CHALLENGES AND POLICY FOR BIOMASS ENERGY IN INDONESIA

Sapuan Dani
Aditya Wibawa

ABSTRACT

Development of biomass energy can reduce environmental problems as well as energy problems. The amount of biomass in Indonesia approximately 146.7 million per year obtains reduce the emission of greenhouse gas (GHG). The abundant biomass makes biomass the most promising energy in Indonesia. Electricity demand in Indonesia is still not evenly distributed, need for optimum utilization of biomass and biomass utilization policy for the fulfillment of electrical energy to the small community. In this regard, this paper focuses on biomass conditions in Indonesia and analyzes government policy on biomass and the government's strategic step forward for energy demand in Indonesia. Biomass in Indonesia has not been utilized optimally, the company utilizes their own biomass to supply own energy requirement. The government policy that obtains advantages the small scale private power plan biomass in rural area which is then purchased by PT PLN electricity, this step is expected that the sufficiency of electric energy in Indonesia can be felt by the small community.

Key words: biomass, policy, Indonesia, energy demand, electricity

Introduction

The Energy used in Indonesia as well as in other countries of the world generally increases rapidly in line with population growth, economic growth, and technological developments. Thus, making the energy supply in sufficient quantities to meet increasing energy requirement. Fulfillment of energy requirement that have been done still be charged to fossil fuels, especially oil and gas (Putera, 2015). Efforts to resolve the crisis are mitigation scenario, energy supply mix for 2030 is 29.5% coal, natural gas 31.4%, petroleum 24.6%, and the remaining 14.5% EBT with prominent types of EBT are Biofuel (5.8%), hydro power (2.9%) geothermal (3.5%) and non-household biomass (2.9%).

Countries in the world are also making efforts to provide energy requirements. Exemplified by (Herawan, 2012) Japan drape over 80% of energy from oil and gas by importing from the Middle East region, this has resulted in energy dependence on foreign countries supplied with a prodigious amount. The shock of the oil crises in 1973, make Japan suffered enormous economic losses (Kuzuhara, 2005). Recognizing this, Japan's energy policy focuses on reducing dependence on petroleum, as well as optimizing other energy such as coal and nuclear. In 2011 Japan suffered an earthquake and tsunami disaster, and triggered a radioactive leak at the Nuclear Power Plant in Fukushima. Public resistance to nuclear safety requires execution of an evaluation of the Nuclear Power Plants, making the Japanese government to reduce the supply of electricity from nuclear power up to zero, resulting in a lack of 30% of energy requirement in Japan. To keep the energy supply shortage, imports from the Middle East increased to 140,000 barrels per day (up to 14%), while gas imports rose to 10%. Japan also has sought the fulfillment of energy requirements, the development of several new and renewable energy sector is on the solar panels and the use of biomass as an energy source.

China with a large population, rapidly growing economy and huge energy supply shortages, that makes the Chinese government's concern on renewable and new energy. The important issue to be solved is to accelerate the development of biomass energy so as to reduce the emphasis on environmental problems and also energy problems. However, China is also committed to the International world to save energy and reduce pollution. Biomass Energy is very promising in China, government promises to increase the percentage of biomass consumption to 15% by 2020 (Peidong, 2007).
Vegetable oil as the main source of biodiesel can be produced from plant oils such as kapok seed oil, palm oil, jatropha oil, coconut oil, and other 30 kinds of Indonesian plants (Prakoso, 2006; Prabhakar, 2009). Indonesia was known as the largest palm oil producer in the world after overtaking Malaysia in 2006. The country produced 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 hectares in 2010 (Permatasari, 2011).

Biomass is used to supply energy requirements, including power generation, home energy, fuel vehicles, and industrial facilities. Biomass production in Indonesia is approximately 146.7 billion tonnes/year (Putera, 2015). In the future, biomass is believed to support the greenhouse gas reductions. As technology develops, currently biomass obtained transform into modern energy such as coke, gasification and biofuels (Bracmort, 2010).

Increased energy demand and require for action from stakeholders, Indonesia involve a strategy framework for renewable energy sources (Mujiyanto, 2013). Other views, Indonesia already has a policy and follows a gradual change approach regarding biomass energy (Singh, 2013), however is less effective and has not dedicated institution that dealing with the biomass energy sector.

The author aims to reveal the development of biomass utilization in Indonesia as well as policies regarding biomass in Indonesia in particular. In the first session will be discussed biomass situation in Indonesia. Hereafter, the next section will discuss the existing policy in Indonesia. Finally, obtain prepared policy recommendations led to the utilization of biomass and biomass energy optimization efforts more hospitable environment in Indonesia.

