Indicative simplified baseline and monitoring methodologies for selected small-scale project activity categories

TYPE I - RENEWABLE ENERGY PROJECTS

Project participants shall apply the general guidelines to small-scale (SSC) clean development mechanism (CDM) methodologies Guidelines on the demonstrating of additionality of SSC project activities and general guidance on leakage in biomass project activities (attachment C to appendix B) available at <http://cdm.unfccc.int/Reference/Guidclarif/index.html#meth> *mutatis mutandis*.

METHODOLOGY MODIFICATION TO AMS I.E, VERSION 03

This methodology is based on the CDM-approved small-scale methodology AMS I.E, Version 03. The American Carbon Registry (ACR) accepts CDM-approved methodologies but provides a process by which project proponents may propose a modification to an existing CDM-approved methodology and have this approved by ACR, either through ACR's regular public consultation and scientific peer review process, or by an independent ACR technical committee in cases where the proposed modification is minor enough not to require the full public consultation and scientific peer review process.

This methodology modification was reviewed and approved by the ACR Agriculture, Forestry and Other Land-Use (AFOLU) Technical Committee. Revisions to AMS I.E, Version 03 approved under this modification are shown in red text.

Separately, ACR proposed and the ACR AFOLU Technical Committee approved a modification to CDM methodology AMS II.G in which the fossil fuel emission factors, used in that methodology to calculate baseline emissions based on an assumed shift from non-renewable biomass to fossil fuels, were replaced by biomass emission factors for fuelwood and charcoal. The rationale was that households in many developing countries where this methodology may be applied are using fuelwood/charcoal in the baseline, and when they install an efficient cookstove they still use fuelwood/charcoal but less of it, rather than switching to fossil fuels. This leads to a reduction in use of and emissions from non-renewable biomass. To recognize this, ACR replaced the fossil fuel emission factors in Equation (1) of AMS II.G with appropriate and conservative biomass emission factors for fuelwood and charcoal, derived from the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*.[1] AMS I.E uses the same fossil fuel emission factors. With the same rationale, ACR in this modification to AMS I.E replaces those with biomass emission factors. Revisions to AMS I.E, Version 03 under this second modification are shown in green text.

I.E. Switch from non-renewable biomass for thermal applications by the user

Technology/measure

1. This category comprises activities to displace the use of non-renewable biomass by introducing renewable energy technologies. Examples of these technologies include but are not limited to biogas stoves, solar cookers, passive solar homes, switching to renewable fuels (e.g., compressed biomass, green charcoal, etc.) in existing stoves, and renewable energy-based drinking water treatment technologies (e.g. sand filters followed by solar water disinfection; water boiling using renewable biomass).

[1] See http://americancarbonregistry.org/carbon-accounting/energy-efficiency-measures-in-thermal-applications-of-non-renewable-biomass for the approved modified methodology AMS II.G and the ACR AFOLU Technical Committee's review.

2. If any similar registered CDM project activities exist in the same region as the proposed project activity then it must be ensured that the proposed project activity is not saving the non-renewable biomass accounted for by the already registered project activities.

3. Project participants are able to show that non-renewable biomass has been used since 31 December 1989, using survey methods or referring to published literature, official reports or statistics.

Boundary

4. The project boundary is the physical, geographical site of the use of biomass or the renewable energy.

Baseline

5. It is assumed that in the absence of the project activity, the baseline scenario would be the use of non-renewable biomass as fuel for the existing, less-efficient thermal applications. Compared to a project scenario of the installation of renewable energy technologies, this reduces GHG emissions by saving non-renewable biomass.

6. Emission reductions would be calculated as:

$$ER_y = B_y * f_{NRB,y} * NCV_{biomass} * EF_{biomass} \quad \textbf{(1)}$$

Where:

ER_y	Emission reductions during the year *y* in tCO_2e
B_y	Quantity of woody biomass that is substituted or displaced in tonnes
$f_{NRB,y}$	Fraction of woody biomass used in the absence of the project activity in year *y* that can be established as non renewable biomass using survey methods or government data or approved default country specific fraction of non-renewable woody biomass *(fNRB)* values available on the CDM website[2]

[2] Default values endorsed by designated national authorities and approved by the Board are available at <http://cdm.unfccc.int/DNA/fNRB/index.html>.

