A6.4-MEP016-A04

Information note

Analysis of matters raised by the Supervisory Body at its 22nd meeting on the “Draft mechanism methodology: Energy efficiency measures in household cooking”

Version 01.0

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1. Procedural background

1. The Supervisory Body of the mechanism established by Article 6, paragraph 4 of the Paris Agreement (Supervisory Body), at its twenty-second meeting (SBM022), considered the draft “Mechanism methodology: Energy efficiency measures in household cooking” (A6.4-MEP014-A04) and requested the Methodological Expert Panel (MEP) to review its recommendation and provide its views on the following questions for its consideration at its next meeting:[1,2]

   (a) Benefits and drawbacks of considering reversal risk and the application of non-permanence provisions for improved cookstove activities, independent of the existing Article 6.4 rules and regulations, taking into consideration the best available science and practical implications;

   (b) The rationales on the 4.5 per cent threshold of “households in the target population with a functional cooking technology that is assessed to have the same or a higher efficiency as the project cookstoves (i.e., equivalent to the project cookstoves)” as set out in paragraph 13(j) of the proposed methodology and whether this is possible under Article 6.4 rules and regulations. The MEP should further consider: (i) the benefits and drawbacks of expanding the scope of exclusions in paragraph 46(a) and (ii) whether the assumptions take into account potential non-linear growth rates of autonomous adoption; and

   (c) Whether the approach in paragraph 57(a), associated with paragraph 52(i) of the version 01.0 of the “Standard: Setting the baseline in mechanism methodologies” (A6.4-STAN-METH-004) (hereinafter referred to as the ”Baseline Standard”), is appropriate in specific instances where data exhibits heavily skewed distributions, and whether alternative approaches such as calculating "the median performance of all the best performing comparable activities including and beyond the selected percentile" may be a more representative metric.

2. This information responds to this request and analyses the above matters.

2. Paragraph 22(a) of the SBM022 meeting report

3. This section provides an analysis of the matter referred in paragraph 22(a) of the SBM022 meeting report. This includes further background information on the matter, including the scientific background (section 2.1); relevant precedents (section 2.2); current practice and context (section 2.3); and the implications of accounting for non-permanence risk (section 2.4). Based on this analysis, the MEP provides a summary of potential benefits and drawbacks of considering reversal risk and the application of non-permanence provisions for clean cooking activities (section 2.5). Lastly, the MEP also identifies and explores alternative approaches to those proposed in the draft mechanism methodology and their potential benefits and drawbacks, noting that none of these approaches constitute a recommendation by the MEP (see Appendix to this document).

[1] See https://unfccc.int/sites/default/files/resource/A6.4-MEP014-A04.pdf.

[2] See paragraph 22(a) of A6.4-SBM022, available at https://unfccc.int/sites/default/files/resource/A6.4-SBM022.pdf.

4. In responding to the request from the Supervisory Body, the MEP did not request the secretariat to undertake a legal analysis. Instead, the MEP considered the benefits and drawbacks of applying non-permanence provisions to improved cookstove activities independently of the mechanism's existing rules and regulations, including the “Standard: Requirements for activities involving removals under the Article 6.4 mechanism” (A6.4-STAN-METH-002) and the “Standard: Addressing non-permanence and reversals in mechanism methodologies” (A6.4-STAN-METH-007) (hereinafter referred to as the “Reversals Standard”).[3,4]

2.1. Scientific background

5. This section provides further background information on the scientific basis for considering reversal risk for activities that reduce the consumption of non-renewable biomass, such as clean cooking activities. The note provides information on how such activities generate emission reductions; how emission reductions are quantified; whether and how the emission reductions could be reversed; the likelihood and magnitude of reversal risks for activities that reduce the consumption of non-renewable biomass; and how concerns about over- and under-crediting relate to non-permanence.

2.1.1. How are emission reductions generated?

6. Clean cooking activities reduce the consumption of fuelwood or charcoal by introducing more efficient cookstoves (e.g., stoves that burn less fuelwood or charcoal) or by introducing cookstoves that use other energy sources (e.g., electric stoves) and displace fuelwood or charcoal consumption.

7. Reducing the consumption of biomass fuels is considered to generate emission reductions because it is assumed that part of the biomass consumed is not renewable. In the proposed draft “Mechanism methodology: Energy efficiency measures in household cooking” (A6.4-MEP016-A03) and draft “Mechanism methodology: Cooking energy transitions” (A6.4-MEP016-A01) (together hereinafter referred to as “A6.4 clean cooking methodologies”), as well as other carbon crediting methodologies for clean cooking, the degree to which this occurs is determined through the fraction of non-renewable biomass (fNRB). The fraction of non-renewable biomass is defined as “the proportion of harvested biomass that exceeds the natural rate of regeneration of the landscape during a given period”.[5] If biomass harvest exceeds the natural rate of regeneration, this means that losses of carbon stocks through harvest exceed the gains in carbon stocks through natural regeneration, leading to a net loss of carbon stocks. Specifically, in the case of improved cookstove activities, the reduction in non-renewable biomass consumption results in higher levels of carbon stocks in the form of above-ground biomass in the Article 6.4 activity scenario compared to the baseline scenario. This is illustrated in the left part of Table 1 below (“Emission reductions are generated”).

8. By contrast, if biomass is renewable, then the losses from harvested biomass would be equal to, or lower than, the gains from the natural rate of regeneration and carbon stocks

[3] See https://unfccc.int/sites/default/files/resource/A6.4-STAN-METH-002.pdf.

[4] See https://unfccc.int/sites/default/files/resource/A6.4-STAN-METH-007.pdf.

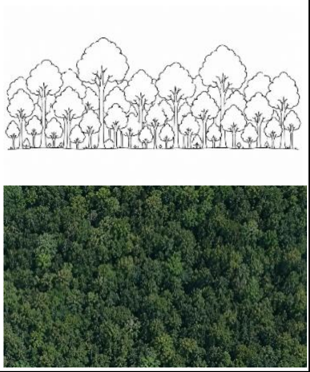
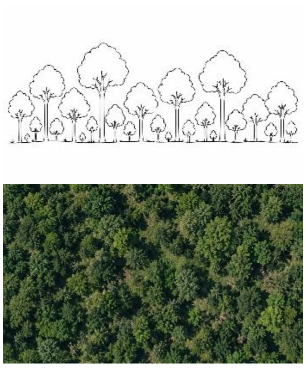
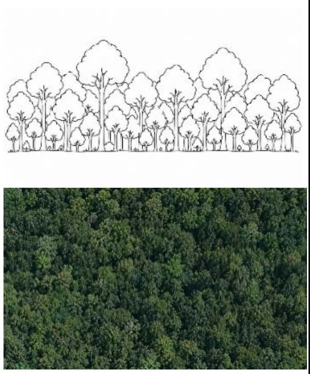
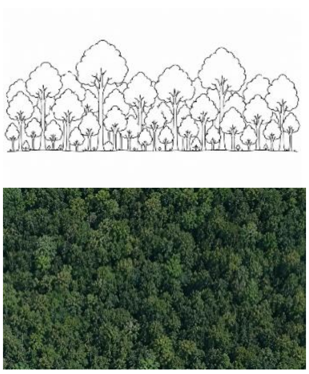
[5] See paragraph 6(b) of version 1.0 of the “Methodological tool: Fraction of non-renewable biomass” (A6.4-AMT-009).

in the landscape would not decline.[6] If clean cooking activities were to only use renewable biomass, then the value of fNRB would be zero, such that the deployment of cookstoves that reduce biomass consumption would not generate emission reductions of CO_2.

9. Both draft Article 6.4 clean cooking methodologies include "above ground woody biomass in landscape" as the "primary source of harvested biomass" that is included in both the baseline and activity scenarios, meaning that changes to carbon stocks in these greenhouse gas reservoirs are included in methodological calculations for crediting emission reductions.

10. In conclusion, clean cooking activities only generate emission reductions if they reduce the consumption of non-renewable biomass and thereby preserve carbon stocks from being lost. If carbon stocks were not affected, clean cooking activities would not reduce emissions.

Table 1. How cookstove projects generate emission reductions and could cause reversals

	Time point 1: Start of the first crediting period	**Time point 2 Year X of the crediting period**	**Time point 3 Immediately after year X**
			
Article 6.4 activity scenario			
Description	Biomass carbon stocks in the area where biomass is sourced from	The project reduced the use of non-renewable biomass. This has	One third of the preserved carbon stocks are lost due to

6 Under current approaches, potential increase in accumulation of biomass (removals) as a result of reduced harvesting is not quantified or included in activity mitigation outcomes. This may be an area for improvement in quantification methods.

	Time point 1: Start of the first crediting period	Time point 2 Year X of the crediting period	Time point 3 Immediately after year X
	are equal in the baseline scenario and the Article 6.4 activity (in this case a forest area)	prevented the loss of carbon stocks, i.e. carbon stocks are higher in the Article 6.4 activity scenario than in the baseline scenario	conversion of the forest to cropland
Numerical example		• Biomass demand has been reduced by 100 t (dry matter) • 30 per cent of the biomass is non-renewable • Carbon content in the biomass is 0.5 t C / t biomass • Carbon stocks in the Article 6.4 activity scenario are 15 t higher than in the baseline scenario (100 x 30 per cent x 0.5) • Emission reductions amount to 55 t CO_2 (15 * 44/12)	• 5 t of preserved carbon stocks are lost (15 t x 1/3) • Reversals amount to 18 t CO_2 (5 x 44/12)

Note: Illustrations were generated with artificial intelligence.

2.1.2. How are emission reductions from clean cooking activities quantified?

2.1.2.1. How does the quantification of emission reductions differ from other project types?

11. In contrast to activities such as reforestation, avoided deforestation, or grassland management activities that are implemented in a specific area of land and directly implement mitigation actions on that land area, clean cooking activities implement mitigation measures in households or institutions that use biomass fuels sourced from a different location, affecting carbon stocks in the geographical area where the biomass is harvested. In some contexts (e.g., fuelwood), biomass is collected directly by the households consuming the biomass, thereby affecting carbon stocks nearby the households; in other contexts, biomass is transported further, sometimes crossing borders, and the use of biomass fuels (often, charcoal) may thus affect carbon stocks in more distant places.

