediately developed nationally if/when remain to depended fossil energy, this will generate at least three serious threat namely:

(1) Attenuating petroleum reserve [him/ it] knew (if/when without new oilwell finding)

(2) Increase / instability of fast effect price [of] request of larger ones of oil production, and

(3) Pollution glasshouse gas (especially CO2) effect of combustion of fossil fuel.

Rate of CO2 in this time conceived of highest during 125,000 year latter [2]. If/When man of science still dispute the level of oil reserve which still can dieksplorasi, ugly effect CO2 to global warm-up have been agreed on almost by all circle. This matter generate serious threat to life of mortal on earth. Therefore, new fuel implementation and development friendly environment require to get serious attention.

Energy Supply Model

Model of energy supply allocates various energy sourcesin order to meet energy demand. Important assumptions incorporated into the model are:

• The demand and supply of natural gas follow the Indonesia Gas Balance 2012-2025 by Ministry ofEnergy and Mineral Resources (MEMR), and for 2026- 2030 they follow the trend of gas delivery. Export of natural gas also follows the Indonesia Gas balance and takes the import of gas into consideration up to 2030.

• Oil and coal reserves follow the data from the MEMR with status of January 2012. Oil reserves that are being considered are the proven reserves; on the other hand, mineable reserves and measured reserves are the type considered for coal reserves.Model of energy supply allocates various energy sources in order to meet energy demand. Important assumptions incorporated into the model are:

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Data Update

Key data used in this book are as follows:

• The proven reserves of oil in 2012 is amounted to 3.74 billion barrels based on data from MEMR.

• The proven reserves of natural gas in 2012 is amounted to 103.35 trillion cubic feet based on data from MEMR.

• Coal reserves in 2012 is amounted to 28.9 billion tonnes based on data from MEMR.

• Resources of CBM (Coal Bed Methane) amount to 453 TCF based on data from Directorate General of Oil and Gas, MEMR and from IATMI.

• Resources and reserves of geothermal in 2012 has been calculated for each area with a total of 29 GW based on data from MEMR.

• Potential hydropower has been calculated for each area with a total of 26.3 GW based on the master plan study for hydro power development in Indonesia from Nippon Koei in 2011.

• Development of the national electricity is based on theElectricity Statistics 2013 and New Renewable Energy and Energy Conservation Statistics 2013 from MEMR and also RUPTL 2013-2022 from PT. PLN (Persero).

• Policy of coal is based on the energy security and energy independence policy of Directorate General of Mineral and Coal, MEMR in 2012.

• Refinery capacity and production of Dumai-SP, Musi, Cilacap, Balongan, Balikpapan and Kasim each is obtained from site visit to Pertamina in April 2012.

Business as Usual (BAU) Scenario

• The base year is 2012 with the projection period of 2013-2035.

• There are two scenarios, i.e., business as usual (BAU) scenario and High scenario, and one case which is energy development in supporting fuel substitution programs.

• BAU scenario considered several actions which include the kerosene to LPG substitution program, realization of 10,000 MW coal-fired power plant from the first phase of fast track power development program, and the second phase that encourage the use of renewable energy in power generation sector.

• GDP growth in BAU scenario is assumed to be in line with target of Bappenas' BAU scenario for period 2015- 2019, which increased by an average of 6% per year. GDP growth for period 2020-2035 follows the trend of previous years.

High Scenario

All assumptions in High scenario are the same as BAU scenario except for the economic growth.

• In High scenario, GDP growth is assumed in line with target of Bappenas' comprehensive reform scenario for period 2015-2019, which increased by an average of 7% per year. GDP growth for period 2020-2035 follows the trend of previous years.

• Both BAU and High scenario consider efforts to escape the middle income trap. Indonesia must gain income $ 12,616 per capita in the next few years to be able to become a developed

country. The government shouldno longer depend on production of natural resourcesand low cost labor and needs to encourage national productivity through innovation advancement intechnology.

Table 1.1 Assumptions for BAU scenario and High scenario

Note	Unit	Year					
		2012	2015	2020	2025	2030	2030
Population Average growth	Million	245.4	255.4	271.0	284.8	296.4	305.6
	%/year	1.40	1.40	1.19	1.19	0.08	0.08
Crude Oil Price	USD/barrel						
	Constant 2010	107.0	94.4	86.3	83.7	81.1	78.7
	%/year	112.7	104.9	105.1	111.8	118.9	126.4
Coal Price	USD/ton						
	Constant 2010	90.7	72.5	74.5	76.5	78.5	80.7
	USD/barrel						
LNG Price	USD/MMBTU						
	Constant 2010	15.9	13.8	10.4	9.9	9.8	9.6
	Current Price	16.7	15.3	12.6	13.3	14.3	15.4
Business as Usual (BAU) Scenario							
PDB / GDP	Trillion Rupiah						
	Constant 2010	2,619	3,110	4,431	6,620	9,795	14,193
	Current Price	8,229	11,636	22,057	43,323	84,271	160,542
GDP Growth	%/year	6.2	6.1	8.0	8.4	8.0	7.5

Fig 6. Natural gas consumption by sect

Case

The energy development in supporting fuel substitution program case discusses the development of alternative energy in the context of petroleum fuel use reduction, both in transportation and industrial sector. The discussions include the prospect of biodiesel as substitute for diesel fuel, the development of energy plantations based on oil palm, the prospect of CNG as a substitute fuel for gasoline and also bioethanol development.

