

# Chapter 6

## Conclusions and Recommendations

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## Chapter 6

### Conclusion and recommendations

#### 1. Conclusions

A low-carbon energy transition is a very important policy of Indonesia's Ministry of Energy and Mineral Resources. Indonesia must shift from fossil fuels to low-carbon energy such as hydropower, geothermal power/heat, and solar photovoltaic systems. But the low-carbon fuel should have a stable output, high capacity factor, and no seasonality. Solar is unstable due to sunshine variability, low capacity factor (only 12%–15%), and seasonality (dry and wet season). Hydropower has the drawback of seasonality, and geothermal has a short lifetime (around 10 years due to the decrease of hot water reserve). By contrast, biomass has a stable output, high capacity factor because of burning, and no seasonality. Thus, biomass is an option for low-carbon energy in Indonesia.

The study forecasts biomass demand up to 2040 based on the East Asia Summit Energy Outlook, updated by ERIA every 2 years. We forecast demand for both ethanol and diesel oil assuming a blending ratio to replace gasoline and diesel oil demand in 2040. In addition, we forecast wood pellets or chips demand for co-firing at coal power plants assuming a mixing ratio of biomass to replace coal. The demand for biomass for co-firing at coal power plants is forecasted as 4,596–34,844 kt in 2040 and biodiesel demand is forecasted to be 63.6 million kL.

Secondly, we forecast biomass supply up to 2040. Plentiful biomass supply is forecasted that will cover biomass demand mentioned above. Paying attention to sustainability, Indonesia has to engage in reforestation in order to maintain a carbon sink.

Thirdly, we review biomass power generation in Japan, which has aggressively increased it with support of FITs, as well as biomass co-firing at coal power plants for mitigating CO<sub>2</sub> emissions. It is clear that Japan will increase imports of wood pellets, meaning Indonesia may have an opportunity to become exporters to Japan. In addition, Japan expects that imported wood pellets may contribute to decreased procurement costs for biomass power generation companies.

Fourthly, we analyse the economics of the wood pellet supply business model. Due to the initially high cost of wood pellets, Indonesia should provide incentives to the private sector. In addition, the selling price of wood pellets and the cost of raw woods are key parameters to maintain the wood pellet business model.

## **2. Recommendations**

Though biomass is very important for Indonesia to achieve a low-carbon energy transition, bioethanol and biodiesel and wood pellet prices are still high compared to gasoline and diesel oil and coal. Thus, some incentives from the government are essential.

One way is applying FITs for wood pellets. If PLN adds FITs on the original selling price of electricity, this system surely works; if not, PLN profit will go down. Another way is to change wood pellets to wood chips because they are much cheaper.

Indonesia currently imports gasoline and diesel oil from neighbouring countries but if it increases mixing rate of biofuels to be produced domestically, Pertamina can save costs to import gasoline and diesel oil out of Indonesia. In this way, Pertamina can allocate the cost of the imports to purchase biofuels from biofuel produces in Indonesia.

Carbon pricing is also an option for Indonesia. Once the Ministry of Environment formulates a carbon tax, coal power generation costs will increase, so that biomass power generation and biomass co-firing coal power generation will be competitive. Further, biofuel is also competitive to original gasoline and diesel oil.

International cooperation of wood pellets and biofuel production is crucial because innovative technologies are owned by developed countries; transfer of these technologies from developed countries to Indonesia inevitably drives down the cost of biomass utilisation.