12. These circumstances raise two challenges for quantifying emission reductions:

    (a) **Identification of the affected carbon stocks:** Compared to activities such as reforestation and avoided deforestation, where the carbon stocks are geographically clearly defined, carbon stocks affected by cookstove activities are more difficult to delineate, owing to the disseminated, informal and distributed nature of the harvesting and consumption of biomass fuels (Bailis et al. 2015, Ghilardi et al. 2016, Sola et al. 2017). The “Methodological tool: Fraction of non-renewable biomass” (A6.4-AMT-009) addresses this matter by providing default values for fNRB for different geographical areas at the subnational, national, and multinational levels and by including a provision that requires mechanism methodologies to specify how to select the applicable geographic region; [7]

(b) **Feasibility to directly monitor carbon stock changes:** The difference between the location where clean cookstoves are deployed and the areas where biomass harvest is reduced also means that clean cooking activities influence reservoirs where carbon stocks are preserved but have no control over them. It is therefore not practical for clean cooking activity participants to directly monitor carbon stock changes in these reservoirs. Moreover, it may not be feasible to attribute changes in those reservoirs to clean cooking activities. For example, changes in carbon stocks observed at a country level may only be partially attributable to clean cooking projects since they may also occur due to other drivers of carbon stocks losses (e.g., the degree of land conversion for agriculture or natural disturbance). Therefore, and similar to all other available clean cooking methodologies, the proposed Article 6.4 clean cooking methodologies determine emission reductions indirectly by quantifying the total reduction in biomass consumption and the fraction of that biomass consumption that is non-renewable, rather than directly monitoring changes in carbon stocks. This approach avoids the direct monitoring of carbon stock changes and ensures that only those stock changes that are attributable to clean cooking are included in the calculation of emission reductions.[8]

2.1.2.2. Are changes in carbon stocks different from changes in carbon fluxes?

13. Emissions and removals associated with changes in greenhouse gas reservoirs can generally be determined in two different ways, by:

(a) Determining differences in stocks between two different points in time; or

(b) Measuring the flux of carbon over time.

14. The two approaches are fundamentally equivalent and interoperable: the flux of carbon over a given period (e.g. the mass flow of a fuel over time, e.g. t C in biomass fuels / year) corresponds to the difference in stocks between the start and end of that period (e.g., $t\ C_{last\ day\ of\ year\ y} – t\ C_{first\ day\ of\ year\ y}$), and vice versa. Which method is more appropriate depends on the availability of data and the practicality and accuracy of the available measurement methods. For example, most land-sector activities quantify emissions and removals by measuring changes to carbon stocks between two points in time. By contrast, for activities that capture and store carbon dioxide in geological reservoirs (i.e., carbon capture and storage (CCS) projects), it can be more practical to measure the flux of carbon dioxide into the reservoir (e.g., by measuring the flow of t CO_2 / minute) and ensure that none has leaked back to the surface, rather than to directly quantify the total mass of carbon dioxide stored in the reservoir.

15. In this regard, the choice to quantify a flux (e.g., non-renewable biomass consumption expressed in air-dry tonnes of biomass per year), rather than to directly estimate changes

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[7] See https://unfccc.int/sites/default/files/resource/A6.4-AMT-009-v01.0.pdf.

[8] These same considerations also allow the Supervisory Body to approve alternative approaches to monitoring, reporting, and remediation of reversals pursuant to paragraphs 13 through 15 of version 1.0 of the Reversals Standard.

in carbon stocks (e.g., changes in above-ground biomass expressed in tonnes of carbon), is not unique to clean cooking activities. It can also be applied for other activities involving changes in carbon stocks.

16. Flexibility to quantify emissions or removals via stocks or fluxes is also consistent with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. In the context of the land sector, which includes above-ground woody biomass stocks, the IPCC has recognized that one can calculate the annual change in biomass carbon stocks using two approaches (IPCC 2006, Chapter 2.3.1.1):

    (a) The "Gain-Loss" method, which calculates annual carbon stock changes based on annual biomass growth and biomass losses. This is conceptually equivalent to inferring changes to above-ground woody biomass by accounting for the fraction of harvested biomass that exceeds the natural rate of regeneration, as the fNRB Tool does; and

    (b) The "Stock-Difference" method, which calculates annual carbon stock changes by quantifying carbon stocks at two different points of time and dividing the difference by the time elapsed between carbon-stock quantifications.

17. Accordingly, section 6 of version 1.0 of the Reversals Standard provides flexibility to use either approach. Its formal equations for quantifying emission reductions or removals are based on stock changes, but it explicitly allows quantification based on fluxes as long as this approach delivers an equivalent outcome (see footnote 18 of version 1.0 of the Reversals Standard).

2.1.2.3. How are these matters addressed for clean cooking activities?

18. In the context of clean cooking activities, determining differences in the relevant carbon stocks between two different points in time is challenging because it is difficult to identify the specific geographic boundary in which carbon stocks are affected and because it is difficult to attribute changes to the relevant carbon stocks in a defined geographic boundary (see paragraph 12 above).

19. Due to these challenges, clean cooking activities have typically used flux-based methods to quantify their emission reductions over an identified geographic boundary, using the fNRB to attribute reductions in non-renewable biomass consumption to changes in carbon stocks (e.g., to quantify reductions in non-renewable biomass consumption expressed in air-dry tonnes of biomass per year).

20. The MEP notes that the challenges described in paragraph 13 above apply equally to the quantification of emission reductions and characterization of reversal risks, as both applications require methodological judgments to determine the relevant geographic boundary in which carbon stocks are affected and to identify the extent to which carbon stock changes are attributable to clean cooking activities. Thus, arguments that it may be impossible to identify or attribute reversal risks to clean cooking activities imply that it is impossible to identify or attribute emission reductions to these activities, and vice versa.

21. In the context of reversal risk assessment, the MEP has proposed to align its approach with the approach taken to quantify emission reductions. Specifically, the geographic boundary selected for reversal risk assessment would be the same boundary used to set the fNRB value used to quantify emission reductions from clean cooking activities (i.e., that reversal risks would be calculated for the same geographic boundary and the same greenhouse gas reservoir used to quantify emission reductions).

22. The MEP further notes that challenges with identifying and attributing changes in emission rates or carbon stocks are not unique to activities that reduce non-renewable biomass consumption. For example, similar methodological considerations arise with respect to activities that reduce emissions from grid-connected electricity power plants, e.g., as addressed in the “Methodological tool: Emissions from electricity generation and consumption” (A6.4-AMT-007). [9] When a low- or zero-carbon power plant supplies electricity to an electric grid, it is not possible to physically measure the effect on every other grid-connected power plant. Nevertheless, using technical information about electricity grid infrastructure and transmission constraints, it is possible to identify a relevant *geographic region* over which impacts are expected to occur. Similarly, using energy models or analytical methods based on the generation capacity and operational characteristics of power plants in the relevant geographic area, A6.4-AMM-003 and A6.4-AMT-007 attribute the provision of low- or zero-carbon electricity by Article 6.4 activities to *changes in generation* by facilities through the grid emissions factor and A6.4-AMT-007, through the grid emissions factor, attribute the provision of low- or zero-carbon electricity by Article 6.4 activities to changes in generation by other facilities.

23. Methodological choices to identify and attribute indirect changes to stocks and flows are subject to uncertainty. This uncertainty is systematically addressed in quantifying overall emission reductions in mechanism methodologies, consistent with requirements in the “Standard: Setting the baseline in mechanism methodologies” (A6.4-STAN-METH-004).[10] For example, the uncertainty associated with fNRB has been considered by the MEP in a Monte Carlo analysis to ensure that the proposed methodology meets the requirements of that standard in the case of MEP014-A04. Similarly, the uncertainty associated with different methods to determine the emission factor for an electricity system is accounted for in the “Methodological tool: Emissions from electricity generation and consumption” (A6.4-AMT-007).

24. In conclusion, cookstove activities reduce emissions indirectly, as they affect carbon stocks that are located in different places than where the mitigation measure is implemented. Under these circumstances, determining emission reductions based on fluxes (i.e., the reduction in the consumption of non-renewable biomass) is more appropriate than direct measurements of carbon stock changes (determining carbon stocks in affected geographical areas at two points in time). Indirect, flux-based quantifications of emission reductions involve significant uncertainty, however, which is accounted for in the proposed mechanism methodologies.

2.1.3. Could emission reductions be reversed and how?

25. Above-ground woody biomass carbon stocks associated with clean cooking activities are found in a variety of ecosystems, including forests, savannas, and grasslands. A wide range of scientific literature finds that carbon stocks in these ecosystems are at risk of being lost due to natural and human-induced factors (e.g., Andela et al. 2017, Anderegg et al. 2020, Brunner et al. 2024, Friedlingstein et al. 2026, Sims et al. 2025, Zhou et al. 2022), including as assessed in the latest IPCC report (see section 5.4.3 of Canadell et al. 2021) and specifically in the context of clean cooking activities (Gill-Wiehl et al. 2024, supplementary information).

[9] See https://unfccc.int/process-and-meetings/the-paris-agreement/article-6/article-64-pacm/mechanism-process/methodologies/a64-amt-007-emissions-from-electricity-generation-and-consumption.

[10] See https://unfccc.int/sites/default/files/resource/A6.4-STAN-METH-004.pdf.

26. Therefore, the emission reductions from clean cooking activities would be reversed if the carbon stocks preserved as a result of the project are lost at a later point in time. If all the preserved carbon stocks were lost, an activity would – cumulatively over time – not have resulted in emission reductions of CO_2 (see example in Table 1 above, including a numerical example). The preserved carbon stocks could be lost for different reasons, including natural risks (e.g., wildfires or drought) or human-induced risks (e.g., conversion of forest land for agriculture or mining).

