CLEAN DEVELOPMENT MECHANISM

**CDM-SSCWG48-A02**

# Small-scale Methodology

# AMS-II.G: Energy efficiency measures in thermal applications of non-renewable biomass

Version 07.0

Sectoral scope(s): 03



United Nations
Framework Convention on
Climate Change

# COVER NOTE

## 1. Procedural background

1. The recommended revision of "AMS II.-G: Energy efficiency measures in thermal applications of non-renewable biomass" is based on the following:

   (a) The Board agreed at its seventy-eight meeting to further work of simplification and streamlining of methodological products under MAP project 223, as per tables 1 to 4 of EB78 Annex 08; and

   (b) In SSC-WG 46, members agreed to Project 223 proposal to explore opportunities for simplification of two methodologies, AMS-III.AV and AMS-II.G.

## 2. Purpose

2. The proposed revision aims to:

   (a) Provide one more option to calculate the biomass savings by including a new method of calculating thermal energy output;

   (b) Provide simplified options to take into consideration the loss of efficiency of the appliances that reduces monitoring requirements; this simplified monitoring requirements aims to reduce transaction costs without compromising environmental integrity;

   (c) Ensures all the data parameters that are required to be monitored are listed in the monitoring section.

## 3. Key issues and proposed solutions

3. The existing options to calculate the biomass savings requires survey to establish certain parameters; the new additional option using the useful thermal energy output allows a calculation of biomass savings based on the rated capacity of the appliance and efficiency- values that the manufacturers can provide. When such information is easily available, the estimation of biomass savings is simplified. Existing options are also retained to allow flexibility for the project participants who can opt for any method as per their own preference.

4. Existing method to calculate the loss of efficiency requires extensive monitoring annually. A simplified option to account for loss in efficiency for cook stove appliances is introduced to reduce monitoring requirements.

## 4. Impacts

5. The proposed revision will facilitate the development and implementation of CDM project activities and Programme of activities/Component project activities (PoAs/CPAs) to encourage the use of improved, energy efficient appliances to reduce the fuel consumption. The project activities and CPAs covered under this methodology are very

relevant to the least developed countries (LDCs) and other regions that are underrepresented in the CDM.

## 5. Subsequent work and timelines

6. The methodology is recommended by the SSC WG for consideration by the Board at its eighty-first meeting. No further work is envisaged.

## 6. Recommendations to the Board

7. The SSC WG recommends that the Board adopt this final draft methodology, to be made effective at the time of the Board's approval.

## 7. References:

(a) EB78 Annex 08 (Paragraph 1) - Further work on methodologies, tools and standards" (Version 01.0) available at <http://cdm.unfccc.int/EB/archives/meetings_14.html#78>;

(b) SSC-WG 46 Meeting report (Paragraph 21) - "Small-Scale Working Group forty-sixth meeting" (version 01.0) available at <https://cdm.unfccc.int/Panels/ssc_wg/index.html>;

(c) "Small-scale Methodology AMS-II.G.: Energy efficiency measures in thermal applications of non-renewable biomass available at <https://cdm.unfccc.int/methodologies/DB/UFM2QB70KFMWLVO7LJN8XD1O2RKHEK>.

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# 1. Introduction

1. The following table describes the key elements of the methodology:

**Table 1. Methodology key elements**

| | |
|---|---|
| **Typical project(s)** | Introduction of efficient thermal energy generation units utilizing non-renewable biomass (e.g. complete replacement of existing biomass-fired cook stoves or ovens or dryers with more efficient appliances), or retrofitting of existing units reducing the use of non-renewable biomass for combustion |
| **Type of GHG emissions mitigation action** | Energy efficiency |

# 2. Scope, applicability, and entry into force

## 2.1. Scope

2. This methodology comprises efficiency improvements in thermal applications of non-renewable biomass. Examples of applicable technologies and measures include the introduction of high efficiency biomass fired project devices (cook stoves or ovens or dryers) to replace the existing devices and/or energy efficiency improvements in existing biomass fired cook stoves or ovens or dryers.[1]

3. In the case of cook stoves, the methodology is applicable to introduction of single pot or multi pot portable or in-situ cook stoves with rated efficiency of at least 20 per cent.

## 2.2. Applicability

4. The aggregate energy savings of a single project activity shall not exceed the equivalent of 60 GWh per year or 180 GWh thermal per year in fuel input.

5. Non-renewable biomass has been used in the project region since 31 December 1989, using survey methods or referring to published literature, official reports or statistics.

6. For cases where the biomass is sourced from renewable sources, the project participants should use a corresponding Type I methodology.

