

CDM-MP80-A16

Concept note

Methodological approaches for calculating emission reductions from project activities, resulting in the reduced use of non-renewable biomass in households

Version 01.0



United Nations
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1. Procedural background

1. The Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP), at its fourteenth session, encouraged the CDM Executive Board (hereinafter referred to as the Board) to review methodological approaches for calculating emission reductions from project activities, resulting in the reduced use of non-renewable biomass (NRB) in households (decision 4/CMP.14, para. 4)
2. The Board, at its 102nd meeting, considered the methodological approaches for calculating emission reductions from project activities, resulting in the reduced use of non-renewable biomass in households, and requested the Methodologies Panel (MP) to conduct an analysis on the following issues:
 - (a) The use of fossil fuel emission factor as surrogates for biomass combustion (Issue 5 in table 1 of Annex 6 to the annotated agenda): The MP should explore options for revising the globally applicable default factor taking into account data on actual usage of various fossil fuels for cooking in different regions/countries of the world. The MP should also explore a method for providing an option for the Project Participants to determine the factor for their project or PoA based on geographic coverage of the project or PoA and fossil fuel usage in the region for cooking;
 - (b) Non-CO₂ greenhouse gas (GHG) emissions such as methane and nitrous oxide emissions (Issue 6 in table 1 of Annex 6 to the annotated agenda); The MP should explore including these gases in the project boundary considering the same mix of fossil fuels that are identified under issue 5;
 - (a) Harmonized standards for stove tests (Issue 8 in table 1 of the Annex 6 to the annotated agenda): The MP should explore options for applying international (e.g. International Organization for Standardization (ISO)) standards and national standards where they are available to determine the performance of the stoves.
3. The Board, at its 103rd meeting, considered the concept note "Methodological approaches for calculating emission reductions from project activities, resulting in the reduced use of non-renewable biomass in households" prepared by MP79 and requested the MP to conduct further work as follows:
 - (a) The MP should consider additional sources of data on the actual usage of various fossil fuels for cooking in different regions/countries of the world (e.g. data from the International Energy Agency). In doing so, the MP may consider, besides the simple average of country specific values currently applied, using other ways of calculating a weighted average. The analysis may be limited to countries/regions with a registered project activity or a PoA for clean cook stoves and take into account the greater use of fossil fuels for cooking in urban areas as compared to rural areas;
 - (b) Regarding the harmonized standards for stove tests, the Board encouraged the MP to continue to consider the issue (e.g. explore what guidance would be required when applying the International Organization for Standardization standards as an option for testing the efficiency of stoves) and make a recommendation.

4. In this context, the Board requested the MP to recommend revised versions of the small-scale methodologies "AMS-I.E.: Switch from non-renewable biomass for thermal applications by the user" and "AMS-II.G: Energy efficiency measures in thermal applications of non-renewable biomass" for approval, together with the revised concept note above, for consideration by the Board at its 105th meeting.

2. Purpose

5. The purpose of this concept note is to present the revised concept note as requested by the Board including references to the possible draft revised methodologies for consideration of the Board.

3. Key issues and proposed solutions

3.1. Default global fossil fuel emission factor

3.1.1. Mandate

6. The Board requested to the MP to explore options for revising the globally applicable default factor taking into account data on actual usage of various fossil fuels for cooking in different regions¹/countries of the world.

3.1.2. Analysis and proposed solutions

7. A hypothetical emission factor ($EF_{\text{projected_fossilfuel}}$) (hereinafter referred as fossil fuel emission factor) was introduced in methodology AMS-II.G. which was cross referenced in AMS-I.E., following the guidance from the Board at its twentieth meeting (see appendix).
8. Version 3 to version 8 of AMS-II.G. had included a default value of 81.6 t CO₂/TJ for the fossil fuel emission factor based on the following assumptions; a 50 per cent weight is assigned to coal as the alternative solid fossil fuel (96.0 t CO₂/TJ) and a 25 per cent weight is assigned to both liquid and gaseous fuels (71.5 t CO₂/TJ for kerosene and 63.0 t CO₂/TJ for LPG).
9. Version 9 and version 10 (current) of AMS-II.G. included a default value of 63.7 t CO₂/TJ for the fossil fuel emission factor based on the following assumptions; 9 per cent weight assigned for kerosene (71.5 t CO₂/TJ) and 91 per cent for LPG (63.0 t CO₂/TJ).
10. To analyze actual usage of various fossil fuels/electricity for cooking in different regions/countries, the data² from DHS Program- Demographic and Health surveys are used. No comprehensive data source other than DHS was found. Then, an emission factor per country, average per region (simple average, weighted average by population,

¹ For the purpose of the analysis below, the definition of developing regions provided by United Nations (<http://hdr.undp.org/en/content/developing-regions>) is used.