27. The MEP further notes that the determination of fNRB values does not account for potential reversals, since the fNRB determine the extent to which changes in woodfuel consumption reduce non-renewable biomass depletion, whereas reversal risk assessment concerns the subsequent persistence of the resulting mitigation outcome. As part of the MEP’s deliberations on the draft clean cooking methodologies, this was confirmed directly with the authors of the scientific analysis on which the fNRB tool default values are based. In the proposed draft methodologies, reversal risks to credited reductions are accounted for by determining the reversal risk (in losses of above-ground woody biomass) and forwarding and cancelling a respective share of A6.4ERs in the reversal risk buffer pool account.

28. In conclusion, the carbon stocks preserved due to clean cooking activities could be reversed due to natural risks (e.g., wildfires) or human-induced risks (e.g., conversion of land for agriculture).

2.1.4. What are the magnitude and likelihood of reversal risks for cookstove projects?

2.1.4.1. What type of activities are subject to reversal risks?

29. Generally speaking, all activities that involve, relative to the baseline scenario, an increase in carbon storage in a greenhouse gas reservoir or a reduction of carbon losses in a greenhouse gas reservoir are subject to reversal risks. In all such cases, the credited amount could be lost at a later point in time.

30. By contrast, activities that do not credit changes in any greenhouse gas reservoir(s) do not have a reversal risk. In these instances, the emission reduction can physically not be reverted. An example is the N_2O abatement from nitric acid production.

31. For activities involving greenhouse gas reservoirs, the magnitude and likelihood of the risk differ strongly depending on the activity type and reservoir:

(a) **Greenhouse gas reservoirs in the biosphere**, including reservoirs that are affected by forestry or clean cooking activities, directly interact with the atmosphere. They are subject to both natural risks, such as wildfires, storms, or pests, as well as human-induced risks, such as land-use changes or changes in land management. This risk is commonly deemed significant, but the likelihood and magnitude of these risks may vary depending on the type of activity, the characteristics of the reservoir, the opportunity cost of competing land uses, and local circumstances.

(b) **Geological greenhouse gas reservoirs**, such as in the case of CCS activities, are also subject to both natural reversal risks (e.g., resulting from earthquakes) or human-induced risks (e.g., well integrity failure). The risks are commonly deemed to be relatively low in cases where geologic reservoirs have been well characterized and appropriate management practices are employed (e.g., Xiao et al. 2024);

(c) **Projects that affect fossil fuel reservoirs** can also have a reversal risk. These projects may lead to a greater storage of carbon in the reservoir relative to the baseline scenario. If the reservoirs are depleted at a later point in time, then the emission reductions would be reversed. The materiality of the risk depends strongly on the project type:

(i) **Projects reducing fossil fuel demand**: For projects that reduce fossil fuel demand, such as renewable energy or energy efficiency measures for fossil fuel consumption, the reversal risk is commonly deemed to be very low, for several reasons (FAO 2024). First, fossil fuel reservoirs that do not interact with the atmosphere are not susceptible to any significant level of natural depletion. Second, a reversal would only materialize if all or a large share of the available fossil fuel reserves would be depleted. Given the large size of fossil fuel reservoirs, this is unlikely to occur, even in scenarios of higher global warming levels.[11] Third, while activities that reduce fossil fuel consumption can cause an increase in some kinds of fossil fuel consumptions (e.g., through rebound effects or market-mediated forces), these effects, where material, must be addressed by mechanism methodologies as leakage emissions, pursuant to the “Standard: Addressing leakage in mechanism methodologies” (A6.4-STAN-METH-005).[12] Lastly, while both clean cooking activities and activities reducing fossil fuel demand face the risk that the carbon in the reservoir may later be used as a fuel, carbon stocks in biospheric reservoirs are also subject to other human-induced risks, in particular land-use change, that do not apply at a comparable geographic scale for fossil fuel production;

(ii) **Projects preserving fossil fuel carbon stocks that interact with atmosphere**: By contrast, projects that preserve specific fossil fuel carbon stocks that may interact with the atmosphere can be subject to significant reversal risks. For example, projects extinguishing uncontrolled fires in coal mines are subject to reversal risk, given that such fires could resume once the project is no longer operational.

32. Version 1.0 of the Reversals Standard recognises these differences. It deems emission reductions from activities that do not affect reservoirs, such as N_2O abatement from nitric acid, or that reduce fossil fuel demand, such as renewable power generation or energy efficiency measures, as permanent (see paragraph 7). By contrast, projects affecting carbon storage in biospheric or geological reservoirs, as well as fossil fuel reservoirs that interact with atmosphere are considered to be subject to reversal risks (see paragraph 6).

33. In conclusion, clean cooking activities whose emission reductions are associated with a reduction of carbon losses in greenhouse gas reservoirs in the biosphere – such as forests, savannas, and grasslands – are subject to significant natural and human-induced reversal risks. These risks are significant in terms of likelihood and magnitude, with the magnitude limited by the total quantity of A6.4ERs issued.

[11] For example, Parker and Mainelli (2022) find that combustion of all ‘proven reserves’ of fossil fuels in 2022 would generate an estimated 4777 Gt of CO_2, which corresponds to continuing current global CO_2 emission levels for more than 100 years.

[12] See https://unfccc.int/sites/default/files/resource/A6.4-STAN-METH-005.pdf.

2.1.4.2. Does the presence or absence of requirements to monitor greenhouse gas reservoirs affect their associated reversal risks?

34. A greenhouse gas reservoir’s reversal risk depends in part on how it is managed. Monitoring of a greenhouse gas reservoir enables implementing strategies to better manage the reservoir and thereby reduce reversal risk. For example, the risk that a subsurface geologic reservoir will experience a reversal depends on whether an activity participant who is injecting carbon dioxide underground monitors the reservoir and can thus detect seepage and implement measures to stop it, or not. Similarly, efforts to reduce deforestation by halting illegal forest logging, such as by funding government regulatory efforts or sustainable land management practices that reduce pressures for illegal logging, may reduce reversal risk by actively monitoring the same forests and sustainable land management practices to detect the effectiveness of interventions and make changes as circumstances warrant. If the activity participant does not monitor the reservoir, reversal risks may increase.

35. While monitoring a greenhouse gas reservoir does not by itself decrease the reservoir’s reversal risks, monitoring is a prerequisite for some strategies to reduce reversal risks. As a result, monitoring is generally a desirable feature and may enable lower-risk outcomes.

36. The MEP further notes that reversal risks can be reduced not only by activity participants, but also by other parties who may implement monitoring and interventions to reduce reversal risks, such that the benefits of monitoring and reversal risk reductions are not limited to monitoring conducted by activity participants.

37. Critically, however, reversal risks do not diminish or disappear in the absence of monitoring. For example, neither the risk of a wildfire nor the risk of illegal logging disappears simply because no one is monitoring a forest. As discussed previously, while it may be particularly difficult to attribute carbon stocks in a specific location to a specific clean cooking activity, the reduction in losses of carbon stocks must exist somewhere in order to have been credited in the first place, and therefore that carbon stock is subject to reversal risk, whether it can be monitored directly, or not.

38. In conclusion, while monitoring of carbon stocks may enable the implementation of some measures to reduce reversal risk, the risk is present irrespective of whether monitoring is applied.

2.1.4.3. How can reversals be distinguished from other phenomena?

39. A reversal should be distinguished from an overall increase in emissions despite implementation of a mitigation activity. For example, total emissions from an electricity system may rise even where renewable-energy activities reduce emissions relative to the baseline scenario. Such an increase in overall emissions does not in itself constitute a reversal, noting that the emissions would have been higher in the absence of the activity.

40. A reversal should also be distinguished from issues such as rebound effects and induced demand, which should be categorized as leakage. These may arise where resources saved by an activity become available for use by others, thereby reducing the net mitigation attributable to the activity. Their potential significance depends on the scale of the activity relative to the affected resource or market. For clean cooking activities, for example, non-renewable woody biomass no longer used by activity households may be used by other users. Such effects concern the net emission reductions attributable to the activity and should be accounted for as leakage where applicable; a reversal, by contrast, concerns the subsequent loss of a previously credited carbon stock difference.

2.1.5. How do concerns about over-crediting or under-crediting relate to addressing non-permanence?

41. Scientific studies, that evaluate the effectiveness of carbon crediting mechanisms, often quantify crediting accuracy by assessing whether outcomes have been over-credited (meaning that activities receive more carbon credits than estimated true emission reductions or removals) or under-credited (meaning that activities receive fewer carbon credits than estimated true emission reductions or removals) (e.g., Probst et al. 2024). This kind of analysis is focused on whether the quantification of total carbon credit issuance is accurate.

42. In contrast, non-permanence is distinct from the accuracy of total credit issuance. It concerns the risk that credited greenhouse gas storage may not persist over time and could be reversed within a specified period (Michaelowa et al. 2025). In the context of carbon crediting mechanisms that use buffer pools as the Article 6.4 mechanism does, non-permanence is addressed by requiring activities to contribute a percentage of total carbon credit issuance to a common buffer pool, based on a reversal risk analysis. The purpose of a reversal risk analysis is to quantify the risk that credited emission reductions or carbon removals are lost to future reversals and relies on the assumption that total emission reductions or carbon removals are quantified robustly (Badgley et al. 2022).

43. Thus, while concerns about the efficacy of carbon crediting need to address over-crediting (or under-crediting) and non-permanence, the two concepts are distinct in their technical implementation and scientific foundations. For example, an activity can be over-credited with an accurate reversal risk assessment or perfectly accurately credited with an erroneously low reversal risk assessment; both outcomes fail to robustly quantify climate benefits with a high degree of confidence. The MEP notes that conservative methodological standards are designed to produce a specified level of confidence that outcomes are not over-credited, which may also lead to under-crediting as a result.

