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TYPE I - RENEWABLE ENERGY PROJECTS

Project participants shall apply the general guidelines to SSC CDM methodologies, information on additionality (attachment A to Appendix B) and general guidance on leakage in biomass project activities (attachment C to Appendix B) provided at <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html> *mutatis mutandis*.

I.I. Biogas/biomass thermal applications for households/small users

Technology/measure

1. This category comprises activities for generation of renewable thermal energy using renewable biomass or biogas for use in residential, commercial, institutional applications (e.g. for supply to households, small farms or for use in built environment of institutions such as schools).[1] Examples of these technologies that displace or avoid fossil fuel use include but are not limited to biogas cook stoves, biomass briquette cook stoves, small scale baking and drying systems, water heating, or space heating systems.

2. The total installed/rated thermal energy generation capacity of the project equipment is equal to or less than 45 MW thermal.[2]

3. Each unit (e.g. cook stove, heater) shall have a rated capacity equal to or less than 150 kW thermal.[3] Projects that include units with rated capacity greater than 150 kW thermal may explore AMS I.C "Thermal energy production with or without electricity".

4. For the specific case of biomass residues processed as a fuel (e.g. briquettes, wood chips), it shall be demonstrated that:

(a) It is produced using solely renewable biomass[4] (more than one type of biomass may be used). Energy use for renewable biomass processing (e.g. shredding and compacting in the case of briquetting) may be considered as equivalent to the upstream emissions associated with the processing of the displaced fossil fuel and hence disregarded;

(b) The "General guidance on leakage in biomass project activities" (attachment C to Appendix B of 4/CMP.1 Annex II) shall be followed;

[1] Hereafter these applications are denoted by the term 'user' in this document.

[2] For thermal applications of biomass/biogas, the limit of 45 MW_{th} is the installed/rated capacity of the thermal application equipment or device/s. Refer to the latest version of "General Guidelines to SSC CDM methodologies". The manufacturers' specifications on the installed/rated thermal output may be used. In the absence of manufacturers' specification the installed/rated thermal output shall be determined based on a lab test undertaken by a nationally approved/accredited laboratory or alternatively by a laboratory complying with the requirements of a relevant national or international standard, e.g. ISO/IEC 17025. Relevant national/international standards for testing shall be used.

[3] This is consistent with the policy of the Board to allow for simplifications using the size of units included in the project as a criteria e.g. micro scale additionality guidelines (see annex 15 of EB 54), debundling guidelines (see annex 13 of EB 54)

[4] Refer to EB 23, annex 18 for the definition of renewable biomass.

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(c) The project participant can monitor the mass, moisture content and NCV of the resulting biomass fuel, through sampling that meets the confidence/precision level of 90/10;

(d) Where the project participant is not the producer of the renewable fuel, the project participant and the producer are bound by a contract that shall enable the project participant to monitor the source of renewable biomass to account for any emissions associated with biomass production (as per 4 (b) above). Such a contract shall also ensure that there is no double counting of emission reductions.

Project boundary

5. The project boundary is the physical, geographical sites of the equipment producing thermal energy during the crediting period.

Baseline emissions

6. The baseline is the fuel consumption of the thermal application used or that would have been used in the absence of the project activity times an emission factor for the fossil fuel displaced.

Emission reductions

7. The emission reductions of the project activity shall be determined using one of the options below.

Option 1: Based on avoided quantity of fossil fuel consumption (applicable only to biogas projects)

8. The emission reductions are calculated based on the reduced or avoided quantity of fossil fuel consumption. Emission reductions, ER_y is determined as:

$$ER_y = BE_y - PE_y - LE_y \quad \textbf{(1)}$$

Where:

ER_y Emission reductions during the year y (tCO_2)

BE_y Baseline emissions during the year y (tCO_2)

PE_y Project emissions during the year y (tCO_2)

LE_y Leakage during the year y (tCO_2)

