CLEAN DEVELOPMENT MECHANISM

CDM-MP97-A07

Small-scale Methodology

Emission reduction through sustainable charcoal production and consumption

Version 05.0

Sectoral scope(s): 05

United Nations
Framework Convention on
Climate Change

COVER NOTE

1. Procedural background

1. The Executive Board of the clean development mechanism (CDM) (hereinafter referred to as the Board), at its 116th meeting, considered the information on development of accurate and reliable region-specific default values for fraction of non-renewable biomass (f_{NRB}) that can be applied in methodologies for clean cooking and requested the Methodologies Panel (MP) to develop subnational/regional values of f_{NRB}, building on scientific studies and engaging external experts. The Board highlighted that such default values should be consistent with the methods contained in "TOOL30 Calculation of the fraction of non-renewable biomass" (hereinafter referred to as TOOL30). In this regard, the Board requested the MP to prepare a concept note based on the work undertaken for consideration by the Board at a future meeting. The Board further requested the MP to propose a revision to TOOL30 and/or related methodologies/tools if there is a need to further clarify and/or revise elements of TOOL30 or related methodologies/tools, in light of the work undertaken on default values.

2. Purpose

2. The purpose of the revision is to remove the references to TOOL30 and refer to the TOOL33 that provides default values for f_{NRB} at the national and regional (continental) level. The revision also provides an option for stakeholders to submit new methodological approaches for calculation of f_{NRB} values that result in further advancements in terms of accuracy and conservativeness.

3. Key issues and proposed solutions

3. The revision of the methodology allows stakeholders to use the default values of f_{NRB} included in TOOL33; it also provides an option for stakeholders to submit new methodological approaches for calculation of f_{NRB} values that result in further advancements in terms of accuracy and conservativeness.

4. Impacts

4. The national and regional (continental) default values of f_{NRB} will ensure the reliability of calculating emission reductions, reduce transaction cost and facilitate the implementation of CDM project activities and PoAs in the household cookstove sector.

5. Subsequent work and timelines

5. The MP, at its 97th meeting, agreed to seek public inputs on the revised version of the methodology. If inputs are received, they will be discussed with the MP and forwarded to the Board for its consideration. If no inputs are received, the MP recommends that the Board approve the proposed draft version of the methodology. No further work is envisaged.

6. Recommendations to the Board

6. The MP recommends that the Board approve the proposed revision to the 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 projects	Introduction of new and efficient charcoal production technologies using renewable biomass aimed at displacing the production of charcoal in unimproved traditional kilns that use non-renewable biomass. The charcoal is supplied to the identified consumers (e.g. households, small and medium enterprises (SMEs)) included in the project boundary thereby leading to emission reductions. The project activity shall install and operate new (Greenfield) charcoal production facilities characterized by a new investment. This methodology is also applicable to charcoal for thermal application generated as a by-product in micro gasifier stoves used by households for cooking
Type of GHG emissions mitigation action	Displacement of more-GHG-intensive, non-renewable biomass-fuelled applications by introducing renewable energy technologies

2. Scope, applicability, and entry into force

2.1. Scope and applicability

2. This methodology is applicable to project activities that displace the use of non-renewable biomass in the production of charcoal supplied to identified consumers for thermal applications included in the project boundary.

3. This methodology is also applicable to charcoal generated as a by-product in micro-gasifier stoves using woody biomass for households cooking when used in conjunction with "AMS-II.G.: Energy efficiency measures in thermal applications of non-renewable biomass". Auxiliary power consumption in a blower or fan for forced convection is not covered by the methodology.

4. End users of charcoal shall be: (i) households; or (ii) small and medium enterprises (SMEs); or (iii) a group of households served by a charcoal market (e.g. charcoal consuming urban areas).[1] End users do not include large scale industries.

5. Measures such as contractual agreements shall be implemented to avoid potential double counting because of potential claims of emission reductions by the end users. These measures shall be described in the Project Design Document (PDD).

[1] Acceptable evidence includes but are not limited to: sales records and receipts of delivery of charcoal products directly to eligible end-users, long-term contracts with an entity (retailer, cooperative, trader etc.) supplying charcoal products to the eligible end-users.

6. Project activities, except for the case indicated in paragraph 3 above, shall introduce efficient charcoal production technologies using biomass feedstock such as biomass residues to displace the production of charcoal in unimproved traditional kilns by the informal sector thereby leading to emission reductions. Charcoal production facility may include briquetting facility for the agglomeration of smaller biomass particles. Methane produced during charcoaling process is either: (a) captured and destructed or gainfully used for heat or electricity; or (b) not captured and not destructed. Examples of these technologies include but are not limited to:

   (a) Retort sedentary kilns[2] which capture the pyrolysis gas; captured gas may be gainfully used for example as a fuel for pre-heating the facility or for wood drying or for production of heat and/or power;

   (b) Improved sedentary kilns without the capture of pyrolysis gas;

   (c) Casamance kilns.

