SCM0001 - Methodology for the installation of Energy Efficient Cookstoves

Document Prepared by the Social Carbon Foundation

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Methodology Details

1. Sources

This methodology uses the following sources:

- SOCIALCARBON Standard v6.0
- SOCIALCARBON Standard Definitions
- Energy efficiency measures in thermal applications of non-renewable biomass; version 12
- The latest version of the CDM methodology AMS-II.G: “Energy efficiency measures in thermal applications of non-renewable biomass”
- The latest version of the CDM General guidelines for SSC CDM methodologies
- The latest version of the CDM Standard for sampling and surveys for CDM project activities and programme of activities
- Water Boiling Test Protocol 4.2.3
- Gold Standard “Technologies and Practices to Displace Decentralized Thermal Energy Consumption” (Version 4.0)
- The latest version of the CDM methodology “Biogas/Biomass thermal applications for households/small users”
- The GHG Protocol for Project Accounting
- The latest version of the CDM Tool 30: “Calculation of the fraction of non-renewable biomass”
- The latest version of the CDM Tool 33: “Default values for common parameters”
- The latest version of the CDM methodology AMS-I.K: “Solar cookers for households”

Please view the 10. References section of this document to see the full list of sources used to develop this methodology.

2. Summary description of the Methodology

Additionality and Crediting Method	
Additionality	Project Method
Crediting Baseline	Project Method

This methodology is applicable to project activities that introduce new efficient thermal energy generation units, e.g. efficient biomass fired cookstoves, ovens, or dryers, or the retrofit of existing units to reduce the use of nonrenewable biomass for combustion. Through this methodology solar cookers and efficient biomass fired cookstoves, ovens, or dryers, may replace fossil fuel fired baseline stoves/dryers.

3. Definitions

In addition to the definitions set out in the latest version of the SOCIALCARBON Standard Definitions, the following definitions apply to this methodology:

Project device (ICS)[1]
Solar cookers or solid-fuel stoves that improve on traditional baseline biomass technologies in terms of fuel savings via improved fuel efficiency and lower emissions through improved combustion efficiency. Examples of solid-fuel stoves include, but at not limited to, basic chimney ICS, intermediate ICS, portable ICS etc.

Basic Chimney
ICS Solid-fuel cookstoves whose chimneys feature minimal to moderate improvements in thermal efficiency.

Basic Portable ICS
Portable biomass cookstoves that are unvented and feature moderate improvements in thermal efficiency. This category includes minimally improved ceramic and clay cookstoves simple efficient wood cookstoves and metal insulator-lined cookstove technologies.

Intermediate ICS
A wide range of solid fuel cookstoves with significant improvements in fuel efficiency (>25%). Intermediate cookstoves utilize rocket stove principles (i.e., an L-shaped combustion chamber design) for wood/crop or waste/ dung fuel cooking or have other design features that promote thermal efficiency as in the case of intermediate coal and charcoal ICS. Stoves in this category can be portable, semi-portable or built-in and may be either unvented or combined with chimneys, depending on the design.

Advanced Cookstoves (ACS)
Fan draft or natural draft biomass gasification cookstoves. Stoves in this category include natural draft models, fan draft rocket-style stoves, and top-loading fan gasifiers.

Project Technology
Design and performance characteristics of the project device. Project technologies can be considered similar if they are based on the same fundamental combustion technology and their respective thermal efficiencies or specific consumptions do not differ by more than +/-5% in absolute terms. Comparable project technologies can share the same monitoring procedures. Project technologies with significantly

[1] Definitions adopted from 'The State of The Global Clean And The Improved Cooking Sector' – Technical report 007/15

different performance characteristics such as combustion technology or fuel consumption characteristics must be treated as independent project scenarios and hence monitored separately.

Rudimentary Cookstove
Traditional solid-fuel cooking solutions such as open fire, three-stone fires, unvented mud/clay “U” shaped stoves, and basic charcoal or coal cookstoves.

Rural Area
Area or region that consists of a population who predominantly use traditional cookstoves.

Solar Cooker
A device which uses the energy of direct sunlight to heat or cook food and liquids.

Vintage
Operational cookstoves correspond with one calendar year. Example: cookstoves that have been in operation for less than or equal to 365 days belong to Vintage 1. Cookstoves that have been operational for more than 365 days but less than or equal to 730 days belong to vintage 2.

4. Applicability Conditions

This methodology is applicable under the following conditions:

- Project activities must introduce efficiency improvements in thermal applications of non-renewable biomass in the following premises: households, community-based kitchens., institutions (e.g., schools) or small and medium sized enterprises (SMEs). The project device shall have thermal efficiency of at least 20% per the manufacturer’s specifications and shall exclusively use woody biomass and can be single pot or multi-pot; in case of project device replacing fossil fuel baseline device, it shall exclusively use renewable biomass. Alternatively, the project activities must introduce solar cookers in the following premises: households, community-based kitchens., institutions (e.g., schools) or small and medium sized enterprises (SMEs). The use of the solar cookers will reduce or displace the use of the existing cookstove(s) and displace the consumption of fossil fuels (e.g. Kerosene or LPG) or non-renewable biomass (NRB).
- Both ‘Projects’ and ‘Large Projects’ can use this methodology.
- For the specific case of biomass residues processed as a fuel (e.g. briquettes, wood chips):

  (a) It must be demonstrated that the fuel is produced using exclusively renewable biomass (more than one type of biomass may be used);

  (b) The consumption of the fuel should be monitored during the crediting period; and

(c) Energy use for renewable biomass processing (e.g. shredding and compacting in the case of briquetting) may be considered as equivalent to the upstream emissions associated with the processing of the displaced fossil fuel and hence disregarded.

- To foster continued and frequent use of the devices:
    - Participating stakeholders (device users) are required to pay at least a portion of the cost of the device;
    - Participating stakeholder shall receive training for appropriate use of the type of device, at or before the time of distribution of the device. This training shall take into account local cooking habits (e.g. types of food prepared, customary mealtimes, etc.);
    - A local organization shall be involved on an ongoing basis to assist in promoting and facilitating the continued use of the devices.
- If the selected crediting period is longer than the manufacturer-specified lifetime, then it shall be demonstrated that an ongoing maintenance and replacement program is in place, through which devices that are no longer functioning, will be repaired or replaced.
- The host country or project location's region is not implementing a jurisdictional REDD+ programme[2]

5. Project Boundary

The greenhouse gases included in or excluded from the project boundary are shown in Table 1 below.

Table 1: GHG Sources included in or excluded from the Project Boundary

Source		Gas	Included?	Explanation
Baseline	Emission from use of non-renewable biomass / fossil fuel	CO_2	Yes	Major source
		CH_4	Yes	Major source
		N_2O	Yes	Major source
		Other	No	No other source identified
		CO_2	Yes	Can be a major source

[2] In the event that the project's location resides within a jurisdictional REDD+ programme and the project itself if focused on reducing the consumption of non-renewable wood fuel, the project is not permitted to issue carbon credits under the SOCIALCARBON Standard due to the double counting risks. See the SOCIALCARBON FAQs for SCM0001 for more details on the rationale and exemptions.