² Source: The DHS Program- Demographic and Health surveys - STATcompiler (www.statcompiler.com) except for China where the data was sourced from *Cashman S, Rodgers M, Huff M, Feraldi R, Morelli B. Life Cycle Assessment of cookstove fuels in India and China. Washington, DC U.S. Environmental Protection Agency; 2016.*

simple and weighted average only for the countries where cookstove CDM POAs exist) are calculated and the results are summarized below.

- (a) Case 1: Simple average global/regional values;
- (b) Case 2: Weighted average global/regional values, taking into account country's population along with fuel use;
- (c) Case 3: Simple average global/regional values of the countries where cookstove CDM PoAs exist;
- (d) Case 4: Weighted average global/regional values of the countries where cookstove CDM PoAs exist, taking into account country's population along with fuel use.

Table 1. Values of the fossil fuel emission factor (CO₂ and Non-CO₂ GHG emissions)

		Fossil fuel emission factor (t CO ₂ /TJ)	Fossil fuel emission factor (t CO ₂ e/TJ) incl. CH ₄ and N ₂ O emissions
AMS-II.G. (ver. 3 to 8) and AMS-I.E. (ver. 4 to 7)		81.6	Not considered
AMS-II.G. (ver. 9 and 10) and AMS-I.E. (ver. 8 and 9)		63.7	Not considered
Case 1: Simple average global/regional values	World (developing countries)	70.5	71.0
	Arab States	63.7	63.9
	East Asia and the Pacific	84.9	85.7
	Europe and Central Asia	57.7	57.8
	Latin America and the Caribbean	68.4	68.6
	South Asia	64.2	64.4
	Sub-Saharan Africa	72.4	73.2
Case 2: Weighted average global/regional values, taking into account countries population along with fuel use	World (developing countries)	72.5	73.7
	Arab States	63.6	63.8
	East Asia and the Pacific	82.4	84.9
	Europe and Central Asia	57.5	57.6
	Latin America and the Caribbean	66.1	66.3
	South Asia	65.2	65.4
	Sub-Saharan Africa	69.5	70.2
Case 3: Simple average global/regional values of the countries where cookstove CDM PoAs exist	World (CDM countries)	71.0	72.0
	Arab States	No CDM PoAs exists	No CDM PoAs exists
	East Asia and the Pacific	86.4	88.1
	Europe and Central Asia	No CDM PoAs exists	No CDM PoAs exists
	Latin America and the Caribbean	76.6	76.9
	South Asia	64.1	64.4

		Fossil fuel emission factor (t CO ₂ /TJ)	Fossil fuel emission factor (t CO ₂ e/TJ) incl. CH ₄ and N ₂ O emissions
	Sub-Saharan Africa	68.6	69.7
Case 4: Weighted average global/regional values of the countries where cookstove CDM PoAs exist, taking into account countries population along with fuel use	World (CDM countries)	74.1	75.6
	Arab States	No CDM PoAs exists	No CDM PoAs exists
	East Asia and the Pacific	86.6	89.7
	Europe and Central Asia	No CDM PoAs exists	No CDM PoAs exists
	Latin America and the Caribbean	74.0	74.2
	South Asia	65.5	65.8
	Sub-Saharan Africa	66.6	67.2
Information for comparison:	Emission factor of wood is 112.0 (t CO ₂ /TJ) and 120.7 t CO ₂ e/TJ including CH ₄ and N ₂ O emissions		

11. The MP recommends to include **simple average regional values calculated under Case 1** as it is the simplest method. Also, calculated values in Case 3 and Case 4 do not consider the countries where currently there do not exist any CDM cookstove PoAs but PoAs may be developed in the future. The table below will be included in the draft revision to the methodologies AMS-I.E. and AMS-II.G.