7. Project kilns not equipped with capture and destruction of the pyrolysis gases are not eligible to claim emission reductions on account of avoidance of methane emissions from the project activity under this methodology. It is assumed that methane emissions in the project equals to methane emissions in the baseline charcoal generation process.

8. Project activities shall install and operate new (Greenfield) charcoal production facilities characterized by a new investment; replacement and retrofit of existing facilities is not eligible under this methodology. Provisions of "General guidelines for SSC CDM methodologies" shall be applied to demonstrate that the most plausible baseline scenario is the production of charcoal in unimproved traditional kilns by the informal sector.

9. Charcoal manufacturing equipment transferred from existing or decommissioned charcoal production facilities are not eligible.

10. The biomass utilized by the project activity shall not be chemically processed (e.g. esterification to produce biodiesel, degumming and/or neutralization by chemical reagents) prior to the pyrolysis, but it may be processed mechanically (e.g. pressing, filtering, agglomeration) or thermally (e.g. drying, roasting).

11. Biomass used by the project facilities is not stored for more than one year. No storage of the biomass is done in anaerobic conditions.

12. The embedded energy in charcoal produced as by-product in micro-gasifier stoves as indicated in paragraph 3 above shall be neglected when performing water boiling test as per AMS-II.G. (see paragraph 17 of AMS-II.G., version 6) to ensure that efficiency estimates are conservative.

2.2. Entry into force

13. The date of entry into force is the date of the publication of the EB ### meeting report on # Month 2025.

[2] These kilns emit minimal amount of methane during the charcoaling process i.e. efficient process is employed that will result in high charcoal yield and the small amount of methane that is emitted is captured and used or destroyed.

2.3. Applicability of sectoral scopes

14. For validation and verification of CDM projects and programme of activities by a designated operational entity (DOE) using this methodology, application of sectoral scope 05 is mandatory and application of sectoral scope 15 is conditional.

3. Normative references

15. Project participants shall apply the "General guidelines for SSC CDM methodologies", "TOOL22: Leakage in biomass small-scale project activities" and the "TOOL21: Demonstration of additionality of small-scale project activities" provided at <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html> mutatis mutandis.

16. This methodology also refers to the latest approved versions of the following methodologies and tools:

    (a) "AMS-II.G.: Energy efficiency measures in thermal applications of non-renewable biomass";

    (b) "AMS-I.E.: Switch from non-renewable biomass for thermal applications by the user" (hereinafter referred to as AMS-I.E.);

    (c) "AMS-III.K.: Avoidance of methane release from charcoal production" (hereinafter referred to as AMS-III.K.);

    (d) "TOOL03: Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion";

    (e) "TOOL16: Project and leakage emissions from biomass" (hereinafter referred to as TOOL16);

    (f) "TOOL05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation";

    ~~(g) "TOOL30: Calculation of the fraction of non-renewable biomass" (hereinafter referred to as TOOL30);~~

    (h) "TOOL33: Default values for common parameters" (hereinafter referred to as TOOL33).

4. Definitions

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

18. For the purpose of this methodology, the following definitions apply:

    (a) **Charcoal** - a solid biofuel obtained from biomass by means of a thermo-chemical process known as "pyrolysis" or "carbonization process", which consists of the thermal decomposition of biomass. Charcoal may be in the form of blocks or can take the form of charcoal briquettes (agglomeration of small carbonized particles or agglomeration of particles that are carbonised);

(b) **Informal charcoal sector** - referred to as individuals or a group of individuals involved in charcoal production but are not formally registered or formally charged with production and supply of charcoal products or related service by the authorities. It is characterized by the use of traditional kilns such as earth mound kilns, pit kilns or equivalent open-end technologies which require no investment besides labour. Newly established formalized organization by such individuals, e.g. cooperative, can also be considered as the informal sector for the purpose of this methodology;

(c) **Charcoal production facility** - a facility comprising one or more carbonization units and which produces one or more types of charcoal products (charcoal, charcoal briquettes);

(d) **Micro gasifier stove** - a woodstove used for cooking at household level that operates by burning generated wood gas from pyrolysis process simultaneously generating charcoal as a by-product (e.g. TLUD (top lid up draft) stove).[3] The micro-gasifier stove eligible under this methodology shall use woody biomass and shall not use auxiliary fuel/devices, like blower or fan for its operation.