44. The MEP notes that it is relevant to consider the total quantity of carbon credits issued to activity participants, net of both under-crediting from conservativeness determinations and buffer pool contributions from reversal risk assessments. These considerations can be used to assess the expected cost of an activity’s carbon credits and other policy considerations, including equity; however it is not appropriate from a technical perspective to conflate over-crediting or under-crediting with buffer pool contributions. Without prejudice to other potential interventions or rationales, examples of scientifically inconsistent interventions include:

    (a) Choosing to exempt an activity from reversal risk assessment and buffer pool contributions because its methodology under-credits outcomes; and

    (b) Choosing to apply a higher buffer pool contribution than an activity’s reversals risk assessment because its methodology over-credits outcomes.

45. In both examples referenced in paragraph 44, an appropriate intervention would be modifying the carbon crediting methodology to address any identified under-crediting and over-crediting, respectively, rather than to address these concerns through a modification to the reversal risk assessment or its application.

46. In conclusion, over-crediting and non-permanence constitute two different risks to environmental integrity. They should both be addressed in mechanism methodologies.

2.2. Precedents

2.2.1. Comparison between the CDM and the Article 6.4 mechanism

47. Under the Clean Development Mechanism (CDM), an assumption was made to simplify the quantification of emission reductions from reducing the use of non-renewable biomass through efficient and clean cooking by assuming that the baseline cooking energy would be provided by a fossil fuel:

(a) This simplification came about in response to paragraph 30 of decision 1/CMP.2 from 2006, in which the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP) requested the Executive Board (EB) of the CDM 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. It further specified that approval of such methodologies by the EB for use for CDM project activities can occur only after concurrence of the CMP;

(b) In 2007, the CDM EB at its thirty-fourth meeting submitted two methodologies to the CMP for its consideration. These were SSC I.E. “Switch from Non-Renewable Biomass for Thermal Applications by the User” and SSC II.G. Energy Efficiency Measures in Thermal Applications of Non-Renewable Biomass”. Both methodologies stated that “it is assumed that in the absence of the project activity, the baseline scenario would be the use of fossil fuels for meeting similar thermal energy needs;”

(c) The use of a fossil fuel baseline was recommended by the CDM Small-scale working group (SSC WG) at its tenth meeting (paragraph 4) for consistency with the requirements of the CDM modalities and procedures (M&P), which in paragraph 7(a) of decision 17/CP.7 states “that the eligibility of land use, land-use change and forestry project activities under the clean development mechanism is limited to afforestation and reforestation”. The recommendation by SSC WG recognized that the real impact of the reduction in harvest of non-renewable biomass is a land-use change impact that is not generation of removals from afforestation or reforestation but rather a reduction in emissions resulting from land-use change. However, given the request from the CMP, an alternative approach was needed to enable methodologies that reduce the use of non-renewable biomass to be credited under the CDM, while still complying with the M&P;

(d) At the end of 2007, the CMP at its third session through paragraph 24 of decision 2/CMP.3 requested the CDM EB to approve the two methodologies related to non-renewable biomass for thermal application, thereby giving its approval to the workaround proposed by the CDM EB for crediting reductions in the use of non-renewable biomass. The CDM EB then approved the two methodologies at its thirty-seventh meeting in 2008 as "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".

48. Hence, a fossil fuel emission factor was applied to the baseline, and the calculation used in the CDM methodologies did not factor in that the baseline was biomass. This allowed the CDM not to address non-permanence in emission reductions from clean cooking. Therefore, the CDM did not set a precedent for how to manage reversal risk in the context of the Article 6.4 mechanism, where the recommendation is to consider the true baseline

of biomass fuels, such as wood and charcoal, when estimating emission reductions from clean cooking activities that reduces the use of non-renewable biomass.

49. Unlike the CDM, the Rules, Modalities and Procedures (RMP) of the Article 6.4 mechanism established by decision 3/CMA.3 do not contain a restriction on the specific types of land use, land-use change and forestry project activities eligible under the mechanism. Furthermore, mitigation outcomes from the Article 6.4 mechanism may be authorized for use towards nationally determined contributions (NDCs) or other international mitigation purposes (OIMP) and subsequently be subject to corresponding adjustments (e.g., RMP paragraph 3), whereby mitigation outcomes in the t CO_2eq of individual mitigation activities will be added to the emissions covered by the NDC of the host Party. In this context, seeking alignment in the overall methodological approach between the quantification of emission reductions and removals for mitigation activities and national inventory reporting may facilitate transparency, comparability and consistency in applying corresponding adjustments.

50. According to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, CO_2 from the use of biomass fuels by households is reported in national greenhouse gas inventories under Category 1.A.4.b as an informational item and is not included in the sectoral or national totals, to avoid double counting with the agriculture, forestry and other land use (AFOLU) categories (2006 IPCC Guidelines, Chapter 2, section 2.3.3.4). Simultaneously, any net changes to emissions resulting from harvesting of wood fuels would be reported in the inventory under Category 3.B related to land use change. Therefore, it is consistent for the mitigation outcomes from Article 6.4 clean cooking activities to relate to the land use change emissions reported by Parties, and not the household energy CO_2 emissions from biomass fuels, which are only an informational item not included in national totals.

2.3. Current practice and context

2.3.1. Other carbon crediting programmes

51. The following table provides an assessment of the way that various carbon-crediting programmes treat reversal risks in clean cooking activities.

Table 2. Treatment of reversal risks in clean cooking activities

Carbon-crediting programme	Methodology	Date of current version	Date of first version	Projects & PoAs (all versions)	Treatment of reversal risks (current version)	Rationale provided
Gold Standard	Metered & Measured Energy Cooking Devices (MECD) — GS4GG PAA M400-09	v2.0 — 05/05/2026	v1.0 — 07/10/2021	28	**Section 12.1.1-12.1.2:** The activity generates emission reductions by avoiding the combustion of non-renewable biomass; the methodology clarifies that it "does not generate credits for quantified carbon stock sequestered or its avoided loss." While avoidance of the specific combustion event is immediate and permanent, it acknowledges that "the biomass stocks preserved by the activity remain subject to potential future depletion due to natural disturbances (e.g., fires, pests) or anthropogenic drivers (e.g., land clearance)." **Section 12.1.3:** The activity developer "possesses no legal control, land tenure, or management authority over the physical greenhouse gas reservoir." Consequently, "the activity is formally classified under the 'No Control' exemption regarding the carbon reservoir. Non-permanence buffer pool deductions are therefore fundamentally inappropriate for activities	The core rationale is that "the mitigation outcome is generated via avoidance (not sequestration)." **Section 12.1.3:** Second rationale: the developer's lack of control over the physical reservoir, making it "fundamentally inappropriate" to require buffer backing for an asset it does not control. **Section 12.3.1:** Third rationale: macro-level non-permanence risk "is addressed ex-ante for future crediting periods via the dynamic updating of the fNRB and baseline fuel scenario," so "retrospective cancellation of credits or contributions to a Reversal Risk Buffer Pool are not required."
	Reduced Emissions from Cooking and Heating (RECH) — GS4GG PAA M400-08 — formerly "Technologies and Practices to Displace Decentralized Thermal Energy Consumption" (TPDDTEC)	v5.0 — 05/05/2026	v1.0 — 11/04/2011	193		
	Simplified Methodology for Clean and Efficient Cookstoves (SMEC) — GS4GG PAA M400-07	v4.0 — 05/05/2026	v1.0 — 2013	25		

Carbon-crediting programme	Methodology	Date of current version	Date of first version	Projects & PoAs (all versions)	Treatment of reversal risks (current version)	Rationale provided
					applying this methodology and shall not be required". **Section 12.2.1–12.2.2:** In place of a buffer pool, a dynamic monitoring approach applies: mandatory periodic updating of the fNRB (Fraction of Non-Renewable Biomass) parameter and the baseline fuel scenario at each crediting period renewal, including (a) dynamic fNRB updating using standardized tools (MoFuSS/A6.4), (b) a qualitative "Catastrophic Disturbance Events" check, and (c) if severe depletion of the historic biomass resource is confirmed, formal re-evaluation of the baseline scenario via an updated survey. **Section 15.2.1:** Non-permanence risk is managed structurally via mandatory ex-ante reassessment of the baseline fuel scenario, the Catastrophic Disturbance Check, and fNRB updating at each crediting period renewal — not through continuous ex-post monitoring	
Global Carbon Council (GCC)	Methodology for Clean Cooking Transitions using	v1.0 — 19/01/2026 (Under	NA	0	**Section 11.5, para. 193:** Activities under this methodology do not involve direct removal or long-term	**Para. 195:** "although cookstove projects reduce demand for biomass, they do not

Carbon-crediting programme	Methodology	Date of current version	Date of first version	Projects & PoAs (all versions)	Treatment of reversal risks (current version)	Rationale provided
	DMRV Protocol (GCCNMT016)	developme nt)			sequestration of carbon into biomass or soils. Instead, they "reduce emissions at the point of fuel use by avoiding the inefficient combustion of non-renewable biomass fuels." **Para. 194:** The methodology explicitly acknowledges that clean cooking activities "may be viewed as emission reduction activities with potential reversal risks, on the basis that biomass not harvested for cooking could later be harvested for other uses." However, it states that it does not require the full suite of provisions from the "Requirements for activities involving removals under the Article 6.4 mechanism" standard, justified across five points (a–e): **(a) No defined carbon pool or storage to reverse: "**cookstove projects do not create or maintain a physical carbon stock. that could later be lost due to a fire, pests, or other disturbances." If cookstove use declines in the future, "it simply reduces or halts future emission reductions; it does not undo the climate benefit already achieved."	involve removals or the creation of a well-defined carbon pool subject to reversal. While indirect reversal risks may theoretically exist, the methodology already accounts for them through conservative quantification (via fNRB) and a robust emissions reduction framework." In conclusion, according to GCC, the core rationale combines: (1) absence of a credited stock as removals or sequestration, (2) the practical impossibility of attributable monitoring given the geographic diffuseness of the effect, and (3) fNRB as an indirect conservativeness mechanism that already absorbs the risk, substituting the need for a buffer pool

Carbon-crediting programme	Methodology	Date of current version	Date of first version	Projects & PoAs (all versions)	Treatment of reversal risks (current version)	Rationale provided
					(b) Indirect and diffuse impacts: the impact on biomass stocks is spread across wide, indeterminate geographic areas, making it "infeasible to delineate specific zones where potential reversals could be measured or monitored." **(c) No practical pathway for reversal risk monitoring:** establishing causality between cookstove adoption and observed biomass stock changes is "highly uncertain." **(d) Focus on degradation, not deforestation:** non-renewable biomass use "primarily contributes to forest degradation rather than deforestation," a phenomenon that is significantly harder to detect and monitor. **(e) Methodology already integrates permanence considerations:** requires application of a "scientifically derived and periodically updated" fNRB value, such that credits are only issued for "the portion of biomass that would not have regrown without the project activity, implicitly addressing non-permanence/potential reversal risks."	