## 2.3. Entry into force

7. The date of entry into force is the date of the publication of the EB 85 meeting report on 24 July 2015

## 2.4. Normative references

8. Project participants shall apply the "General guidelines for SSC CDM methodologies", "Guidelines on the demonstration of additionality of small-scale project activities" and "Project and leakage emissions from biomass" available at:

[1] Implementation of Greenfield applications is not covered in this methodology.

<https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-16-v2.pdf/history_view>.

# 3. Definitions

9. The definitions contained in the Glossary of CDM terms shall apply.

10. For the purpose of this methodology, the definitions of demonstrably renewable woody biomass and non-renewable woody biomass provided in paragraphs 27 and 28 shall apply.

11. The following definition shall also apply:

(a) **Batch** - is defined as the population of the device of the same type commissioned at a certain calendar year. To establish the date of commissioning, the Project Participant may opt to group the devices in "batches" and the latest date of commissioning of a device within the batch shall be used as the date of commissioning for the entire batch.

# 4. Baseline methodology

## 4.1. Project boundary

12. The project boundary is the physical, geographical site of the efficient devices that utilize biomass.

## 4.2. Emission reductions

13. It is assumed that in the absence of the project activity, the baseline scenario would be the projected use of fossil fuels to meet similar thermal energy needs as those provided by the project devices.

14. Emission reductions are calculated as:

$$ER_y = \sum_i \sum_j ER_{y,i,j} - LE_y$$ Equation (1)

Where:

| | |
|---|---|
| $i$ | Indices for the situation where more than one type of project device is introduced to replace the pre-project devices[2] |
| $j$ | Indices for the situation where there is more than one batch of project device |
| $ER_y$ | Emission reductions during year *y* in t $CO_2e$ |
| $ER_{y,i,j}$ | Emission reductions by project device of type i *and* batch j during year *y* in t $CO_2e$ |

[2] For example, in some instances, full replacement of the pre-project device would require the implementation of more than one project device (e.g. one stove suitable for cooking and the other stove suitable for cooking/boiling water).

$$ER_{y,i,j} = B_{y,savings,i,j} \times N_{y,i,j} \times \frac{\mu_{y,i,j}}{365} \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected\_fossil\ fuel}$$ Equation (2)

Where:

| | | |
|---|---|---|
| $B_{y,savings,i,j}$ | = | Quantity of woody biomass that is saved in tonnes per cook stove device of type *i* and batch *j* during year *y* |
| $f_{NRB,y}$ | = | Fraction of woody biomass that can be established as non-renewable biomass using survey methods or government data or default country specific fraction of non-renewable woody biomass (fNRB) values available on the CDM website.[3] . |
| $NCV_{biomass}$ | = | Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.015 TJ/tonne, based on the gross weight of the wood that is 'air-dried') |
| $EF_{projected\_fossilfuel}$ | = | Emission factor for the fossil fuels projected to be used for substitution of non-renewable woody biomass by similar consumers. Use a value of 81.6 t CO2/TJ[4] |
| $N_{y,i,j}$ | = | Number of project devices of type *i* and *batch j* operating during year *y*, |
| $\mu_{y,i,j}$ | = | Number of days of utilization of the project device *i* and batch *j* during the year *y*. |
| $LE_y$ | = | Leakage emissions in the year *y* |

15. $B_{y,savings,i,j}$ due to implementation of efficient thermal devices is estimated as per the following options

16. Option-1: Thermal Energy Output (TEO)

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

[4] This value represents the emission factor of the substitution fuels likely to be used by similar users, on a weighted average basis. It is assumed that the mix of present and future fuels used would consist of a solid fossil fuel (lowest in the ladder of fuel choices), a liquid fossil fuel (represents a progression over solid fuel in the ladder of fuel use choices) and a gaseous fuel (represents a progression over liquid fuel in the ladder of fuel use choices). Thus a 50 per cent weight is assigned to coal as the alternative solid fossil fuel (96 t $CO_2$/TJ) and a 25 per cent weight is assigned to both liquid and gaseous fuels (71.5 t $CO_2$/TJ for kerosene and 63.0 t $CO_2$/TJ for liquefied petroleum gas (LPG).

$$B_{y,savings,i,j} = \frac{HR_{y,i,j}}{NCV_{biomass}} \times \left( \frac{1}{\eta_{old,i,j}} - \frac{1}{\eta_{new,i,j}} \right)$$ Equation (3)

$HR_{y,i,j}$ Useful thermal energy output delivered per project device *i* in batch *j* during year y (TJ),

$\eta_{old,i,j}$ Efficiency of the old devices being replaced by project devices of type *i* and batch *j*.