	Production & Transport of Fuel	CH_4	Yes	Can be a major source
		N_2O	Yes	Can be a major source
		Other	No	No other source identified
Project	Emission from use of non-renewable biomass / fossil fuel	CO_2	Yes	Major source
		CH_4	Yes	Major source
		N_2O	Yes	Major source
		Other	No	No other source identified
	Production & Transport of Fuel	CO_2	Yes	Can be a major source
		CH_4	Yes	Can be a major source
		N_2O	Yes	Can be a major source
		Other	No	No other source identified

6. Baseline Scenario

The baseline scenario is the continued use of non-renewable wood fuel (firewood/charcoal) or fossil fuel (coal/kerosene) in the existing devices by the target population to meet similar thermal energy needs as provided by project devices in absence of project activity.

7. Additionality

This methodology uses a project method for the demonstration of additionality.

Step 1: Regulatory Surplus

Project proponents must demonstrate regulatory surplus in accordance with the rules and requirements regarding regulatory surplus set out in the latest version of the SOCIALCARBON Methodology Requirements.

Step 2: Project Method

The project activity shall apply the additionality analysis method set out in the latest version of the *CDM Tool for the Demonstration and Assessment of Additionality* to determine that the proposed project activity is either:

1) not common practice, demonstrating ex ante that the penetration of the project device type is equal to or less than 20 percent of the technologies/measures providing similar services in the region; and
2) not the most economically or financially attractive; or
3) not economically or financially feasible.

8. Quantification of GHG Emission Reductions and Removals

8.1 Baseline Emissions

This methodology does not account for baseline emissions separately, but instead quantifies emission reductions as a function of the reduction in the amount of non- renewable biomass fuel consumption in the efficient project device as compared to baseline device. This revision follows the same convention.

8.2 Project Emissions

This methodology does not account for project emissions separately, but instead quantifies emission reductions as a function of the reduction in the amount of non-renewable biomass fuel consumption in the efficient project device as compared to baseline device.

8.3 Leakage

Leakage shall be considered in accordance with Section 5.4 of AMS-II.G.

8.4 Net GHG Emission Reductions and Removals

Net GHG emission reductions are calculated by applying Equations 1 and 2 for project activities replacing baseline device using non-renewable biomass (e.g. firewood or charcoal), Equations 1 and 8 for project activities replacing baseline device using fossil fuel (e.g. coal or kerosene), and Equations 1 and 10 for

project activities replacing either displace the consumption of fossil fuels (e.g. Kerosene or LPG) or non-renewable biomass (NRB) with a solar cooker:

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

Where:

i	=	Indices for the situation where more than one type/model of project device is introduced to replace the baseline device (e.g. three-stone fire)
j	=	Indices for the situation where there is more than one batch of project device of type i
ER_y	=	Emission reductions during year y; tCO2e
$ER_{y,i,j}$	=	Emission reductions by project device of type i and batch j during year y; tCO2e

$$ER_{y,i,j} = B_{y,savings,i,j} \times f_{NRB,y} \times NCV_{wood\ fuel} \times \left(EF_{wf,CO2} + EF_{wf,non\ CO2}\right) \times N_{y,i,j} \quad \text{(Equation 2)}$$

Where:

$B_{y,savings,i,j}$	=	Quantity of woody biomass that is saved in tonnes per project device of type i and batch j during year y; tonnes
$f_{NRB,y}$	=	Fraction of woody biomass that can be established as non-renewable biomass; %
$NCV_{wood\ fuel}$	=	Net calorific value of the non-renewable woody biomass that is substituted or reduced; TJ/tonne (IPCC default for wood fuel, 0.0156 TJ/tonne)[3]
$EF_{wf,CO2}$	=	CO2 emission factor for the use of wood fuel in baseline scenario; tCO2e/TJ (IPCC default for wood fuel, 112 tCO2/TJ)[4]
$EF_{wf,non\ CO2}$	=	Non-CO2 emission factor for the use of wood fuel in baseline scenario; tCO2e/TJ (IPCC default for wood fuel, 9.46 tCO2e/TJ)[5]
$N_{y,i,j}$	=	Number of project devices of type i and batch j operating during year y

[3] The value prescribed by the latest version of AMS II.G must be used

[4] 2006 IPCC Guidelines for National Greenhouse Gas Inventories; Chapter 2 Stationary Combustion

[5] 2006 IPCC Guidelines for National Greenhouse Gas Inventories; Chapter 2 Stationary Combustion

The quantify of woody biomass saved $B_{y,savings,i,j}$ due to implementation of project devices can be estimated by one of the following options[6] set out in Equations 3 and 4:

$$B_{y,savings,i,j} = B_{old} \times (1 - \frac{n_{old}}{n_{new,i,j}}) \quad \text{(Equation 3)}$$

$$B_{y,savings,i,j} = B_{y=1,new,i,survey} \times (\frac{n_{new,i,j}}{n_{old}} - 1) \quad \text{(Equation 4)}$$

Where:

B_{old}	=	Annual quantity of woody biomass that would have been used in the absence of the project activity (in tonnes per device) to generate useful thermal energy equivalent to that provided by the project device; tonnes (The value of B_{old} can be sourced from historical data or baseline surveys. Alternatively, a default value of 0.4t/capita/year may be used[7])
n_{old}	=	Efficiency of baseline cookstove; %
$n_{new,i,y}$	=	Efficiency of the project device type i and batch j; % (determined through water boiling test (WBT)
$B_{y=1,new,i,j,survey}$	=	Annual quantity of woody biomass used by project devices in tonnes per device of type i and batch j; tonnes (determined in the first year of the implementation of the project through a sample survey)

Where the project households continue to use baseline devices along with project devices, B_{old} shall be adjusted ex-post based on the percentage of project households found to continue such practice according to Equation 6. For such cases, the quantity of woody biomass saved $B_{y,savings,i,j}$ due to implementation of project devices shall be calculated using an adjusted value to account for ex-post use of baseline device in addition to the project device.

$$B_{old,adjusted} = B_{old} \times (1 - \mu_y) \quad \text{(Equation 5)}$$

[6] The option to determine the $B_{y,savings,i,j}$ must be decided prior to validation of the project

[7] The value prescribed by the latest version of CDM TOOL33 must be used

Where:

$B_{old,adjusted}$	=	Adjusted B_{old} to account for the ex post usage of firewood in baseline device(s) by project households in addition to the project device; tonnes per device
μ_y	=	Baseline device usage factor to account for use of baseline device along with project device

The quantity of firewood consumed in absence of project activity (B_{old}) shall be determined using an estimation of average annual consumption of firewood per household which may be derived using any of the following options:

(a) **Historical Data.** Project proponent must ensure that the relevance of data is appropriately justified for the target population and is the latest available data from credible source(s).

(b) **Baseline Survey of Local Usage.** Project proponent must carry out a survey of usage prior to implementation of the project activity following the sampling approach described in the latest version of the CDM document S*ampling and surveys for CDM project activities and programme of activities*. Alternatively, the project participant may follow the simple random sampling approach and the minimum sample size should be determined as per the following guidelines:

- Project target population < 300: Minimum sample size 30
- Project target population 300 – 1000: Minimum sample size 10% of group size
- Project target population > 1000: Minimum sample size 100

This simplified approach may also be used for determining the minimum sample size for parameters listed under Sections 9.1 and 9.2 in which case it is not a requisite for the sample size to meet confidence/precision requirements.

(c) **Minimum Service Level**. Where historical data or a baseline survey has not been conducted, a default value of 0.4 ton/capita/year may be considered as the baseline biomass consumption[8]. Household size shall be determined using credible references/literature or target population specific surveys. The survey shall be conducted as per the guidelines outlined in option (b) above.

