JCM Proposed Methodology Form

Cover sheet of the Proposed Methodology Form

Form for submitting the proposed methodology

Host Country	Chile
Name of the methodology proponents submitting this form	Institute for Global Environmental Strategies
Sectoral scope(s) to which the Proposed Methodology applies	1. Energy industries (renewable- / non-renewable sources)
Title of the proposed methodology, and version number	Installation of biomass power plant, version 01.0
List of documents to be attached to this form (please check):	☐The attached draft JCM-PDD: ☒Additional information
Date of completion	06/01/2023

History of the proposed methodology

Version	Date	Contents revised
01.0	06/01/2023	First Edition

A. Title of the methodology

Installation of biomass power plant, version 01.0

B. Terms and definitions

Terms	Definitions
Biomass power plant	A biomass power plant, which consists of a biomass boiler, a generator set (genset) and auxiliary equipment. The biomass boiler generates heat by combusting biomass as its fuel, and the genset uses the heat to generate electricity.
Biomass	Biomass is non-fossilized and biodegradable organic material originating from plants, animals and microorganisms. This shall include products, by-products, residues and waste from agriculture, forestry and related industries as well as the non-fossilized and biodegradable organic fractions of industrial and municipal wastes. Biomass also includes gases and liquids recovered from the decomposition of non-fossilized and biodegradable organic material.
Biomass residue	Biomass residues are defined as biomass that is a by-product, residue or waste stream from agriculture, forestry and related industries. This shall not include municipal waste or other wastes that contain fossilized and/or non-biodegradable material (however, small fractions of inert inorganic material like soil or sands may be included).
Biomass boiler	A boiler which combusts biomass fuel to heat water and produce steam.
Recipient facility	A facility (e.g., building, plant, etc.) or a cluster of facilities to which electricity generated by a biomass power plant is supplied.

C. Summary of the methodology

Items	Summary

GHG emission reduction measures	GHG emission reductions can be achieved through the displacement of grid and/or captive electricity by installation and operation of a biomass power plant.
Calculation of reference emissions	Reference emissions are calculated from net electricity generated by a biomass power plant multiplied by a CO_2 emission factor for grid electricity or captive electricity.
Calculation of project emissions	Project emissions include the emissions from combustion of biomass fuels in a biomass power plant, the emissions from combustion of fossil fuel at a biomass power plant and the emissions from transportation of biomass residues. [Emissions from biomass fuel combustion] The emissions resulting from combustion of biomass fuels are zero since they are carbon neutral. [Emissions from fossil fuel combustion] The emissions from combustion of fossil fuel at a biomass power plant are calculated from the amount of fossil fuel consumption, a net calorific value of the fuel and a CO_2 emission factor of the fuel. [Emissions from transportation of solid biomass fuels] The emissions from transportation of biomass residues are calculated from the amount of fossil fuel consumption by the transportation, a net calorific value of the fuel and a CO_2 emission factor of the fuel, if applicable. If not applicable, the emissions from transportation of solid biomass fuels are calculated from total mass of freight transported from each collecting site, distance between each collecting site and a biomass power plant and a CO_2 emission factor of the transportation.
Monitoring parameters	● Net amount of electricity generated by a biomass power plant ● On-site consumption of fossil fuel for operating a biomass power plant ● Consumption of fossil fuel by transportation, if applicable ● Round trip distance between collecting site and a biomass power plant, if applicable

	● Total mass of freight transported from collecting site, if applicable

D. Eligibility criteria

This methodology is applicable to projects that satisfy all of the following criteria.

Criterion 1	A biomass power plant is newly installed and supplies electricity to the regional grid and/or a recipient facility.
Criterion 2	The project power plant(s) uses only solid biomass fuels made of biomass residues.
Criterion 3	Solid biomass fuels utilized for the project are not used for energy applications in absence of the project activity. This can be demonstrated by the letter from suppliers of biomass residues.

