Chapter 4

Recommendations for the ASEAN Region

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Chapter 4

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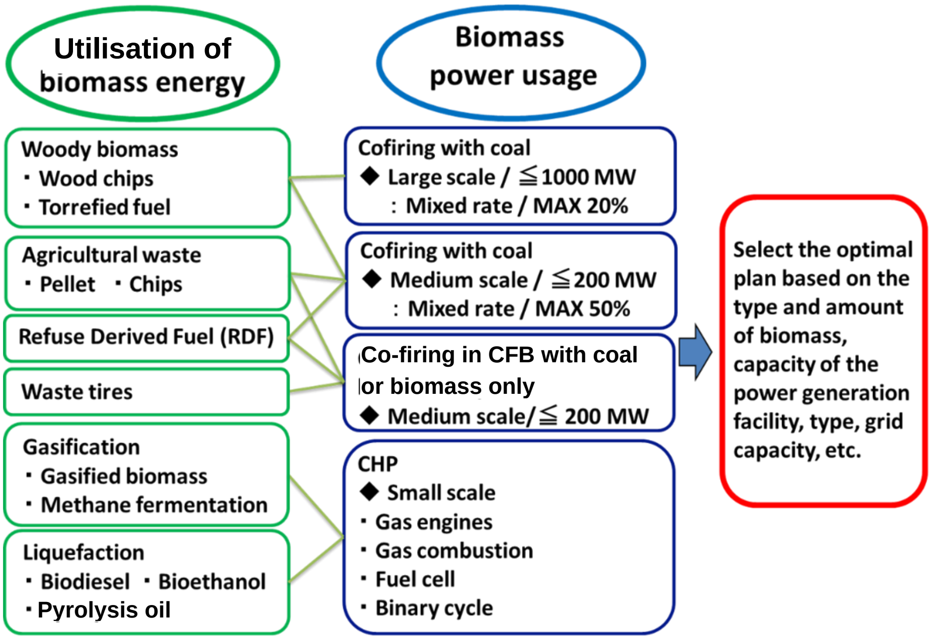
1. Available Technologies and Technical Solutions

It is always important for an energy project, regardless of scale, to identify a choice – or choices, if available – of technologies and technical solutions most suitable to the given conditions of the project. In this regard, we would like to overview the available technologies and technical solutions that applicable to the AMS (Figure 4.1).

Figure 4.1. Available Technologies and Technical Solutions for ASEAN Member States



CFB = circulating fluidised bed, CHP = combined heat and power.
Source: Study Team.

Biomass energy can be used either directly or through processing, such as liquefaction and gasification. Direct use includes the use of wood chips and woody biomass as a torrefaction or semi-carbonised fuel. Agricultural wastes are available for direct use or in the form of pellets or chips. Waste tires are a well-known fuel called tire-derived fuel. The use of derived gases, such as biomass gasification and methane fermentation, is also proven. The other option is liquefied biomass, such as biodiesel or bioethanol.

A biomass project developer should identify the optimal combination of technology, equipment, and capacity considering demand, grid capacity in case of grid-connected, and the available type and volume of biomass.

On biomass utilisation in the power sector, one of the most practical options is cofiring with coal at a pulverised CFPP. The technically proven and viable cofiring ratio is 20% for large scale (600–1,000 MW) and 30%–50% for medium scale (200–<600 MW).

Pulverisation is not required in the case of CFB, and dedicated biomass firing will be available in addition to the choice of cofiring with coal. The scale of CFB units is generally smaller, with most commercially operating units being 200 MW or so. However, recent technology development has enabled proven USC-level high-efficiency and environmentally compliant 550 MW CFB units.

There are also technologies combined with heat utilisation such as gas engine combined heat and power (CHP), gasification gas combustion CHP, fuel cell CHP, and binary power generation CHP for units smaller than 5 MW.

2. Available Technologies and Technical Solutions: By-Country Recommendations

Chapter 3 discussed the by-country situation of the four target AMS in pursuit of biomass utilisation possibilities through biomass cofiring or dedicated biomass firing.

Below is a summary of the by-country recommendations.