In order to address the potential source of leakage which can be attributed to the diversion of non-renewable biomass saved by project devices to non-project households which previously used renewable biomass the requirements of the latest version of the AMS-II.G must be followed.

[8] The value prescribed by the latest version of CDM TOOL33 must be used

The above equations assume that a single baseline device is replaced by a single project device. However, in some cases more than one project device may be required to achieve service levels equal to the baseline device. For such cases, the displaced biomass shall be apportioned between the project device while calculating B_{old}.

The equations below shall be used for calculating biomass consumed in absence of project activity in case more than one project device is used in a household:

$$B_{old,i,j} = B_{old,HH} \div N_{d,HH} \quad \text{(Equation 6)}$$

$$B_{old,HH} = B_{old,p} \times N_{p,HH} \quad \text{(Equation 7)}$$

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
$B_{old,p}$	=	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 households

For projects opting for $B_{y=1,new,i,j,survey}$, it shall be demonstrated that the consumption of biomass for individual project device can be measured exclusive of one another.

For project devices replacing fossil fuel with renewable biomass, the following equations shall apply:

$$ER_{y,i,j} = N_{y,i} \times B_{renewable,y} \times EF_{ff} \times n_{PJ/BL} \times NCV_{biomass} - LE_y \quad \text{(Equation 8)}$$

Where:

$N_{y,i}$	=	Number of project devices of type i operating during year y

$B_{renewable,y}$ = The net quantity of renewable biomass consumed by the project device in year y; tonnes

EF_{ff} = CO2 emission factor for fossil fuel j; tCO2/TJ

$n_{PJ/BL}$ = Ratio of efficiencies of project equipment and baseline equipment

$NCV_{biomass}$ = Net calorific value of renewable biomass substituting fossil fuel

LE_y = Leakage in year y; tCO2e (Only, if the energy generating equipment introduced by the project activity is transferred from outside the boundary to the project activity, leakage is to be considered)

$$EF_{ff} = EF_{ff\_CO2} + EF_{ff\_CH4} \times GWP_{CH4} \times EF_{ff\_N2O} \times GWP_{N2O} \quad \text{(Equation 9)}$$

Where:

EF_{ff_CO2} = CO2 emission factor for fossil fuel 'j'. Default values are mentioned in Table 2

EF_{ff_CH4} = CH4 emission factor for fossil fuel 'j'. Default values are mentioned in Table 2

GWP_{CH4} = Global warming potential of CH4 according to fifth assessment report.[9]

EF_{ff_N2O} = N2O emission factor for fossil fuel 'j'. Default values are mentioned in Table 2

GWP_{N2O} = Global warming potential of N2O according to fifth assessment report

For solar cookers replacing baseline fuels, the following equations shall apply:

$$ER_{y,i,j} = (FC_{BL,i,j} \times NCV_j \times (EF_{wf,CO2} + EF_{wf,non\,CO2}) \times N_{y,i,j}) - PE_y - LE_y \quad \text{(Equation 10)}$$

Where:

$FC_{BL,i,j}$ = Quantity of fuel consumed of type i per household in the baseline scenario; mass or volume unit per household cooking

NCV_j = Net calorific value of the baseline fuel that is displaced; TJ/tonne

[9] https://www.ghgprotocol.org/sites/default/files/ghgp/Global-Warming-Potential-Values%20%28Feb%2016%202016%29_1.pdf

$EF_{wf,CO2}$	=	CO2 emission factor for the use of fuel j in baseline scenario; tCO2e/TJ (IPCC default values must be used)
$EF_{wf,non\ CO2}$	=	Non-CO2 emission factor for the use of fuel j in baseline scenario; tCO2e/TJ (IPCC default values must be used)
$N_{y,i,j}$	=	Number of project devices of type i and batch j operating during year y
PE_y	=	Project emissions in year y; tCO2e
LE_y	=	Leakage in year y; tCO2e

$$PE_y = (FC_{PJ,i,j} \times NCV_j \times (EF_{wf,CO2} + EF_{wf,non\ CO2}) \times N_{y,i,j}) \quad \text{(Equation 11)}$$

Where:

$FC_{pj,i,j}$	=	Quantity of fuel consumed of type i per household in the project scenario; mass or volume unit per household cooking

Table 2: Default Values for fuel types

Emission Factor	Kerosene	Coal
CO2 emission factor (kg/TJ)	71,900	94,600
CH4 emission factor (kg/TJ)	10	300
N2O emission factor (kg/TJ)	0.6	1.5

9. Monitoring

9.1 Data and Parameters Available at Validation

Project proponents must follow the monitoring procedures outlined in sections 9.1 below.

Data / Parameter	B_{old}
Data unit	tonnes/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.
Equations	3 and 5
Source of data	Calculated according to options stated in 'Determination of quantity of firewood consumed in absence of project activity' as per options provided in Section 8.4 above
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	This parameter shall be determined ex-ante
Purpose of Data	Calculation of emission reduction
Comments	Parameter B_{old} once determined shall remain fixed for the entire crediting period. Where charcoal is used by baseline devices, a default wood to charcoal conversion factor of 4 kg of firewood per kg of charcoal must be used in line with the latest version of the CDM Tool 33.

Data / Parameter	n_p
Data unit	Fraction
Description	Efficiency of project device at the start of project activity

Equations	N/A
Source of data	Manufacturer's specification
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	This parameter shall be determined ex-ante
Purpose of Data	Calculation of n_{new}
Comments	N/A

Data / Parameter	f_{NRB}
Data unit	Fraction
Description	Fraction of woody biomass that can be established as non-renewable biomass
Equations	2 and 12
Source of data	Determined using one of the following options: i. Calculate a f_{NRB} value as per Appendix 1; or ii. Use the default value as provided in CDM TOOL33; or iii. Calculate a f_{NRB} value utilizing WISDOM[10]
Value applied	Determined based on any of the three options above mentioned above.
Justification of choice of data or description of measurement methods and procedures applied	This parameter shall be determined ex-ante
Purpose of Data	Calculation of $ER_{y,i,j}$

[10] Masera, Omar, et al. "WISDOM: A GIS-based supply demand mapping tool for woodfuel management." Biomass and Bioenergy 30.7 (2006): 618-637; http://www.wisdomprojects.net/global/method.asp; Bailis, R., Drigo, R., Ghilardi, A., & Masera, O. (2015). The carbon footprint of traditional woodfuels. Nature Climate Change, 5(3), 266-272. 15; Bailis, R., Wang, Y., Drigo, R., Ghilardi, A., & Masera, O. (2017). Getting the numbers right: Revisiting woodfuel sustainability in the developing world. Environmental Research Letters, 12(11), 115002.

