

CDM-SSCWG51-A03

Draft Small-scale Methodology

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

Version 08.0 - Draft

Sectoral scope(s): 03



United Nations
Framework Convention on
Climate Change

COVER NOTE

1. Procedural background

1. The methodology AMS-II.G covers project activities for 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.
2. The Executive Board of the clean development mechanism (CDM) (hereinafter referred to as the Board), at its 89th meeting, requested the Small-Scale Working Group (SSC WG) to propose revisions to the approved methodologies “AMS-I.E: Switch from non-renewable biomass for thermal applications by the user” and “AMS-II.G: Energy efficiency measures in thermal applications of non-renewable biomass” to address identified issues relevant to both methodologies, and to provide a consistent approach in the two cook stove methodologies. The issues identified are detailed in paragraph 33 of the meeting report of the 50th meeting of the SSC WG.
3. For AMS-II.G, a call for public inputs was launched from 29 April to 14 May 2016. As a result, no input was received.

2. Purpose

4. The draft methodology proposed in this document aims to include the procedures to quantify baseline woody biomass consumption for the entire household.

3. Key issues and proposed solutions

5. In order to adapt the methodologies to the information that is collected on the ground, the procedures to quantify baseline woody biomass consumption for the entire household was newly included.

4. Impacts

6. The proposed revision will facilitate the implementation of CDM project activities and component project activities (CPAs) distributing renewable energy based technologies (e.g. cook stoves), which are very relevant for the least developed countries (LDCs) and other regions that are underrepresented in the CDM.

5. Subsequent work and timelines

7. The methodology is recommended by the SSC WG for consideration by the Board. No further work is envisaged.

6. Recommendations to the Board

8. The SSC WG recommends that the Board approve this draft revised methodology, to be made effective at the time of the Board’s approval.

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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 90 meeting report on 22 July 2016.

2.4. Applicability of sectoral scopes

8. For validation and verification of CDM projects and programme of activities by a designated operational entity (DOE) using this methodology, application of sectoral scope 3 is mandatory.

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

3. Normative references

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

4. Definitions

10. The definitions contained in the Glossary of CDM terms shall apply.
11. For the purpose of this methodology, the definitions of demonstrably renewable woody biomass and non-renewable woody biomass provided in paragraphs 28 and 29 shall apply.
12. 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.

5. Baseline methodology

5.1. Project boundary

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

5.2. Emission reductions

14. 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.
15. 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 devices²
- j = Indices for the situation where there is more than one batch of project device

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	=	Emission reductions during year y in t CO ₂ e
$ER_{y,i,j}$	=	Emission reductions by project device of type i and batch j during year y in t CO ₂ e
LE_y	=	Leakage emissions in the year y

$$ER_{y,i,j} = B_{y,savings,i,j} \times N_{y,i,j} \times \frac{\mu_y}{365} \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected_fossil\ fuel} \quad \text{Equation (2)}$$

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 CO ₂ /TJ ⁴
$N_{y,i,j}$	=	Number of project devices of type i and batch j operating during year y
μ_y	=	Adjustment to account for any continued use of pre-project devices. Number of days of utilization of the project device i and batch j during the year y when applying equations 6 and 8 (fraction). Use 1.0 in other cases

³ Default values endorsed by designated national authorities and approved by the Board are available at <http://cdm.unfccc.int/DNA/fNRB/index.html> or http://cdm.unfccc.int/methodologies/standard_base/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 CO₂/TJ) and a 25 per cent weight is assigned to both liquid and gaseous fuels (71.5 t CO₂/TJ for kerosene and 63.0 t CO₂/TJ for liquefied petroleum gas (LPG)).

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

17. Option 1: Thermal Energy Output (TEO):

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

$HR_{y,i,j}$ 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

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

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

$HC_{i,j}$ 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

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

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

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>)

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

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

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

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):

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

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. The calculations in the equations above assume that there is only one device per household. Considering that baseline surveys or other methods may estimate the total consumption per household, an adjusted formula as below shall be used in case more than one project device is used in the household. For example, if 2 project devices are installed per household, 0.5 times the baseline woody biomass consumption per household ($B_{old,HH}$) is used as the total annual quantity of woody biomass that would have been used in the absence of the project activity in each device ($B_{old,i,j}$). Where more detailed data is available e.g. the thermal capacity of the project devices and respective utilisation hours, a weighted average thermal output ($HR_{y,i,j}$) may be used to determine the savings of baseline consumption for each device.