Carbon-crediting programme	Methodology	Date of current version	Date of first version	Projects & PoAs (all versions)	Treatment of reversal risks (current version)	Rationale provided
Verra, Verified Carbon Standard (VCS)	VM0050 — Energy Efficiency and Fuel-Switch Measures in Cookstoves (v1.0) / renamed "in Cooking Devices" in the v2.0 draft	v2.0 remains in public consultation (draft dated 25 Aug 2026, not yet adopted	v1.0 — 09 Oct 2024	33	VM0050 addresses reversal within **Section 9.3** "Leakage Emissions" (v2.0)/**Section 8.3** (v1.0): "Leakage emissions associated with reduced or avoided use of non-renewable biomass: (a) Use of non-renewable biomass by other users and other types of GHG reversals" (footnote 23: "This includes other non-permanence risks, such as forest fires"). The treatment consists of a fixed 0.95 adjustment factor applied to net emission reductions. In other words, a single blanket percentage discount that bundles reversal together with other leakage resources (non-renewable biomass use by other users, reuse of baseline stoves outside the project), with no separate buffer pool or dedicated reversal monitoring. Version 2.0 added an explicit row in **table 1 of GHG sources:** "Use of non-renewable biomass by other users and other types of GHG reversals," classified as a leakage source	The methodology does not articulate an explicit theoretical rationale as the basis for its treatment of reversal risk, it simply bundles reversal within the leakage category and absorbs it with the same 0.95 discount that also covers biomass use by other users and reuse of baseline stoves. There is no paragraph explaining why 0.95 is sufficient to cover reversal risk, and the value is applied in aggregate across all three leakage categories

2.3.2. The Integrity Council for the Voluntary Carbon Market

52. The Integrity Council for the Voluntary Carbon Market (ICVCM) is an independent non-profit governance body that assesses and approves carbon crediting mechanisms and carbon crediting methodologies against its Core Carbon Principles (CCPs).

53. The ICVCM’s CCPs state, as a category-independent principle, that emission reductions or removals "shall be permanent or, where there is a risk of reversal, there shall be measures in place to address those risks and compensate for reversals".

54. The ICVCM’s Assessment Framework identifies the displacement of non-renewable biomass as a carbon credit category to which non-permanence risks apply (criterion 9.1) and requires carbon crediting programmes for such activities to “assess the risk of reversals and where material risk is identified, have appropriate measures to avoid material risks of reversals”.[13]

55. The Governing Board of the ICVCM approved cookstove carbon credit categories from different carbon crediting programmes and methodologies as CCP eligible, including from carbon crediting programmes and methodologies that include provisions to address reversal risk (e.g. VCS Methodology VM0050) and those that do not (e.g. Gold Standard and other VCS methodologies). The Governing Board issued a document with observations that describes further background on its decision, as follows: “The assessment process considered numerous viewpoints on this issue and noted that methodologies may not directly measure and address reversal risks because emission reductions are derived from energy displaced or saved, rather than from maintaining biomass stocks. It was noted that biomass stocks (i.e., forests, woods etc) are outside the control of energy displacement and efficiency projects. Were it even possible to control such stocks as part of a project, the location of them (i.e., the source areas of fuel) cannot be determined with certainty; for example, charcoal is frequently sourced from neighbouring countries. In conclusion, the assessment found that at present there is no reliable way to systematically and comprehensively identify and assess material risk from these activities and so it is not currently feasible to implement appropriate measures to address them. The Governing Board recognises that further research and evaluation would be required to precisely identify material reversal risks and the ICVCM will be attentive to new emerging methods that can manage and account for them.”[14]

56. In conclusion, independent carbon-crediting programmes, including those with a material participation in crediting of clean and efficient cooking activities, recognise that the projects impact carbon reservoirs that may have reversal risks. However, some programmes have exempted projects from addressing reversal risk due to lack of control over reservoirs (Gold Standard) or practical impossibility to attribute impacts (GCC), while one programme implemented a standard deduction of 5 per cent of emission reductions to address leakage including reversal risks of all clean cooking activities applying its methodology (VCS). Separately, the ICVCM concluded that since there was no way to systematically and comprehensively identify and assess material risk from clean cooking activities, it was not feasible to require carbon crediting programmes to implement appropriate measures to

[13] See https://icvcm.org/wp-content/uploads/2024/02/CCP-Section-4-V1.1-FINAL-15May24.pdf.

[14] See https://icvcm.org/wp-content/uploads/2025/03/Board-Observations_Cookstoves-and-Biodigesters-FINAL.pdf.

address the reversal risks, while noting that it would evaluate further research and new emerging methods as they become available.

57. As discussed in the Scientific Background section of this document, there is a need to address non-permanence for all Article 6.4ERs subject to reversal risk. Neither difficulties with specific attribution, nor lack of control of reservoirs, may be considered adequate justification for not taking into account reversal risks, in general, in mitigation actions. With respect to clean cooking activities, acknowledging that other carbon crediting programmes have not applied reversal risk assessment to this activity type, the MEP has developed a new approach that proposes to systematically estimate reversal risks of the emission reductions from clean cooking activities on the basis of default values developed for jurisdictional geographic areas and proposes it as a way to quantify these risks.

2.4. Implications

2.4.1. Transactions costs of the proposed approach to account for reversal risk

58. The two draft clean cooking methodologies and the draft methodological tool to assess reversal risk adopt a simplified approach to address reversals risks for clean cooking activities. The proposed approach makes use of the provision in paragraph 13 of version 1.0 of the Reversals Standard, which allows mechanism methodology proponents to propose alternative approaches to certain monitoring, reporting, and post-crediting rules under certain conditions: i.) when activity participants do not control the relevant greenhouse gas reservoir, ii) when the reservoir is not in the same location as the activity, and iii.) changes in the reservoir cannot be traced back to the activity. The Article 6. methodologies for clean cooking activities rely on this flexibility to exempt activity participants from reversal monitoring, reporting, and post-crediting monitoring. The proposed methodologies allow using default values to account for the risk of reversals that are included in the draft methodological tool. The values have the same geographical aggregation as the fNRB values.

59. In conclusion, the proposed approach is simple to implement and does not involve any material transaction costs for activity participants, as the calculation of reversal risks relies on default factors and no monitoring of any parameters is required.

2.4.2. Implications on the number of A6.4ERs issued to activity participants

60. In the two draft clean cooking methodologies, reversal risk is assessed and non-permanence is addressed as follows. A fraction ($F_{buffer,i,t}$), representing the level of risk, is multiplied by the emission reductions associated with the greenhouse gas reservoir subject to reversal risk (aboveground woody biomass in landscapes). The resulting number is subtracted from the total number of A6.4ERs to be issued to the activity participants and those subtracted A6.4ERs are forwarded to the reversal risk buffer pool account.

61. Since reversal risk for clean cooking activities has not been systematically assessed and addressed by other carbon crediting programmes, the two draft clean cooking methodologies under the Article 6.4 mechanism would represent the first time that activity developers of this activity type receive significant fewer carbon credits than the total emission reductions calculated. Historically, many clean cooking methodologies under the CDM and other carbon crediting programmes utilized a standard leakage deduction of 5 per cent of outcomes; therefore, participants were accustomed to a 5 per cent deduction,

but the potential deductions from the reversal risk assessment are higher than this (see the draft methodological tool: Reversal Risk Assessment (MEP016-A07)).

62. Table 3 provides a comparison of the estimated total emission reductions per household for different hypothetical examples of clean cooking activities when applying the two draft clean cooking methodologies and specifies the estimated number and proportion of A6.4ERs that are subject to reversal risk.

Table 3. Illustrative Emission Reductions Estimates per Household before addressing non-permanence[15]

Hypothetical activity	Emission reductions				Per centage reductions subject to reversal risk	
	Total (t CO_2eq / household-year)		Subject to reversal risk (t CO_2 / household-year) [16]			
	MEP014-A04	MEP015-A01	MEP014-A04	MEP015-A01	MEP014-A04	MEP015-A01
Fuelwood efficiency	0.39	0.38	0.32	0.33	83	85
Charcoal efficiency	0.35	0.30	0.18	0.15	51	51
Charcoal to Electricity	NA	0.84	NA	0.42	NA	50

63. When the contribution to the reversal risk buffer pool account is subtracted from the emission reductions, this reduces the quantity of A6.4ERs that will be issued to activity participants. Table 4 illustrates how different contribution levels to the reversal risk buffer pool account ($F_{buffer,i,t}$), for the hypothetical examples modelled here, would reduce the number of A6.4ERs issued to activity participants by as little as approximately 6 per cent (charcoal to electricity, in the 10 per cent reversal reduction scenario), to close to 60 per cent (fuelwood efficiency, in the 50 per cent reversal reduction scenario).