$\eta_{new,i,j}$ Efficiency of the project device *i* and batch *j*.

17. The useful thermal energy shall be calculated based on the rated capacity of the project device multiplied by the number of utilization hours:

$$HR_{y,i,j} = HC_{i,j} \times t_{y,i,j} \times 0.0000036$$ Equation (4)

$HC_{i,j}$ Rated thermal capacity as per manufacturer specification (kW).

$t_{y,i,j}$ Number of hours of utilization of the device during the year y

$0.0000036$ Factor to convert kWh to TJ

18. Option 2: kitchen performance test (KPT):

$$B_{y,savings,i,j} = B_{old,i,j} - B_{new,KPT,i,j}$$ Equation (5)

Where:

$B_{old,i,j}$ Annual quantity of woody biomass that would have been used in the absence of the project activity to generate useful thermal energy equivalent to that provided by the project device type *i and* batch *j*

$B_{new,KPT,i,j}$ Annual quantity of woody biomass used in tonnes per project device of type *i* and batch *j*, measured as per the KPT protocol, for the initial efficiency determined in the year of its commissioning. The KPT shall be carried out in accordance with national standards (if available) or international standards or guidelines (e.g. the KPT procedures specified by the partnership for clean indoor air (PCIA): http://www.pciaonline.org/node/1049).

19. This calculation assumes that there is only one device per household. Considering the KPT is used to estimate the consumption per household, an adjusted formula shall be used in the PDD in case more than one device is used to serve n number of persons.

20. Option 3: water boiling test (WBT):[5]

$$B_{y,savings,i,j} = B_{old,i,j} \times (1 - \frac{\eta_{old,i,j}}{\eta_{new,i,j}}) \quad \text{Equation (6)}$$

$$B_{y,savings,i,j} = B_{y=1,new,i,j,survey} \times (\frac{\eta_{new,i,j}}{\eta_{old,i,j}} - 1) \quad \text{Equation (7)}$$

Where:

| | |
|---|---|
| $B_{y=1,new,i,j,survey}$ | Quantity of woody biomass used by project devices in tonnes per device of type *i* and batch *j*. |

21. Option 4: controlled cooking test (CCT):

$$B_{y,savings,i,j} = B_{old,i,j} \times (1 - \frac{SC_{new,i,j}}{SC_{old}}) \quad \text{Equation (8)}$$

Where:

| | |
|---|---|
| $SC_{old}$ | Specific fuel consumption or fuel consumption rate of the pre-project devices. |
| $SC_{new,i,j}$ | Specific fuel consumption or the fuel consumption rate of the devices of type *i* and batch *j* deployed as part of the project. |

22. Where charcoal is used as the fuel by baseline (old) or project (new) devices, the quantity of woody biomass shall be determined by using a default wood to charcoal conversion factor of 6 kg of firewood (wet basis) per kg of charcoal (dry basis).[6] Alternatively, credible local conversion factors determined from a field study or literature may be applied.

23. The life span[7] of each type of the project devices shall be documented in the PDD based on manufacturer's specification.

24. The loss in efficiency of the project devices *i* in each batch *j* due to aging shall be accounted during the monitoring period y. The Project participant may choose any option below to account for the loss in efficiency; the option should be identified and fixed ex-ante in the PDD at the time of registration.

[5] Based on whether $\eta_{new,i,j}$ or $B_{y=1,new,ij,survey}$ is used for monitoring, either equation (6) or (7) may be used respectively.

[6] Refer to:<http://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1ref3.pdf>.The term 'wet basis' assumes that the wood is 'air-dried' as is specified in the IPCC default table.

[7] The life span should be reported in cases where the PPs are opting to account the efficiency loss as per paragraph 23 (a).

(a) A default schedule of linear decrease in efficiency up to the terminal efficiency assumed as 20 per cent shall be applied through the life span of the project device[8]. For example, if the life span of project device is five years and project device has an efficiency of 30 per cent at commissioning then a 2 per cent decrease in efficiency every year shall be applied; or

(b) Manufacturer of project devices shall confirm with technical justification based on certification by a national standards body or an appropriate certifying agent recognized by that body that no decrease in efficiency of project device is envisaged during the crediting period ; or

(c) Determine[9]the rate of efficiency drop for a representative sample of the first batch of project device i in year y and assume that same rate of loss in efficiency applies to all other batches. In other words, it may be assumed that the degradation of efficiency measured in a representative sample of the first batch of project devices i apply to all subsequent batches. The efficiency of the project devices in the first batch has to be monitored annually through representative samples and this rate of loss in efficiency may be applied correspondingly to all batches.