$NCV_{biomass}$	Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.015 TJ/tonne)
$EF_{biomass}$	Emission factor for biomass fuels whose consumption is reduced by the project activity. Use a value of 119.5 t CO_2/TJ for wood and 116.5 tCO_2/TJ for charcoal[3]

B_y is determined by using one of the following options.

(a) Where the project involves introducing new stoves or other energy generation appliances, B_y will be calculated as the product of the number of appliances multiplied by the estimate of average annual consumption of woody biomass per appliance (tonnes/year); This can be derived from historical data or estimated using survey methods

(b) Alternatively, B_y will be calculated from the thermal energy generated in the project activity as:

$$B_y = HG_{p,y} / (NCV_{biomass} * \eta_{old}) \quad \textbf{(2)}$$

Where:

$HG_{p,y}$	Quantity of thermal energy generated by the new renewable energy technology in the project in year *y* (TJ) For a biogas digester, it shall be monitored as per the requirements stipulated in the Table 1 of AMS-I.I "Biogas/biomass thermal applications for households/small users". Alternatively project proponents may use a default biogas generation value of 0.13 $Nm^3.m^{-3}.day^{-1}$ (i.e. volume of biogas generated in normal conditions of temperature and pressure per unit useful volume of the digester per day) for regions/countries where annual average ambient temperature is higher than 20°C
η_{old}	1. Efficiency of the system being replaced, measured using representative sampling methods or based on referenced literature values (fraction), use weighted average values if more than one type of system is being replaced; 2. A default value of 0.10 may be optionally used if the replaced system is a three stone fire, or a conventional system with no improved combustion air supply or flue gas ventilation system, i.e. without a grate or a chimney; for other types of systems a default value of 0.2 may be optionally used

(c) Where the project involves introducing new renewable fuels instead of new appliances, B_y will be calculated as a fixed percentage of the total volume (tonnes/year) of new biomass fuels sold using equation (3).

[3] This value represents the emission factor of the fuels likely to be used by similar users. The emission factor is derived from the 2006 IPCC *Guidelines for National Greenhouse Gas Inventories*, 2006, Volume 2, Table 2.5 (page 2.23). It is based on the default emission factors for CO_2, CH_4 and N_2O, calculated as carbon dioxide equivalents using a GWP of 21 for CH_4 and 310 for N_2O.

B_y = (Quantity of renewable fuel sold) * (discount factor) * ($NCV_{renewable}$ / $NCV_{conventional}$) **(3)**

The discount factor used in equation (3) must be selected by the project proponent and justified in the project design document. The maximum allowable discount factor is 0.95, which applies in cases where the project proponent can compellingly demonstrate (e.g., via sales records, fuel scarcity data, fuel consumption data) that virtually all of the new renewable fuel sold ends up replacing traditional biomass fuels. Where this condition does not hold, a lower value must be selected that can be demonstrated to be conservative.

The net calorific value of the new renewable fuel introduced must capture the energy inputs that go into its production. This may include energy inputs into diverse processes (e.g., gathering biomass feedstocks, drying, compacting, heating, and transporting final products). The adjustment in net calorific values will vary from project to project. Where energy inputs into such processes are insignificant (e.g., electricity or transport is by non GHG-emitting means), they may be ignored. Where energy inputs are into production are significant, these inputs must be deducted from figures for net calorific value of the new fuels.

(d) Where the project involves renewable energy-based water treatment technologies, B_y is calculated as the product of target population of the project multiplied by the volume of drinking water per person per day and the mass of woody biomass that would have been required to boil one litre of water as per the equation 4.

$$B_y = N_{p,y} * QDW_{p,y} * WB_{BL} * 365 * 10^{-3} \quad \textbf{(4)}$$

Where:

$N_{p,y}$	Project population in year *y* (number). For establishing the project population a baseline survey shall be conducted to demonstrate target population supplied with renewable energy based water treatment technology by the project would have used water boiling as the water purification method in the absence of the project activity
$QDW_{p,y}$	Volume of drinking water in litres per person per day (litres). The volume of drinking water in litres per person per day shall be established using survey methods, subject to a cap of 5.5 litres[4]
WB_{BL}	Mass of woody biomass that would have been required to boil one litre of water (kg/litre). The quantity of mass of woody biomass that would have been required to boil one litre of water for five minutes determined through a water boiling test (World Health Organization (WHO) recommends a minimum