Table 2. Proposed revised values of the fossil fuel emission factor (CO₂ and Non-CO₂ GHG emissions)

	Fossil fuel emission factor (t CO ₂ /TJ)	Fossil fuel emission factor (t CO ₂ e/TJ) incl. CH ₄ and N ₂ O emissions
Arab States	63.7	63.9
East Asia and the Pacific	84.9	85.7
Europe and Central Asia	57.7	57.8
Latin America and the Caribbean	68.4	68.6
South Asia	64.2	64.4
Sub-Saharan Africa	72.4	73.2

3.2. Non-CO₂ GHG emissions

3.2.1. Mandate

12. The Board requested the MP to explore including non-CO₂ emissions i.e. methane and nitrous oxide or CH₄, and N₂O emissions in the project boundary considering the same mix of fossil fuels that are identified under the issue above.

3.2.2. Analysis and proposed solutions

13. Default emission factors for stationary combustion in the residential and agriculture/forestry/fishing/fishing farms categories provided in 2016 IPCC Guidelines are extracted and provided below in Table 3 and 4:

Table 3. Default emission factors for stationary combustion in the residential and agriculture/forestry/fishing/fishing farms categories (kg of GHG per TJ on a Net Calorific Basis)

Fuel	CO ₂			CH ₄			N ₂ O		
	Default Emission Factor	Lower	Upper	Default Emission Factor	Lower	Upper	Default Emission Factor	Lower	Upper
Other Kerosene	71,900	70,800	73,700	10	3	30	0.6	0.2	2
Liquefied Petroleum Gases	63,100	61,600	65,600	5	1.5	15	0.1	0.03	0.3
Anthracite	98,300	94,600	101,000	300	100	900	1.5	0.5	5
Other Bituminous Coal	94,600	89,500	99,700	300	100	900	1.5	0.5	5
Sub-Bituminous Coal	96,100	92,800	100,000	300	100	900	1.5	0.5	5
Lignite	101,000	90,900	115,000	300	100	900	1.5	0.5	5
Wood / Wood Waste	112,000	95,000	132,000	300	100	900	4	1.5	15
Charcoal	112,000	95,000	132,000	200	70	600	1	0.3	3

Table 4. Default emissions factors after multiplying Global Warming Potential (GWP) values

	Unit	LPG	Kerosene	Coal	Wood
CO₂ Emission factor	t CO ₂ /TJ	63.1	71.9	94.6	112.0
CH₄ Emission factor (GWP: 25)	t CO ₂ e/TJ	0.13	0.25	7.50	7.50
N₂O Emission factor (GWP: 298)	t CO ₂ e/TJ	0.03	0.18	0.45	1.19
GHG Emission Factor	t CO ₂ e/TJ	63.25	72.33	102.55	120.69

Source: Table 2.5, Chapter 2, 2006 IPCC Guidelines for National Greenhouse Gas Inventories

14. With the inclusion of CH₄ and N₂O emissions, fossil fuel emission factors will attain values shown in Table 1 and 2 above when CH₄ and N₂O emission factors of the same mix of fossil fuels are used.
15. The MP recommends the regional default values of fossil fuel emission factor in Table 2, which includes CH₄ and N₂O emissions using the same mix of fossil fuels.

16. As decision 17/CP.7 (see appendix) placed restrictions only on considering changes to carbon pools, use of CH₄ and N₂O emission factors of wood was considered as a plausible alternative. However, the MP did not recommend it, taking into account guidance from the Board to consider the fossil fuel non-CO₂ emissions as reflected above.
17. Furthermore, it is acknowledged that the above recommended values do not take into consideration the effects of fuel shifts on the energy efficiency of the thermal appliances, consideration of which would lead to lowering of the value of the fossil fuel emission factor.

3.3. Option for the Project Participants to determine the fossil fuel emission factor for their project or PoA

3.3.1. Mandate

18. The Board requested the MP to explore a method for providing an option for the Project Participants to determine the fossil fuel emission factor for their project or PoA based on geographic coverage of the project or PoA and fossil fuel usage in the region for cooking.

3.3.2. Analysis and proposed solutions

19. As an alternative to the use of the default value for the regional default fossil fuel emission factor, the proposed new formula will allow project participants to estimate the fossil fuel emission factor for their project or PoA by determining x_j (a fraction representing fuel type j used in the region/country or project area for cooking) has been proposed in the draft revision of methodologies AMS-I.E. and AMS-II.G.