(d) Determine the loss in efficiency annually from a representative sample of each batch and use the actual loss rate that is measured.

25. If the life span of devices is less than the crediting period it shall be demonstrated that the devices shall be replaced after the life span has ended. In such cases, if it cannot be demonstrated that the project devices will be replaced with new devices, no emission reductions can be claimed beyond the life span of the project devices.

### 4.2.1. Differentiation between non-renewable and renewable woody biomass

26. Project participants shall determine the shares of renewable and non-renewable woody biomass in $B_{old,i,j}$ (the quantity of woody biomass used in the absence of the project activity in tonnes per device of type i and batch j), 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.

### 4.2.2. Demonstrably renewable woody biomass[10] (DRB)

27. Woody[11] biomass is 'renewable' if one of the following two conditions is satisfied:

(a) The woody biomass originates from land areas that are forests[12] where:

[8] If the efficiency of the project devices falls below 20%, it is no longer eligible to be considered a project device.

[9] Example: For the representative sample of Batch 1, if the efficiency of a new project device is 30% and at the end of Year 1, the efficiency is monitored to be 29%; the loss rate is (30%-29%)/1=1%. Then this 1% loss rate is to be assumed to be applicable for all the devices in the first batch and subsequent batches for first year of operation.

[10] This definition uses elements of annex 18, EB 23.

[11] In the case of charcoal produced from woody biomass, the demonstration of renewability shall be done for the areas where the woody biomass is sourced.

(i) The land area remains a forest;

(ii) 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);

(iii) Any national or regional forestry and nature conservation regulations are complied with;

(b) The biomass is woody biomass and originates from non-forest areas (e.g. croplands, grasslands) where:

(i) The land area remains as non-forest or is reverted to forest;

(ii) Sustainable management practices are undertaken on these land areas to ensure that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting);

(iii) Any national or regional forestry, agriculture and nature conservation regulations are complied with.

### 4.2.3. Non-renewable biomass

28. *NRB* is, the quantity of woody biomass used in the absence of the project activity in tonnes per device of type *i* ($B_{old,i,j}$) minus the *DRB* component, as long as at least two of the following supporting indicators are shown to exist:

(a) 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;

(b) 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;

(c) Increasing trends in fuel wood prices indicating a scarcity of fuel-wood;

(d) Trends in the types of cooking fuel collected by users that indicate a scarcity of woody biomass.

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

$$f_{NRB,y} = \frac{NRB}{NRB + DRB} \quad \text{Equation (9)}$$

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

[12] The forest definitions as established by the country in accordance with the decisions 11/CP.7 and 19/CP.9 shall apply.

## 4.3. Leakage

31. Leakage related to the non-renewable woody biomass saved by the project activity shall be assessed based on ex post surveys of users and the areas from which this woody biomass is sourced (using 90/30 precision for a selection of samples). The potential source of leakage due to the use/diversion of non-renewable woody biomass saved under the project activity by non-project households/users that previously used renewable energy sources shall be considered. If this leakage assessment quantifies an increase in the use of non-renewable woody biomass by the non-project households/users, that is attributable to the project activity, then $B_{old,i,j}$ is adjusted to account for the quantified leakage. Alternatively, $B_{y,savings,i,j}$ is multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required

32. If devices currently being utilised outside the project boundary are transferred to the project activity, then leakage is to be considered.

33. Project activities switching from baseline device using firewood to efficient project device using charcoal or switching from firewood to efficient project device using briquette shall take into account the leakage effects related to the charcoal or briquette production.

34. A default value of 0.030 t $CH_4$/t charcoal may be used in accordance with "AMS-III.BG: Emission reduction through sustainable charcoal production and consumption".

## 4.4. Data and parameters not monitored

35. In addition to the parameters listed in the tables below, the provisions on data and parameters not monitored in the tools referred to in this methodology apply.