Discussion

Current Situation of biomass in Indonesia

As an agricultural country, the energy potential from biomass resources in Indonesia is relatively abundant. Solid biomass waste from forestry, agriculture and plantations are the most potent first waste than waste e.g. rice, maize, cassava, coconut, oil palm and sugar cane. The amount of solid biomass waste potential in Indonesia is 49,807.43 MW. In addition to forestry and agricultural waste, livestock waste and urban waste obtain to processed biomass energy producer.

From all sources of biomass, wood is a biomass which has long been known by the public. Wood as biomass is renewable fuel. During the production and utilization of wood, the carbon produced is almost neutral. Although the CO_2 produced during the combustion of wood, wood also absorbs CO_2 during photosynthesis. With an estimated Indonesia produced 146.7 million tons of biomass per year, or equal to 470 GJ /years. In table 1 shows, the main source of biomass energy in Indonesia is produced from rice residues to provide energy potential of 150 GJ / year, rubber wood with 120 GJ / year, sugar residues with 78 GJ / year, palm oil residues, 67 GJ / year, And the rest with smaller than 20 GJ / year are from plywood and veneer residues, logging residues, sawn timber residues, coconut residues, and agricultural wastes (Abdullah, 2006).

Table 1: Major Biomass Residues Potential as Energy Sources.

Biomass	**Main region**	**Production [million t/year]**	**Technical energy potential [million GJ/year]**	**Remarks**
Rubber wood	Sumatera, Kalimantan, Java	41 (replanting)	120	small logs Ø <10 cm big and medium logs are used as fire wood in brick and roof tile industry: price 20,000 – 30,000 IDR/m³
Logging residues	Sumatera, Kalimantan	4.5	19	
Sawn timber residues	Sumatera, Kalimantan	1.3	13	Residues of the factories are often used as fire wood by local communities, residues available for free
Plywood and veneer production residues	Kalimantan, Sumatera, Java, Papua, Maluku	1.5	16	Residues are generally used, yet
Sugar residues	Java, Sumatera, South Kalimantan	Bagasse: 10 cane tops: 4 cane leaves: 9.6	78	Bagasse is generally used in sugar factories (90 %) The use of cane tops and leaves needs to be investigated
Rice residues	Java, Sumatera, Sulawesi, Kalimantan, Bali/Nusa Tenggara	Husk: 12 bran 2.5 stalk: 2 straw: 49	150	Stalk and straw are generated at the field and generally burnt, in some areas used for feeding or raw material for paper industry Husks often burnt uncontrolled
Coconut	Sumatera, Java,	Shell: 0.4 husk: 0.7	7	Residues are generated

residues	Sulawesi			decentralized and usually left on the plantation field Largely used as fire wood and for the production of charcoal
Palm oil residues	Sumatera new areas: Kalimantan, Sulawesi, Maluku, Nusa Tenggara, Papua	Empty fruit bunches: 3.4 Fibers: 3.6 palm shells: 1.2	67	Palm shells and fibers are common fuel sources, EFB are generally incinerated

Source: Abdullah, 2006.

Biomass energy can be also converted to produce electricity and mechanical energy, which are necessary to support our daily activities at home, office or industries (Abdullah, 2006). Table 2, a saw mill with 1000 – 3000 m3/y capacity can produce 40 - 100kWe using CHP (combined heat and power) technology, while a sugar mill with 1000- 4000 TCD (total cane/day) can produce 3-10 MWe. Boilers work with pressures up to 15 bar mostly used to produce the steam process e.g. to cook sugar cane in the sugar industry and produce mechanical energy using steam engines. This boiler represents approximately 66% of the total boiler installed in a sugar factory. Boilers operating above 15 bar are mostly combined with large steam turbines for power generation. Despite Indonesia's enormous biomass energy potential, utilization in Indonesia is limited to large sugar and palm oil plantations.