9. The amount of baseline emissions BE_y is calculated by:

$$BE_y = \sum_k \sum_j N_{k,0} * n_{k,y} * FC_{BL,k,j} * NCV_j * EF_{FF,j} \quad \textbf{(2)}$$

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Where:

BE_y	Baseline emissions during the year *y* (tCO_2)
k	Index for the type of thermal applications introduced by the project activity (e.g. cook stove, water heater)
j	Index for the type of baseline fossil fuel consumed
$N_{k,0}$	Number of thermal applications *k* commissioned
$n_{k,y}$	Proportion of $N_{k,0}$ that remain operating in year *y* (fraction)
$FC_{BL,k,j}$	Annual consumption of baseline fossil fuel *j* (mass or volume unit)
NCV_j	Net calorific value of the fossil fuel *j* (GJ/mass or volume unit)
$EF_{FF,j}$	CO_2 emission factor of fossil fuel *j* (tCO_2/GJ)

10. Annual consumption of baseline fossil fuel ($FC_{BL,k,j}$) can be determined using one of the two methods (a) and (b) below:

(a) Consumption of baseline fossil fuel *(* $FC_{BL,k,j}$), can be determined using one of the two following options:

Option (i):

Measurement for a minimum of 90 days at a representative sample of targeted users before installation/commissioning of the project equipment. The days selected for measurement of fuel consumption shall take into account seasonal variations in fuel consumption, or else the data from the measurement campaign shall be extrapolated in order to take into account the seasonal pattern of usage of the thermal application. In locations where households use fossil fuels in standard unit weights/dimensions (e.g. honeycomb coal briquettes of 500g/unit), the counting of fossil fuel units used (e.g. number of briquettes) and the unit weight[5] (e.g. unit weight of coal briquette) can be used for the purpose of measurement.

Option (ii):

Determining the average quantity of fossil fuel consumption in a year from a representative sample survey of targeted households prior to the installation/commissioning of the project equipment. This data on annual baseline fuel consumption obtained from households shall be cross checked with purchase

[5] If the unit weight is not uniform in the project area (i.e. various sizes and weights of briquettes are likely to be available in a project area with multiple manufacturers), the specific unit weights shall be applied.

receipt(s) submitted by the household. The value obtained is multiplied by 0.89[6] to account for uncertainties. This option can only be applied for residential applications.

The data collected through sample-based measurements shall comply with the 90% confidence interval and 10% margin of error requirement. Account shall be taken of possible stratification of the sampled population (e.g. average income level, household occupancy, food or heating habits, climate/temperature zone, availability, price and type of fuel used).[7] The latest version of "General guidelines for sampling and surveys for small-scale CDM project activities" shall be complied with. Fuel consumption will be directly determined as mass or volume consumed per unit time;

(b) A baseline control group of users not supplied with the project equipment shall be set up. Relevant parameters of influence pertaining to the project region shall be defined and the control group shall be set up, taking into account these parameters (e.g. average income level, household occupancy, food or heating habits, climate/temperature zone, availability, price and type of fuel used).[7] Fossil fuel consumption of the control group is monitored throughout the crediting period, using the same sampling requirements described in Option 10 (a).

11. Project emissions from any continued use of fossil fuel *j,*[8] are calculated by:

$$PE_y = \sum_m \sum_j N_{m,y} * FC_{m,j} * NCV_j * EF_{FF,j} \quad \textbf{(3)}$$

Where:

PE_y	Project emissions during the year y (tCO_2)
m	Index for thermal application (e.g. cook stove, water heater) not decommissioned by the project activity[9]
$N_{m,y}$	Number of thermal application m remaining in use in year y
$FC_{m,j}$	Annual consumption of fossil fuel type j (physical units, mass/volume) by application m (use 90/10 precision for sampling and sampling requirements specified for baseline sampling described in paragraph 10 (a) above may be applied. If Option (ii) under paragraph 10(a) is chosen, the value obtained is multiplied by 1.12[6] to account for uncertainties)

[6] To account for uncertainties of the method, estimated to be in the range 30-50% (See "Annex III Table of conservativeness factors", page 25, FCCC/SBSTA/2003/10/Add.2, page 25).

