Chapter 1

Introduction

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1. Background

Indonesia is endowed with various types of renewable energy that are found across the archipelago. Solar energy has the largest potential with 207.8 GW, followed by hydro (94.6 GW), wind (60.6 GW), bioenergy (32.6 GW), geothermal (23.9 GW), and wave energy (17.9 GW). In 2020, the largest installed capacity was hydro at around 6.1 GW, followed by geothermal (2.1 GW), bioenergy (1.9 GW), wind (154.3 MW), and solar (153.8 MW).

Indonesia is a tropical country with huge forests and plentiful agricultural land, and biomass sources varying from wood residues/scraps, rice husks, corn residues, or from dedicated wood plantations. Of a total of around 74.4 million hectares of production forest, around 1.3 million hectares are allocated for energy-related plantations, with 32 companies already committed to development (MEBI, 2021). In terms of biomass supply for electricity, Sumatra has the biggest potential of 15,588 MWe, followed by Java and Bali (9,215 MWe), Kalimantan (5,062 MWe), Sulawesi (1,937 MWe), Nusa Tenggara (636 MWe), and Maluku and Papua (218 MWe). When classified into types of biomass, the largest potential is palm oil at around 12,654 MWe, rice husks (9,808 MWe), municipal waste (2,066 MWe), rubber (2,781 MWe), corn (1,733 MWe), wood (1,335 MWe), sugar cane (1,295 MWe), others (983 MWe) (DJ EBTKE, 2020).

Indonesia has set its long-term energy mix policy, with renewables targeted to reach 23% of the total in 2025 and 31% in 2050. Indonesia has also set its Nationally Determined Contribution (NDC) to reduce greenhouse gas (GHG) emissions in 2030 by 29% from the business-as-usual (BAU) scenario by its own effort and 41% with international support. To reach this target, the energy sector must reduce its emissions by around 314 million tonnes by 2030.

Based on Government Regulation Number 79 of 2014 on the National Energy Policy (NEP), the targeted primary energy supply of 2025 is around 400 million tonnes of oil equivalent (mtoe), of which around 92 mtoe is from renewables, or 23% of the total. By 2025, around 69 mtoe of the renewables total is projected to be used for electricity sector, with bioenergy's share of the total renewables supply projected to reach 5,532 MW, or 12.2%; in 2050, it will reach 26,123 MW or 15.6% of total. For the non-electricity sector, the projected supply of biofuel in 2025 is 13.9 million kL (not including biodiesel for electricity use at around 0.7 million kL), biomass for other use 8.4 million tonnes, and biogas at around 489 million cubic metres. In 2050, the biofuel supply is projected to reach 52.3 million kL (not including biodiesel for electricity use at 1.2 million kL), biomass for other use (22.7 million tonnes), and biogas (1.958 billion cubic metres).

Given biomass's enormous potential, the related policy is getting more progressive, with the government increasing its mix in diesel fuel to 30% (B-30) since January 2020. The supply of biodiesel also increased from 0.9 million kL in 2015 to 8.46 million kL in 2020. In contrast to the success of biodiesel, the implementation of bioethanol in the transportation sector has not been as expected. According to Ministry of Energy and Mineral Resources Decree Number 12 of 2015, the gradual mix of bioethanol has been determined at 1% (E1) in 2015 to 5% (E5) in 2020 and E20 in 2025 for public transport and other uses, while, for non-public transport, and the industrial and commercial sectors, the mix shall be 2% in 2015, 10% in 2020 and 20% in 2025. The use of bioethanol E5 in the transport sector started in 2006–10 in West Java and Bali, but was then not continued due to several factors, especially those related to the price of bioethanol and issues of storage and blending.

Recently, Indonesia has updated its plan under the Grand Strategy of National Energy (GSEN) to increase the use of biofuel from 159,000 barrels of oil equivalent per day (boepd) in 2020 to 238,000 boepd in 2030 and 257,000 boepd in an effort to reduce import dependency and to help reduce GHG emissions from fossil fuel use. Under the GSEN, the use of dimethyl ether and bioethanol are projected to reach 3.5 million tonnes liquefied propane gas equivalent in 2025 and 2.7 million tonnes liquefied propane gas equivalent in 2040. In line with the increasing share of renewables in the transport sector, the state-owned oil and gas company PT Pertamina is currently conducting studies to develop green diesel, green gasoline, and green aviation fuel utilising crude palm oil (CPO). The company is expected to produce this green energy in 2022. The impact of GHG reduction from the use of bioethanol and green fuel is huge as the consumption of gasoline and diesel fuel is projected to increase in the future.