2.1. Cambodia

The Government of Cambodia sees that the country has high potential in wood biomass by fuel tree planting, considering that agricultural biomass utilisation is mostly established and no more surplus for power generation is expected. The following are the advantages of wood biomass for power generation compared to agricultural biomass clarified by the government.

- Planned and stable fuelwood supply is possible in the case of tree planting.
- Even in the case of cultivation of energy trees, the fuel cost holds only a small fraction of total electricity generation cost (11% in the case of 13 kWh monthly electricity consumption per household). Using agricultural residues does not reduce the cost dramatically.
- The purchasing cost of cultivated trees is not high (about $20/t). Using agricultural residue could be more expensive when transportation cost occurs.
- Woody biomass is generally the best fuel for gasification.

Wood biomass utilisation, often criticised for possibly leading to deforestation, will be more sustainable if such tree plantation is combined with low-value wood as a by-product of a traditional timber harvest. An appropriate regulatory framework by the government for overall forest management, not limited to tree planning, and market development should be established, and well-organised management by the developer and/or the concerned community should be ensured.

a) Conduct a basic study to identify the availability of wood biomass resources in terms of amount, areas, and prices. Collaboration with forestry experts shall be crucial, since the study must consider sustainable tree planting and wood biomass utilisation.

b) Following the basic study, conduct a model study for biomass collection and procurement with the community and community-based organisations' roles in mind.

c) Biomass technologies are to be also studied in close cooperation with biomass power–related technology specialists.

d) Literature study complemented with some interviews to identify financing schemes for dedicated biomass firing would be helpful.

e) In parallel with the previous studies, the government is expected to make policy efforts to consider and set up incentives for biomass cofiring in existing and incoming CFPPs. Wood biomass cofiring has been implemented in many countries, including Japan. Thus, no major studies may be required to recommend power plant producers for biomass cofiring.

f) Based on the outcomes of the studies in (a), (b), (c), a model project on dedicated biomass firing well connected to the community and community-based organisations is to be planned and implemented.

2.2. Indonesia

The government of Indonesia continues policy efforts to increase the contribution of renewable energy in the energy mix. In the power sector, the government, in close cooperation with the PLN, is taking various measures, amongst others, tests for promotion, and disseminates biomass use to enhance the national efforts to commit to the Paris Agreement. In this context, we would like to highlight the following two recommendations:

➢ Biomass power, by providing options for village electrification through the sales of off-grid captive power to the PLN or direct supply of such off-grid biomass power to the local area, would be conducive to the government's acceleration plan of electrifying 2,500 villages with over 10 million people.

➢ While ample amounts of corn and coconut wastes are available throughout the year, small-scale farmers might have barriers in procurement, i.e. collecting and transporting them to the power plant. In this context, a cooperative would play a key role in assisting local farmers. Further, a special purpose association involving such farmers, business owners, and related organisations would be more functional in managing biomass throughout the procurement value chain, i.e. for collection, transportation, and supply.

Working with a cooperative or a cooperative association would result in benefits like tax exemption, which will improve the project's economy. This, together with the related jobs created, will enhance the local economy as well.

2.3. Philippines

➢ Coal-fired power will continue to play an important role, but it is essential to control the increase in CO_2 emissions.

➢ The use of biomass in coal-fired power generation facilities is being implemented in many countries. In addition to cofiring biomass with PC-fired boilers and CFBs are CFBs dedicated to biomass combustion. Fossil fuel consumption has been reduced for biomass use. Since biomass is carbon neutral, it is advantageous in terms of CO_2 reduction in power generation facilities.

- Biomass with coal-fired power can also be used with existing coal-fired power. In PC-fired boilers, the cofiring rate is generally limited to a few percent because the amount of biomass used is limited by the crusher's capacity. On the other hand, in CFB, since restrictions are few due to the crushing device, the cofiring rate can increase and the biomass can be exclusively burned. To increase the biomass cofiring rate in the existing CFPP, it is necessary to appropriately modify the equipment according to the type of biomass and the planned cofiring rate.
- The use of biomass in a new CFPP necessitates the planning of a power plant according to the site area and facility scale. For small and midsized power generation facilities of 400 MW or less, a CFB with subcritical pressure can be selected according to the installation area, the presence or absence of grid connection, and the type and amount of available biomass.
- For relatively large-scale power generation facilities of 400 MW or more, grid connections are used, and there are many options. It is also possible to cofire biomass as a USC-PC-fired power generation facility to make it highly efficient. In this case, torrefied biomass is used to increase the cofiring rate, but the cofiring rate is 20% or less. USC-type CFBs have a proven track record and can improve efficiency.