5. Baseline methodology

5.1. Project boundary

19. The project boundary includes the physical, geographical site(s) of:

(a) The use of biomass;

(b) The carbonization units (including the micro-gasifier) included in the project activity;

(c) The areas for storage, processing, bagging and weighting of inputs (biomass) and outputs (charcoal and/or charcoal briquettes);

(d) The use of charcoal or charcoal products.

5.2. Baseline scenario

20. For the portion of charcoal ~~portion~~ produced from non-renewable biomass in the baseline, it is assumed that in the absence of the project activity, the baseline scenario would be the future use of fossil fuels for meeting similar thermal energy needs.

21. For the portion of charcoal ~~portion~~ produced from renewable biomass in the baseline, the baseline scenario would be traditional open-ended methods resulting in methane emitted to the atmosphere. ~~forms the baseline scenario~~.

[3] https://woodgas.com/resources/ ~~<http://www.drtlud.com/tlud-technology/introduction/>.~~

5.3. Emission reductions

22. For the project technology equipped with capture and destruction of the pyrolysis gases, including micro-gasifier, emission reductions are calculated as follows:

$$ER_y = \sum_i Q_{CCP,i_y} \times \left[\left(CF \times NCV_{wood} \times \frac{NCV_{charcoal,i}}{NCV_{charcoal,default}} \times f_{NRB,BL,wood} \times EF_{projected\_fossilfuel}\right) + \left(SMG_{y,b} - M_d\right) \times (1 - f_{NRB}) \times GWP_{CH4,y}\right] - PE_{y,fugitive} - PE_{y,flaring} - PE_{FF,y} - PE_{El,y} - PE_{BC,y}$$

Equation (1)

Where:

ER_y	=	Emission reductions in year *y*[4] (t CO_2e/yr)
Q_{CCP,i_y}	=	Quantity of charcoal type *i* produced and used in year *y* (t)
CF	=	Wood-to-charcoal conversion factor
NCV_{wood}	=	Net calorific value of wood (TJ/t)
$NCV_{charcoal,i}$	=	Net calorific value of the charcoal type *i* produced during the project (TJ/t)
$NCV_{charcoal,default}$	=	Default net calorific value of charcoal (TJ/t)
f_{NRB}	=	Fraction of biomass used in the absence of the project activity that can be established as non-renewable biomass (fraction or %)
$EF_{projected\_fossilfuel}$	=	Emission factor for the substitution of non-renewable woody biomass by similar consumers (t CO_2/TJ)
$GWP_{CH4,y}$	=	Global warming potential of methane applicable to the crediting period (t CO_2e/t CH_4)
$SMG_{y,b}$	=	Specific methane generation for the baseline charcoal generation process in the year *y* (tonnes CH_4/t charcoal product); a default value of 0.030 t CH_4/t charcoal may be used. Alternatively, the value can be determined in accordance with the procedure provided in the latest version of AMS-III.K.
M_d	=	Factor to account for any legal requirement for capture and destruction of methane in the charcoal production facility (tonne of CH_4/tonne of raw material)

[4] Project emissions on account of transport are assumed to be negligible.

$PE_{y,flaring}$	=	If applicable, emissions due to the flare inefficiency in the project charcoal manufacturing plant in the year *y* (t CO_2e) determined in accordance with the procedure provided in AMS-III.K. In case captured pyrolysis gas is gainfully used (e.g. as fuel for pre-heating the facility, or for wood drying, or used for production of heat and/or power as in the case of micro-gasifier), then it can be taken as zero
$PE_{FF,y}$	=	Project emissions due to fossil fuel consumption in charcoal production facilities in year *y* (t CO_2)
$PE_{El,y}$	=	Project emissions due to electricity consumption in charcoal production facilities in year *y* (t CO_2)
$PE_{BC,y}$	=	Project emissions due to biomass cultivation in year *y* (t CO_2)

23. $PE_{y,fugitive}$ is calculated as follows:

$$PE_{y,fugitive} = \sum_{i} Q_{CCPi,y} \times GWP_{CH4,y} \times SMG_{y,b} \times f \quad \text{Equation (2)}$$

Where:

$PE_{y,fugitive}$	=	Fugitive emissions from operation of charcoal producing facility (physical leakage) in the year *y* (t CO_2e)
f	=	A fraction attributed to project charcoal production technology, use a default value of 0.1

24. For the project activity not equipped with capture and destruction of the pyrolysis gases, emission reductions are calculated as follows:

$$ER_y = \sum_{i} Q_{CCP,i_y} \times \left[\left(CF \times NCV_{wood} \times \frac{NCV_{charcoal,i}}{NCV_{charcoal,default}} \times f_{NRB} \times EF_{projected_{fossil\,fuel}}\right)\right] - PE_{FF,y} - PE_{El,y} - PE_{BC,y} \quad \text{Equation (3)}$$

25. Project activities using cultivated biomass shall calculate $PE_{BC,y}$ according to TOOL16.

5.4. Leakage emissions

26. General guidance on leakage in biomass project activities shall be followed to quantify leakages pertaining to the use of biomass residues.