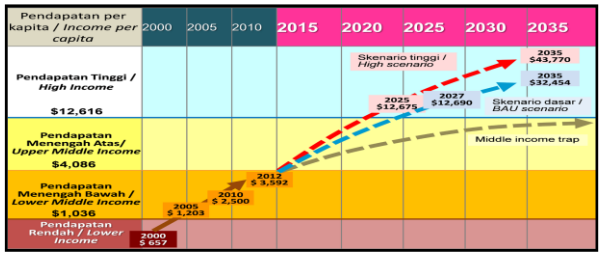

Figure 1.1 Assumptions of economic growth

Source : World Bank data 2013 and own assumption

Current Energy Conditions and Issues

Gross Domestic Product and Population

The population of Indonesia in 2012 reached 245 million or increase of an average of 1.42% per year since 2000. At this time approximately 54% of the population lives in urban areas. While gross domestic product (GDP) in 2012 reached 2,619 trillion rupiah (constant 2000 prices) with GDP growth rate averaged over the last 12 years reached 5.4%. In 2012, the national economic growth reached 6.3% per year lower than the growth in 2011 of 6.5%.Income per capita increased from 6.7 million Rupiah per capita in 2000 to 34.1 million Rupiah per capita in 2012. Based on the World Bank criteria, Indonesia in 2012 is included in lower middle income country with an income of 3,592 dollars per capita.

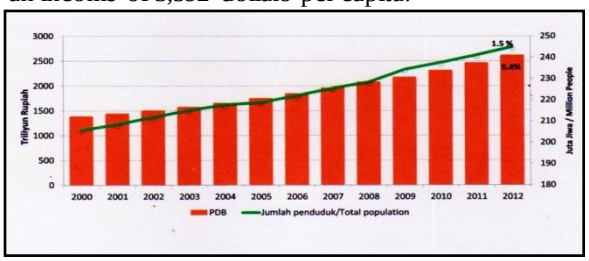

Figure 2.1 Population and gross domestic product

Final Energy Consumption

Final Energy Consumption by Sector

Final energy consumption (including biomass) in the period2000-2012 increases from 764 million BOE in 2000 to 1,079 million BOE in 2012 or grow an average of 2.91% per year. The final energy consumption doesn't take account of other petroleum products, such as lubricant, asphalt, etc., In 2012, the largest share of energy demand is industry sector industry sector. (34.8%) followed by the household (30.7%), transportation (28.8%), commercial (3.3%), and other sector (2.4 %). During the period 2000-2012, the transportation sector experienced the largest growth reached 6.92% per year, followed by commercial sector (4.58%), and industry sector (2.51%). The growth in household sector amounted to only 0.92%, and other sectors decreased by 0.94%.The high rate growth of final energy consumption in transport sector due to the rapid growth of motor vehicles in the period 2000-2012 to reach about 14.3% per year. Household sector energy consumption growth is low due to equipment and technologies change to a more efficient one as well as firewood replaced by LPG and electricity

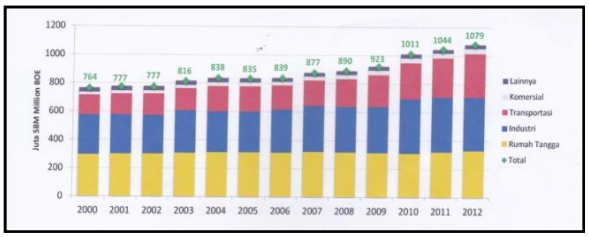

Figure 2.2 Final energy consumption by sector

Final Energy Consumption by Type

Final energy consumption by type, during the years 2000-2012, was dominated by petroleum fuel (avtur, avgas, gasoline, kerosene, diesel oil, diesel oil, and fuel oil). During this period, the total fuel consumption increased from 315 million BOE in 2000 to 398 million BOE in 2012, an increase of an average of 1.9% per year. In 2000, the consumption of diesel oil has the largest share (42%) followed by kerosene (23%), gasoline (23%), fuel oil (10%), and avtur (2%).Subsequently in 2012 the order is turned into gasoline (50%),diesel oil (37%), avtur (7%), kerosene (4%), and fuel oil (2%).Patterns change of fuel consumption is due to the highrate consumption of gasoline by private cars, the high rateconsumption of avtur/avgas by aircraft, the diversification energy in the industry sector, and

the kerosene substitution program with LPG in the household sector.Coal consumption increased from 36.1 million BOE in 2000 to 123 million BOE in 2012, rise with an average of 9.9% per year. The entire consumption of coal is used to meet the energy demand of industry sector, mainly for cement, textile,and paper industry. Consumption of natural gas increased from 87.2 million BOE in 2000 to 125.3 million BOE in 2012 with an average growth rate of 2.8% per year. Limited infrastructure and distribution of national gas transmission causing natural gas supply to meet the demand of industry is also limited.Electricity consumption during the period 2000-2012 had an average growth of 6.2% per year, which is still lower than coal (9.9%), and LPG (13.5%). This led to the national electrification ratio that only reach 75.8% in 2012. This means that 24.8% of the Indonesian population has not been electrified. This condition reveals that Indonesian electrification rate is still low compared to other ASEAN countries such as Singapore 100%, Malaysia 99.4%,Philippines 89.7%, and Vietnam 97.6%.