2.4. Thailand

By-products throughout the community power plant should be used for the sustainable development of the community. Discharged ash can be utilised as feed material for cement, block production. The overall optimisation of by-products use might be the way to realise a carbon-neutral or carbon-minus community and improve the community economy.

The simultaneous feed of municipal waste with biomass in a combustion chamber is a measure to address municipal waste issues. In this option, flue gas treatment such as de-SOx, de-NOx, and SPM filtering facilities, is essential.

Financial support of the plant facility is a critical item to materialise the community power plant project. The JCM is to facilitate the diffusion of leading low-carbon technologies, products, systems, services, and infrastructure as well as the implementation of mitigation actions and contribution to the sustainable development of developing countries. The biomass power plant is thought to be consistent with the concept of the JCM.

Biomass cofiring in existing CFPPs should be considered in terms of energy security, flexibility, and maximum utilisation of existing infrastructures, not only domestic biomass utilisation. In this regard, further studies on essential technology and investment for biomass cofiring is recommended.

3. Policy Recommendations for ASEAN

3.1. Benefits of biomass cofiring at coal-fired power plants

Coal is an affordable, available, and reliable fuel for power generation; yet, it is also the largest emitter of all fuels. Biomass, as a renewable and carbon-neutral generation source, is advantageous as it contributes to the reduction of CO_2 emission.

ASEAN is expected to undergo energy transition, where massive introduction of renewables is expected., Achieving grid flexibilisation is crucial in making a dynamic shift to introduce renewables energy on a massive scale in ASEAN since renewables energy is inherently variable and intermittent. Such massive introduction may cause system fluctuation if no measures are taken. In this context, coal and biomass have similar advantages in their competency in flexible operation that is crucial in enabling successful energy transition. Coal is excellent in supply reliability but is a large CO_2 emitter. Biomass is carbon-neutral, but its supply is seasonal. So, both are complementary and would make a good combination. This complementary relation between coal and biomass is a key to understanding biomass cofiring.

3.2. Benefits of dedicated biomass firing

Thanks to policy efforts in the past decades, a few AMS have achieved 100% electrification, and others are supposed to follow. However, those following the AMS seem to be struggling to achieve a few percent more towards full electrification. In this connection, dedicated biomass firing would be a suitable option for rural electrification and social development as it is small scale, labour intensive. It is also less costly, procurement is ensured by indigenous fuel utilisation, less intermittent (only seasonal), and options are available for both off-grid and on-grid generation.

3.3. Envisaged policy initiatives to facilitate biomass utilisation in the power sector of the AMS

ASEAN and respective AMS are expected to initiate the following as part of their facilitation programmes for biomass use:

(1) Survey and evaluate biomass resources to ensure that relevant policy implementation and actions go in the right direction.

(2) Ensure networking and association with all stakeholders and organisations that would support and/or facilitate or benefit from programmes and projects with biomass power.

(3) Conduct a comprehensive model study on biomass power generation technology and finance, and supporting schemes, such as organisational set-up and increased job opportunities, given the importance of implementing local electrification and rural development programmes combined with a biomass firing project.

(4) Deliberate and consider economic incentives to implement such programmes and projects. Incentives are essential, especially at the initial stage of introduction.

(5) Forge measures to promote biomass collection, such as creating regional bases and promoting related employment, for which formulation of a new cooperative association or leveraging existing cooperatives would be a key.

(6) Formulate a platform involving both in-region and external experts to discuss relevant technical, policy, and financial issues to further facilitate biomass utilisation and learning opportunities from international cooperation projects and collaboration activities.