**Data / Parameter table 1.**

| **Data / Parameter:** | $\mathbf{B_{old,i,j}}$ |
|---|---|
| Data unit: | t/year |
| Description: | Annual quantity of woody biomass used in pre project scenario. |
| Source of data: | - |
| Measurement procedures (if any): | This parameter shall be determined ex-ante using one of the following options:<br>1. A default value of 0.5 tonnes/capita per year may be used to derive this parameter. Number of persons served per device shall be based on survey conducted prior to project implementation. This option is limited to household project devices (not eligible for oven and dryers).<br>2. Based on the historical data or a sample survey conducted as per the latest version of "sampling and surveys for CDM project activities and programme of activities", to determine the average annual consumption of woody biomass per device (tonnes/year). If the monitoring period is shorter or longer than one year, the result may be extrapolated for the monitoring period. |
| Monitoring frequency: | Ex-ante |
| QA/QC procedures: | - |
| Any comment: | - |

**Data / Parameter table 2.**

| **Data / Parameter:** | $f_{NRB,y}$ |
|---|---|
| Data unit: | - |
| Description: | Fraction of woody biomass saved by the project activity during year *y* that can be established as non-renewable biomass |
| Source of data: | - |
| Measurement procedures (if any): | As per paragraphs 14 and 26 |
| Monitoring frequency: | Ex-ante |
| QA/QC procedures: | - |
| Any comment: | - |

**Data / Parameter table 3.**

| **Data / Parameter:** | $SC_{old}$ |
|---|---|
| Data unit: | t fuel/unit output or t fuel/hour |
| Description: | Specific fuel consumption or fuel consumption rate of the pre-project devices |
| Source of data: | |
| Measurement procedures (if any): | 1. Specific fuel consumption or fuel consumption rate of the pre-project devices, that is fuel consumption per quantity of item/s processed (e.g. food cooked) or fuel consumption per hour, respectively. Specific fuel consumption or fuel consumption rate are to be determined using the CCT protocol carried out in accordance with national standards (if available) or international standards or guidelines.<br>2. Use weighted average values if more than one type of device is being replaced (taking the amount of woody biomass consumed by each device as the weighting factor). |
| Monitoring frequency: | Ex-ante |
| QA/QC procedures: | - |
| Any comment: | - |

**Data / Parameter table 4.**

| Article I. **Data / Parameter:** | $HCi,j$ |
|---|---|
| Data unit: | kW |
| Description: | Rated capacity for delivering heat as per manufacturer specification (kW). |
| Source of data: | |

| | |
|---|---|
| Measurement procedures (if any): | The useful thermal energy shall be calculated based on the rated capacity of the project device multiplied by the number of utilization hours. Refer equation 4. |
| Monitoring frequency: | Ex-ante |
| QA/QC procedures: | - |
| Any comment: | - |

# 5. Monitoring methodology

36. The PP shall maintain a record for the date of commissioning of project devices of each type *i* and batch *j*.

37. In order to assess the leakage described in section 4.3 above, 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.

38. Relevant parameters shall be monitored and recorded during the crediting period as indicated in section 5.1 below. The applicable requirements specified in the "General guidelines for SSC CDM methodologies" are also an integral part of the monitoring guidelines specified below and therefore shall be followed by the project participants.

## 5.1. Data and parameters monitored

**Data / Parameter table 5.**

| **Data / Parameter:** | $N_{y,i,j}$ |
|---|---|
| Data unit: | - |
| Description: | Number of project devices of type i and batch j operating during year y. |
| Source of data: | - |
| Measurement procedures (if any): | Measured directly or based on a representative sample. Sampling standard shall be used for determining the sample size to achieve 90/10 confidence precision. A discount shall be applied based on the percentage of devices operational as determined by the sample survey e.g. if survey shows that 10% of the devices is non-operating, an adjustment factor of 0.9 shall be applied to number of project devices commissioned in a particular batch. Separate samples shall be taken for each batch. |
| Monitoring frequency: | At least once every two years (biennial) |
| QA/QC procedures: | |
| Any comment: | - |

**Data / Parameter table 6.**

| **Data / Parameter:** | $\mu_{y,i,j}$ |
|---|---|
| Data unit: | Days |
| Description: | Number of days of utilization of the project device *i* and batch *j* during the year y. |
| Source of data: | - |
| Measurement procedures (if any): | This parameter should be monitored using one of the following methods:<br><br>1. If the pre-project devices are decommissioned and no longer used, its value is 365 days. If both the project devices and pre-project devices are used together, measurement campaigns shall be undertaken using data loggers such as stove utilization monitors (SUMs) which can log the operation of all devices (recording the situation of the device being used or not during any day 'd' of the measurement campaign) in order to determine the average device utilization intensity (to establish the relative share of the usage of the devices). The measurement campaign shall be conducted in at least 10 randomly selected participant households of the project activity or the component project activity (CPA) for at least 90 days during the year y. If seasonal variation is observed, the average value determined through the campaign shall be annualised taking into account seasonal variation of device utilization.<br><br>2. Alternatively, surveys may be conducted if the use of data loggers to record the continued operation of baseline devices is demonstrated to be not practical, for example when the baseline device is the three stone fire. The surveys should be designed to capture the cooking habits and stove usage of households in the region, including quantification of use of baseline devices, by formulating questions and/or collecting evidences to determine the frequency of usage of both the project devices and baseline devices. |
| Monitoring frequency: | Yearly |
| QA/QC procedures: | - |
| Any comment: | - If equation (6) under option 3 (WBT) is used combined with direct measured of Biomass new, then $\mu_{y,i,j}$ (parameter 2) may be assumed as 365 days<br>- when the data loggers are used, the days when only project devices or only pre-project devices are used will be attributed accordingly. The days where both devices have been used, if the data loggers are able to detect and record the time each device has been used (e.g. in hours), the share in the total duration of utilization will be used to attribute a fraction of this day to one or to the other device. Alternatively, if the data loggers are not able to determine the duration of the utilization, but only the situation of the device being on or off (i.e. used or not used during that day), the share of 50:50 may be used. |