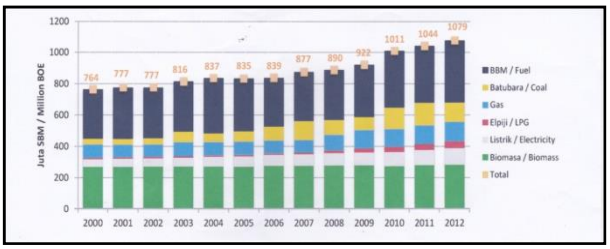

Figure 2.3 Final energy consumption by type

Electricity

To meet national electricity demand, electricity in Indonesia is not only managed by PT PLN (Persero), but also by private sector, namely Independent Power Producer (IPP), Private Power Utility (PPU) and operation permits for non petroleum fuel. In 2012, total national power generation capacity (PLN IPP, PPU, and IO non oil fuel) in Indonesia was of 44.8 GW.

Approximately 73% of them are in Java and Bali, as wellas 18% in Sumatra. The rest are in Kalimantan and OtherIslands (Sulawesi, Maluku, NTB-NTT, Papua). In terms of fuel, coal-fired plants and gas has the highest share, whichamounted to 43% (19.1 GW) and 27% (12 GW), followedby oil-fired plants with a share of around 18% (8.1 GW).The share of NRE power plants was increasing, such as geothermal with a share of close to 3% (1.3 GW), as well as hydro-based generation with a share of 9% (4.2 GW). In addition, solar pp and wind pp have also started operating with a total capacity of 6.9 MW. Furthermore in 2012, electricity generation by PLN still dominates with a share of more than 73% (32.9 GW), IPP power plants with a share of 17% (7.4 GW), and the rest is filled by PPU (Private Power Utility) and non oil fuel power plants with operating licenses and rental electric generation unit with a share of about 10% (4.5 GW).

Energy Resources Potential

Fossil Energy Resource Potential

Fossil energy that consist of coal, oil, and gas is the main energy resources in Indonesia. Most of coal resource and coal mineable reserve were in Sumatera and Kalimantan,especially in South Sumatera and East Kalimantan. During 2011-2012 there is a decline on coal resource from 120 billion tons to 119 billion tons, while coal reserves grew from 28 billion tons to 29 billion tons. With production rate of 353 million tons in 2011 and 386 million tons in 2012, the ratio of reserves to production (R/P) of coal dropped from 79 years in 2011 to 75 years in 2012. In 2011, total oil reserve in Indonesia was 7.73 billion barrel that consisted of about 4.04 billion barrel of proven reserve and 3.69 billion barrel of potential reserve. In 2012, the total oil reserve decreased to 7.41 billion barrel that consisted of 3.74 billion barrel of proven reserve, and 3.67 billion barrel of potential reserve. Based on the crude oil production level of 329 million barrel in 2011 and 315 million barrel in 2012, the reserve to production ratio (R/P) of oil is about 12 years in both 2011 and 2012. Most of oil resource was outside Jawa, especially in Sumatera with 60% share. The other oil resources was spreaded out in Kalimantan, Papua, Sulawesi, and Maluku. More than 8% from the oil reserve was in Kalimantan. The oil reserve in Jawa was about 21% from total national oil reserve. Total reserves of natural gas in 2011 reached about 153 TSCF consisting of proven reserves of 105 TSCF and potential reserves of more than 48 TSCF. The total reserve in 2012 decrease to 151 TSCF that consist of 103 TSCF of proven reserve and 47 TSCF of potential reserve. With gas production level, both associated and non associated, reached 3.26 TCF in 2011 and 3.17 TCF in 2012, the reserve to production ratio increased from 32 years in 2011 to 33 years in 2012. The gas resources in general was in outside Jawa, especially in Sumatera (included Natuna) that constitutes of almost 56%.Others resources were spreaded out in Papua, Kalimantan, Maluku and Sulawesi that each had gas reserves of 16%, 11%, 10%, and 2% respectively. Meanwhile, gas reserve in Jawa had only eight percent.Based on the reserve to production ratio of fossil energy, coal has the biggest potential with lifetime of 75 years. While gas potential would be finished in the next 33 years. Oil is the smallest potential of fosil energy resources with potential last only until the next 12 years, if no new reserves are foun