E. Emission Sources and GHG types

Reference emissions	
Emission sources	GHG types
Grid electricity and/or captive power generation	CO_2
Project emissions	
Emission sources	GHG types
Biomass fuel combustion in a biomass power plant	N/A
Fossil fuel consumption for operating a biomass power plant	CO_2
Fossil fuel consumption by transportation of solid biomass fuels and/or materials of solid biomass fuels from collecting sites to a biomass power plant	CO_2

F. Establishment and calculation of reference emissions

F.1. Establishment of reference emissions

Reference emissions are calculated based on the net amount of electricity generated by a biomass power plant which replaces grid electricity and/or captive use where the project is implemented during a given time period.

The default emission factor is set in a conservative manner for the Chilean regional grids: the National Electricity System (SEN), the Aysén system and the Magallanes system. The emission factor is calculated based on the conservative operating margin that reflects on the latest electricity mix including low cost/must run resources for each regional grid in Chile during 2019-2021 and refers to the conservative emission factor of each fossil fuel power plant to secure net emission reductions. The conservative emission factor of each plant is calculated to be 0.826 tCO_2/MWh for coal-fired power plant and 0.352 tCO_2/MWh for gas-fired power plant based on the survey on heat efficiency of power plant in Chile. The emission factor for diesel power plant is calculated to be 0.533 tCO_2/MWh based on a default heat efficiency of 49%, an efficiency level which is above the value of the world's leading diesel power generators. As a result, in case a biomass power plant in a proposed project activity is connected to the regional grid, the emission factors shown in section I of this methodology are applied. In case a biomass power plant in a proposed project activity is connected to an internal grid which is not connected to the regional grid, the emission factor is set to 0.533 tCO_2/MWh.

The emission factors for each region are shown in Section I.

F.2. Calculation of reference emissions

$$\boldsymbol{RE_p = NEG_p \times EF_{RE,elec}}$$

Where

RE_p : Reference emissions during the period p [tCO_2/p]

NEG_p : Net amount of electricity generated by the biomass power plant during the period p [MWh/p]

$EF_{RE,elec}$: CO_2 emission factor of the regional grid or the consumed electricity in the recipient facility [tCO_2/MWh]

*NEG_p is a difference between amount of gross generated electricity and amount of electricity consumed by a project biomass power plant (e.g., building, plant, etc.) during the period p.

G. Calculation of project emissions

$$\boldsymbol{PE_p = PE_{onsite,p} + PE_{trans,p}}$$

Where

PE_p : Project emissions during the period p [tCO_2/p]

$PE_{onsite,p}$: Project emissions by on-site consumption of fossil fuel for operating a biomass power plant during the period p [tCO_2/p]

$PE_{trans,p}$: Project emissions by transportation activity of solid biomass fuels from collecting sites to a biomass power plant during the period p [tCO_2/p]

$PE_{onsite,p}$ is calculated as below.

$$\boldsymbol{PE_{onsite,p} = \sum_i FC_{onsite,i,p} \times NCV_i \times EF_{fuel,i}}$$

Where

$FC_{onsite,i,p}$: On-site consumption of fossil fuel i for operating a biomass power plant during the period p [mass or volume/p]

NCV_i : Net calorific value of fossil fuel i used for operating a biomass power plant [GJ/mass or volume]

$EF_{fuel,i}$: CO_2 emission factor of fossil fuel i used for operating a biomass power plant [tCO_2/GJ]

i : Indication number of fossil fuel type consumed on-site [-]

*If the total rated electrical output capacity of the project biomass power plant is equal to or less than 15 MW, the emissions from on-site consumption of fossil fuel for operating a biomass power plant may be neglected, following CDM Methodological Tool "Project and leakage emissions from biomass (version 04.0)."

$PE_{trans,p}$ is calculated using one of the following options.

Option 1 : Monitoring fuel consumption

$$\boldsymbol{PE_{trans,p} = \sum_j FC_{trans,j,p} \times NCV_j \times EF_{fuel,j}}$$

Where

$FC_{trans,j,p}$: Consumption of fossil fuel j by transportation during the period p [mass or volume/p]

NCV_j : Net calorific value of fossil fuel j used for transportation activity of solid biomass fuels to a biomass power plant [GJ/mass or volume]

$EF_{fuel,j}$	:	CO_2 emission factor of fossil fuel j used for transportation activity of solid biomass fuels to a biomass power plant [tCO_2/GJ]
j	:	Indication number of fossil fuel type consumed for transportation [-]