64. Considering both the lower emission reductions resulting from the two draft clean cooking methodologies, as well as the deduction of the contribution to the reversal risk buffer pool account, the number of A6.4ERs issued to activity participants from these methodologies will be substantially lower than the emission reductions credited for activities of a similar scope under other carbon crediting programmes.

[15] Note that the numbers in this table have been rounded.

[16] Note that non-CO_2 emission reductions are not subject to reversal risk.

Table 4. Comparison of Illustrative Emission Reductions Estimates per Household (t CO_2-eq / household-year) after buffer pool deduction

	Total emission reductions (t CO_2 eq / household-year)		After contribution to the buffer pool account (t CO_2 eq / household-year)[17]					
Hypothetical activity	MEP014-A04	MEP015-A01	MEP014-A04			MEP015-A01		
Contribution to the buffer pool for reversal risk ($F_{buffer,i,t}$) *in per centage*	NA		10	30	50	10	30	50
Fuelwood efficiency	0.39	0.38	0.36	0.29	0.23	0.35	0.29	0.22
Charcoal efficiency	0.35	0.30	0.33	0.29	0.26	0.28	0.25	0.22
Charcoal to Electricity	NA	0.84	NA	NA	NA	0.79	0.71	0.63

65. This reduction in credits issued to the activity participants would translate into lower income per stove implemented, as compared to clean cooking credits for which reversal risks are not addressed, unless higher credit pricing makes up the difference. As described previously, other carbon crediting programmes currently do not systematically assess and address reversal risks, so their clean cooking activities would receive higher revenues for the same clean cooking intervention, if pricing is the same across the Article 6.4 mechanism and other markets. Therefore, respectively higher prices would need to be paid for A6.4ERs to ensure the feasibility of clean cooking activities addressing reversal risks. Table 5 below outlines illustrative examples of revenues in different markets, without buffer pool contributions for the hypothetical fuelwood efficiency project.

Table 5. Example revenue per household per year for the hypothetical fuelwood efficiency project, without buffer pool deductions

Market	**Indicative price (USD/ t CO_2 eq)**	**Example revenue without buffer pool deduction (USD/ household-year)** [18]	
	Price	MEP014-A04	MEP015-A01
Voluntary market — no label	\$ 2.50[19]	\$ 0.97	\$ 0.96

[17] These numbers do not address contributions to SOP or OMGE.

[18] These numbers do not address contributions to SOP or OMGE.

[19] Source: Emsurge Open Markets (EOM) — VCM Price Assessment, August 2026.

Market	**Indicative price (USD/ t CO_2 eq)**	**Example revenue without buffer pool deduction (USD/ household-year)** [18]	
Voluntary market — Cookstoves CCP (ICVCM) label	$ 15.00[20]	$ 5.85	$ 5.76
CORSIA Phase 1	$ 10.55[20]	$ 4.11	$ 4.05
ITMOs under a cooperative approach	$ 22.50[21]	$ 8.77	$ 8.64

66. Table 6 below outlines the price increases required for the hypothetical examples of the three activity types (fuelwood efficiency, charcoal efficiency and charcoal to electricity) to achieve the same level of revenue as the same activity if it were not subject to reversal risk or deductions. Where such higher prices are not paid, the clean cooking activities may not go ahead, and both project developers and buyers may move to relatively cheaper activities instead. Conversely, if consistently higher pricing is available to A6.4ERs, then the relative lower volume of credits may not affect the ability to implement clean cooking activities under the Article 6.4 mechanism.

Table 6. Estimated price increase required after buffer pool deductions

Contribution to the buffer pool for reversal risk ($F_{buffer,i,t}$) *in per centage*:	**10**		**30**		**50**	
Parameter	MEP014-04	MEP015-A01	MEP014-04	MEP015-A01	MEP014-04	MEP015-A01
Fuelwood efficiency	0.09	0.09	0.22	0.23	0.71	0.74
Charcoal efficiency	0.05	0.05	0.12	0.12	0.34	0.34
Charcoal to electricity	NA	5	NA	0.12	NA	0.33

2.5. Potential benefits and drawbacks of accounting for non-permanence risk

67. The main purpose and benefit of accounting for reversal risk is the preservation of environmental integrity of A6.4ERs issued under the Article 6.4 mechanism, since emission reductions from clean cooking activities are subject to reversal risks. When reversal risk is accounted for, this enables ensuring that the cumulative emission reductions resulting from those activities over time are not overstated. If reversal risk would not be accounted for, this could lead to higher global greenhouse gas emissions compared to using A6.4ERs from an activity with permanent emission reductions or compared to the situation where the buyer of A6.4ERs would reduce its own emissions. In this regard, accounting for reversal risk is an important prerequisite for achieving environmental integrity.

[20] Source: Fastmarkets — Veethika Jain and Sam Carew, “Cookstove developers face CCP vs CORSIA trade-off as price premiums clash”, 1 June 2026.

[21] Source: S&P Global – Vandana Sebastian, “Senegal, Ghana sell cookstove carbon credits to Switzerland in $20-25/mtCO2e range”, 29 September 2023

68. A decision not to account for reversal risk could be viewed as not complying with RMPs which require reversals to be addressed "in full" (paragraph 31(d)(ii)). This might have broader implications for the mechanism beyond methodologies for clean cooking activities, as some stakeholders may view the mechanism as not complying with the RMPs and failing to address integrity concerns that had earlier been identified with regard to reversal risks of cookstove methodologies.

69. Further benefits and drawbacks depend on the relevant market actors and their perspectives and preferences. Market actors — such as activity participants, host countries, and buyers of A6.4ERs — may respond differently to the accounting for reversal risk, depending on their perspectives and preferences.

70. For some market actors, the pricing of A6.4ERs is the main consideration. As accounting for reversal risk increases the cost per unit of generating A6.4ERs from clean cooking activities (see section 2.4.2 above) and therefore also the price per unit when those A6.4ERs are sold, some market actors could engage with other carbon crediting programmes that do not require accounting for reversal risks so as to continue implementing clean cooking activities at a lower cost or to continue purchasing carbon credits from this activity type at a lower price. Also, some market actors could pursue instead other type of Article 6.4 activities that are associated with lower mitigation costs compared to the clean cooking activities. This could lead to *fewer* clean cooking activities being implemented specifically under the Article 6.4 mechanism, or overall in other carbon crediting programmes.

71. For some market actors, the environmental integrity of carbon credits is the main consideration. Since one element of environmental integrity is addressing the risk of reversals in full, accounting for reversal risks is necessary to achieve environmental integrity; therefore, some market actors may prefer to engage with the Article 6.4 mechanism to pursue clean cooking activities, rather than with other carbon crediting programmes that do not address reversal risk. Conversely, if reversal risk would not be accounted for, these types of market actors could view this aspect of environmental integrity as being undermined and could pursue other mitigation activities which they perceive to have higher environmental integrity. In this regard, not accounting for reversal risk could also lead to a lower uptake of clean cooking activities under the Article 6.4 mechanism and a shift towards other types of activities, with the reverse benefits and drawbacks compared to those described earlier in this paragraph 70 above.

72. For these reasons, accounting or not accounting for reversal risk could lead to shifts in the market, noting that the direction of the shift may depend on the perspectives and preference of market actors. The MEP observes the following consequences of such shifts:

    (a) A shift from clean cooking to other (e.g., lower cost) activities under Article 6.4 would be a drawback for clean cooking activities developers and a benefit for the developers of the types of projects where the demand would shift to.

    (b) In terms of sustainable development co-benefits, a shift away from Article 6.4 clean cooking activities may be viewed as a drawback, as clean cooking activities commonly have high sustainable development benefits for low-income households (which includes, for example, reduction in in-door air pollution or household labour). They also provide benefits to communities with the lowest income (see section 4 in Appendix 7 of MEP016-A03).

(c) A lack of development of clean cooking activities under Article 6.4 mechanism, due to market actors choosing the other carbon-crediting programmes instead for these activities, would be a drawback for host Parties wishing to use the centralized mechanism under the authority of the CMA to contribute to emission reductions, and may provide benefits for Article 6.2 approaches (if these apply different standards than the Article 6.4 mechanism) and other carbon crediting programmes that could host clean cooking activities if interest in these activities continues. Since the countries hosting clean cooking activities are developing countries, including LDCs, this could be a barrier to the participation of such countries in the Article 6.4 mechanism and may be considered a drawback.

73. The relative prices of A6.4ERs and the economic efficiency of carbon markets are another key consideration for some market actors. Other activity types that are subject to reversal risks, particularly those that have comparable or lower reversal risks and higher costs, would be put at a competitive disadvantage by a decision to not account for reversal risks of activities that reduce non-renewable biomass consumption since this decision would artificially lower the cost of the latter. If A6.4ERs are issued to some activity types that have reversal risks without accounting for non-permanence, all activity types that have reversal risk and do account for non-permanence would be penalized in relative economic terms. This would reduce the efficiency of carbon markets and could thereby lead to higher costs of mitigating climate change. These considerations may be particularly important for the inclusion of approaches to support anthropogenic removals, including land-sector-based approaches (e.g., afforestation) and novel carbon removal pathways (e.g., enhanced weathering, other alkalinity enhancements, and direct air capture with subsurface geologic storage). In other words, not taking into account the reversal risks of activities that reduce non-renewable biomass consumption would benefit clean cooking activities by lowering their relative cost, to the disadvantage of other activity types with reversal risks such as removals activities.