Comments	N/A

Data / Parameter	NCV_j
Data unit	TJ/tonne
Description	Net calorific value of the baseline fuel that is displaced
Equations	10 and 11
Source of data	The latest IPCC default values shall be used for the specific baseline fuel.
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	This parameter shall be determined ex-ante
Purpose of Data	Calculation of $ER_{y,i,j}$ if displacing fuel with solar cooker
Comments	N/A

Data / Parameter	$FC_{BL,i,j}$
Data unit	Mass or volume unit per household cooking
Description	Quantity of fuel consumed of type i per household in the baseline scenario
Equations	11
Source of data	This may be calculated through three options: 1. *Ex post* Measurement Campaign: Consumption of baseline fuel is determined in a measurement campaign for a minimum of 15 days per year at a representative sample of targeted users who have solar cookers but do not use them for the duration of the campaign. The days selected for measurement of fuel consumption shall take into account seasonal and weekday/weekend differences in fuel consumption (if any), or else the data from the measurement campaign shall be extrapolated in order to take into account the seasonal

cooking patterns and fuel use. In locations where households use fossil fuels in standard unit weights/dimensions (e.g. honeycomb coal briquettes of 500g/unit), the counting of fossil fuel units used (e.g. number of briquettes) and the unit weight[11] (e.g. unit weight of coal briquette) may be used for the purpose of measurement. Fuel consumption data collected through sample-based measurements shall comply with the 90% confidence interval and 10% margin of error requirement. Households may be stratified into similar groups (k) or clusters according to the relevant characteristics of the sampled population (e.g. average income level, household occupancy, diet and cooking habits, climate/temperature zone, plus availability, price and type of fuel used). The latest version of CDM "Standard for sampling and surveys for CDM project activities and programme of activities" shall be complied with;

2. *Ex ante* Measurement Campaign: Consumption of baseline fuel is determined in a measurement campaign for a minimum of 90 days at a representative sample of targeted users before the acquisition/installation of the solar cookers. Fuel consumption is monitored using the same procedures and sampling requirements described in Option (1). This data on annual baseline fuel consumption obtained from households shall be cross checked with purchase receipt(s) submitted by the households. The values obtained are multiplied by 0.89[12] to account for uncertainties;
3. A group of users not supplied with project equipment shall be set up as a control group. The control group shall be made up of households that are as similar to the project participant group as possible. Relevant parameters of influence pertaining to the project region shall be defined and the control group shall be set up taking into account these parameters (e.g. average income level, household occupancy, diet and cooking habits, climate/temperature zone, and the availability, price and type of fuel used).[13] Fuel consumption of the control group is monitored throughout the crediting period,

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

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

[13] Alternatively, a conservative approach may be adopted in the sampling design to account for these issues.

	for a minimum of 15 days per year, using the same sampling requirements described in Option 1.
Value applied	Determined based on any of the three options above mentioned above.
Justification of choice of data or description of measurement methods and procedures applied	See source of data section above.
Purpose of Data	Calculation of $ER_{y,i,j}$ if displacing fuel with solar cooker
Comments	N/A

Data / Parameter	HW
Data unit	tonnes/household
Description	Average consumption of wood fuel per household, including fuelwood and charcoal, in the applicable area in the relevant period
Equations	14
Source of data	Use one of the following options: (a) Approved standardized baselines valid for the applicable area; or (b) Official statistics or peer-reviewed literature; or (c) Results of a sampling survey conducted as per the latest CDM version of "Standard for sampling and surveys for CDM project activities and programmes of activities"; or (d) The default value provided in CDM TOOL30 for the average annual consumption of woody biomass per person for cooking multiplied with the average number of people per household. The most recent available historical data shall be used. However, the vintage of the above data shall not be before year 2015.
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	N/A

Purpose of Data	Calculation of f_{NRB}
Comments	If national studies or government data are used, cross-check the values with global data (e.g. Global Forest Resources Assessment by the FAO, other UN data) and provide justification for any differences

Data / Parameter	CE
Data unit	tonnes
Description	Commercial woody biomass consumption for energy applications (e.g. commercial, industrial or institutional uses of woody biomass in ovens, boilers etc.) that are extracted from forests or other land areas in the applicable area in the relevant period
Equations	14
Source of data	For country or region, it may be determined through existing studies or government data or surveys. For the project area, it may be determined through surveys. The most recent available historical data shall be used. It shall be demonstrated that there is no double counting in calculating CE values, as a part of which may be actually used for household purposes (e.g. production of charcoal used for households may be already counted under HW). In case national studies or government data do not provide clear information to demonstrate that the values are only for commercial purpose and do not include household consumption, supporting evidence or an official letter of confirmation signed by appropriate government authority should be provided. In the absence of such evidence, the estimation of fuelwood and charcoal for energy applications in commercial sector shall be based on data on consumption estimates and not the supply of fuelwood and charcoal for energy applications as the latter is very likely to lead to double counting.
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of Data	Calculation of f_{NRB}

Comments	If national studies or government data are used, cross-check the values with global data (e.g. Global Forest Resources Assessment by the FAO, other UN data) and provide justification for any differences

Data / Parameter	NE
Data unit	Tonnes
Description	Commercial woody biomass consumption for non-energy applications (e.g. construction, furniture) that are extracted from forests or other land areas in the applicable area in the relevant period
Equations	14
Source of data	For country or region, it may be determined through existing studies or government data or surveys. For the project area, it may be determined through surveys. The most recent available historical data shall be used.
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of Data	Calculation of f_{NRB}
Comments	If national studies or government data are used, cross-check the values with global data (e.g. Global Forest Resources Assessment by the FAO, other UN data) and provide justification for any differences

Data / Parameter	N
Data unit	Number
Description	Number of households consuming fuel within the applicable area in the relevant period
Equations	14
Source of data	For country or region, it may be determined through existing studies or government data or surveys. For the project area, it may be determined through surveys.

	If the most recent available data for N is only available for an earlier year than the year for which the estimation of f_{NRB} (or other fuel usage) value is done, then the historical annual population growth rate may be used to estimate the population value for the year for which the f_{NRB} value (or other fuel usage) is established. For example, if the latest available historical population data is 2015, it may be extrapolated, taking into account the historical annual population growth rate to calculate the population in 2018 (year in which the estimation of f_{NRB} (or other fuel usage) is being done).
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of Data	Calculation of f_{NRB}
Comments	When average consumption of wood fuel per household (HW) is given in terms of average value per household using wood fuel, the number of households should be counted only for the households consuming wood fuel excluding the ones consuming other fuels

Data / Parameter	$MAI_{forest,i}$
Data unit	tonnes/ha/yr
Description	Mean Annual Increment of woody biomass growth per hectare in subcategory i of forest areas in the relevant period
Equations	15
Source of data	The following data source may be used: (a) Global Forest Resources Assessment 2000 by the FAO for "Distribution of total forest area by ecological zone" (Table 14); and/or (b) 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories for "Above-ground biomass growth rates for different ecological zones" (Chapter 4, Table 4.9). Use a weighted average based on the forest area of three categories (i.e. primary forests, above and below 20 years secondary forests), if such data is available. Otherwise, use a simple average of the two age categories of secondary

	forests or a simple average of the three categories if primary forests exist; and/or (c) National studies or government data or official statistics. The most recent available data shall be used. However, the vintage of the above data shall not be before year 2015 (unless data source option (a) is used). It is required to determine MAI values for different sub-categories of forest areas and other land areas. However, in the absence of the local data in the country, global data (such as 2019 Refinement to 2006 IPCC Guidelines) or data of similar ecological zones in other regions may be used with due justification. Further, if the MAI value for other land areas is not available in a country while only the MAI value for forest areas exits, the MAI value for forest areas may be used as the MAI value for other land areas with due justification.
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of Data	Calculation of f_{NRB}
Comments	If national studies or government data or official statistics are used, compare values with FAO and IPCC defaults and provide justification of differences. Mean Annual Increment (MAI) and Mean Annual Change (MAC) are two different concepts. The Annual Change in Growing Stock (m^3 /ha/year) should not be considered as MAI. In the context of this document, the MAI expresses the production potential of a land area to deliver woody biomass, and it should be understood as an average quantity of woody biomass produced per hectare of forest areas or other land areas during one year of growth (m^3/ha/year) or (tonnes/ha/year). The MAC, understood as net change in growing stock of total forest area, can be negative if there is a net reduction in the growing stock in a given year, say in the case of deforestation; however, the MAC is not used in the equations of this document.