6. Monitoring methodology

27. Relevant parameters shall be monitored as indicated in the table 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 referred by the project participants.

6.1. Data and parameters not monitored

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

Data / Parameter table 1.

Data / Parameter:	***CF***
Data unit:	-
Description:	Wood-to-charcoal conversion factor
Source of data:	One of the following three options should be used to determine this factor: i) The default value provided in TOOL33 may be used; ii) Project participants may determine the factor applicable to their region based on a sample of tests of kilns. In this case, the project participants should provide a clear description of the testing method used including the standard followed and the sampling approach; iii) Project participants may use country or region specific values included in an approved and valid standardized baseline
Measurement procedures (if any):	
Any comment:	

Data / Parameter table 2.

Data / Parameter:	NCV_{wood}
Data unit:	TJ/t
Description:	Net calorific value of wood
Source of data:	IPCC2006[5]
Measurement procedures (if any):	Use a default value of 0.015 TJ/t based on the gross weight of the wood that is 'air-dried'
Any comment:	-

[5] The 2006 IPCC Guidelines recommends a net calorific value of 15.6 TJ/Gg (terajoules per gigagram) i.e. 0.0156 TJ/t (rounding off to 0.015 TJ/t) for wood.

Data / Parameter table 3.

Data / Parameter:	$NCV_{charcoal,default}$
Data unit:	TJ/t
Description:	Default net calorific value of charcoal
Source of data:	-
Measurement procedures (if any):	Use a default value provided in section 1 in the appendix
Any comment:	-

Data / Parameter table 4.

Data / Parameter:	f_{NRB}
Data unit:	Fraction or %
Description:	Fraction of biomass used in the absence of the project activity that can be established as non-renewable biomass
Source of data:	-
Measurement procedures (if any):	Determined using one of the following options: (a) ~~Calculate a fNRB value as per TOOL30; or~~ (b) Use the default value as provided in TOOL33. Alternatively, stakeholders may submit new methodological approaches for calculation of f_{NRB} values for consideration by the Board. (c) ~~Use a default value included in an approved standardized baselines~~
Any comment:	For project activities in urban areas and in countries where more than 20% of the woodfuel consumed in the country is imported, the weighted average of the fNRB of the host country and the fNRB of countries from where woodfuel is imported shall be used to calculate a relevant value for the project activity.

Data / Parameter table 5.

Data / Parameter:	$EF_{projected\_fossil\ fuel}$
Data unit:	t CO_2/TJ
Description:	Emission factor for the substitution of non-renewable woody biomass by similar consumers
Source of data:	-
Measurement procedures (if any):	~~Use a default value of 81.6~~ This parameter can be sourced from approved methodology AMS-I.E. (i.e. Table 2 in version 14~~0~~.0 of AMS-I.E., if there are updates use the information from the latest version of AMS-I.E.)
Any comment:	-

Data / Parameter table 6.

Data / Parameter:	$GWP_{CH4,y}$
Data unit:	t CO_2e/t CH_4
Description:	Global warming potential of methane applicable to the crediting period
Source of data:	-
Measurement procedures (if any):	-
Any comment:	-

Data / Parameter table 7.

Data / Parameter:	M_d
Data unit:	tonne of CH_4/tonne of raw material
Description:	Factor to account for any legal requirement for capture and destruction of methane in the charcoal production facility. This parameters is equal to zero for the case of charcoal produced from micro-gasifier
Source of data:	-
Measurement procedures (if any):	-
Any comment:	-

6.2. Data and parameters monitored

29. In addition to the parameters listed in the tables below, the monitoring provisions in the tools and methodologies referred to in this methodology shall apply.

Data / Parameter table 8.