[4] Based on WHO recommendations (Domestic Water Quantity, Service Level and Health, Table 2: Volumes of water required for hydration, WHO 2003).

duration of five minutes of water boiling)[5]

Differentiation between non-renewable and renewable woody biomass

7. Project participants shall determine the shares of renewable and non-renewable woody biomass in B_y (the quantity of woody biomass used in the absence of the project activity) the total biomass consumption using nationally approved methods (e.g. surveys or government data if available) and then determine $f_{NRB,y}$ as described below. The following principles shall be taken into account:

Demonstrably renewable woody biomass[6] (DRB)

Woody[7] biomass is "renewable" if one of the following two conditions is satisfied:

1. The woody biomass is originating from land areas that are forests[8] where:
   (a) The land area remains a forest;
   (b) Sustainable management practices are undertaken on these land areas to ensure, in particular, that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting); and
   (c) Any national or regional forestry and nature conservation regulations are complied with.
2. The biomass is woody biomass and originates from non-forest areas (e.g. croplands, grasslands) where:
   (a) The land area remains cropland and/or grasslands or is reverted to forest;
   (b) Sustainable management practices are undertaken on these land areas to ensure in particular that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting); and
   (c) Any national or regional forestry, agriculture and nature conservation regulations are complied with.

Non-renewable biomass

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5 WHO guidelines for Emergency Treatment of drinking water at point of the use - <http://www.searo.who.int/LinkFiles/List_of_Guidelines_for_Health_Emergency_Emergency_treatment_of_drinking_water.pdf>.

6 This definition uses elements of Annex 18, EB 23.

7 In cases of charcoal produced from woody biomass, the demonstration of renewability shall be done for the areas where the woody biomass is sourced.

8 The forest definitions as established by the country in accordance with the Decisions 11/CP.7 and 19/CP.9 should apply.

Non-renewable woody biomass (*NRB*) is the quantity of woody biomass used in the absence of the project activity (B_y) minus the *DRB* component, as long as at least two of the following supporting indicators are shown to exist:

- A trend showing an increase in time spent or distance travelled for gathering fuel-wood, by users (or fuel-wood suppliers) or alternatively, a trend showing an increase in the distance the fuel-wood is transported to the project area;
- Survey results, national or local statistics, studies, maps or other sources of information such as remote sensing data that show that carbon stocks are depleting in the project area;
- Increasing trends in fuel wood prices indicating a scarcity of fuel wood;
- Trends in the types of cooking fuel collected by users that indicate a scarcity of woody biomass.

8. Thus the fraction of woody biomass saved by the project activity in year *y* that can be established as non-renewable is:

$$f_{NRB,y} = \frac{NRB}{NRB + DRB} \qquad \textbf{(5)}$$

9. Project participants shall also provide evidence that the trends identified are not occurring due to the enforcement of local/national regulations.

Leakage

10. Leakage related to the non-renewable woody biomass saved by the project activity shall be assessed based on *ex post* surveys of users and areas from which woody biomass is sourced (using 90/30 precision for selection of samples). The following potential source of leakage shall be considered:

(a) The use/diversion of non-renewable woody biomass saved under the project activity by non-project households/users that previously used renewable energy sources. If this leakage assessment quantifies an increase in the use of non-renewable woody biomass used by the non-project households/users, that is attributable to the project activity, then B_y is adjusted to account for the quantified leakage. Alternatively, B_y is multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required.

11. If the equipment currently being utilised is transferred from outside the boundary to the project boundary, leakage is to be considered.

Monitoring

12. In cases where new appliances are introduced, monitoring shall consist of checking of all appliances or a representative sample thereof, at least once every two years (biennial) to ensure that they are still operating or are replaced by an equivalent in service appliance.

13. In order to assess the leakages specified under paragraph 11, monitoring shall include data on the amount of woody biomass saved under the project activity that is used by non-project households/users (who previously used renewable energy sources). Other data on non-renewable woody biomass use required for leakage assessment shall also be collected.

14. Monitoring should confirm the displacement or substitution of the non-renewable woody biomass at each location. In the case of appliances switching to renewable biomass the quantity of renewable biomass used shall be monitored.

15. In case option (b) in paragraph 6 is chosen for baseline calculations, monitoring shall include the amount of thermal energy generated by the new renewable energy technology in the project in year *y*, where applicable.

