1. Typical Project
   • Installations of a new power plant or a heat supply facility that utilizes biomass as a fuel.
   • Fuel switch from fossil fuels to biomasses, or retrofit at an existing power plant or heat supply facility.

2. Applicability
   (1) Utilization of biomass, e.g. agricultural/forestry co-products/residues/wastes not including general wastes.
   (2) Installations of a new power plant or a heat supply facility that utilizes biomass as a fuel.
   (3) Fuel switch from fossil fuels to biomasses or retrofit at an existing power plant or heat supply facility for biomass utilization.

3. Methodology of Emission Reduction Calculation
   The emission reduction from the project activity is determined as the differences between the GHG emission of baseline scenario (use fossil fuels to obtain an equivalent amount of energy generated by the project) and project scenario (energy generation with utilization of biomasses).

\[
ER_y = BE_y - PE_y
\]

\( ER_y \): GHG emission reduction through the project in year \( y \) (t-CO\(_2\)/y)
\( BE_y \): GHG emission from the baseline scenario in year \( y \) (t-CO\(_2\)/y)
\( PE_y \): GHG emission from the project scenario in year \( y \) (t-CO\(_2\)/y)

(1) Calculation of Baseline Emission
   Baseline GHG emission is calculated based on the amount of annual electricity and thermal energy generated by the project and CO\(_2\) emission factor of the electricity and fossil fuel respectively.

\[
BE_y = BE_{elec,y} + BE_{heat,y}
\]

\( BE_{elec,y} \): Baseline emission from the generation of electricity which is replaced by the biomass power plant in year \( y \) (t-CO\(_2\)/y)
\( BE_{heat,y} \): Baseline emission from the generation of heat which is replaced by the biomass heat plant in year \( y \) (t-CO\(_2\)/y)
\( EG_{pj,y} \): Power generation by the biomass power plant in year \( y \) (MWh/y)
\( EF_{elec} \): CO\(_2\) emission factor of the electricity (t-CO\(_2\)/MWh)
\( HG_{pj,y} \): Amount of heat supply by the project in year \( y \) (TJ/y)
\( EF_{fuel,i} \): CO\(_2\) emission factor of the baseline fuel \( i \) (t-CO\(_2\)/TJ)
\( \eta_{therm} \): Baseline boiler efficiency

(2) Calculation of Project Emission
   Project GHG emission is calculated based on the annual electricity and fossil fuel consumption associated with transportation of biomass residue and the biomass facility, and CO\(_2\) emission factors of the electricity and fossil fuel.
16. Renewable Energy / Biomass

\[ PE_y = PE_{\text{elec},y} + PE_{\text{fuel},y} = (EC_{p,j,y} \times EF_{\text{elec}}) + \sum_j (FC_{p,j,y} \times NCV_j \times EF_{\text{fuel},j}) \]

- **PE\text{elec,y}**: Project emission associated with electricity consumption (t-CO\textsubscript{2}/e/y)
- **PE\text{fuel,y}**: Project emission associated with fossil fuel consumption (t-CO\textsubscript{2}/e/y)
- **EC\text{p,j,y}**: Electricity consumption by biomass transportation and facility in year y (MWh/y)
- **EF\text{elec}**: CO\textsubscript{2} emission factor of the electricity (t-CO\textsubscript{2}/MWh)
- **FC\text{p,j,y}**: Consumption of the fuel j by biomass transportation and facility in year y (t/y)
- **NCV\textsubscript{j}**: Net calorific value of the fuel j (TJ/t)
- **EF\text{fuel,j}**: CO\textsubscript{2} emission factor of the fuel j (t-CO\textsubscript{2}/TJ)

### 4. Data and Parameters Estimated and Need Monitoring

<table>
<thead>
<tr>
<th>Data</th>
<th>Description</th>
<th>Data Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>For baseline emission calculation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ex-ante</td>
</tr>
<tr>
<td>EG_{p,j,y}</td>
<td>Power generation by the biomass power plant in year y (MWh/y)</td>
<td>A planned value</td>
</tr>
<tr>
<td>HG_{p,j,y}</td>
<td>Amount of heat supply by the project in year y (TJ/y)</td>
<td>A planned value</td>
</tr>
</tbody>
</table>
| EF_{\text{elec}} | In the case of the grid connection: CO\textsubscript{2} emission factor of the grid electricity (t-CO\textsubscript{2}/MWh) | From the following sources in the order of priority
i) A project specific value by an interview to the related power supply company
ii) A published value of the country
iii) A default value (Table 4, Appendix) |
| EF_{\text{fuel,i}} | CO\textsubscript{2} emission factor of the baseline fuel i (t-CO\textsubscript{2}/TJ) | From the following sources in the order of priority
i) A national default value
ii) A default value (Table 2, Appendix) | N/A |
| EF_{\text{fuel,j}} | CO\textsubscript{2} emission factor of the fuel j (t-CO\textsubscript{2}/TJ) | N/A | From the following sources in the order of priority
i) A national default value
ii) A default value (Table 2, Appendix) |
| \(\eta_{\text{therm}}\) | Baseline boiler efficiency | From the following sources in the order of priority
i) A catalog value
ii) A default value (Table 6, Appendix) | N/A |
| EC_{p,j,y} | Electricity consumption by biomass transportation and facility in year y (MWh/y) | A planned value | A monitored value (Electric meter or purchase receipt) |
16. Renewable Energy / Biomass

<table>
<thead>
<tr>
<th>FC_{pjy}</th>
<th>Consumption of the fuel j by biomass transportation and facility in year y (t/y)</th>
<th>A planned value</th>
<th>A monitored value (Purchase receipt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCV_{j}</td>
<td>Net calorific value of the fuel j (TJ/t)</td>
<td>From the following sources in the order of priority</td>
<td></td>
</tr>
<tr>
<td></td>
<td>i) A national default value</td>
<td>ii) A default value (Table 1, Appendix)</td>
<td></td>
</tr>
</tbody>
</table>

### 5. Others

(1) **Project Boundary**

The physical boundary for estimating GHG emissions includes the facility in the project site and other sites where biomass residues generated.

(2) **Leakage**

There are indirect emissions that potentially lead to leakage due to activities such as manufacturing and transport of materials and construction processes. However, these emissions are temporary and negligible compare to the project scale. Therefore, they can be ignored.

(3) **Comparison with existing methodologies**

There are CDM methodologies such as AMS I.D. (Grid connected renewable electricity generation) and ACM0006 (Consolidated methodology for electricity and heat generation from biomass residues) can be references for development of the methodology. Compared with AMS I.D., the logic of emission reduction calculation in the methodology is basically same. However, this methodology simplifies the calculation way by providing default values for the grid CO₂ emission factor. ACM0006 includes the baseline emission associated with uncontrolled burning and decay of biomass residue, and the project emissions associated with methane emissions associated with combustion of biomass residues, wastewater treatment etc. On the other hand, this methodology does not consider these aspects. The CDM methodology is applicable to the projects that the generation capacity may not exceed 15 MW (AMS I.D.); however, these applicability conditions are not included in this methodology. In regard to leakage, the CDM methodology considers assessment of leakages such as an increase in emissions from fossil fuel combustion or other sources due to diversion of biomass residues from other uses to the project plant as a result of the project activity. However, in this methodology this is not considered.