Data / Parameter:	$Q_{CCP,i,y}$
Data unit:	tonnes
Description:	Produced quantity of charcoal product *i* in year *y*
Source of data:	Measurement from project activity production
Measurement procedures (if any):	The parameter can be monitored according to one of the following options: Option1: Direct measurement (e.g. use of a scale) of the weight of charcoal products supplied; Option 2: Calculation of the total weight of charcoal supplied; based on the total number of bags supplied and the average weight of charcoal product per bag. The weight of charcoal products per bag is determined on sample basis in accordance with the sampling standard (e.g. using systematic sampling method). Option 2 can only be used if Option 1 is not available. Charcoal generated from only woody biomass is eligible for the case of micro-gasifier

Monitoring frequency:	in batches
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 9.

Data / Parameter:	$NCV_{charcoal,i}$
Data unit:	TJ/t
Description:	Net calorific value of the charcoal *i* produced
Source of data:	-
Measurement procedures (if any):	The value can be determined according to one of the following options: Option 1: monitored once during the first year of the crediting period. Measurement is undertaken in laboratories according to relevant national/international standards. Measure quarterly, taking at least three samples for each measurement. The average value can be used for the rest of the crediting period provided that there is no change in the biomass types used for charcoal *i* production. For the purpose of ex ante calculation, IPCC default value can be used. Option 2: using one of the options provided in the appendix. In case of charcoal generated from micro gasifier, Option 1 above or option 2 in the appendix. Determination of net calorific value of charcoal' shall be used
Monitoring frequency:	Frequency depends on the option chosen above
QA/QC procedures:	If option 1 is chosen, check the consistency of the measurements by comparing the measurement results with, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC. (If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements or provide justification)
Any comment:	-

Appendix. Determination of net calorific value of charcoal

1. NCV of charcoal may differ from the standard IPCC value for charcoal due to: (i) operating parameters of the carbonization process; as well as (ii) the types of inputs (types and quality of biomass).

2. $NCV_{charcoal,i}$ can be determined according to the following Options 1 to 2.

1. Option 1: deemed value

3. For the charcoal from coconut husks, bamboo and other purely woody source of biomass, the following assumption can be made:

$$NCV_{charcoal,i} = 29.5 GJ/tonne \quad \text{Equation (1)}$$

(Value ~~assumed~~: from IPCC 2006, Volume 2, Table 1.2)

4. For other charcoal sources such as mixed agricultural wastes, the following minimum default value can be used:

$$NCV_{charcoal,i} = 0.66 \times 29.5\ GJ/tonne = 19.47 GJ/tonne \quad \text{Equation (2)}$$

2. Option 2: determination of $NCV_{charcoal,i}$ based on the three feedstock sizes

5. In accordance with the correlation developed by Parikh et al. (2005) as found in Misginna et al., the net calorific value of charcoal produced can be determined based on the following equation:

$$NCV_{charcoal,i} = 0.3536 \times CC_{i,PJ,y} + 0.1559 \times VM_{i,PJ,y} - 0.0078 \times ASH_{i,PJ,y} \quad \text{Equation (3)}$$

Where:

$NCV_{charcoal,i}$	=	Net calorific value of charcoal *i* produced (TJ/t)
$CC_{i,PJ,y}$	=	Carbon content in the charcoal product from the biomass type *i*, in year *y* (kg carbon/kg charcoal product)
$VM_{i,PJ,y}$	=	Share of volatile matter in the charcoal product from the biomass type *i*, in year *y* (kg volatile matter/kg charcoal product)
$ASH_{i,PJ,y}$	=	Ash content in the charcoal product from the biomass type *i*, in year *y* (kg ash/kg charcoal product)

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Document information

Version	*Date*	*Description*
05.0	6 May 2025	MP 97, Annex 7 A call for input will be issued for this draft document. If no input is received, the draft document will be considered by the Board at EB 125. Revision to remove reference to TOOL30 and to allow stakeholders to calculate f_{NRB} values using new methodological approaches.
04.0	8 September 2022	EB 115, Annex 18 Revision to introduce a reference to TOOL33.
03.0	1 June 2014	EB 79, Annex 16 The revision: (i) Includes charcoal produced as a by-product in micro-gasifier wood stoves used in household applications applying AMS-II.G.; (ii) Removes the PoA-specific provision to scrap the baseline equipment; (iii) Replaces the applicability conditions and emission calculations related to the cultivation of biomass, by including reference to the methodological tool "Project emissions from cultivation of biomass ", in response to Board mandates from EB 76, (para. 53 of the meeting report) and EB 67 (para. 76 of the meeting report).
02.0	31 May 2013	EB 73, Annex 11 The revision corrects error in unit of NCV in equation 4 and 5 in appendix 1.
01.0	23 November 2012	EB 70, Annex 27 Initial adoption.

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