Data / Parameter	$MAI_{other,i}$

Data unit	tonnes/ha/yr
Description	Mean Annual Increment of woody biomass growth per hectare in subcategory i of other land areas in the relevant period
Equations	15
Source of data	The following data source may be used: (a) Global Forest Resources Assessment 2000 by the FAO for "Distribution of total forest area by ecological zone" (Table 14); and/or (b) 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories for "Above-ground biomass growth rates for different ecological zones" (Chapter 4, Table 4.9). Use a weighted average based on the forest area of three categories (i.e. primary forests, above and below 20 years secondary forests), if such data is available. Otherwise, use a simple average of the two age categories of secondary forests or a simple average of the three categories if primary forests exist; and/or (c) National studies or government data or official statistics. The most recent available data shall be used. However, the vintage of the above data shall not be before year 2015 (unless data source option (a) is used). It is required to determine MAI values for different sub-categories of forest areas and other land areas. However, in the absence of the local data in the country, global data (such as 2019 Refinement to 2006 IPCC Guidelines) or data of similar ecological zones in other regions may be used with due justification. Further, if the MAI value for other land areas is not available in a country while only the MAI value for forest areas exits, the MAI value for forest areas may be used as the MAI value for other land areas with due justification.
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of Data	Calculation of f_{NRB}

Comments	If national studies or government data or official statistics are used, compare values with FAO and IPCC defaults and provide justification for differences. Mean Annual Increment (MAI) and Mean Annual Change (MAC) are two different concepts. The Annual Change in Growing Stock (m^3 /ha/year) should not be considered as MAI. In the context of this document, the MAI expresses the production potential of a land area to deliver woody biomass, and it should be understood as an average quantity of woody biomass produced per hectare of forest areas or other land areas during one year of growth (m^3/ha/year) or (tonnes/ha/year). The MAC, understood as net change in growing stock of total forest area, can be negative if there is a net reduction in the growing stock in a given year, say in the case of deforestation; however, the MAC is not used in the equations of this document.

Data / Parameter	$F_{forest,i}$
Data unit	hectares
Description	Extent of forest in sub-category i in the relevant period
Equations	15
Source of data	The following data source may be used: (a) Global Forest Resources Assessment by the Food and Agriculture Organization of the United Nations (FAO); (b) Official statistics; (c) Project-specific survey data. (d) Remote sensing analysis If the value of f_{NRB} is calculated for a project area for the year y, and during this year a decrease in the forest area is projected to occur, the extent of the forest area available to provide woody biomass to the users can correspond to the forest area (hectares) at the beginning of the year y, or the average of the values of the forest area at the beginning and at the end of the year y.
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	N/A

Purpose of Data	Calculation of f_{NRB}
Comments	Project Proponents are permitted to utilise emerging technology (e.g. remote sensing) with known uncertainty to measure changes in carbon stocks for the class of vegetation cover. These emerging technology approaches must be supported by peer-reviewed literature which validates their accuracy and uncertainty. Justification for the chosen approach should be documented in the Project Description Document supplemented with appropriate evidence. Any uncertainty in the approach used must be discounted for. Models must at a minimum: • be publicly available from a reputable and recognized source (e.g., the model developer's website, IPCC, or government agency); and • have been appropriately reviewed and tested under similar ecosystemic conditions by a recognized, competent organization, or an appropriate peer review group; and • have comprehensive and appropriate requirements for estimating uncertainty in keeping with IPCC or other appropriate guidance, and the model shall be calibrated by parameters such as geographic location and local climate data; and • apply conservative factors to discount for model uncertainty and shall use conservative assumptions and parameters that are likely to underestimate, rather than overestimate, the GHG emission reductions. All parameters, data sources and assumptions applied by the emerging technology, alongside evidence of compliance with the minimum requirements outlined above, must be documented in the Project Description Document.

Data / Parameter	$F_{other,i}$
Data unit	hectares
Description	Extent of other land in sub-category i in the relevant period
Equations	15
Source of data	The following data source may be used: (a) Global Forest Resources Assessment by the Food and Agriculture Organization of the United Nations (FAO); (b) Official statistics; (c) Project-specific survey data.

	(d) Remote sensing analysis If the value of f_{NRB} is calculated for a project area for the year y, and during this year a decrease in the other land area is projected to occur, the extent of the other land area available to provide woody biomass to the users can correspond to the other land area (hectares) at the beginning of the year y, or the average of the values of the other land area at the beginning and at the end of the year y.
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of Data	Calculation of f_{NRB}
Comments	Project Proponents are permitted to utilise emerging technology (e.g. remote sensing) with known uncertainty to measure changes in carbon stocks for the class of vegetation cover. These emerging technology approaches must be supported by peer-reviewed literature which validates their accuracy and uncertainty. Justification for the chosen approach should be documented in the Project Description Document supplemented with appropriate evidence. Any uncertainty in the approach used must be discounted for. Models must at a minimum: • be publicly available from a reputable and recognized source (e.g., the model developer's website, IPCC, or government agency); and • have been appropriately reviewed and tested under similar ecosystemic conditions by a recognized, competent organization, or an appropriate peer review group; and • have comprehensive and appropriate requirements for estimating uncertainty in keeping with IPCC or other appropriate guidance, and the model shall be calibrated by parameters such as geographic location and local climate data; and • apply conservative factors to discount for model uncertainty and shall use conservative assumptions and parameters that are likely to underestimate, rather than overestimate, the GHG emission reductions. All parameters, data sources and assumptions applied by the emerging technology, alongside evidence of compliance with the minimum requirements outlined above, must be documented in the Project Description Document.

Data / Parameter	$P_{forest,i}$
Data unit	Hectares
Description	Extent of non-accessible area due to geographically remoteness) within forest areas (in sub-category i) in the relevant period.
Equations	15
Source of data	The following data source may be used: (a) Global Forest Resources Assessment by the Food and Agriculture Organization of the United Nations (FAO); (b) Official statistics; (c) Project-specific survey data. (d) Remote sensing analysis Conservatively, it is assumed that forests and wooded areas within a distance of 2.5 thousand meters (km) of all roads are harvestable, regardless of how geographically remote or inaccessible these roads may be. This is conservative when compared with studies analysing walk durations to fuelwood sourced for poor and non-poor households. Jumbe & Angelson (2011); Bandyopadhyay et al., (2011). All areas that are accessible to either the forest industries or to individual households are considered to be “accessible”. Therefore, wood extraction by the forest industries and fuelwood collection by individual households should both be considered when estimating the “non-accessible areas”
Value applied	NA
Justification of choice of data or description of measurement methods and procedures applied	Approach ensures conservative estimates of non-renewable biomass.
Purpose of Data	Calculation of f_{NRB}
Comments	Protected areas accessible for wood extraction shall also be considered “Assessible”. Whilst wood extraction is typically not permitted in these areas, analysis suggests that this activity still occurs (Angelstam et al., 2021). The inclusion of protected areas shall also increase the conservatism.