Table 2.1 Fosil energy potential 2011-2012

Energy Type	*Year*	*Potential Reserve*	*Proven Reserve*	Total
Oil (Billion Barrel)	2011	3.69	4.04	7.73
	2012	3.67	3.74	7.41
Gas (TSCF)	2011	48.18	104.71	152.89
	2012	47.35	103.35	150.70
		Resource	*Reserve*	
Coal (Billion Ton)	2011	120.33	28.01	
	2012	119.42	28.97	

***Source*: CDIEMR (2012, 2013)**

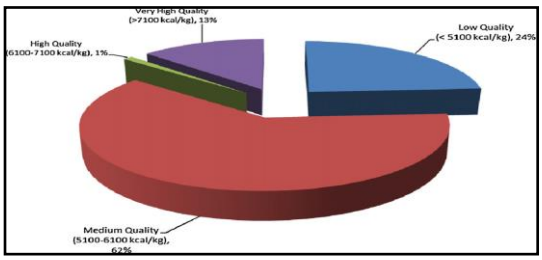

Fig 9. Indonesia's distribution coal reserve potential.

New and Renewable Energy Resource Potential

Stages;Steps Policy.

Policy of Energy Just executed to [pass/through] :

Energy Conservation.

Pushing exploiting of energy efficiently and rational without lessening penggunan of real correct energi [of] correctness needed.

- Conservation beside generating, preceded by audit of energi

- Lessening usage of electrics having the character of is consumptive
- Changing equipments which [do] not effisien
- Lead the time usage of equipments of electrics

Diversifying Energy

Strive ready penganekaragaman and exploiting various source of energy in order to ready optimasi energy. In order to diversified, usage of energy of resources energy non-renewable to resources energy renewable, for example 1. Effort Menggagas change BBM with Bio-Diesel 2. Pushing development of hydro micro PLT is rural 3. Lessening role of generating of BBM and replacing him with generating of non-BBM (mixture 10 [gratuity/ %] of biodiesel and 90 [gratuity/ %] of diesel fuel) becoming Rp 2.400 per litre, a[n price which [do] not too high to burn friendlier requirement of Indonesia diesel fuel [about/around] 23 million ton per year (7,2 million ton of didiimpor), usage of B-10 will [among/between] him need 2,3 million ton of biodiesel, or equivalent by 2,415 million ton of CPO able to be yielded from [about/around] 700.000 ha coconut garden of sawit, and can take care of [about/around] 350.000 family farmer of coconut of sawit, with assumption of[is ownership of farm 2 ha per family. Many advantage of usage of biodiesel. this Fuel type .do] not contain compound and sulphur of benzene carcinogenic, so that biodiesel represent to be compared to handled to be easier and cleaner fuel diesel fuel. Difference [among/between] diesel fuel and biodiesel especially komposisinya.Biodiesel consist of sour ester methyl vegetation fat, while diesel fuel its elementary hidrokarbon.Pada needn't there diesel engine modification if its fuel use biodiesel. Biodiesel even have sweeping effect to fuel tank, hose and injector. Biodiesel not add glasshouse effect as does diesel fuel, because yielded carbon still in cycle of karbon.Energi yielded by biodiesel similar to diesel fuel, so that torque engine and horse power similar yielded also. Besides biodiesel yield storey;level Iubrication of machine compared to higher level [of] solar.Sumber : Voice Renewal (20/6/05 .

Intensification of Energy

Strive seeking of source of energi new so that can improve reserve energi utilize to be exploited to yield electric power Development of PLT Wind with location spread over (2 unit expected to finish 2006, and 10 unit finish after 2006) Development of PLT Hybrid [in] area of terpe .

General Issues

In general, energy sector is currently facing challenges inboth global and national scope. Some actual problems are:

• The population of Indonesia in 2012 reached 241 million, increased from 205 million in 2000 with an

• average growth of 1.31% per year. Kalimantan regionexperienced the highest increasing rate of population,while the lowest growth rate is at Jawa Island. Currently,

• 57% of the population lives on Jaxa, with an area of129,438 km2, or about 6.7% of Indonesia's land. JawaIsland is also densed with industry, leading to problemsin land use, population, housing and transportation.Jawa Island requires a very high energy supply, while its potential energy resource is very limited.

• Oil production continues to decline while the demand for energy continues to grow which led to the increase in import of crude oil and petroleum products. This was shown by the deficit 3,5 billion Dollar at oil account in second quarter which increased from 2,1 billion Dollar deficit in first quarter of 2014 financial year. On the other hand, fuel subsidy is relatively high, due to increased domestic consumption, the increase in international oil prices and the decline in the exchange rate against dollar and other foreign currencies. It is estimated that fuel subsidies until the end of 2014 will

• exceed the budget allocation in 2014.

• Although the potential of Indonesia is quite large but the utilization of natural gas in the country is still

• limited. This is due to the inadequate infrastructure of natural gas as well as the long-term contract of large export of gas.