$$B_{old,i,j} = B_{old,HH} \div N_{d,HH} \quad \text{Equation (9)}$$

$$B_{old,HH} = B_{old,p} \times N_{p,HH} \quad \text{Equation (10)}$$

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

Where:

$B_{old,HH}$ = Annual quantity of woody biomass that would have been used in the household in the absence of the project activity to generate useful thermal energy equivalent to that provided by the project devices (tonnes/household/year)

$N_{d,HH}$ = Number of project devices per household (number)

$B_{old,p}$ = Annual quantity of woody biomass that would have been used per person in the household in the absence of the project activity to generate useful thermal energy equivalent to that provided by the project devices (tonnes/person/year).

$N_{p,HH}$ = Average number of persons per household (number)

23. 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.
24. The life span⁷ of each type of the project devices shall be documented in the PDD based on manufacturer's specification.
25. 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.
 - (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 device⁸. 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) Determine⁹ 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

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 25 (a).

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.

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.
26. 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.

5.2.1. Differentiation between non-renewable and renewable woody biomass

27. 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.

5.2.2. Demonstrably renewable woody biomass¹⁰ (DRB)

28. Woody¹¹ biomass is 'renewable' if one of the following two conditions is satisfied:
- (a) The woody biomass originates from land areas that are forests¹² where:
 - (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

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.

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

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.

5.2.3. Non-renewable biomass

29. *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.

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

$$f_{NRB,y} = \frac{NRB}{NRB + DRB} \quad \text{Equation (11)}$$

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

5.3. Leakage

32. 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.

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

34. 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.
35. A default value of 0.030 t CH₄/t charcoal may be used in accordance with “AMS-III.BG: Emission reduction through sustainable charcoal production and consumption”.

5.4. Data and parameters not monitored

36. 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:	$B_{old,p}$
Data unit:	tonnes/person/year
Description:	Annual quantity of woody biomass that would have been used per person in the household in the absence of the project activity to generate useful thermal energy equivalent to that provided by the project devices
Source of data:	Where applicable a value from a standardised baseline may be used as an alternative to the default value provided
Measurement procedures (if any):	A default value of 0.5 tonnes/capita per year ¹³ may be used. This option is limited to household project devices (not eligible for oven and dryers)
Monitoring frequency:	Ex-ante
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 2.

Data / Parameter:	$N_{p,HH}$
Data unit:	Number
Description:	Average number of persons served per household prior to project implementation
Source of data:	Established ex-ante prior to project implementation based on records of households served by the project
Measurement procedures (if any):	-
Monitoring frequency:	Ex-ante
QA/QC procedures:	-
Any comment:	-

¹³ Refer to “Annex 5 - Information note on the rationale for default factors used in AMS-I.E and AMS-II.G” of the SSC WG 42 meeting report for the derivation of the default.

Data / Parameter table 3.

Data / Parameter:	$B_{old,HH}$
Data unit:	tonnes/household/year
Description:	Annual quantity of woody biomass that would have been used in the household in the absence of the project activity to generate useful thermal energy equivalent to that provided by the project devices
Source of data:	This parameter shall be determined ex-ante
Measurement procedures (if any):	Use one of the following options: 1. $B_{old,p}$ times $N_{p,HH}$ or 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 4.

Data / Parameter:	$B_{old,i,j}$
Data unit:	tonnes/year
Description:	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 Annual quantity of woody biomass used in pre project scenario.
Source of data:	This parameter shall be determined ex-ante
Measurement procedures (if any):	$B_{old,HH}$ divided by $N_{d,HH}$
Monitoring frequency:	Ex-ante
QA/QC procedures:	-
Any comment:	$B_{old,i,j}$ equals $B_{old,HH}$ when only one project device per household is distributed For $N_{d,HH}$, please refer to Data / Parameter table 21.

Data / Parameter table 5.

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 27 to 30

Monitoring frequency:	Ex-ante
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 6.

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):	<ol style="list-style-type: none"> 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. 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 7.

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:	-

6. Monitoring methodology

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

38. In order to assess the leakage described in section 5.3 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.
39. Relevant parameters shall be monitored and recorded during the crediting period as indicated in section 6.1 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.

6.1. Data and parameters monitored

Data / Parameter table 8.

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:	Monitoring
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 9.