Data / Parameter	$P_{other,i}$
Data unit	Hectares
Description	Extent of non-accessible area due to geographically remoteness) within other wooded areas (in sub-category i) in the relevant period.
Equations	15
Source of data	The following data source may be used: (e) Global Forest Resources Assessment by the Food and Agriculture Organization of the United Nations (FAO); (f) Official statistics; (g) Project-specific survey data. (h) Remote sensing analysis Conservatively, it is assumed that forests and wooded areas within a distance of 2.5 thousand meters (km) of all roads are harvestable, regardless of how geographically remote or inaccessible these roads may be. This is conservative when compared with studies analysing walk durations to fuelwood sourced for poor and non-poor households. Jumbe & Angelson (2011); Bandyopadhyay et al., (2011). All areas that are accessible to either the forest industries or to individual households are considered to be “accessible”. Therefore, wood extraction by the forest industries and fuelwood collection by individual households should both be considered when estimating the “non-accessible areas”
Value applied	NA
Justification of choice of data or description of measurement methods and procedures applied	Approach ensures conservative estimates of non-renewable biomass.
Purpose of Data	Calculation of f_{NRB}
Comments	Protected areas accessible for wood extraction shall also be considered “Assessible”. Whilst wood extraction is typically not permitted in these areas, analysis suggests that this activity still occurs (Angelstam et al., 2021). The inclusion of protected areas shall also increase the conservatism.

Data / Parameter	CF
Data unit	-
Description	Wood-to-charcoal conversion factor
Equations	N/A
Source of data	CDM Tool 33.
Value applied	Charcoal conversion factor of 4 kg of firewood per kg of charcoal must be used in line with the latest version of the CDM Tool 33.
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of Data	Calculation of f_{NRB}
Comments	N/A

9.2 Data and Parameters Monitored

Project proponents must follow the monitoring procedures outlined in sections 9.2 below.

Data / Parameter:	$N_{y,j,k}$
Data unit:	Number
Description:	Number of project devices of type i and batch j operating during year y
Equations	2
Source of data:	Monitoring survey
Description of measurement methods and procedures to be applied:	Measured directly or based on a representative sample. Sampling standard shall be used for determining the sample size to achieve 90/10 confidence precision according to the latest version of CDM standard for sampling and surveys for project activities and programme of activities. Alternately, simplified approach proposed in option (b) under Section 8.4 above may be used for determining the minimum

	sample size in which case compliance with 90/10 confidence precision is not obligatory.
Frequency of monitoring/recording:	At least once every two years
QA/QC procedures to be applied:	N/A
Purpose of data:	Calculation of emission reduction
Calculation method:	N/A
Comments:	Proportion of operational devices obtained from the survey is multiplied by the total operational devices to arrive at this value.

Data / Parameter:	$n_{new,i,j}$
Data unit:	Fraction
Description:	Efficiency of the device of each type i and batch j implemented as part of the project activity
Equations	3 and 4
Source of data:	Measurements at project facility
Description of measurement methods and procedures to be applied:	Project devices produced in the formal sector do not vary in characteristics such as design, material, critical dimensions, etc. beyond a range of acceptable limits hence efficiency shall be measured as per the following: i. Conduct WBT test on a sample of three project devices with three tests conducted for each device. The test can be carried out by project proponents by themselves or device's manufacturers or other third parties. ii. Efficiency to be tested is high-power thermal efficiency. The high-power thermal efficiency is the average of the Cold Start and Hot Start phases[14]. iii. The average of all results for each device type/model and batch shall be taken as the efficiency for each device type and batch. iv. If the standard deviation of the test results indicated above is very small[15] and 90/10 precision requirement is met (in

[14] CDM Methodologies Panel Clarification on water boiling test under AMS II.G (SSC_752)

[15] Less than or equal to 0.05

	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.
Frequency of monitoring/recording:	Annually
QA/QC procedures to be applied:	N/A
Purpose of data:	Calculation of emission reduction (non-solar cookers)
Calculation method:	N/A
Comments:	N/A

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
Equations	4
Source of data:	Survey
Description of measurement methods and procedures to be applied:	Minimum sample size of each type i and batch j should be in line with the latest version of the CDM guidelines for sampling and surveys for project activities and programme of activities or guidelines provided in section 8.4 option (b). 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. (a) Baseline devices have been completely decommissioned and only project devices 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 firewood being used by each device. In other words, if more than one device, or another device that consumes firewood, are in use in project households, then the sample survey needs to distinguish the quantity

	of firewood used by the project device and the other devices that use firewood.
Frequency of monitoring/recording:	Determined in the first year of project implementation
QA/QC procedures to be applied:	N/A
Purpose of data:	Calculation of emission reduction
Calculation method:	N/A
Comments:	N/A

Data / Parameter:	μ_y
Data unit:	Fraction
Description:	Adjustment to account for any continued use of pre-project devices during the year y
Equations	5
Source of data:	Monitoring
Description of measurement methods and procedures to be applied:	Minimum sample size of each type i and batch j should be in line with guidelines provided in section 8.4 option (b). This parameter should be monitored using one of the following methods: (a) If the baseline devices are decommissioned and no longer used, as determined by the monitoring survey its value is 0 and B_{old}, adjusted is equal to B_{old}. (b) If both the project devices and baseline devices are used together then surveys shall be conducted to record the average continued operation of baseline devices in a sample of households. The surveys should be designed to capture the cooking habits and device usage of households in the region, including quantification of use of baseline devices, by formulating questions and/or collecting evidence to determine the frequency of usage of both the project devices and baseline devices. For example, if there were 3 baseline devices in a 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 0.33 is applied to B_{old}. Another example would be the case where there was only one baseline devices per household and its use during the project period continues along with the project devices to meet 25% of the

	cooking needs of the household in which case the adjustment factor will be 0.25. Another example would be to interview the household and have them estimate the time of usage of the baseline devices and project device on an average day.[16]
Frequency of monitoring/recording:	At least once every two years
QA/QC procedures to be applied:	N/A
Purpose of data:	Calculation of emission reduction
Calculation method:	For Projects that opt for $B_{y=1,new,i,j,survey}$, i.e., direct measurement of biomass used in project devices, then μ_y is not required to be computed.
Comments:	N/A

Data / Parameter:	n_{old}
Data unit:	Fraction
Description:	Efficiency of baseline devices
Equations	3 and 4
Source of data:	Default value: 0.15 (three-stone fire using firewood) or 0.25 (Charcoal or other devices)[17]; or Surveyed prior to implementation of project activity
Description of measurement methods and procedures to be applied:	(a) A default value of 0.15 shall be used if baseline device 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. (b) A default value of 0.25 shall be used for other types of devices. (c) If more than one type of baseline device is being replaced in the project region, weighted average values (taking the amount of woody biomass consumed by each device as the weighting factor) shall be used.

[16] For example, if a household reports to be preparing 3 meals in a day using 35 minutes each, out of which one meal is prepared on the baseline devices, then cooking time on the baseline devices and project devices would be 0.33 and 0.66 respectively.