Potency of Source of New Energy in Indonesia

Hot Energy Earth

As area of vulkanik, regional Indonesia most rich will the source of hot energy earth. Mount band have fire unfold in Indonesia from tip of Island Sumatra as long as Java, Bali, NTT, NTB to Archipelago of Banda, Halmahera, and Island Sulawesi. Long that band more than 7.500km widely gyrate 50-200 km with amount of volcano both for active and also which have is inactive amounting to 150. Pursuant to research which have been conducted alongside that band, there are 217 hot prospect area hot energy bumi.Potensi total earth 19.658 MW with detail of Java 8.100 MW, Island Sumatra 4.885 MW, and the rest spread over Island Sulawesi and other archipelago. Source of earth heat which have been exploited in this time 803 MW. Usually data of energy hot earth can be grouped into data of energy and reserve of energy the source of. Expense of invesment there two kinds of is. First expense of development and eksplorasi equal to 500-1.000 ACE dollar / kw 1. [Both/ second], expense of generating equal to 1.500 dollar / kW (capacities 15 MW), 1.200 dollar / kW (capacities 30 MW), and 910 dollar / kW (capacities 55 MW 2. To the expense of energy of earth heat 3-5 cent / kWh .

Energy Water

Indonesia have big potency for the development of power station of water power. That caused the condition of Indonesia topography have mount and hilly and also emited a stream of by many certain area area and river have lake / accumulating basin which is potential enough as source of water energy. Power station of water power (PLTA) one of technology which have proven , not destroy environment, supporting to be diversified energy by exploiting new energy, supporting program reduction of exploiting of BBM, and most wearing local content. Big potency of energi irrigate in Indonesia 74.976 MW, counted 70.776 MW outside Java, which have been exploited equal to 3.105,76 MW most residing in Java. Development each;every power station type relied on economic and technical elegibility of electrics center and also result of study analyse to regarding environmental impact. As consideration available of source of certain energi, existence of requirement of electrics energy, expense of low evocation, and also specific characteristic from each;every generating type for the supporter of norm load/burden (base of load) or peak load/burden (peak of load) Besides PLTA, mikrohidro energy (PLTMH) having capacities 200- its 5.000 potency kW 458,75 MW, very competent developed to fulfill requirement of electric power [in] rural area [in] rural cloistered hinterland and or [in] isles with drainage basin which .narrow;tight. Expense of invesment for the development of power station of cheaper mikrohidro relative compared to the expense of invesment of PLTA. This Matter caused the existence of moderation of adapted for construction standard rural

condition. Expense of invesment of PLTMH the more or less 2.000 dollar / kW, while expense of energy with generating capacities 20 kW (flatten to flatten used in countryside) Rp 194/ kWh.

Energy Plant (Bio Energy)

Energy Plant

Year 2025 targeting usage of bahar burn alternative of biofuel equal to twenty five [gratuity/ %] . goals five tired [by] year 2010, mounting to become 20 [gratuity/ %] in the year 2020, and 25 [gratuity/ %] in the year 2025 **Alcohol.**

In the year 1995 Department of Mining and of Energy report in Public Plan Development of New and New Energy that production of etanol upon which the mutual tired dropping 35-42 million litre per year. That amount will reach 81 million litre per year if/when entire/all drip production used to make etanol. In this time some of Indonesia molasses production exported out country and some of again exploited for industry besides etanol.

Biodiesel

Year-End 2004 wide totalizeing plantation of coconut of sawit in Indonesia have reached 5,3 million hektare (ha) with palm oil production (oil palm crude / CPO) equal to 11 million ton. Growth of plantation of this sawit still continue and estimated in five year come Indonesia will become producer of CPO biggest [in] world totally produce equal to 15 million ton per year. One of [the] product go downstream from palm oil able to be developed in Indonesia [is] biodiesel able to be used as alternative fuel, especially for diesel engine. With its excelsior petroleum price recently, time has come if Indonesia start to develop biodiesel, good to domestic consumption and also for the exporting of. price of Biodiesel pure very is base on price of CPO which always have fluctuation. To is big scale, price of CPO US$ 400 per ton, price of biodiesel estimated to reach [about/around] US$ 560 per ton, so that price of B-10 (mixture 10 [gratuity/ %] of biodiesel and 90 [gratuity/ %] of diesel fuel) becoming Rp 2.400 per price liter,suatu which not too high for friendlier fuel [of] .Requirement of Indonesia diesel fuel [about/around] 23 million ton per year (7,2 million ton [is] among others imported), usage of B-10 will need 2,3 million ton of biodiesel, or equivalent by 2,415 million ton of CPO able to be yielded from [about/around] 700.000 ha coconut garden of sawit, and can take care of [about/around] 350.000 family farmer of coconut of sawit, with assumption of[is ownership of farm 2 ha per family. Many advantage of usage of biodiesel. this Fuel type not contain compound and sulphur of benzene carcinogenic, so that biodiesel represent to be compared to handled to be easier and cleaner fuel diesel fuel. Difference [among/between] and biodiesel of sola especially [at] its composition. Biodiesel consist of ester methyl HALTED. CROSSING PARAGRAPH LIMITATION,

