JCM Proposed Methodology Form

Cover sheet of the Proposed Methodology Form

Form for submitting the proposed methodology

Host Country	The Kingdom of Cambodia
Name of the methodology proponents submitting this form	Tokyo Carbon Management Ltd (TCM)
Sectoral scope(s) to which the Proposed Methodology applies	3. Energy demand
Title of the proposed methodology, and version number	Energy Saving by Introduction of High Efficiency Firewood Cookstove to Replace Traditional Cookstove, Version 01.0
List of documents to be attached to this form (please check):	☐The attached draft JCM-PDD: ☒Additional information:
Date of completion	23/02/2024

History of the proposed methodology

Version	Date	Contents revised
01.0	31/07/2023	First Edition

A. Title of the methodology

Energy Saving by Introduction of High Firewood Efficiency Cookstove to Replace Traditional Cookstove, Version 01.0

B. Terms and definitions

Terms	Definitions
Batch	Batch is the population of the device of the same type commissioned during a certain period of time (e.g. week or month) in 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 is used as the date of commissioning for the entire batch.
Reference cookstove	The cookstove style in which three-stones are placed on the ground using firewood (not charcoal), or a cookstove with no improved combustion air supply or flue gas ventilation.

C. Summary of the methodology

Items	Summary
GHG emission reduction measures	The proposed project activity aims at reducing the use of and demand for non-renewable biomass that would have been used for cooking by distributing improved cookstove (ICS, project cookstove) to households and/or communities.
Calculation of reference reductions	Reference emissions are calculated for each reference cookstove by using the following parameters: • Quantity of woody biomass used by reference cookstove • Fraction of woody biomass saved by the project activity that can be considered as non-renewable biomass • Net calorific value of the non-renewable woody biomass • Emission factor of fossil fuel projected to be used to substitute non-renewable woody biomass • Adjustment to account for any continued use of

	reference cookstove • Discount factor to account for the potential source of emissions which may occur due to the use of biomass by non-project households/communities
Calculation of project reductions	The project emissions are calculated for each project cookstove by using the following parameters: • Quantity of woody biomass used by project cookstove • Fraction of woody biomass that can be considered as non-renewable biomass • Net calorific value of the non-renewable woody biomass that is used by project cookstove • Emission factor of fossil fuel projected to be used to substitute non-renewable woody biomass • Adjustment to account for any continued use of reference cookstove
Monitoring parameters	• Number of project cookstove commissioned • Proportion of commissioned project cookstove remain operating • Adjustment to account for any continued use of reference cookstove • Quantity of woody biomass that is used per project cookstove (Option 2) • Number of project cookstoves distributed per household • Date of commissioning of batch j • Date of commissioning of project device i • The operating lifetime of project device • Operation years of the project cookstove

D. Eligibility criteria

This methodology is applicable to projects that satisfy all of the following criteria.

Criterion 1	The project distributes cookstoves to households or community (ies) where the reference cookstove is three-stone fire.
Criterion 2	The project cookstoves exclusively use wood fuel.
Criterion 3	The methodology is applicable to the introduction of single pot or multi pot portable or in-situ cookstoves with rated efficiency of at least 25 per cent. The options for testing and certification of rated efficiency as well as supporting

	documentation (e.g. certificate issued by third party or test results) are available at the time of validation.
Criterion 4	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.
Criterion 5	Each project cookstove is given an identifiable serial number to avoid double counting of emission reductions.
Criterion 6	The project has procedures to prevent double counting of emission reductions, for example to avoid that project stove manufacturers, wholesale providers or others claim credit for emission reductions from the project devices.