[17] The value prescribed by the latest version of CDM TOOL33 must be used

	If this parameter is surveyed, project promoters may use simplified guidelines stated under Option (b) in Section 8.4 above for arriving at the minimum sample size.
Frequency of monitoring/recording:	Fixed for each individual household at the time of project implementation
QA/QC procedures to be applied:	N/A
Purpose of data:	Calculation of emission reduction
Calculation method:	N/A
Comments:	N/A

Data / Parameter:	Lifespan
Data unit:	Years
Description:	The operating lifetime of project devices
Equations	N/A
Source of data:	Manufacturer's specification
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	Once at the time of Project devices installation
QA/QC procedures to be applied:	N/A
Purpose of data:	Calculate efficiency of device at the year of use
Calculation method:	N/A
Comments:	N/A

Data / Parameter:	$N_{y,i}$
Data unit:	Number
Description:	Number of project devices of type i operating during year y
Equations	8
Source of data:	Monitoring
Description of measurement methods and procedures to be applied:	Measured directly or based on a representative sample. Sampling standard shall be used for determining the sample size to achieve 90/10 confidence precision according to the latest version of Standard for sampling and surveys for project activities and programme of activities Alternately, simplified approach proposed in option (b) under Section 8.4 above may be used for determining the minimum sample size in which case compliance with 90/10 confidence precision is not obligatory.
Frequency of monitoring/recording:	Annual
QA/QC procedures to be applied:	N/A
Purpose of data:	Calculation of emission reduction
Calculation method:	N/A
Comments:	Proportion of operational devices obtained from the survey is multiplied by the total operational devices (in use) to arrive at this value.

Data / Parameter:	$B_{Renewable,y}$
Data unit:	tonnes
Description:	Quantity of renewable biomass used by project devices in tonnes per device of type i
Equations	8
Source of data:	Survey
Description of measurement methods	Minimum sample size of each type i and batch j should be in line with the guidelines for sampling and surveys for project activities and programme of activities or guidelines provided in section 8.4 option (b)

and procedures to be applied:	in which case requirements to meet confidence/ precision is not obligatory. Determined 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. (i) Baseline devices have been completely decommissioned and only project devices 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 firewood being used by each device. In other words, if more than one device, or another device that consumes firewood, are in use in project households, then the sample survey needs to distinguish the quantity of firewood used by the project device and the other devices that use firewood.
Frequency of monitoring/recording:	Annual
QA/QC procedures to be applied:	N/A
Purpose of data:	Calculation of emission reduction
Calculation method:	N/A
Comments:	N/A

Data / Parameter:	$n_{PJ/BL}$
Data unit:	Fraction
Description:	Ratio of Efficiency of project devices and baseline devices
Equations	8
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	(a) Both PJ and BL to be measured once prior to validation using same test procedure. (b) Test results from accredited lab are acceptable if it can be established that it was done as per national/international standards.

	Alternatively, WBT test on a sample of three devices with three tests conducted for each devices can be used. The test can be carried out by project proponents by themselves or devices manufacturers or other third parties.
Frequency of monitoring/recording:	Once prior to validation
QA/QC procedures to be applied:	N/A
Purpose of data:	Calculation of emission reduction
Calculation method:	N/A
Comments:	N/A

Data / Parameter:	$NCV_{biomass}$
Data unit:	TJ/tonne
Description:	Net calorific value of the non-renewable woody biomass, renewable biomass, briquettes or pellets used in project devices
Equations	2 and 8
Source of data:	Default or measured
Description of measurement methods and procedures to be applied:	(a) IPCC default for wood fuel, 0.0156 TJ/tonne, based on the gross weight of the wood that is 'air-dried' may be used if fuel used in project device is woody biomass/renewable biomass. For the case of processed renewable biomass (e.g. briquettes), test report from laboratories according to relevant national/international standards or manufacturer's data or test reports.
Frequency of monitoring/recording:	Annual
QA/QC procedures to be applied:	Measurement in laboratories according to relevant national / international standards based on dry biomass. Consistency of the measurements to be checked by comparing the measurement results with measurements from previous years, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC.
Purpose of data:	Calculation of emission reduction

Calculation method:	N/A
Comments:	N/A

Data / Parameter:	$FC_{PJ,i,j}$
Data unit:	Mass or volume unit per household cooking
Description:	Quantity of fuel consumed of type i per household in the project scenario
Equations	11
Source of data:	Determined through a measurement campaign for a minimum of 30 days per year (to take into account variations in weather conditions that would impact use of solar cookers) at a representative sample of targeted users.
Description of measurement methods and procedures to be applied:	Consumption of baseline fuel is determined in a measurement campaign for a minimum of 30 days per year at a representative sample of targeted users who have solar cookers but do not use them for the duration of the campaign. The days selected for measurement of fuel consumption shall take into account seasonal and weekday/weekend differences in fuel consumption (if any), or else the data from the measurement campaign shall be extrapolated in order to take into account the seasonal cooking patterns and fuel use. In locations where households use fossil fuels in standard unit weights/dimensions (e.g. honeycomb coal briquettes of 500g/unit), the counting of fossil fuel units used (e.g. number of briquettes) and the unit weight[18] (e.g. unit weight of coal briquette) may be used for the purpose of measurement. Fuel consumption data collected through sample-based measurements shall comply with the 90% confidence interval and 10% margin of error requirement. Households may be stratified into similar groups (k) or clusters according to the relevant characteristics of the sampled population (e.g. average income level, household occupancy, diet and cooking habits, climate/temperature zone, plus availability, price and type of fuel used). The latest version of CDM "Standard for sampling and surveys for CDM project activities and programme of activities" shall be complied with;
Frequency of monitoring/recording:	This parameter shall be determined ex-ante

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

QA/QC procedures to be applied:	N/A
Purpose of data:	Calculation of PE_y if displacing fuel with solar cooker.
Calculation method:	N/A
Comments:	N/A

9.3 Description of the Monitoring Plan

The project proponent shall maintain a record for the date of commissioning of project devices of each type i and batch j. Relevant parameters shall be monitored and recorded during the crediting period as indicated in section 9 above. The applicable requirements specified in the latest version of "General guidelines for SSC CDM methodologies" must be followed by the project participants. Only operational project devices shall be monitored by the project i.e., the device has been distributed to the project stakeholders and is being used.

Data Recording

The project proponent must compile data on each device that is derived from the total sales record with project technologies differentiated by different project scenarios. This data must be differentiated into sections based on the results of the applicable monitoring studies for each project scenario, so that emission reduction calculations can be conducted appropriately section by section. Devices aged beyond their useful lifetime, as established in the usage survey, are removed from the project and no longer credited.

The following is the minimum information that must be captured for each project device in order to be eligible for inclusion in the project:

1. Date of sale
2. Geographic area of sale
3. Date of distribution and delivery to stakeholder
4. Model/type of project technology sold/distributed
5. Quantity of project technologies sold/distributed
6. Name and telephone number (if available), and address of recipient
7. Unique identification alpha/numeric ID for each device that is sold/distributed

In any given year, emission reductions can only be claimed for devices that are demonstrated to be in place and operational. An annual survey must be conducted for sites included in the project to determine the number of devices that remain in operation. To ensure that emissions reductions are accurately calculated, the months of operation per device shall be calculated to reflect devices that have been operational for less than 12 months in the year. This shall be calculated using the “Date of distribution and delivery to stakeholder” recorded for the device.

The survey must obtain, at minimum, the following:

1. The devices distributed under the project that are being used.
2. The project devices are operational and in good condition.
3. Baseline devices, if any are being used along with the project devices.
4. Monthly fuel consumption per household.
5. A photo of the device.

Where devices monitor usage in real-time, the data collected may be used to evidence device usage (points 1 and 2 above).