Biomassa/Biogas

Biomassa represent the source of very potential primary energi in Indonesia, which yielded from its natural resources in the form of tropical forest vegetasi. Biomassa can be turned into heat or electrics with technological process which have established. Besides ligneous biomassa, of industrial activity processing of forest, plantation and agriculture, waste of biomassa (Tables of . 2.2) very big its amount at the moment also not yet been exploited better. Solid waste Munisipal (MSW) [in] big kotakota represent prima facie town waste him in the form of biomassa, becoming problem of serious because bothering environment potency of energi which can be exploited better. waste of Biomassa solid of forestry sector, agriculture, and plantation first waste which most have potency [to] compared to for example paddy waste waste, maize, cassava, coconut, coconut of sawit sugar cane and. Level of waste potency of biomassa solid in all Indonesia [is] 49.807,43 MW. Of crop conducting technology, conducive [development of forest of energi for the levying of biomasa as according to requirement in number which many and waste berkelanjutan.Selain of biomassa solid, biogas energi can be yielded from animal dirt waste, for example ox dirt, buffalo, horse, and pig [is] also met in all Indonesia provinsi with amount which different each other. Exploiting of biomassa energi and of biogas in all Indonesia [about/around] 167,7 MW coming from sugar cane waste and of biogas equal to 9,26 yielded MW of process of gasifikasi. Expense of invesment of biomassa [is] to gyrate 900 dollar / kW until 1.400 dollar / kW and expense its him [is] Rp 75 / kW-Rp 250 / kW.

Energy Samudra/Laut

In Indonesia, potency of energy great/ sea very big because Indonesia archipelagic country which consist of 17.000 coastline and island as long as 81.000 km, consist of deep sea , shallow Sea. and [about/around] 9.000 out of reach isles National electrics current, and his resident live by marine product. With estimate of such potency, entire/all coast in Indonesia can yield more than 2 ~ 3 Tar Watt of Ekwivalensi electrics, assumed 1% from coastal length Indonesia (~ 800 km) earn minimum memasok ~ 16 GWATT or [is] equal to pasokan entire/all electrics in Indonesia year 2005.Energi great there four kinds of, that is hot energy sea, ebb energy, energy waving, sea current energy. Principal each activity .

Cell Fuel (" Fuel Cell")

Especial Raw material as source of fuel cell energy gas of hidrogen.Gas hydrogen earn direct used in evocation of electrics energi and have closeness of energy which raw material alternative . like methane, sea water, freshwater, and pregnant elements hydrogen earn also used but needed purification system so that add the amount of its generating cost system. Expense of invesment not yet can know because still many research which 1. Hot Energy sea that is by using temperature difference [among/between] temperature permukaa go out to sea and temperature sea floor 2. Ebb Energy by using height difference [among/between] biggest tide sea and smallest ebb sea 3. Wave Energy by using is big height of wavelength and wave 4. principal Current sea Energi its [job/activity] precisely equal to wind turbine. By using turbine will be yielded hot energy listrik.Potensy energy sea in Indonesia can yield energy [about/around] 240.000 MW, but technological, power station of energy go out to sea not yet been developed and mastered while for the energy of and ebb of energy waving still is difficult diprediksi because still many research manner which not yet data can by rinci. energy great above in Indonesia still implementation not yet because still many factor so that till now still discourse level and research of research. Expense of invesment not yet can know in Indonesia but pursuant to test-drive some industrial state go forward to gyrate 9 cent / kWh till 1sen / kWh highly varied which not yet can wear as directive .

Wind

In general Indonesia enter state category without wind, considering that speed of mean minimum wind which economically can be developed as penyedia of service of energy 4m/ dt. Kendatipun that way there are some region where source of competent big possibility wind energy the . For example East Nusa Tenggara (NTT), West Nusa Tenggara (NTB),SULAWESI South and South-East, Coastal North and South Java and of Karimun Java. Scale exploiting of Wind power in general grouped in is small scale, big and middle as follows Tabel.2.2

Surya

Pursuant to data irradiating of mustered sun from 18 location in Indonesia menunjukan that surya radiasi in Indonesia can be classified berturutturut for the area of Indonesia east and west with irradiating distribution " West Indonesia area (KBI) = 4.5 kWh / m2.hari, monthly variation [about/around] 10 " East Indonesia area (KTI) = 5.1kWh / m2.hari, monthly variation [about/around] 9 " Mean Indonesia = 4.8 kWh / monthly m2.hari,variasi [about/around] 9%.Hal this sign that " available surya radiasi almost year meratasepanjang " Indonesia east area have more irradiating surya baik.Energy can be exploited to [pass/through] two kinds of technology that is termal surya energy and of surya fotovoltaik .