16. In the case of introducing new renewable fuels instead of new appliances, use of these new fuels in place of non-renewable biomass by households in the project area must be monitored to ensure that fuel substitution is taking place as proposed. Monitoring shall consist of an annual check of a representative sample of customer households in the project area. If one or more renewable fuels are already available in the area, then monitoring of fuel use must also ensure that the renewable fuels introduced by the proposed project are not replacing existing renewable fuels.

17. In the case of renewable energy based water treatment technologies, water quality shall be monitored to ensure that it conforms to drinking water quality specified in relevant national microbiological water quality guidelines/standards of the host country. In case a national standard/guideline is not available, the standards/guidelines by the World Health Organization (WHO) or United States Environmental Protection Agency (US-EPA) shall be applied.

Representative sampling methods

18. A statistically valid sample of the locations where the systems are deployed, with consideration, in the sampling design, of occupancy and demographics differences can be used to determine parameter values used to determine emission reductions, as per the relevant requirements for sampling in the "Standard for sampling and surveys for CDM project activities and programme of activities". When biennial inspection is chosen a 95% confidence interval and a 10% 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 a 10% margin of error requirement shall be achieved for the sampled parameters. In cases where survey results indicate that 90/10 precision or 95/10 precision is not achieved, the lower bound of a 90% or 95% confidence interval of the parameter value may be chosen as an alternative to repeating the survey efforts to achieve the 90/10 or 95/10 precision.

Project activity under a programme of activities

19. The use of this methodology in a project activity under a programme of activities is legitimate if the following leakages are estimated, if required on a sample basis using 90/30 precision for selection of samples, and accounted for:

(a) Use of non-renewable woody biomass saved under the project activity to justify the baseline of other CDM project activities can also be potential source of leakage. If this leakage assessment quantifies a portion of non-renewable woody biomass saved under the project activity that is used as the baseline of other CDM project activity then B_y is adjusted to account for the quantified leakage;

(b) Increase in the use of non-renewable woody biomass outside the project boundary to create non-renewable woody biomass baselines can also be potential source of leakage. If this leakage assessment quantifies an increase in use of non-renewable woody biomass outside the project boundary then B_y is adjusted to account for the quantified leakage.

(c) As an alternative to subparagraphs (a) and (b), B_y can be multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required.

20. The following further conditions apply for the value of fraction of non-renewable (fNRB) applied in a component project activity (CPA) of a POA. The choice between (a) conduct own studies to determine the local fNRB value and then apply those values in the CPAs; and (b) use default national values approved by the Board; shall be made ex ante. A switch from national value i.e. choice (b) to sub-national values i.e. choice (a) is permitted, under the condition that the selected approach is consistently applied to all CPAs.

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History of the document

Version	Date	Nature of revision
02-ACR	25 July 2013	Methodology revision, incorporating replacement of fossil fuel emission factors with fuelwood and charcoal emission factors for the baseline, as approved by ACR AFOLU Technical Committee in an analogous modification to CDM methodology AMS II.G
05.0	20 July 2012	EB 68, Annex 22 Includes: • A reference to the available country specific default values for fNRB; • A default biogas generation rate for regions/countries where annual average ambient temperature is higher than 20°C; and Specifies: • The requirements of using national or local fNRB values for CPAs under a PoA.
04	EB 60, Annex 20 15 April 2011	Requirements for leakage estimation simplified, default net gross adjustment factor is included as an option to account for any leakages, emission factor for the projected fossil fuel revised, more options for sampling and survey included.
01-ACR	12 April 2011	Methodology revision for ACR, approved by ACR AFOLU Technical Committee To expand applicability to introducing renewable fuel technologies in existing appliances, and provide new calculation and monitoring methodologies for this project type
03	EB 56, Annex 17 17 September 2010	To expand applicability to renewable energy water treatment technologies.

02	EB 53, Annex 18 26 March 2010	To include the changes below which are consistent with the changes to AMS-II.G approved by the Board at its fifty-first meeting: • Further clarification on the eligible technology/measures; • Default efficiency factors for baseline cook stoves; • Procedures for sampling; • Revised procedures for quantity of woody biomass that can be considered as non-renewable; and • Clarifications as to which leakage requirements are appropriate for projects versus PoAs.
01	EB 37, Annex 6 1 February 2008	Initial adoption.
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