E. Emission Sources and GHG types

Reference emissions	
Emission sources	GHG types
Wood fuel consumption by reference cookstove	CO_2
	N_2O
	CH_4
Project emissions	
Emission sources	GHG types
Wood fuel consumption by project cookstove	CO_2
	N_2O
	CH_4

F. Establishment and calculation of reference emissions

F.1. Establishment of reference emissions

The reference emissions are calculated for each reference cookstove by multiplying the quantity of woody biomass that is used by the reference cookstove, the fraction of non-renewable biomass, net calorific value of the non-renewable biomass, the emission factor of fossil fuel projected to substitute non-renewable woody biomass, adjustment to account for any continued use of reference cookstove and the conservative emission factor.
It is assumed that in the absence of project activity, the reference scenario is the continued use

of non-renewable biomass in the reference cookstove by the target population to meet the similar thermal energy needs as those provided by the project cookstove.
The actual reference scenario used in the calculation is the use of fossil fuel. Since non-renewable biomass has higher carbon intensity than the fossil fuel, this calculation leads to the conservative emission reductions. The quantity of biomass used in reference cookstove for target customer will be determined in each project activity.
The efficiency of reference cookstove is conservatively set *ex ante* at 0.15 so as to ensure net emission reductions.

F.2. Calculation of reference emissions

$$RE_p = \sum_i \sum_j RE_{p,i,j} \qquad \textbf{Equation (1)}$$

Where:

i	:	Indices for the type of project cookstove
j	:	Indices for batch of project cookstove of type *i*
RE_p	:	Reference emission during the period *p* (tCO_2e/p)
$RE_{p,i,j}$	:	Reference emission by reference cookstove for the project cookstove of type *i* and batch *j* during the period *p* (tCO_2e/p)

$$RE_{p,i,j} = B_{ref,i,j} \times f_{NRB} \times NCV_{biomass} \times EF_{projected\ fossil\ fuel} \times N_{p,i,j} \times n_{p,i,j} \times \mu_p \times 0.95 \qquad \textbf{Equation (2)}$$

Where:

$B_{ref,p,i,j}$	:	Quantity of woody biomass that is used per reference cookstove before replaced by the project cookstove of type *i* and batch *j* during the period *p* (tonne/p)
f_{NRB}	:	Fraction of woody biomass that can be established as non-renewable biomass (fraction or %)
$NCV_{biomass}$	:	Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.0156 TJ/tonne, based on the gross weight of the wood that is "air-dried")
$EF_{projected\ fossil\ fuel}$	:	Emission factor of fossil fuels projected to be used to substitute non-renewable woody biomass by similar consumers (tCO_2e/TJ)
$N_{p,i,j}$	:	Number of project cookstoves of type i and batch j commissioned during the period *p* (number)

$n_{p,i,j}$	:	Proportion of commissioned project device of type *i* and batch *j* during the period *p*
μ_p	:	Adjustment to account for any continued use of reference cookstove during the period *p*
0.95	:	Discount factor to account for the potential source of leakage due to the use of biomass by non-project households/ communities

$B_{ref,p,i,j}$ is estimated as per any of the following options:

Option 1: $B_{ref,p,i,j}$ is estimated via $B_{ref,HH}$. There are 2 cases below:

In case more than one project cookstove is distributed in households:

$$B_{ref,p,i,j} = B_{ref,HH} \div N_{d,HH} \quad \textbf{Equation (3)}$$

$$B_{ref,HH} = B_{ref,p} \times N_{p,HH} \quad \textbf{Equation (4)}$$

In case only one project cookstove per household is distributed:

$$B_{ref,p,i,j} = B_{ref,HH} \quad \textbf{Equation (5)}$$

Where:

$B_{ref,p,HH}$	:	Quantity of woody biomass that would have been used in the household in the absence of the project activity to generate thermal energy equivalent to that provided by the project devices during the period *p* (tonne/household/period)
$N_{d,HH}$	:	Number of project devices per household (number)
$B_{ref,p,p}$	:	Quantity of woody biomass that would have been used per person in the household in the absence of the project activity to generate thermal energy equivalent to that provided by the project devices during the period *p* (tonne/person/period). A default value for the average annual consumption of woody biomass is 0.4 tonne/person/year may be used[1]
$N_{p,HH}$	:	Average number of person per household prior to project implementation (number)

Option 2:

$$B_{ref,p,i,j} = B_{pc,i,j} \times \frac{\eta_{pc,y,i,j}}{\eta_{ref,i,j}} \quad \textbf{Equation (6)}$$