[7] Alternatively, the sampling design can adopt a conservative approach to account for these issues e.g. measurement taken up during a warm season.

[8] If it can be demonstrated that the project equipment is not able to operate using fossil fuel (e.g. coal), and that the baseline equipment is decommissioned by the project activity, the project emissions may be disregarded; otherwise they shall be accounted for.

[9] *m* also includes the units introduced by the project activity, in case such units can operate with both renewable biomass and fossil fuel as inputs.

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12. Option 1 can only be applied where it can be demonstrated that the biogas digesters or the cookstoves are designed, constructed and operated to the requirements of a relevant national or international standard or comparable literature. Latest guidelines issued by a relevant national authority or an international organisation may also be used.

Option 2: Based on thermal energy generated

13. The emission reduction is calculated based on the thermal energy generated using the measured quantity of biomass/biogas:

$$ER_y = \sum_k N_{k,0} * n_{k,y} * BS_{k,y} * EF * \eta_{PJ/BL} * NCV_{biomass} - LE_y \quad \textbf{(4)}$$

Where:

$BS_{k,y}$ The net quantity of renewable biomass or biogas consumed by the thermal application k in year y (mass or volume units, dry basis)

EF CO_2 emission factor (tCO_2/GJ)

$$EF = \sum_j x_j * EF_{FF,j}$$

Where:

x_j is a fraction representing fuel type j used by the baseline thermal applications displaced by biomass/biogas

$\eta_{PJ/BL}$ Ratio of efficiencies of project equipment and baseline equipment (e.g. cook stove using coal) measured once prior to validation applying the same test procedure (e.g. lab test), as per a national or an international standard. Official data or scientific literature can be used for cross-check purposes

$NCV_{biomass}$ Net calorific value of the biomass (GJ/unit mass or volume, dry basis). For biogas, use default value: 0.0215 GJ/m^3 biogas (assuming NCV of the methane: 0.0359 GJ/m^3, default methane content in biogas: 60%)

Leakage

14. If the energy generating equipment introduced by the project activity is transferred from outside the boundary to the project activity, leakage is to be considered.

15. In case of biogas digesters which are not part of a Type III CDM project activity:

(a) Any leakage due to change in manure management practice shall be taken into account e.g. referring to methods provided in AMS-III.D "Methane recovery in animal manure management systems",[10]

[10] Under certain situations it is possible that biogas for energy generation is sourced from a manure treatment system that replaces a pre-project manure treatment system with lesser emission intensity with a consequent net positive contribution to anthropogenic emissions. For example animal manure treated in the baseline in 'drylots' is now treated in 'biogas digesters' to supply biogas to the Type I project activity.

(b) Physical leakage of biogas shall be accounted for as per the methods specified under AMS-III.D "Methane recovery in animal manure management systems".

Monitoring

16. At the time of installation all project activity systems shall be inspected and undergo acceptance testing (commissioning) for proper operation in compliance with specifications. The installation date of each system shall be recorded.

17. Emission Reductions can only be applied to systems that are demonstrated to be operational and in compliance with manufacturer required maintenance procedures, at least once every two years (biannual) during the crediting period. After the inspection and acceptance testing at year of installation, the inspections can be done in years 3, 5, 7, etc. and the results of such inspections can be applied to crediting years 3 and 4, 5 and 6, 7 and 8, etc. On-going rental/lease payments or a recurring maintenance fee by users can be a substitute to actual site visits. A statistically valid sample of the residences where the systems are installed, with consideration, in the sampling design, of occupancy and demographic differences can be used to determine the percentage of systems operating, as per the relevant requirements for sampling in the "General guidelines for sampling and surveys for small-scale CDM project activities". When biannual inspection is chosen, a 95% confidence interval and 5% margin of error requirement shall be achieved for the sampling parameter. On the other hand, when the project proponent chooses to inspect annually, a 90% confidence interval and 10% margin of error requirement shall be achieved for the sampling parameter.