3.4. Harmonized standards for stove tests

3.4.1. Mandate

20. The Board requested to the MP to explore options for applying international standards (e.g. ISO) and national standards where they are available to determine the performance of the stoves.

3.4.2. Analysis and proposed solutions

21. Building on the past work done in the area, ISO has recently published a series of standards for harmonized lab and field tests of cookstoves to determine emission performance and efficiency, such as *ISO 19867-1:2018: Clean cookstoves and clean cooking solutions -- Harmonized laboratory test protocols -- Part 1: Standard test sequence for emissions and performance, safety and durability*.³ ISO 19867-1:2018 specifies laboratory measurement and evaluation methods for a) particulate and gaseous air pollutant emissions, b) energy efficiency, c) safety, and d) durability of

³ In addition, *ISO/FDIS 19869: Clean cookstoves and clean cooking solutions -- Field testing methods for cookstoves* is under development

cookstoves, and it provides a standard test sequence to establish comparability in measurement of cookstove emissions and efficiency.

22. The MP is of the view that the use of ISO standards should also be cited in CDM methodologies, besides other international standards or national standards which are currently available and in use. During the practitioner workshop⁴ held on 06 May 2019, stakeholders requested the continued use and acceptance of the existing protocols (e.g. Water Boiling Test protocol, Controlled Cooking Test protocol, Kitchen Performance Test protocol listed in Clean Cooking Alliance) alongside the recently approved ISO Standards as there is limited experience in its application.
23. The MP also noted that under ISO's laboratory testing protocol, thermal efficiency is calculated as simple or weighted averages of the three test phases (high, medium, low powers), while under the WBT protocol, only high power thermal efficiency is calculated as the average of the two phases (i.e. cold start high-power, hot-start high-power, not including the simmer phase).
24. The MP also considered that it may be necessary that the same protocol for stove testing is consistently used both for the baseline and project parameters, in order to ensure comparability of the test results between baseline test and project tests that will be conducted during the crediting period.
25. Furthermore, considering that infrastructure for stove test (e.g. accredited laboratories) for ISO 19867-1:2018 is currently not widely available, the MP considered that the flexibility with lab testing available for other protocols (e.g. WBT protocol or a national standard are eligible under the methodology) should also apply while using the ISO standard.
26. Based on the above analysis, the MP recommends a revision of AMS-I.E. and AMS-II.G. to include ISO 19867-1:2018 standard as an optional method for testing the efficiency of stoves.

4. Impacts

27. The improvement of the methodological approaches for the calculation of emission reductions by reducing use of non-renewable biomass will facilitate the implementation of CDM project activities and PoAs in the household cookstove sector, which have strong relevance for the regions that are underrepresented in the CDM.

5. Subsequent work and timelines

28. The draft revision to the methodologies AMS-I.E. and AMS-II.G are proposed together with this revised concept note.

⁴ Practitioner workshop on methodological issues related to clean cookstoves, safe drinking water and sampling held in Bonn on 06 May 2019

6. Recommendations to the Board

29. The MP recommends that the Board consider the concept note and provide further guidance.

Appendix. Background

1. Past decisions related to the reduced use of non-renewable biomass

1. An earlier version of the methodology “AMS-I.C. Thermal energy for the user”¹ stated that “This category comprises renewable energy technologies that supply individual households or users with thermal energy that displaces fossil fuels or non-renewable sources of biomass....For renewable energy technologies that displace non-renewable sources of biomass, the simplified baseline is the non-renewable sources of biomass consumption of the technologies times an emission coefficient for the non-renewable sources of biomass displaced. Intergovernmental Panel on Climate Change (IPCC) default values for emission coefficients may be used”, until the provision was revised at the twenty first meeting of the Board (September 2005) through a revision to its appendix B of the methodology. Few CDM project activities for clean cookstoves were registered by then, applying the methodology AMS-I.C, notably the two biogas project activities in Nepal².
2. Subsequently the Conference of the Parties (COP) decided that “... the eligibility of land use, land-use change and forestry project activities under the CDM is limited to afforestation and reforestation” (decision 17/CP.7). In response, the Board at its twentieth meeting agreed that (see EB20 report, annex 8, para. 3(b)):
 - (a) Where a project activity, which does not seek to obtain temporary certified emission reductions (tCERs) or long-term certified emission reductions (ICERs) from afforestation or reforestation project activities, may directly or indirectly result in a **net increase of carbon pools** compared to what would occur in the absence of the project activity, this **increase should not be taken into account in the calculation of emission reductions**;
 - (b) Where a project activity, which does not seek to obtain tCERs or ICERs from afforestation or reforestation project activities, may directly or indirectly result in a **net decrease of carbon pools** compared to what would occur in the absence of the project activity, such changes **should be taken into account** in the calculation of emission reductions by subtracting the corresponding quantities from emission reductions.
3. This Board decision was translated in version 06 of appendix B of the methodology AMS-I.C. as “.... Combustion of any non-renewable biomass shall be accounted in the same way as combustion of fossil fuels. Emissions reductions due to the displacement of non-renewable biomass shall not be accounted”.