Table 2: Potential for biomass technologies in rural industry

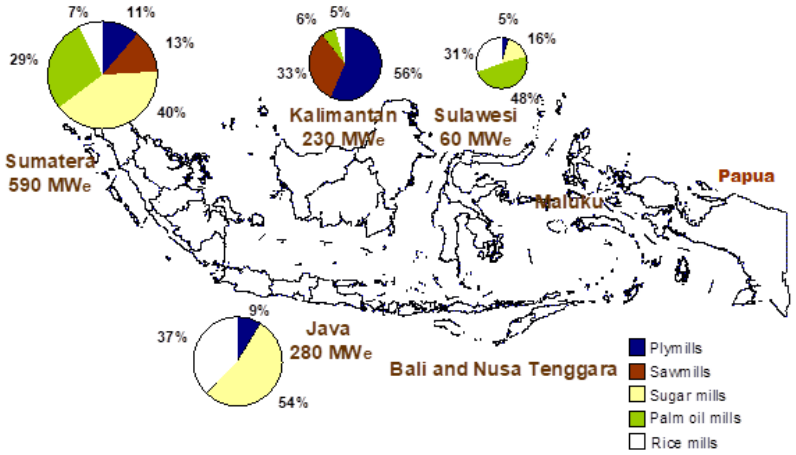
Biomass	**Mill size**	**Capacity of CHP technology**	**Biomass potential for power generation**
1. Saw mills	1000-3000 m3/y	40-100 kWe	0.6 m3 wood waste/m3 sawn timber ~ 130 kWh/m3 sawn timber
2. Ply wood mills	40 000-120 000 m3/y	1.5 – 3 MWe	0.8 m3 wood waste/m3 plywood ~ 200kWh/m3 plywood
3. Sugar mills	1000- 4000 TCD	3-10 MWe	0.3 t bagasse/t sugarcane ~ 100 kWh/t sugar cane
4. Rice mills	< 0.7 t/h >0.7 t/h	30-70 kWe 100-300 kWe	280 kg husk/t paddy ~ 120 kWh/t paddy
5. Palm oil mills	20- 60 t FFB/h	2-6 MWe	0.2 t EFB/t FFB 0.2 t fibre/t FFB 70 kg shells/t FFB ~160 kWh/t FFB

Note: TCD= tonnes of Cane per day; FFB= Full Fruit Bunches; EFB= Empty Fruit Bunches.
Source: ZREU, 2000

Fig. 1 below shows the market potential for power generation and process heat using biomass energy in Indonesia. Total Potency of 1.160 MWe with the largest sugar mills spread in Java and Sumatra.

Table 2 and fig. 1 are capable of producing much higher capacity to reduce production costs. The proposed market potential is intended to support supply electricity to remote communities; however, many commercial biomass power plants are already used in sugar and oil palm plantations for their own enterprise requirement.

Figure 1: Potential market for biomass power generation



Sources: (Abdullah 2006; ZREU 2000)

Biomass policy in Indonesia

Like other countries, Indonesia was shocked by the world's oil shocks in the 1970s. Indonesia took the initiative to resolve the matter and also to answer the challenges of the future energy supply by making his first policy under Presidential Instruction no. 9/1982, with its main focus on energy conservation. The policy is focused on directing all government ministries and state-owned agencies and enterprises to undertake energy conservation measures. Furthermore, after year 2000 when the Ministry of Mines and Energy was reformed as the Ministry of Energy and Mineral Resource (ESDM), the energy sector in Indonesia has been dominated by four policy objectives (energy diversification, rational energy pricing, energy sector reform and rural electrification). The policy was also aimed at bringing reforms at institutional, financial, governance and industrial levels, with the aim to bring about transparency and inclusion for planning and implementation.

The energy demand, especially the need for electricity energy in Indonesia becomes more substantial in relation with the rapid growth of technology, industry, and information. The national electricity company, PT PLN (Perusahaan Listrik Negara), was established in 1950 and it has been given a great role in the electricity development in Indonesia. The growth of electricity supplied by PLN is steadily increasing. However, it cannot provide sufficient supply of electricity to fulfill the demand due. The above mentioned Indonesian government policies can bring benefits to small-scale private companies to invest in renewable power plants under the terms of PLN to purchase the generated electricity up to 1 MW capacity.

Biomass energy policy in Indonesia basically follows Presidential Regulation no. 5/2006 on National Energy Policy as the basis for biomass energy development. It set the targets for an optimal energy mix in 2025, where renewables contribute more than 15% of the total energy mix. Thus, biomass energy is expected to contribute about 5–10% of the total energy mix in 2025. The policy gave more emphasis on the utilization of biofuel. This was after Presidential Instruction (Inpres) no. 1/2006 on the supply and use of biofuel was issued. At the micro level, this aimed at creating pro-job biofuel projects and encouraging local development.