Data / Parameter:	μ_y
Data unit:	Days Fraction
Description:	Adjustment to account for any continued use of pre-project devices Number of days of utilization of the project device i and batch j during the year y
Source of data:	When applying equations 6 and 8, it is a fraction based on monitoring results. In other cases (i.e. applying equations 3, 5 and 7), use 1.0.

Measurement procedures (if any):	<p>This parameter should be monitored using one of the following methods:</p> <p>1. If the pre-project devices are decommissioned and no longer used, as determined by the monitoring survey its value is 1.0 365 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.</p> <p>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. For example if there were 3 pre-project devices per household and it was determined during the survey that use of one of them continues during the crediting period then a conservative adjustment factor of 0.66 is applied for the relevant monitoring period. Another example would be the case where there was only one pre-project device per household and its use during the project period continues along with the project stove to meet 25% of the cooking needs of the household in which case the adjustment factor will be 0.75. Where a more precise data is available i.e. the thermal capacity of the project and pre-project devices and respective utilisation hours, a weighted average adjustment factor may be used.</p>
Monitoring frequency:	<p>Yearly At least once every two years (biennial)</p>

QA/QC procedures:	-
Any comment:	<p>- If equation (6) under option 3 (WBT) is used combined with direct measurement of d of Biomass new, then $\mu_{y,i,j}$ (parameter 2) may be assumed as 1.0 365 days</p> <p>- 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.</p>

Data / Parameter table 10.

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 11.

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):	<p>Efficiency shall be measured/estimated as per the following:</p> <ol style="list-style-type: none"> 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. 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 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): <ol style="list-style-type: none"> i. Conduct a sample test on three cook stoves with three tests conducted for each stove; 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:	<p>(i) Recorded at the time of commissioning/distribution (ii) Adjusted for the loss in efficiency as paragraph 25.</p>
QA/QC procedures:	-
Any comment:	Follow provisions in paragraph 25 to account for loss in efficiency of the project devices.

Data / Parameter table 12.

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):	<p>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. If briquette or charcoal is used as project fuel NCV shall be measured annually.</p>
Monitoring frequency:	Yearly
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 13.

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 21, using the controlled cooking test (CCT) procedure.
Monitoring frequency:	Yearly
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 14.

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 27 to 30
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 15.

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):	<p>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:</p> <p>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.</p>
Monitoring frequency:	First year of installation.
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 16.

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 17.

Data / Parameter:	$\eta_{old,i,j}$
Data unit:	<p>(I) Default 0.1 or 0.2 (please see details below)</p> <p>(II) Establish prior to start of implementation based on survey</p>

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 18.

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 25.
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 19.

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 20.

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:	-

Data / Parameter table 21.

Data / Parameter:	$N_{d,HH}$
Data unit:	Number
Description:	Number of project devices distributed per household
Source of data:	Internal records
Measurement procedures (if any):	-
Monitoring frequency:	Recorded at the time of commissioning/distribution of project devices
QA/QC procedures:	-
Any comment:	-

6.2. Representative sampling methods

40. 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.
41. 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.

6.3. Project activity under a programme of activities

42. 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 0.95¹⁴ to account for both leakages, in which case surveys are not required.
43. 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 3). 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.
44. Monitoring approaches for $B_{y,savings,i,j}$ (Option 1, 2, 3 or 4 in paragraphs 13-18,¹⁵ and values for parameters fNRB (when Option (a) in paragraph 43 38 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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¹⁴ The adjustment factor does not need to be applied twice for option (a) and (b).

¹⁵ Any one of the four options in paragraphs 17 to 21 13, 15, and 18 may be used for a particular CPA, but there should be no change in the chosen option during the crediting period.

Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
08.0	4 July 2016	SSC WG 51, Annex 3 To be considered by the Board at EB 90. A call for input (CDM-SSCWG50-A04) was issued and available from 29 April to 14 May 2016. Revision to include the procedures to quantify baseline woody biomass consumption for the entire household.
07.0	24 July 2015	EB 85, Annex 14 Revision to simplify the baseline emission equation, determination of efficiency and monitoring parameters.
06.0	21 February 2014	EB 77, Annex 11 Revision to: <ul style="list-style-type: none"> • Introduce simplified approaches to determine the thermal efficiency of project devices; • Introduce default values for baseline fuel wood consumption.
05.0	23 November 2012	EB 70, Annex 30 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 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 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 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 Initial adoption.

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