Option 2 : Monitoring trip road distance and mass of freight

$$\boldsymbol{PE_{trans,p} = \sum_{k}\sum_{l} D_k \times FR_{k,l,p} \times EF_{vehicle,l}}$$

Where

D_k	:	Round trip distance between collecting site k and a biomass power plant [km]
$FR_{k,l,p}$	:	Total mass of freight transported from collecting site k by vehicle type l during period p [ton/p]
$EF_{vehicle,l}$	:	CO_2 emission factor of vehicle type l [tCO_2/ton-km]
k	:	Indication number of collecting site [-]
l	:	Indication number of vehicle type [-]

*If the round-trip distance between collecting site k and a biomass power plant (D_k) is less than 200 km and the total rated electrical output capacity of the project biomass power plant is equal to or less than 15 MW, the emissions from the transportation may be neglected, following CDM Methodological Tool "Project and leakage emissions from biomass (version 04.0)."

H. Calculation of emissions reductions

$$\boldsymbol{ER_p = RE_p - PE_p}$$

Where

ER_p	:	Emission reductions during the period p [tCO_2/p]
RE_p	:	Reference emissions during the period p [tCO_2/p]
PE_p	:	Project emissions during the period p [tCO_2/p]

I. Data and parameters fixed *ex ante*

The source of each data and parameter fixed *ex ante* is listed as below.

Parameter	Description of data	Source
$EF_{RE,elec}$	CO_2 emission factor for the regional grid electricity or the consumed electricity in the recipient facility [tCO_2/MWh] The value for $EF_{RE,elec}$ is selected from the emission factor for grid electricity or for captive electricity in the following manners: In case a biomass power plant in a proposed project activity is connected to the regional grid, the following factor is applied for the respective region. Regional grid name: — Emission factor SEN (National System) — 0.361 tCO_2/MWh Aysén System — 0.214 tCO_2/MWh Magallanes System — 0.348 tCO_2/MWh In case a biomass power plant in a proposed project activity is connected to an internal grid which is not connected to the regional grid, 0.533 tCO_2/MWh is applied.	The default emission factor is obtained from a study of electricity systems in Chile and the most efficient diesel power generator (49% heat efficiency). Once the default values are revised, the revised values are applied.
NCV_i	Net calorific value of fossil fuel *i* used for operating a biomass power plant [GJ/mass or volume]	In the order of preference: a) values provided by fuel supplier; b) measurement by the project participants; c) regional or national default values; or d) IPCC default values provided in 2006 IPCC Guidelines on National GHG Inventories. Upper value is applied.
NCV_j	Net calorific value of fossil fuel *j* used for transportation activity of solid biomass fuels to a biomass power plant [GJ/mass or volume]	

<table>
<tr><td>$EF_{fuel,i}$</td><td>CO_2 emission factor for fossil fuel i used for operating a biomass power plant [tCO_2/GJ]</td><td rowspan="2">In the order of preference:
a) values provided by fuel supplier/collector;
b) measurement by the project participants;
c) regional or national default values; or
d) IPCC default values provided in 2006 IPCC Guidelines on National GHG Inventories. Upper value is applied.</td></tr>
<tr><td>$EF_{fuel,j}$</td><td>CO_2 emission factor of fossil fuel j used for transportation activity of biomass residues to a biomass power plant [tCO_2/GJ]</td></tr>
<tr><td>$EF_{vehicle,l}$</td><td>CO_2 emission factor of vehicle type l [tCO_2/ton-km]

<table><tr><th>Vehicle class</th><th>$EF_{vehicle,l}$</th></tr><tr><td>Light vehicle</td><td>0.000245 tCO_2/ton-km</td></tr><tr><td>Heavy vehicle</td><td>0.000129 tCO_2/ton-km</td></tr></table>
Vehicles with a gross vehicle mass being less or equal to 26 tonnes are classified in light vehicle. Vehicles with a gross vehicle mass being higher than 26 tonnes are classified in heavy vehicle.

* If both vehicle classes are used in the project, the larger value (0.000245 $tCO_2/(t{\cdot}km)$) is applied.</td><td>The default values provided in the CDM Methodological Tool “Project and leakage emissions from transportation of freight.”</td></tr>
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