Another initiative to increase the use of biomass is a co-firing programme with coal conducted by the state electricity company, PT PLN. Under the co-firing programme, 3% to 5% biomass in the form of wood pellets or woodchips will be injected in 114 units of coal-fired power plants (CFPPs) in 52 locations across the country. The co-firing program will be conducted in Java with the capacity of 14,330 MW, Sumatra (2,315 MW), Kalimantan (824 MW), Sulawesi (473 MW), Bali and Nusa Tenggara (142 MW), and Maluku and Papua (70 MW). With 3% to 5% mix, annual demand for biomass is projected to be around 4.2 million tonnes. Electricity production from biomass is projected to reach 8,783 GWh/year from 2021 to 2024 and 10,601 GWh/year from 2025 to 2035. The demand for biomass is projected to reach 7.54 million tonnes/year in 2021–24 and will reach around 9.02 million tonnes/year in 2025–35 (DJ EBTKE, 2021).

The benefit of a co-firing program is not only reducing GHG and sulphur emissions from the power sector, but also creating a local economic value chain. The study made by PT Pembangkitan Jawa Bali, a subsidiary of PT PLN, shows that co-firing of 5% biomass on the Java Bali system created 160 biomass industries employing around 1,600 people (PJB, 2020). The co-firing program can also reduce the electricity production cost (BPP) as indicated from one CFPP in West Java that reduced it to Rp. 21.26/kWh (around

$0.0015/kWh) and one in West Kalimantan to Rp. 5.09/kWh (around $0.0004/kWh) (DG Electricity, 2020).

Despite enormous opportunities, some challenges hinder biomass for energy use. The most important is the security of biomass supply for electricity. There are no mature biomass industries currently with the capacity to meet the prospective demand. This makes the price of wood pellets and wood chips uneconomical when compared to coal, especially when they are imported. Another challenge is that only PT PLN has indicated its commitment by starting to implement co-firing. As a result, the biomass market has yet to attract large-scale wood pellet or wood chip industries. As the main off-taker, PT PLN determines the price of biomass with a certain formula that is less attractive to biomass producers. A further challenge is that most biomass feedstock is coming from the sawdust, palm oil, rice husk, rubber and corn residues that are suitable for co-firing, but not sufficient for large-scale biomass power plants, which need sustainable dedicated biomass sources.

The challenge facing the use of biomass for transportation, especially bioethanol, is that it still costs more than gasoline. The challenge on the price can be traced back to the price of molasses, the main feedstock of bioethanol production. With less certainty on the security of domestic demand for bioethanol, most producers prefer to sell molasses to other industries or export it. This causes some of bioethanol factories to stop production. Another challenge is the lack of government incentives. This is important since developing second-generation bioethanol will secure Indonesia's supply for a long time. However, the cost to produce this type of bioethanol currently is even more expensive than the price of the first-generation bioethanol unless collaboration is made with global second-generation producers.

2. Objectives

The objectives of this study are as follows:

- To analyse biomass demand potential for energy sector to 2040;
- To analyse biomass supply potential for energy sector to 2040;
- To analyse biomass power generation business in Japan related to technical and environmental requirement as a reference for biomass development in Indonesia;
- To analyse wood pellet business model in Indonesia;
- To analyse opportunities and challenges of biomass development for energy sector in Indonesia; and
- To recommend strategies to increase biomass use for energy sector in Indonesia

3. Methodology

This study was conducted first with data collection on the potential of biomass resources in Indonesia. To understand the supply and demand outlook for energy sector biomass, this study refers to the outlook made and published by the Economic Research Institute for ASEAN and East Asia (ERIA). A series of discussions were conducted with relevant stakeholders including government representatives, biomass producers/associations, bioethanol producers/experts, wood pellet consumers from Japan, and the Japanese coal association to gain direct and in-depth understanding of the biomass potential. A webinar was also conducted with biomass consumers and the coal association to understand its demand for wood pellets, including technical and environmental requirements.