**Data / Parameter table 7.**

| **Data / Parameter:** | $t_{y,i,j}$ |
|---|---|
| Data unit: | Number of hours |
| Description: | Number of hours of utilization of the device during the year y. |
| Source of data: | - |
| Measurement procedures (if any): | The rated capacity shall be based on the manufacturer specification. The number of utilization hours shall be estimated based the biennial survey following a 95 per cent confidence interval and a 10 per cent margin of error in accordance with the "Standard for sampling and surveys for CDM project activities and programme of activities". |
| Monitoring frequency: | Yearly |
| QA/QC procedures: | - |
| Any comment: | - |

**Data / Parameter table 8.**

| **Data / Parameter:** | $\eta_{new,i,j}$ |
|---|---|
| Data unit: | Fraction |
| Description: | Efficiency of the device of each type *i and batch j* implemented as part of the project activity. |
| Source of data: | - |
| Measurement procedures (if any): | Efficiency shall be measured/estimated as per the following:<br>1. The efficiency of the project devices shall be based on certification by a national standards body or an appropriate certifying agent recognized by that body.<br>2. Alternatively, manufacturer specifications on efficiency based on water boiling test (WBT) may be used. The sampling test of stoves by such certification bodies/agents or manufacturers shall be conducted following a 90/10 precision in accordance with the "Standard for sampling and surveys for CDM project activities and programme of activities<br>3. However, the following simplified approach may be used, when the efficient cook-stoves are produced by a manufacturer with a good quality management system in place to ensure that the individual equipment produced do not vary beyond the range of acceptance limits (e.g. characteristics such as materials, critical dimensions):<br>i. Conduct a sample test on three cook stoves with three tests conducted for each stove;<br>ii. If the standard deviation of the nine test results indicated above is very small and 90/10 precision requirement is met (in this case, the value of the t-distribution for 90 per cent confidence shall be used instead of Z value), the efficiency determined is acceptable, otherwise more sample tests would be required until 90/10 precision is met. |

| | |
|---|---|
| Monitoring frequency: | (i)Recorded at the time of commissioning/distribution<br>(ii) Adjusted for the loss if efficiency as para 24-25. |
| QA/QC procedures: | - |
| Any comment: | Follow provisions in paragraph 24-25 to account for loss in efficiency of the project devices. |

**Data / Parameter table 9.**

| **Data / Parameter:** | **$NCV_{biomass}$** |
|---|---|
| Data unit: | TJ/tonne |
| Description: | Net calorific value of the non-renewable woody biomass, briquettes or charcoal used in project devices. |
| Source of data: | - |
| Measurement procedures (if any): | IPCC default for wood fuel, 0.015 TJ/tonne, based on the gross weight of the wood that is 'air-dried' can be used if fuel used in project device is also woody biomass.<br>If briquette or charcoal is used as project fuel NCV shall be measured annually. |
| Monitoring frequency: | Yearly |
| QA/QC procedures: | - |
| Any comment: | - |

**Data / Parameter table 10.**

| **Data / Parameter:** | **$SC_{new,i,j}$** |
|---|---|
| Data unit: | t fuel/unit output or t fuel/hour. |
| Description: | Specific fuel consumption or fuel consumption rate during year *y* of the device(s) of type *i* deployed as part of the project that is fuel consumption per quantity of item/s processed (e.g. food cooked) or fuel consumption per hour respectively with the age *a* |
| Source of data: | - |
| Measurement procedures (if any): | As per paragraphs 18 and 34(c), using the controlled cooking test (CCT) procedure. |
| Monitoring frequency: | Yearly |
| QA/QC procedures: | - |
| Any comment: | - |