Where:

$B_{pc,p,i,j}$	:	Quantity of woody biomass used by project cookstove in tonnes per device of type *i* and batch *j* during the period *p* (tonne/period)
$\eta_{pc,p,i,j}$	:	Efficiency of the project cookstove i and batch j during the period *p*

[1] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-33-v2.0.pdf

(fraction). Alternatively, efficiency may be determined using Equation (6)

$\eta_{ref,i,j}$: Efficiency of the reference cookstove being replaced by project cookstove of type *i* and batch *j* (fraction). A default value for this parameter used for cooking and/or water boiling applications is 0.15[2].

$$\eta_{pc,p,i,j} = \eta_{pc,1,i,j} \times (0.99^{y-1}) \times 0.94 \quad \textbf{Equation (7)}$$

$\eta_{pc,1,i,j}$: Efficiency of the project cookstove type *i* and batch *j* at the start of project activity (fraction)

0.99 : Discount factor to account for efficiency loss of project cookstove per year of operation (fraction)

0.94 : Adjustment factor to account for uncertainty related to project cookstove efficiency test

G. Calculation of project emissions

$$PE_p = \sum_i \sum_j PE_{p,i,j} \quad \textbf{Equation (8)}$$

i : Indices for type of project cookstove

j : Indices for batch of project cookstove of type *i*

PE_p : Project emission during the period *p* (tCO_2e/p)

$PE_{p,i,j}$: Project emission by project cookstove of type *i* and batch *j* during the period *p* (tCO_2e/p)

$$PE_{p,i,j} = B_{pc,i,j} \times f_{NRB} \times NCV_{biomass} \times EF_{projected\ fossil\ fuel} \times N_{p,i,j} \times n_{p,i,j} \times \mu_p \quad \textbf{Equation (9)}$$

Where:

$B_{pc,p,i,j}$: Quantity of woody biomass that is used per project cookstove of type *i* and batch *i* during the period *p* (tonne/period)

f_{NRB} : Fraction of woody biomass that can be established as non-renewable biomass

$NCV_{biomass}$: Net calorific value of the non-renewable woody biomass that is used by project cookstove (TJ/tonne)

$EF_{projected\ fossil\ fuel}$: Emission factor of fossil fuels projected to be used to substitute non-renewable woody biomass by similar consumers (tCO_2e/TJ)

[2] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-33-v2.0.pdf

$N_{p,i,j}$	:	Number of project cookstoves of type *i* and batch *j* commissioned during the period *p*
$n_{p,i,j}$	:	Proportion of commissioned project cookstoves of type *i* and batch *j* that remain operating during the period *p*
μ_p	:	Adjustment to account for any continued use of reference cookstove during the period *p*.

$B_{pc,p,i,j}$ implementation of thermal project device is estimated as per any of the following options:

Option 1:

$$B_{pc,p,i,j} = B_{ref,p,i,j} \times \frac{\eta_{ref,i,j}}{\eta_{pc,p,i,j}} \quad \textbf{Equation (10)}$$

Where:

$B_{ref,p,i,j}$	:	Quantity of woody biomass that is used per reference cookstove before replaced by the project cookstove of type *i* and batch *j* during the period *p* (tonne/period)
$\eta_{pc,p,i,j}$	:	Efficiency of the project cookstove *i* and batch *j* during the period *p* (fraction). Alternatively, efficiency may be determined using Equation (7)
$\eta_{ref,i,j}$	:	Efficiency of the reference cookstove being replaced by project cookstove of type i and batch j (fraction). A default value for this parameter used for cooking and/or water boiling applications is 0.15[3].

Option 2: $B_{pc,p,i,j}$ is estimated via sample survey of end-user or direct measurement at each end-user locations.

H. Calculation of emissions reductions

$$ER_p = RE_p - PE_p \quad \textbf{Equation (11)}$$

Where:

ER_p	=	Emission reductions during the period *p* (tCO_2e/p)
RE_p	=	Reference reductions during the period *p* (tCO_2e/p)
PE_p	=	Project reductions during the period *p* (tCO_2e/p)

I. Data and parameters fixed *ex ante*

The source of each data and parameter fixed *ex ante* is listed as below.