Surya Fotovoltaik

Energy Surya or more knowledgeable as diesel fuel of cell or of photovoltaic cell,merupakan a semikonduktor divais owning expanse and consist of network of dioda type of p and of n,yang can change directly surya energy become electrics energy

Surya Termal

Mostly and commercially, exploiting of termal surya energi used many to is ready hot water household, specially urban rumahtangga. Amount of heater irrigate energy of surya (PATS) estimated to amount to 150.000 unit totally collector luasan equal to 400,000 m2. By non-komersial and termal surya tradisional,energy used many for draining various agriculture commodity, fishery, plantation, industrial small, and need of household. Commercially, surya energi have potency economic to is ready heat process low temperature (to 90 oC) using system of energy termik surya (SEST) to need of processing of pasca harvest the the commodity effective with interest and is efficient. Experience indicate that applying of SEST for draining can give various high added value in the form of: guarantee and improvement of quality of product, lessening losss (material losses) during production (a.l. damage and lose), and processing time which is briefer. Though not yet developed many, exploiting of termal surya energi for the process of disalinasi settlement or area of[is near by big possibility coast of berkembanmengingat start appearance many difficulty of water of.

Heat Earth

Pursuant to survey indicate that there are 70 hot location [earth have high temperature with total capacities reach 19.658 MW. Most of the location not yet exploi intensively .

Nuclear Energy

Requirement of national energy from year to year progressively mount, especially requirement of electrics energy. The improvement in line with economic growth rate, resident growth rate, and is fast him growth of sector of industri.Untuk fulfill requirement of insufficient national energi only reliing on the source of existing energy, because source of energy we have cleanseing many for a number of years that ., require to look for the source of the source of other alternative energy yangcukup potential to replacing him, for example new and new energy. Nuclear energy new energy which require to be considered [by] because this energi can yield energy which in big order until thousands of megawatt, but have to pay attention some aspect. That aspect for example safety aspect, social, economics, technical, human resource, and technology .

a. Benefit of PLTN " Usage for the Evocation of Electrics " Diversify : electrics dalambentuk energi pasokan " Conservation: thrift of penggunaan sumber of energy of energi national " Continuation of Environment : Mengurangi emisi Gas glasshouse (GHC) by signifikan " Usage to the Non Electrics Development of reactor concept of cogeneration for the production of clean water/ desalinasi, usage of process heat (for the industry of, pencairan-gasifikasibatubara, hydrogen production, Enhance Oil Recovery, etc

b. Other Benefit [of] Nuclear Iptek in Energy Sector

Technological [of] Nuclear in Indonesia: play a part in Hydro energy [of] management of water and source him mikrohidro (follow the example of [in] Bribin, pengeloaan of ground water in), Geothermal (Sibayak, Kamojang, Lahendong), Biofuel/ biodiesel (sorgum, fence distance), and clean gas of SOX and of NOX of PLTU fossil with EBM. Program nuclear energy usually have to [pass/through] some step which [is] terencana and executed chronically. Beside needed especial activity also activity of other supporter, for example, activity of research / study development of nuclear technology, activity / study recycle nuclear fuel, arrangement / permit in the field of nuclear and also training and education.

Table 2.2 New and renewable energy resources inIndonesia

No	Energy resources	Potential	Installed capacity
1	Geothermal	16.502 MW Reserve	1.341 MW Until May 2013)
2	Hydro	75.000 MW Resource)	7.059 MW
3	Mini-micro hydro	769,7 MW Resource)	512 MW
4	Biomass	13.662 Mwe (Reserve)	1.364 Mwe 75,5 Mwe (On Grid
5	Solar energy	4,80 kWh/m2/day	42,78 MW
6	Wind energy	3-6 m/s	1,33 MW
7	Uranium	3000 MW	30 MW
8	Coal bed methane	453 TSCF Resource	
9	Shale gas	574 TSCF (Resou	

Source: Directorate General of NRE&EC, 2013

This matter also have to entangle some governmental institution, university, organizational [of] sosial,LSM, and its its[his] since year 1972 project of nuclear energy study have been thought of by government body which [is] have this area competence [to], that is Batan. just Only still many its constraint for the diimplementasikan.Berdasarkan of information pemasok of PLTN of[is level of the expense of capital / invesment in the year 1992 for conventional PLTN various jeÿÿÿÿdan ÿÿ urÿÿÿÿ60ÿÿ1.ÿÿÿÿ) gyrating 1.530-2.200 dollar / kW. As for expense of generating depended its capacities, that is 600 capacities of MW its expense gyrate

55,2-61,2 mills / kWh, 900 capacities of MW its expense gyrate 47,4-56,4 mills / kWh. From some study, its result fuel price vary, NEWJEC 1992 equal to 5,9-6,6 mills / kWh, Batan 1992 equal to 15 mills / kWh, and Krebs et. Al/ Siemens 1993 equal to 11,2 mills / kWh, while operating expenses and conservancy equal to 77 dollar / kW

