Additional information on emissions from transportation of rice husk

Summary

- In Ayeyarwady region, total maximum input of rice husks that would be used for a rice husk power plant, whose power generation capacity and efficiency are 15 MW at most and 16.0 % at least respectively, could be collected from rice mills located within an 83 km radius of the project power plant.
- Emissions from transportation of rice husks to a project power plant can be neglected considering the transportation distance is unlikely to exceed 200 km.

I. General information

Rice production in Ayeyarwady region

Ayeyarwady region is known as a rice-producing region, where a large number of rice mills exist and produce about a third of Myanmar's total rice production. As a result of the rice milling, the annual production of rice husks amounts to 1.4 million tons.

Table 1 Rice and rice husk production in Ayeyarwady region

Item	Value
Number of rice mills	3,927 unit
Area of region	35,140 km^2
Rice production	6,917,007 tons/year
Rice husk production	1,405,955 tons/year
Rice husk consumption	1,057,600 tons/year
Surplus of rice husk	348,355 tons/year

Source: New Energy and Industrial Technology Development Organization[1]

II. Estimation of transportation distance for rice husk

Estimation of maximum input for power generation

To estimate transportation distance for rice husks, the maximum input of rice husks for power generation needs to be estimated first. To this end, necessary characteristics related to a rice husk power plant and the biofuel (rice husk) are defined as shown in the following table.

[1] "Demonstration Project on Resource Circulation System of Rice Husk Ash (Silica etc.)" https://app5.infoc.nedo.go.jp/disclosure/SearchResultDetail

Table 2 Characteristics of rice husk power plant and biofuel

Item	Value	Source
Power generation capacity	15 MW or less	CDM standard[2]
Power generation efficiency	16.0 %	Electric efficiency of biomass CHP, IEA-ETSAP and IRENA[3]
Heating value of rice husk	14 GJ/t	Net calorific value of rice husk, UN FAO[4]
Operation hour	8,760 [h/year]	Maximum operation hours for one year

The power generation capacity of rice husk power plant is set to 15 MW or less, so that it falls into small scale in line with the CDM standard. The power generation efficiency of the plant is set to 16.0 % or more, derived from the IEA-ETSAP and IRENA publication. Although the power generation efficiency of biomass CHP indicated in the IEA-ETSAP and IRENA publication ranges from 16 % to 36 %, the lowest value is selected considering the efficiency tends to decrease as the power generation capacity does, and the assumed power generation capacity in

[2] "CDM project standard for project activities"
https://cdm.unfccc.int/Reference/Standards/index.html
[3] "Biomass for Heat and Power, Technology Brief"
http://www.irena.org/publications/2015/Jan/Biomass-for-Heat-and-Power
[4] "Unified Bioenergy Terminology"
http://www.fao.org/docrep/pdf/007/j4504e/j4504e00.pdf

Table 2 is 15 MW or less.

The maximum input of rice husks that would be used for the rice husk power plant with these characteristics is calculated as follows.

$$Maximum\ input = \frac{15\ [\mathrm{MW}]}{0.16} \times \frac{3.6\ [\mathrm{GJ/MWh}]}{14\ [\mathrm{GJ/t}]} \times 8{,}760\ [\mathrm{h/year}] = 211{,}179\ \mathrm{tons/year}$$

The input of rice husks for the rice husk power plant may not exceed 211,179 tons/year as long as the power generation capacity of that plant is 15 MW or less, and the power generation efficiency is 16.0 % or more, which is set as an eligibility criterion of this methodology.

Estimation of transportation distance

Considering the number of rice mills in Ayeyarwady region, the area and the surplus of rice husk, it is assumed that each rice mill is located in every 8.95 km^2 and has a surplus of 88.71 tons/year on average. Assuming further that all the rice husks that would be used for the rice husk power plant, amounting to 211,179 tons/year, are transported from other rice mills nearby the project power plant, the rice husks have to be transported from 2,381 unit of rice mills located in the area of 21,310 km^2. With an assumption that these rice mills are uniformly distributed within a circle centered at the project power plant, the rice husks can be assembled within a radius of 82.38 km, and the transportation distance for round trip becomes 164.76 km.

As for project emissions resulted from the transportation of biomass to a utilization facility, CDM Methodological tool "Project and leakage emissions from biomass" stipulates that the emissions can be neglected if the transportation distance is less than 200 km.[5] Therefore, the emissions that might be resulted from the transportation of rice husks to a certain rice husk power plant are neglected in this methodology, as the transportation distance is assumed to be less than 200 km, and the methodology is applied to a project where the power generation capacity and efficiency of the rice husk power plant are at most 15 MW and at least 16.0 % respectively.

[5] "Project and leakage emissions from biomass"
https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-16-v4.pdf