**Data / Parameter table 11.**

| **Data / Parameter:** | **$f_{NRB,y}$** |
|---|---|
| Data unit: | - |
| Description: | Fraction of woody biomass saved by the project activity during year *y* that can be established as non-renewable biomass. |
| Source of data: | - |
| Measurement procedures (if any): | As per paragraphs 14 and 26 |

| | |
|---|---|
| Monitoring frequency: | Yearly, if project proponents opt for annual monitoring instead of fixing the value ex-ante at the beginning of each crediting period. |
| QA/QC procedures: | - |
| Any comment: | - |

**Data / Parameter table 12.**

| **Data / Parameter:** | $B_{y=1,new,i,j,survey}$ |
|---|---|
| Data unit: | Tonnes |
| Description: | Quantity of woody biomass used by project devices in tonnes per device of type i. |
| Source of data: | Sample survey of end user or direct measurement at each end user locations. |
| Measurement procedures (if any): | Determined in the first year of the introduction of the devices (e.g. during the first year of the crediting period, y=1) through measurement campaigns at representative households and/or sample survey. Sample surveys to estimate this parameter, that are solely based on questionnaires or interviews (i.e. that do not implement measurement campaigns) may only be used if the following conditions are satisfied:<br><br>Pre-project devices have been completely decommissioned and only efficient project device(s) are exclusively used in the project households; If multiple devices are used in the project, it is possible from the results of the survey questions to clearly differentiate the quantity of woody biomass being used by each device. In other words, if more than one device, or another device that consumes woody biomass, are in use in project households, then the sample survey needs to distinguish the quantity of biomass used by the project device and the other devices that use biomass. |
| Monitoring frequency: | First year of installation. |
| QA/QC procedures: | - |
| Any comment: | - |

**Data / Parameter table 13.**

| **Data / Parameter:** | $B_{new,KPT,i,j}$ |
|---|---|
| Data unit: | Tonnes |
| Description: | Annual quantity of woody biomass used in tonnes per project device of type i |
| Source of data: | Sample survey |
| Measurement procedures (if any): | Measured as per the KPT protocol, for the initial efficiency determined in the year of its commissioning. The KPT shall be carried out in accordance with national standards (if available) or international standards or guidelines (e.g. the KPT procedures specified by the partnership for clean indoor air (PCIA): http://www.pciaonline.org/node/1049) |
| Monitoring frequency: | Annual monitoring of the quantity of woody biomass used in tonnes per project device of type i and batch j. |

| | |
|---|---|
| QA/QC procedures: | - |
| Any comment: | - |

**Data / Parameter table 14.**

| **Data / Parameter:** | $\eta_{old,i,j}$ |
|---|---|
| Data unit: | (I) Default 0.1 or 0.2 (please see details below)<br>(II) Establish prior to start of implementation based on survey |
| Description: | Efficiency of pre - project device, which is a three stone fire using firewood (not charcoal) , or a conventional device with no improved combustion air supply or flue gas ventilation, that is without a grate or a chimney; for other types of devices, a default value of 0.2 may be optionally used. Use weighted average values (taking the amount of woody biomass consumed by each device as the weighting factor) if more than one type of device is being replaced |
| Source of data: | - |
| Measurement procedures (if any): | - |
| Monitoring frequency: | Fixed for each individual household when included in the project activity database. |
| QA/QC procedures: | - |
| Any comment: | - |

**Data / Parameter table 15.**

| **Data / Parameter:** | **Life Span** |
|---|---|
| Data unit: | Number of years |
| Description: | The operating life time of the project device. The life span should be reported in cases where the PPs are opting to account the efficiency loss as per paragraph 23. |
| Source of data: | Manufacturer (certified by a national standards body or an appropriate certifying agent recognized by that body) |
| Measurement procedures (if any): | |
| Monitoring frequency: | Fixed and recorded at the time of commissioning/distribution |
| QA/QC procedures: | - |
| Any comment: | - |

**Data / Parameter table 16.**

| **Data / Parameter:** | **Date of commissioning of batch j** |
|---|---|
| Data unit: | Date |

| | |
|---|---|
| Description: | To establish the date of commissioning, the Project Participant may opt to group the devices in "batches" and the latest date of commissioning of a device within the batch shall be used as the date of commissioning for the entire batch. |
| Source of data: | Internal records |
| Measurement procedures (if any): | |
| Monitoring frequency: | Fixed and recorded at the time of commissioning/distribution of the last project device in the batch |
| QA/QC procedures: | - |
| Any comment: | To be reported in the monitoring report |