[3] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-33-v2.0.pdf

Parameter	Description of data	Source
$B_{ref,p,p}$	Quantity of woody biomass that would have been used per person in the household in the absence of the project activity to generate thermal energy equivalent to that provided by the project devices during the period *p* (tonne/person/period)	Using the following options: a) Historical data or a sample survey conducted as per the latest version of the "Standard: Sampling and surveys for CDM project activities and programme of activities"; b) A default value for the average annual consumption of woody biomass is 0.4 tonne/person/year may be used[4]
$N_{p,HH}$	Average number of person per household prior to project implementation (number)	Established based on records of households served by the project
$B_{ref,p,HH}$	Quantity of woody biomass that would have been used in the household in the absence of the project activity to generate thermal energy equivalent to that provided by the project devices during the period *p* (tonne/household/period)	Using one of the following options: 1. $B_{ref,p,HH} = B_{ref,p,p} \times N_{p,HH}$ 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". If the monitoring period is shorter or longer than one year, the result may be extrapolated for the monitoring period.
$B_{ref,p,i,j}$	Quantity of woody biomass that is used per reference cookstove before replaced by the project cookstove of type *i* and batch *j* during the period *p* (tonne/period)	Calculated. If it is estimated via $B_{ref,p,HH}$ (Option 1), using one of the following case: 1. In case more than one project cookstove is distributed in households: $B_{ref,p,i,j} = B_{ref,p,HH} \div N_{d,HH}$ 2. In case only one project cookstove per household is distributed:

[4] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-33-v2.0.pdf

<table>
<tr><td></td><td></td><td>$B_{ref,p,i,j} = B_{ref,p,HH}$</td></tr>
<tr><td>$\eta_{ref,i,j}$</td><td>Efficiency of reference cookstove.
Default value: 0.15</td><td>Default value as per applied methodology AMS-II.G, Version 13.0 and CDM tool 33, version 02.0</td></tr>
<tr><td>$\eta_{pc,1,i,j}$</td><td>Efficiency of the project cookstove type i and batch j at the start of project activity (fraction)</td><td>Manufacturer’s specification</td></tr>
<tr><td>$EF_{projected\ fossil\ fuel}$</td><td>Emission factor of fossil fuels projected to be used to substitute non-renewable woody biomass by similar consumers (tCO2e/TJ)
Default value for Cambodia: 85.7 tCO_2e/TJ</td><td>For the emission factor of fossil fuels projected to be used to substitute non-renewable woody biomass by similar consumers, either the default regional values in table below
<table>
<tr><th colspan="2">Emission factor of fossil fuels projected to be used to substitute non-renewable woody biomass by similar consumers (tCO_2e/TJ)</th></tr>
<tr><td>Middle East and North Africa</td><td>63.9</td></tr>
<tr><td>East Asia and the Pacific</td><td>85.7</td></tr>
<tr><td>Europe and Central Asia</td><td>57.8</td></tr>
<tr><td>Latin America and the Caribbean</td><td>68.6</td></tr>
<tr><td>South Asia</td><td>64.4</td></tr>
<tr><td>Sub-Saharan Africa</td><td>73.2</td></tr>
</table>
Refer to Appendix 1 for the definition of the regions which is primarily based on the “developing</td></tr>
</table>

		regions" classification used by the United Nations Development Programme but tailored to the purpose of this CDM methodology.
$\mathbf{NCV}_{biomass}$	Net calorific value of the non-renewable woody biomass that is substituted by project cookstove. A default for wood fuel is 0.0156 TJ/tonne.	Table 1.2, chapter 1, volume 2 of 2006 IPCC Guidelines for National GHG Inventories. Default value is applied.
$\mathbf{f}_{NRB}$	Fraction of woody biomass saved by the project activity that can be established as non-renewable biomass	Calculated by an independent third party or based on national data.