74. Some market actors perceive the proposed treatment of reversal risk as unfair or unreasonable given that clean cooking activity developers have little or no ability to manage the risk for which they would effectively be held responsible. Some may also perceive that the treatment of reversal risk erodes incentives to undertake clean cooking activities under the Article 6.4 mechanism. Perceptions of this nature have been expressed by stakeholders in responses to call for public inputs. If reversal risk is factored in towards calculating emission reductions, such market actors may view the Article 6.4 mechanism negatively and refrain from engaging with the mechanism. By contrast, some stakeholders may perceive a decision not to account for reversal risk as that the Article 6.4 mechanism fails to address this aspect of the environmental integrity of carbon crediting observed in the literature and may question the use of the Article 6.4 mechanism or carbon crediting as policy instrument more broadly. It is not clear what the net impact of these perceptions would be in terms of the quantity or scale of implementation of mitigation actions that would be eligible for the Article 6.4 mechanism.

75. In conclusion, because emissions reduced by clean cooking activities are subject to reversal risk, the central benefit of accounting for reversal risk is the preservation of environmental integrity of the Article 6.4 mechanism as a whole, by addressing non-permanence for all activity types subject to reversal risk. This is consistent with the RMPs, which, in paragraph 31(d)(ii), require reversals to be addressed “in full” (see paragraph 68 of this information note).

76. The other impacts outlined in section 2.5 may be perceived as benefits or drawbacks, depending upon the perspectives of individual markets actors such as activity participants,

host countries, and buyers of A6.4ERs. It is therefore difficult to predict what the net impact of these benefits and drawbacks would be on the Article 6.4 mechanism and on the development of clean cooking activities.

2.6. References

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3. Paragraph 22(b) of the SBM022 meeting report

3.1. Background

77. Paragraph 13(j) of the draft mechanism methodology "Energy efficiency measures in household cooking" (A6.4-MEP014-A04) sets the following applicability condition: "*Prior to the implementation of the Article 6.4 activity, the percentage of households in the target population with a functional cooking technology that is assessed to have the same or a higher efficiency as the project cookstoves is 4.5 per cent or less, as determined by following the methods in section 7.1.1*;".

78. Compliance with this threshold is assessed through the provisions contained in paragraphs 45 to 49 in section 7.1.1 of the draft mechanism methodology, noting in particular that paragraph 47 stipulates that data sources which may be used for this assessment include either national household energy surveys, census data, or other representative market studies; or where no such sources are available, the pre-activity survey may be used. Furthermore, technologies installed as part of an activity registered under another carbon crediting programme may be excluded from the analysis.

79. The rationales for the selected threshold are provided in an updated Appendix 7 to the draft mechanism methodology and are summarized in sections 3.2 and 3.3 below.

80. This applicability condition forms part of the additionality demonstration using performance-based approaches that is applied in A6.4-MEP014-A04. In working drafts of the mechanism methodology, the MEP had included this condition in section 6, Demonstration of Additionality. However, it was observed that the condition effectively functioned as an applicability condition to the mechanism methodology and hence, it

would be logical for the mechanism methodology’s users to encounter this condition at the stage of evaluating eligibility, rather than coming across the condition for the first time in section 6. Therefore, the condition was moved to the applicability conditions, despite its role as a step in the additionality demonstration.

3.2. Compliance with Article 6.4 rules

81. The related conditions of section 6.6.1 of the version 01.2 of the “Standard: Demonstration of additionality in mechanism methodologies” (A6.4-STAN-METH-003) (hereinafter referred to as the “Additionality Standard”) are addressed as follows:

(a) In fulfilment of paragraph 61(a), A6.4-MEP014-A04 uses the baseline approach referred to in paragraph 36(ii) of the rules, modalities and procedures of the Article 6.4 mechanism;

(b) In fulfilment of paragraph 61(b), the type of activity, i.e. more efficient household cooking using fuelwood or charcoal fuel in rural, low-income households, provides the service of thermal energy for cooking events for residents of the household;

(c) In fulfilment of paragraph 61(c), the performance of this type of activity can be standardized across households on the basis of thermal efficiency of the cooking technology and practices that are used for providing the thermal energy for cooking events;

(d) In fulfilment of paragraph 61(d), peer-reviewed literature demonstrates that, across broad geographies, activities with a better performance have a higher likelihood of additionality, for example, improved cookstoves where the fuel is fuelwood or charcoal in low-income households in rural areas. Reports by multilateral agencies (e.g., International Energy Agency (IEA et al. 2025) and peer-reviewed literature (Stoner et al. 2021) confirm that there continues to be lack of access to clean cooking and dominance of solid biomass fuels in rural areas, that lack access to clean cooking correlates with poverty, and that several countries in Sub-Saharan Africa and Southern Asia, in particular, have seen only marginal progress in access to clean cooking and have growing population lacking access; [22]

(e) In fulfilment of paragraph 61(e), robust and representative data from academic literature are available on the performance of household cooking technologies using fuelwood or charcoal fuel in rural, low-income households, providing the service of thermal energy for meal preparation for residents. Lab-based data are also available for improved cookstoves (ICS), e.g., Jetter et al. 2012, Still et al. 2015. [23]

82. A detailed documentation of compliance with all provisions found in section 6.6 of the standard was added in Table 3 of Appendix 7 of this proposed mechanism methodology.

[22] Gill-Wiehl et al. 2026., Berkouwer & Dean 2026.

[23] E.g., Quantifying the Efficiency and Fuel Consumption of Cooking with Traditional Wood and Charcoal Stoves in Malawi, Ghana, and Kenya-Urban et al. 2025.

3.3. Rationales for the 4.5 per cent threshold

83. The threshold seeks to ensure that the Article 6.4 activity is very likely (at least 90 per cent probability) to be additional as detailed in Table 3 of Appendix 7 of the proposed mechanism methodology, in compliance with paragraph 67 of the Additionality Standard.

3.4. Benefits and drawbacks of expanding the scope of exclusions in paragraph 46(a)

84. The intent of the 4.5 per cent limit is to set a threshold which represents the autonomous improved cookstove adoption rate, i.e., without incentives such as government subsidies or carbon finance. For this reason paragraph 46 excludes “technologies installed under as part of an activity registered under another carbon crediting scheme;” since these would not represent an autonomous improved cookstove uptake.

85. Noting the point above, further types of improved cookstoves uptake which are not autonomous could be excluded, among which cookstoves installed as part of the following:

   (a) Although it may be considered self-evident, those installed as part of an Article 6.4 activity could be excluded explicitly;

   (b) Interventions supported by private donations or grants; and

   (c) Interventions supported by bilateral and multilateral development aid.

86. The following benefits with proceeding with these exclusions have been identified:

   (a) Avoiding confusion by explicitly clarifying the exclusion of Article 6.4 activities;

   (b) With respect to the other potential exclusions:

      (i) More closely aligning the mechanism methodology with what the performance-based approach seeks to capture, which is the autonomous (i.e., commercial) uptake of cookstoves;

      (ii) Make the proposed mechanism methodology apply in more locations, since it would increase the ability to demonstrate additionality in contexts where cookstove uptake already happened, but not in an autonomous manner.

87. No drawbacks are identified with explicitly clarifying the exclusion of Article 6.4 activities; therefore, this change was incorporated in the mechanism methodology.

88. With respect to the other potential exclusions, the following drawbacks are identified:

   (a) Difficulty in the objective verification by DOEs that identified cookstoves were obtained due to support by private donations or grants or by bilateral and multilateral development aid. The difficulty in verification would reduce the credibility of these specific exclusions. The case of units from other carbon crediting programme activities does not face the same difficulty, since ample publicly available information is available in each programme’s registry about registered carbon crediting activities (locations, stove descriptions, number, dates of distribution, etc.);

   (b) Weakening of the performance-based additionality demonstration under the mechanism methodology. There is not a strong need to expand the applicability of MEP014-A04 by weakening the additionality demonstration, since activities that do not qualify for MEP014-A04 may consider applying MEP015-A01 and its comprehensive additionality method, if both these draft clean cooking mechanism methodologies are approved by the Supervisory Body.

3.5. Whether the assumptions take into account potential non-linear growth rates of autonomous adoption

89. Potential non-linear growth in autonomous adoption cannot be excluded. Nevertheless, the threshold test adopted on the rate of autonomous adoption is a stock-based test which is agnostic to the type of uptake, whether linear, exponential, or following some other trend.

90. Nevertheless, the academic literature and IEA reports consulted for developing the performance-based approach do not provide evidence of non-linear uptake of improved cookstoves in rural, low-income settings where cooking relies on solid biomass.

91. In practice, however, if autonomous adoption of improved cookstoves were to occur exponentially in parallel with a clean cooking activity applying MEP014-A04, then over the crediting period, this would likely impact the use of project stoves, by substituting them or by households refusing to pay for them or otherwise adopt the units, and the decreased usage would be reflected in household numbers, usage surveys, activity KPTs, and SUMs measurements. Emission reductions would only be calculated according to the observed usage of the project cookstoves. Therefore, the risk of over-crediting under these unlikely circumstances remains low.

4. Paragraph 22(c) of the SBM022 meeting report

4.1. Regulatory background

92. Section 6.2 of the version 01.0 of the Baseline Standard allows setting the baseline based on an ambitious benchmark:

(a) Paragraph 52(h) of this standard specifies that this ambitious benchmark shall be set based on the 20th percentile or less of the best performing comparable activities of the distribution curve;

(b) Paragraph 52(i) clarifies that the ambitious benchmark shall be based on the "weighted average" of all the best performing comparable activities including and beyond (to be understood in this context as having a better performance than) the selected percentile.

4.2. Discussion

93. In the case of clean cooking activities, the application of the approach 36(ii) "ambitious benchmark" of the Rules Modalities and Procedures may lead to a strongly conservative baseline. If cookstoves with excellent performance (for example, electric induction stoves) represent only a small proportion of existing stoves (i.e., a skewed distribution), they would represent a larger proportion of the top performing percentile and would impact a weighted average within that performance segment, thereby generating a baseline level more ambitious than might be achieved by, for example, downward adjustment of historical emissions.

94. In this context, alternative approaches were evaluated and compared. Noting how the Supervisory Body, in its request, outlined an approach which is not aligned with the Baseline Standard, i.e. “the median performance of all the best performing comparable activities including and beyond the selected percentile”, baseline setting alternatives were tested beyond those allowed by this standard, and these are flagged as not aligned in the summary provided in the table below.