Table 3 presents the evolution of several policies related to renewable energy and biomass energy in Indonesia in the period 2002-2010. The policies are more oriented at the macro level for their utilization, such as transport and power generation. The policy is less make changes, the effort to make changes faster is to create other institutions. In the year 2010 in the form of institutions under the ESDM of the Directorate of New and Renewable Energy and Energy Conservation (EBTKE). EBTKE main task is to formulate and implement new and renewable energy policies and regulations. In this way, the biomass energy sector, together with other renewable energy sources, is expected to have institutional and policy support for regulation and implementation.

Table 3: Evolution of policies related to biomass energy in Indonesia during 2005-2014

No	Policy	Purpose
1.	Government Rule no. 3 on Supply of Electricity, 2005	• To supports Law no. 15/1985 on electricity, which was reenacted in late 2005 following a Constitutional Court ruling that annulled Law no. 20/2002 on electricity • To regulate the partnership between independent power

		producers (IPPs) partnered with PLN to develop electricity projects; an exception is given to companies that generate power for their own use or those using renewable energy; this way they can set up plants independently without having to partner with PLN
2.	Blueprint of National Energy Implementation Program 2005–2025 issued by Minister of Energy and Mineral Resources, 2005	• To delineate measures for the enhancement of energy supply security • To provide development road maps for various sectors, covering renewable and non-renewable energy sectors • To design programs to phase out subsidies and improve energy efficiency
3.	Presidential Regulation no. 5 on National Energy Policy, 2006	• To set energy diversification targets for 2025; including 5% biofuel, and 5% geothermal and other renewables such as biomass • To set an energy conservation target of reducing energy intensity by 1% per year
4.	Presidential Decree no. 1 on Supply and Use of Biofuel, 2006	• To set a target for biofuel utilization • To set the guidance for multi-sector coordination in biofuel development
5.	Ministerial Regulation no. 2 on Medium Scale Power Generation from Renewable Energy Sources, 2006	• To extend the same price guidelines as Ministerial Decree no. 1122/2002 for projects from 1 MW to 10 MW
6	Energy Law (Law no. 30/2007):	• To regulate renewable energy development and energy efficiency policy, particularly by increasing the utilization of renewable energy and provide incentives for renewable energy developers for a certain period of time
7.	Electricity Law (Law no. 30/2010):	• To invite private companies to participate in electricity supply • To give higher priority for the use of renewable energy and clean technology for electricity supply • To encourage more utilization of small-scale distributed power generation from renewable sources such as from biomass energy
8	Ministerial regulation No. 4/2012	• To set the Feed in Tariff for electricity generated from biomass
9	Ministerial regulation No. 27/2014	• Increase the portion of renewable energy to at least 23% by 2025 and 31% by 2050 • Utilization of biomass is focused for electricity and transportation • Using feed-in-tariff for the renewable energy • To encourage government and private companies in using biomass and biogas as fuel of power plant

	• To increase the electricity tariff from biomass fueled power plant

Sources: (Singh 2013)

The aim by the Ministry of ESDM introduced the ministerial decree no.1122 on small scale distributed renewable power plant on 2002 policy giving the advantage to the private company to invest on small-scale renewable power plant by providing incentive which requires PT PLN to purchase the electricity up to 1MW capacity. Ministerial Regulation No. 27/2014 aims to increase the utilization of biomass to 31% by 2050, and discuss the electrical tariff of biomass power plants.

Conclusion

Indonesia's potential biomass is estimated to reach 146.7 million tons of biomass per year, equivalent to about 470 GJ /y. Since population and GDP growth are exacerbating already existing supply demand populated Indonesia. The abundant biomass and national energy demand, make the Indonesian government has a strategic policy and regulation on biomass energy, however it need maturation, right application, as well as sustainable. The challenge of application biomass is technology, funding, and area. As is known Indonesia is an archipelago country, by building a power plant in the rural area will help the energy demands are less equitable in Indonesia. The government is expected to have more effort to cooperate to stakeholders, with the maturing Directorate of New and Renewable Energy and Energy Conservation (EBTKE). The government policy and regulation on energy demand and being implemented in the form of distributed power generation program may provide a greater opportunity for biomass energy to play role in helping the utility to provide power for the country. Expected for further research is how the government divides the concentration between fossil energy and biomass energy, then discusses the biomass energy policy that has not been synergized to authorized stakeholders.

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List of Authors:

Sapuan Dani
Faculty of Law
Prof. Hazairin University,
Bengkulu, Indonesia
Email : danisapuan@gmail.com

Aditya Wibawa
Department of ASEM
Kyushu University, Fukuoka, Japan
Email: aditalwi@yahoo.com