**Data / Parameter table 17.**

| **Data / Parameter:** | **Date of commissioning of project device i** |
|---|---|
| Data unit: | Date |
| Description: | Actual date of commissioning of the project device. |
| Source of data: | Internal records |
| Measurement procedures (if any): | - |
| Monitoring frequency: | Fixed and recorded at the time of commissioning/distribution |
| QA/QC procedures: | - |
| Any comment: | - |

## 5.2. Representative sampling methods

39. A statistically valid sample of the locations where the devices are deployed, with consideration, in the sampling design, of occupancy and demographic differences can be used to determine parameter values used to calculate emission reductions, as per the relevant requirements for sampling in the *"*Standard for sampling and surveys for CDM project activities and programmes of activities*"*. When biennial inspection is chosen a 95 per cent confidence interval and a 10 per cent margin of error shall be achieved for the sampling parameter. On the other hand when the project proponent chooses to inspect annually, a 90 per cent confidence interval and a 10 per cent margin of error shall be achieved for the sampled parameters. In cases where survey results indicate that 90/10 precision or 95/10 precision are not achieved, the lower bound of the 90 per cent or 95 per cent 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.

40. Efficiency of devices may be monitored in a common survey with other monitoring parameters; therefore, a random sub-sample within the common survey can be taken for which stove efficiency is tested, as long as the required precision for stove efficiency is achieved.

## 5.3. Project activity under a programme of activities

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

    (a) Use of non-renewable woody biomass saved under the project activity to justify the baseline of other CDM project activities can also be a potential source of leakage. If this leakage assessment quantifies a portion of non-renewable woody biomass saved under the project activity that is then used as the baseline of other CDM project activities then $B_{old,i,j}$ *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 a potential source of leakage. If this leakage assessment quantifies an increase in the use of non-renewable woody biomass outside the project boundary then $B_{old,i,j}$ is adjusted to account for the quantified leakage;

    (c) As an alternative to subparagraphs (a) and (b) $B_{old,i,j}$ can be multiplied by a net to gross adjustment factor of 0.95[13] to account for both leakages, in which case surveys are not required.

42. To determine the value of the fraction of non-renewable biomass (fNRB) to be applied in a Component Project Activity (CPA) of a POA, use one of the two options as follows: (a) Conduct local studies to determine the local fNRB value (sub national values); or (b) Use default national values approved by the Board (see footnote 5). The choice of which option to use shall be made ex ante. However, a switch from a national value of fNRB (i.e. option (b)) to sub-national values (i.e. option (a)) is permitted, under the condition that the selected approach is consistently applied to all CPAs.

43. Monitoring approaches for $B_{y,savings,i,j}$ (Option 1, 2, 3 or 4 in paragraphs 16-20,[14] and values for parameters fNRB (when Option (a) in paragraph 39 is chosen) and the quantity of woody biomass $B_{old,i,j}$ may be determined either at the CPA level before the inclusion of the CPA or at the PoA level before the registration of the PoA-DD.

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[13] The adjustment factor does not need to be applied twice for option (a) and (b).

[14] Any one of the four options in paragraphs 16, 17, 19 and 20 may be used for a particular CPA, but there should be no change in the chosen option during the crediting period.

## Document information

| *Version* | *Date* | *Description* |
|---|---|---|
| 07.0 | 7 July 2015 | SSC WG 48, Annex 2<br>To be considered by the Board at EB85. This draft methodology was available for public input from 12 to 27 May 2015.<br>Revision to simplify the baseline emission equation, determination of efficiency and monitoring parameters. |
| 06.0 | 21 February 2014 | EB 77, Annex 11<br>Revision to:<br>• Introduce simplified approaches to determine the thermal efficiency of project devices;<br>Introduce default values for baseline fuel wood consumption. |
| 05.0 | 23 November 2012 | EB 70, Annex 30<br>Includes clarification on monitoring requirements under different options; and provides a provision of wood to charcoal conversion factor. |
| 04.0 | 20 July 2012 | EB 68, Annex 23<br>Includes a reference to the available country specific default values for fNRB and specifies requirements of using national or local fNRB values for CPAs under a PoA. |
| 03 | 15 April 2011 | EB 60, Annex 21<br>KPT for stove testing included, 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. |
| 02 | 04 December 2009 | EB 51, Annex 18<br>To include: (a) Default efficiency factors for baseline cook stoves; (b) Procedures for sampling, (c) Revised procedures for determination of quantity of woody biomass that can be considered as non-renewable; and (d) Clarifications as to which leakage requirements are appropriate for projects versus PoAs. |
| 01 | 01 February 2008 | EB 37, Annex 7<br>Initial adoption. |

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