18. Relevant parameters shall be monitored as indicated in the Table 1 below. The applicable requirements specified in the "General Guidelines to SSC CDM methodologies" (e.g. calibration requirements, sampling requirements) are also an integral part of the monitoring guidelines specified below and therefore shall be referred to by the project participants.

Table 1: Parameters for monitoring during the crediting period

No.	Parameter	Description	Unit	Monitoring/ recording frequency	Measurement methods and procedures
1	$N_{k,0}$	Number of thermal applications k commissioned		As per paragraph 16	As per paragraph 16
2	$n_{k,y}$	Proportion of $N_{k,0}$ that remain operating at year y (fraction)		As per paragraph 17	As per paragraph 17

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No.	Parameter	Description	Unit	Monitoring/ recording frequency	Measurement methods and procedures
3	Nm,y	Number of thermal application *m* remaining in use in year *y*, which consumes fossil fuel		Annually	As per paragraph 11
4	$FC_{BL,k,j}$	Annual consumption of baseline fossil fuel *j*	Physical units, mass or volume	As per paragraph 10	As per paragraph 10
5	FCm,j	Annual consumption of fossil fuel type *j* by application *m*	Physical units, mass or volume	As per paragraph 11	As per paragraph 11 The difference between $FC_{BL,k,j}$ and FCm,j shall be cross-checked with biogas generation estimated per a relevant national or international standard indicated in paragraph 12
6	$BS_{k,y}$	The net quantity of renewable biomass or biogas consumed by the thermal application *k* in year *y*	mass or volume units		(a) In the case of biogas project activities opting for Option 2 (para 13), gas meters are used to monitor accumulated biogas supplied to thermal energy equipment; Measurement campaigns shall be undertaken at selected sites. At least five campaigns per digester type (e.g. 6 cubic metre or 8 cubic metre capacity, fixed dome or floating dome, region with high average ambient temperature or low average annual temperature) shall be carried out in each year of the crediting period. Continuous measurement made for at least one month at a single digester is considered as a

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No.	Parameter	Description	Unit	Monitoring/ recording frequency	Measurement methods and procedures
					campaign. Monthly average value is annualised taking into account seasonal variation in gas production which is mainly a function of ambient temperature; (b) For the case of processed renewable biomass (e.g. briquettes) data shall be collected for mass, moisture content, NCV of briquettes that are supplied to users with an appropriate sampling frequency. Cross-check with annual energy/mass balance that is based on purchased/sold quantities and stock
~~7~~	~~$\eta_{PJ/BL}$~~	~~Ratio of efficiencies of project equipment and baseline equipment (e.g. cook stove using coal)~~		~~As per paragraph 13~~	~~As per paragraph 13~~
7 ~~8~~	$NCV_{biomass}$	Net calorific value of biomass type	GJ/mass or volume unit	Annually	Measurement in laboratories according to relevant national/international standards. Measure the NCV based on dry biomass. Check the consistency of the measurements by comparing the measurement results with measurements from previous years, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC

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Project activity under a Programme of Activities

19. ~~This methodology is applicable for a project activity under a programme of activities.~~The methodology is applicable to a programme of activities, no additional leakage estimations are necessary other than that indicated under leakage section above.

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History of the document

Version	Date	Nature of revision
03	EB 66, Annex # 02 March 2012	Revision to: • Remove the requirement of monitoring the project/baseline efficiency rate; • Include a correction of the NVC value of biogas.
02	EB 61, Annex 15 03 June 2011	Revision to: • Providing simplified options for the measurement of fossil fuel consumption; • Providing a cross-check method on the measurement of fossil fuel consumption; • Providing clarifications on calculation of CO_2 emission factor for Option 2.
01	EB 59, Annex 2 18 February 2011	Initial adoption.
Decision Class: Regulatory **Document Type**: Standard **Business Function**: Methodology		