10. References

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10. Gold Standard “Technologies and Practices to Displace Decentralized Thermal Energy Consumption” (Version 4.0); https://globalgoals.goldstandard.org/standards/407_V4.0_EE_ICS_Reduced-Emissions-from-Cooking-and-Heating-TPDDTEC.pdfhttps://www.goldstandard.org/project-developers/standard-documents
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12. Kar, A., Brauer, M., Bailis, R., & Zerriffi, H. (2020). The risk of survey bias in self-reports vs. actual consumption of clean cooking fuels. *World development perspectives*, *18*, 100199.
13. Masera, Omar, et al. "WISDOM: A GIS-based supply demand mapping tool for woodfuel management." Biomass and Bioenergy 30.7 (2006): 618-637
14. Policy Research Working Paper 6903- Household Cooking Fuel Choice and Adoption of Project devices in Developing Countries – A Review, https://openknowledge.worldbank.org/handle/10986/18775
15. Technical Report 007/15: The State of the Global Clean And Improved Cooking Sector, https://openknowledge.worldbank.org/handle/10986/21878
16. The latest version of the CDM General guidelines for SSC CDM methodologies.
17. The latest version of the CDM Standard for sampling and surveys for CDM project activities and programme of activities.
18. Water Boiling Test Protocol 4.2.3; https://www.cleancookingalliance.org/binarydata/DOCUMENT/file/000/000/399-1.pdf

Appendix 1: Calculation of the fraction of non-renewable biomass

The following tool is based on the latest version of the CDM TOOL30.

Project proponents shall calculate f_{NRB} by determining the share of renewable and non-renewable woody biomass in the total quantity of woody biomass consumption for the region (e.g. state that the project area resides within) or the project area (hereinafter referred as the applicable area) following the procedure and requirements in the paragraphs below. Where the project area operates across several regions, all regions shall be analysed. The project participants shall compare and analyse the calculated values against the values for f_{NRB} reported in relevant scientific literature and justify any differences. This analysis shall be included in the appropriate section of the PDD. The relevant scientific literature should include at least:

Bailis, R.; Drigo, R.; Ghilardi, A. & Masera, O. (2015). The carbon footprint of traditional woodfuels. Nature Climate Change, 5(3), pp. 266–272.

The fraction of woody biomass that can be established as non-renewable is:

$$f_{NRB} = \frac{NRB}{NRB + RB}$$

(Equation 12)

Where:

f_{NRB}	=	Fraction of non-renewable biomass in the applicable area in the relevant period; %
NRB	=	Quantity of non-renewable biomass consumed in the applicable area in the relevant period; tonnes
RB	=	Quantity of renewable biomass consumed in the applicable area in the relevant period; tonnes

The relevant period should be one year. The value of f_{NRB} for the applicable area shall be calculated using either of the two following options:

(a) Ex ante: the f_{NRB} value is determined once at the validation stage, thus no monitoring and recalculation of the f_{NRB} value during the crediting period is required;

(b) Ex post: the $f_{NRB,y}$ value is determined for the year y in the crediting period, requiring the f_{NRB} value to be updated annually, following a consistent calculation procedure throughout the crediting period.

In the case of ex ante calculation of f_{NRB}, the parameter f_{NRB} shall be estimated using the most recent historical year for which data is available. In the case of ex-post calculation of f_{NRB}, the parameter f_{NRB} shall be estimated for the applicable year y of the crediting period. Where available, the same vintage of data

should be used for all parameters applied in this tool to calculate f_{NRB}. Where data for one single vintage is not available for all parameters, different vintages may be used for parameters, as long as it can be justified (e.g. the use of different vintages leads to a conservative estimate of f_{NRB}).

The quantity of non-renewable biomass consumed in the applicable area (NRB) shall be determined as the difference between the total consumption of woody biomass in the applicable area (H) and the quantity of renewable biomass that can be sustainably harvested in the applicable area (RB):

$$NRB = H - RB \quad \text{(Equation 13)}$$

Where:

H	=	Total consumption of woody biomass in the applicable area in the relevant period; tonnes
NRB	=	Quantity of non-renewable biomass consumed in the applicable area in the relevant period; tonnes
RB	=	Quantity of renewable biomass consumed in the applicable area in the relevant period; tonnes

Cubic meters (m^3) instead of tonnes (t) of wood may be used for estimation of fNRB values, as long as the same unit and the same conversion factor (e.g. wood density, moisture content) are consistently used for estimation of both the total consumption of woody biomass (H) and the renewable biomass available (RB).

Procedure to estimate the total consumption of woody biomass (H)

The total consumption of woody biomass (H) is calculated using the following equation, accounting for all consumption within the applicable area (not only wood fuel but also timber and industrial consumption):

$$H = (HW \times N) + CE + NE \quad \text{(Equation 14)}$$

Where:

H	=	Total consumption of woody biomass in the applicable area in the relevant Period; tonnes
HW	=	Average consumption of wood fuel per household, including fuelwood and charcoal, in the applicable area in the relevant period; tonnes/household
CE	=	Commercial woody biomass consumption for energy applications (e.g. commercial, industrial or institutional uses of woody biomass in ovens, boilers etc.) that are extracted from forests or other land areas in the applicable area in the relevant period; tonnes
NE	=	Commercial woody biomass consumption for non-energy applications (e.g. construction, furniture) that are extracted from forests or other land areas in the applicable area in the relevant period; tonnes

N = Number of households consuming wood fuel within the applicable area in the relevant period; number

For the purpose of this tool, wherever charcoal is used for household or commercial applications, the corresponding quantity of wood fuel shall be determined using a wood to charcoal conversion factor (CF).

When using data expressed in inventoried volumes (e.g. industrial roundwood) to estimate commercial woody biomass consumption for non-energy applications (e.g. construction, furniture), a biomass expansion factor (i.e. ratio of aboveground oven-dry biomass of trees to oven-dry biomass of inventoried volume) may be used to consider the above ground biomass within trunks and branches.

A biomass expansion factor shall not be applied to fuel wood consumption by households or commercial woody biomass consumption for energy applications, when estimating the parameters HW and CE in the equations above.

Procedure to estimate the quantity of renewable biomass available (RB)

The quantity of renewable biomass available in the applicable area (RB) is estimated using the following equation:

$$RB = \sum \left(MAI_{forest,i} \times \left(F_{forest,i} - P_{forest,i} \right) \right) + \left(\sum MAI_{other,i} \times \left(F_{other,i} - P_{other,i} \right) \right)$$

(Equation 15)

Where:

$MAI_{forest,i}$ = Mean Annual Increment of woody biomass growth per hectare in subcategory i of forest areas in the relevant period; tonnes/ha/year

$F_{forest,i}$ = Extent of forest in sub-category i in the relevant period; hectares

$P_{forest,i}$ = Extent of non-accessible area due to geographically remoteness[19] within forest areas (in subcategory i) in the relevant period; hectares

$MAI_{other,i}$ = Mean Annual Increment of woody biomass growth per hectare in subcategory i of other land areas in the relevant period; tonnes/ha/year

$P_{other,i}$ = Extent of non-accessible area due to geographically remoteness within other land areas (in subcategory i) in the relevant period; hectares

$F_{other,i}$ = Extent of other land in sub-category i in the relevant period; hectares

i = Sub-category i of forest areas and other land areas[20]

[19] Conservatively, it is assumed that forests and wooded areas within a distance of 2.5 thousand meters (km) of all roads are harvestable, regardless of how geographically remote or inaccessible these roads may be. This is conservative when compared with studies analysing walk durations to fuelwood sourced for poor and non-poor households. Jumbe & Angelson (2011); Bandyopadhyay et al., (2011).

[20] Other land areas shall include any land areas from which woody biomass may be sourced, such as wooded lands and agricultural lands. Where any of potential sources of supply are not taken into account, it shall be justified.