Table 2.3 Ocean energy development road map in Indonesia

Ocean Energy		2010 - 2015	2010 – 2020	2010 - 2025
Wave Energy				50 MW
a.	*Technology*	*Trial*	*Substitute for diesel power plants in remote areas and small islands*	*Compete with other power plants*
b.	Output per unit	< 100 kW	100 kW – 1 MW	0,5 – 2 MW
c.	*Generating cost*		Rp./kWh 1.500 – 2.000	Rp./kWh 1.000 – 1.500
Tidal Power				1.000 MW
a.	*Technology*	*Pilot Project*	*Main power plant for eastern region of Indonesia*	*Main power plant for eastern region of Indonesia*
b.	Output per unit	1 MW	10 – 50 MW	50 – 200 MW
c.	*Generating cost*		Rp./kWh 1.000 – 1.500	Rp./kWh 600 – 1.000
Ocean Current Energy				500 MW
a.	*Technology*	*Trial*	*Substitute for diesel power plant in NTB and NTT*	
b.	Output per unit	< 100 kW	100 kW – 1 MW	10 – 100MW
c.	*Generating cost*		Rp./kWh 1,500 – 2.000	Rp./kWh 1.000 – 1.500
OTEC (*Ocean Thermal Energy Conversion*)				100 MW
a.	*Technology*	*FS & Pilot Project*	*Substitute for diesel power plants in remote areas and small islands Power plant in the tourist areas and byproducts industry*	*Compete with other power plants*
b.	Output per unit	1 – 5 MW	1 – 5 MW	50 – 100 MW
c.	*Generating cost*		Rp./kWh 1500 – 2.500 *Substitute*	Rp./kWh 1.000 – 1.500
Total 1.650 MW				

Source : The Indonesian Renewable Energy Society

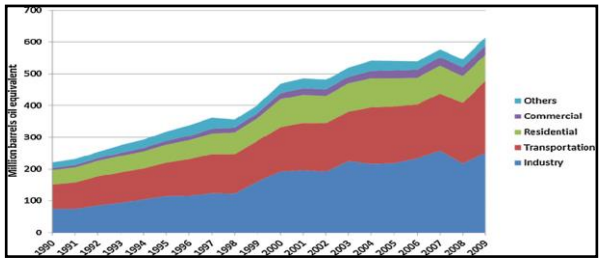

Fig 1.Primary energy supply by fuel type in Indonesia

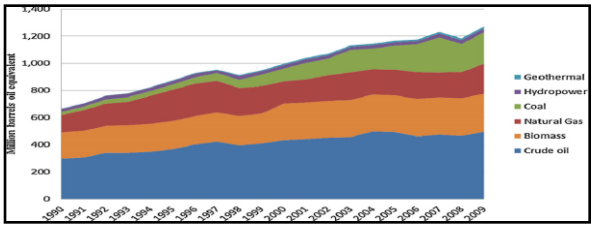

Fig 2. Final energy consumption by sector in Indonesia.

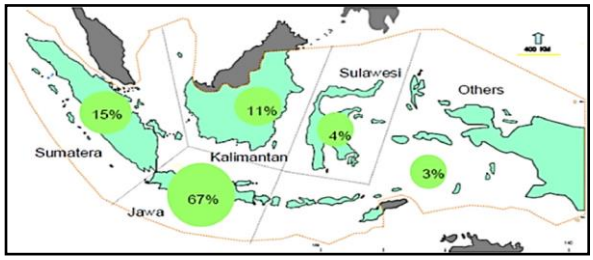

Fig 3. Distribution share of final energy consumption by region in Indonesia.

Conclusion

1) Condition or situation of energi in this time again teach to us that systematic and serious effort to develop and apply the source of new energi utilize to lessen depended to fossil fuel need immediately conducted

2) Usage of source of energy friendly new environment also mean to save environment from various ugly impact which generated effect of usage of BBM

3) There are some source of friendly and new energy applicable environment immediately fatherland, like bioethanol, biodiesel, heating power of bumi,tenaga surya, mikrohidro, energy of angin,dan garbage / waste

4) Cooperation, Technical inter department coordination and also support of society and industry of vital importance to realize implementation of[is source of new energy.

References

[1] Yuli Setyo Indartono, Krisis Energi di Indonesia: Mengapa dan Harus Bagaimana. http://io.ppi-jepang.org/ #bawah.

[2] Service, RF., Is it time to shoot for the Sun?,Science Vol 309, July 22, 2005, 548-551.

[3] Sunggu Anwar Aritonang, Direktur Niaga dan Pelayanan Pelanggan PT PLN (Persero)

[4] Dr A Harsono Soepardjo MEng Ketua Pusat Studi Kelautan FMIPA-UI dan Peneliti Pusat Studi Energi UI " Energi Baru dan Terbarukan" Kompas 24 Oktober 2005.

[5] Ika Heriansyah,"Potensi Pengembangan Energi dari Biomassa Hutan di Indonesia", ISSN : 0917-8376 Edisi Vol.5/XVII/ November 2005 – INOVASI.

[6] Chayun Bodiono, Tantangan dan Peluang Usaha Pengembangan Sistem Energi terbarukan di Indonesia.

[7] OUTLOOK ENERGI INDONESIA 2014