¹ As contained in appendix B of the “Simplified modalities and procedures for small-scale CDM project activities” (version 05 or older).

² <<http://cdm.unfccc.int/Projects/DB/DNV-CUK1132666829.52/view>>
<<http://cdm.unfccc.int/Projects/DB/DNV-CUK1132671435.09/view>>.

4. Subsequently, the CMP, by its decision 7/CMP.1, paragraphs 29 and 30 (December 2005):
 - (a) “Welcomes the public call launched by the Executive Board for “alternative methods for calculating emission reductions for small-scale project activities that propose the switch from non-renewable to renewable biomass”;
 - (b) “Requests the Board to develop, as a priority, a simplified methodology “for calculating emission reductions for small-scale project activities that propose the switch from non-renewable to renewable biomass”.
5. Then the CMP, by its decision 1/CMP.2, paragraphs 29 and 30 (November 2006):
 - (a) “Invites Parties, intergovernmental organizations and non-governmental organizations to submit to the Executive Board proposals for methodologies for small-scale clean development mechanism project activities that propose the switch from non-renewable biomass to renewable biomass, **addressing issues related to leakage, differentiation between renewable and non-renewable biomass and consistency with paragraph 7(a) of decision 17/CP.7**”;
 - (b) “Requests the Executive Board to make a recommendation to the CMP, at its third session, on a simplified methodology for calculating emission reductions for small-scale project activities that propose the switch from non-renewable to renewable biomass; **approval of such methodologies by the Executive Board for use for clean development mechanism project activities can occur only after concurrence of the CMP**”.
6. Furthermore, the CMP, by its decision 2/CMP.3, paragraph 24 (December 2007):
 - (a) “Requests the Executive Board to approve, at its first meeting in 2008, the simplified methodologies for “Switch from non-renewable biomass for thermal application by the user” and “Energy efficiency measures in thermal applications of non-renewable biomass”, as recommended by the Executive Board, for use for clean development mechanism project activities, as contained in annexes 3 and 4 to document FCCC/KP/CMP/2007/3 (Part II), incorporating the necessary changes to ensure that **the application of these methodologies introduces new or improves existing end-user technologies and that, in the case of the methodology “Energy efficiency measures in thermal applications of non-renewable biomass”, the baseline energy efficiency is measured or is based on referenced literature values**”.
7. The Board at its thirty seventh meeting (January–February 2008) approved the revised simplified methodologies “AMS-I.E. Switch from non-renewable biomass for thermal applications by the user” and “AMS-II.G. Energy efficiency measures in thermal applications of non-renewable biomass”.
8. The Board, through its 2017 “Annual Report of the Executive Board of the clean development mechanism to the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (FCCC/KP/CMP/2017/5)”, paragraph 60, requested guidance from the CMP as follows: “The Board, while considering the matter of eligibility under the CDM of a shift from non-renewable biomass to liquefied petroleum gas for end users, noted that the CMP decided that the Board may, if necessary, revise the methodologies called “Switch from non-renewable biomass for thermal application by the

user” and “Energy efficiency measures in thermal applications of non-renewable biomass” without the need to make recommendations to the CMP (decision 2/CMP.3, paragraphs 24 and 25). The Board considered whether it may initiate the development of a methodology on shifting from non-renewable biomass to low-carbon intensive fossil fuels, such as liquefied petroleum gas, for end-users without going back to the CMP. The Board could not reach a consensus and seeks guidance from the CMP on whether the Board may develop this methodology”. The CMP considered the issue but did not provide guidance on the matter.

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Document information

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