Table 7. Indicative results of alternative approaches to setting the ambitious benchmark for the baseline of MEP014-A04

Type of baseline and description	**Indicative crediting baseline cookstove efficiency *(in per centage)***	**Baseline standard compliance [yes/no]**
36(ii) Ambitious benchmark *(weighted average of the top 20 per cent)*	16.6	Yes
Benchmark- *weighted average of the top 30 per cent*	15.0	No
Benchmark- *weighted average of the top 40 per cent*	14.2	No
Benchmark- *applying the median of the top 20 per cent*	11.8	No
Benchmark-*applying the geometric mean of the top 20 per cent*	14.8	No
36(iii) Existing actual or historical emissions approach adjusted downwards	14.0	Yes

95. On this basis, it is concluded that other approaches for setting a baseline benchmark under MEP014-A04 would depart from the descriptor “ambitious”. In particular, applying the median of the top 20th percentile would lead to a higher, less ambitious baseline than that determined according to paragraph 36(iii) of the RMPs and could not be considered below BAU, but rather would fall at the level of BAU.

96. The MEP also notes that a change in the type of calculation used for deriving the ambitious benchmark would require amending the standard “Setting the baseline in mechanism methodology”.

5. Subsequent work and timeline

97. No further work is envisioned to respond to the mandate provided in paragraph 1.

6. Recommendations to the Supervisory Body

98. The Supervisory Body shall consider this information note when considering the MEP recommendation on the (a) “Draft mechanism methodology: Energy efficiency measures in household cooking” and (b) “Draft mechanism methodology: Cooking energy transitions”.

Appendix. Other potential approaches

1. This appendix identifies other potential approaches with regard to the treatment of non-permanence risk and identifies their potential benefits and drawbacks. None of the approaches identified constitutes a recommendation by the MEP nor a consensus view of the MEP. Furthermore, some of the approaches may not align with requirements of CMA decisions or adopted regulatory documents by the Supervisory Body but may require changes to the Article 6.4 rules by the Supervisory Body or the CMA.

1. Requiring accounting for non-permanence risk for authorized A6.4ERs (AERs) but not for mitigation contribution A6.4ERs (MCUs)

2. One approach to be responsive to environmental integrity and stakeholder concerns about the economic impacts of addressing non-permanence in clean cooking activities would be to make a buffer pool contribution mandatory in the case of authorized A6.4ERs but optional for mitigation contribution A6.4ERs (MCUs).

3. The primary rationale behind this approach is that non-permanence concerns are most pronounced when an A6.4ER is used to make a compensation or neutralization claim, such as when it is used by a buyer country to demonstrate compliance with that country’s NDC or by a private buyer in a compliance application (e.g., CORSIA). Non-permanence considerations are most pronounced when an A6.4ER is used to justify ongoing carbon dioxide emissions, which have effectively permanent impacts on the global atmosphere and oceans. Non-permanence considerations are still relevant for contribution claims, as temporary carbon storage contributes benefits only so long as the storage persists, but this potentially shorter duration of the benefit is less critical since it is not compensating or neutralizing a permanent emission.

4. The main advantage of this approach would be to provide flexibility to activity participants to choose an approach while ensuring that environmental integrity is preserved for authorized A6.4ERs.

5. Downside of this approach include that:

    (a) It would create a different level of substantive claims for MCUs and A6.4ERs, as well as between different MCUs. If clean cooking activities choose not to address non-permanence, the resulting MCUs would not address non-permanence. In contrast, MCUs awarded to other activities that are subject to reversal risks would address non-permanence, including clean cooking activities that choose to address non-permanence as well as other non-permanent activity types that are required to address non-permanence. Similarly, any MCUs that are issued to activities that have reversal risks but do not make buffer pool contributions would contrast with the requirement for all activity types to address non-permanence in the context of A6.4ERs. These differences would be less extensive than a decision to exempt clean cooking activities from non-permanence, as the exemption discussed here would be relatively narrower, but it may nevertheless raise concerns for some stakeholders. These differences would also require distinguishing MCUs that do not account for reversal risk from MCUs that are either not subject to reversal risks or that address those risks (e.g., through a tag in the mechanism registry);

(b) It is unclear whether sufficient demand for MCUs would be available from prospective buyers to be responsive to activity participants’ concerns with the buffer pool contributions; and

6. The MEP further notes that rules would need to be developed to address the authorization of already issued MCUs, ensuring that the necessary contribution to the reversal risk buffer pool account is made when MCUs are converted to A6.4ERs.

2. Requiring buffer pool contributions for clean cooking activities to be made by other activity types

7. One approach to be responsive to environmental integrity and stakeholder concerns about the economic impacts of addressing non-permanence in clean cooking activities would be to require other activity participants to contribute A6.4ERs to the buffer pool on behalf of clean cooking activities. This could be accomplished by imposing a new requirement that applies to other activities (i.e., other than clean cooking) to contribute a percentage of total A6.4ER issuance to the buffer pool, with a true-up procedure to track the adequacy of the required contribution and adjust it as needed to ensure the appropriate volume of buffer pool unit contributions over time. The new requirement could be applied to all other activities, or a subset of activities (e.g., those that are not subject to reversal risks). This approach could also be applied until a certain date only, as a bridging measure, i.e. during a transition period (for example, see section 7 of this Appendix).

8. The primary rationale behind this approach is to be responsive to the physical reversal risks and equity considerations associated with imposing the associated economic impacts of addressing non-permanence on clean cooking activities.

9. The main advantages of this approach are that it would preserve environmental integrity and address equity considerations through cost-shifting measures. The primary downside of this approach is that it would impose the costs of addressing non-permanence for one activity type onto other activity types and therefore raise concerns for those stakeholders. This would also set a new precedent wherein other activity types are burdened to make up for the environmental integrity related exemptions for an activity type. In addition, it would require a procedure to develop and oversee the appropriate contribution level, which would be uncertain because it depends on relative issuance volumes across clean cooking and other activity types. The added cost along with the uncertainty could adversely impact the participation of other activity types in Article 6.4.

3. Allow clean cooking activities that are nested under a jurisdictional carbon crediting activity not to account for non-permanence risk

10. Under this approach, clean cooking activities nested under a jurisdictional carbon crediting activity would not need to account for non-permanence risk. This approach could be implemented if several conditions are fulfilled, including that:

(a) The geographical area where biomass harvest is reduced falls within the scope of a jurisdictional carbon crediting activity;

(b) The jurisdictional carbon crediting activity covers the relevant land types (e.g. forests) and accounts for the relevant carbon reservoirs (e.g. above-ground biomass);

(c) The jurisdictional carbon crediting activity is registered under the Article 6.4 mechanism or has approaches equivalent to the Article 6.4 mechanism in place;

(d) The jurisdictional carbon crediting activity has provisions in place to avoid double issuance of carbon credits between the jurisdictional activity and the nested clean cooking activities; and

(e) The jurisdictional carbon crediting activity assumes responsibility for monitoring and compensating for all reversals, including those that occur with respect to emission reductions caused by clean cooking activities.

11. The main benefit of this approach is that integrity would not be undermined as the reversal risk would be accounted for at jurisdictional level, while clean cooking activities would not need to account for the risk and thus receive a larger number of A6.4ERs. The main drawbacks are that jurisdictional activities are not yet available under the Article 6.4 mechanism, that jurisdictional activities under other carbon crediting programme may not align with rules of the Article 6.4 mechanism, including on addressing non-permanence, and that only some but not all relevant jurisdictions may pursue jurisdictional carbon crediting activities. Moreover, crediting at jurisdictional level raises methodological challenges that would need to be addressed.

4. Assume a fossil fuel baseline for clean cooking activities and do not account for non-permanence risk

12. Under this approach, Article 6.4 clean cooking methodologies could apply a fossil fuel emission factor to the baseline, in the same way as under the CDM. If fossil fuel use is the baseline, then the mechanism methodologies would not need to assess reversal risk or address it, thereby avoiding the deduction of a buffer pool contribution from the total emission reductions calculated.

13. A benefit of this approach is that it would align the treatment of this activity type with CDM precedent and current carbon-market practice.

14. Drawbacks of this approach include that:

(a) It may not increase the total amount to be credited, given that the fossil fuel emission factors applied in CDM are lower than the emission factors for biomass fuels like wood and charcoal proposed in the draft mechanism methodologies;

(b) It would not promote alignment in the overall methodological approach between the quantification of emission reductions and removals for mitigation activities and national inventory reporting. For example, it would be inconsistent to treat baseline fuel consumption as fossil fuels in order to avoid addressing reversal risks but applying concepts related to calculating reductions in non-renewable biomass consumption (e.g., through the application of the fNRB Tool), which implies that baseline consumption is non-fossil. The approach could also be perceived as not providing a realistic and credible baseline if the efficiencies and net calorific values using biomass fuels were combined with CO_2 emission factors for fossil fuels.

15. Assuming a suppressed demand fossil fuel baseline, based on the efficiency and emission factors of LPG stoves, could in principles be a more credible and realistic alternative, but would lead to even fewer A6.4ERs than the proposed approach in the two draft methodologies.

5. Limit clean cooking emission reduction calculations to non-CO_2 gases

16. Under this approach, the clean cooking methodologies would only calculate creditable emission reductions from the reductions in CH_4 and N_2O emissions resulting from reduced biomass fuel use and improved combustion (which are currently included in the methodologies). No emission reductions of CO_2 would be calculated (in contrast to their current inclusion in the methodologies), effectively assuming that all biomass fuel is renewable biomass, thereby dispensing with the need to determine fNRB, while also avoiding the quantification and crediting of emission reductions subject to reversal risks.

17. The benefits of this approach would include simplification (no need for fNRB or reversal risk assessment) and that no buffer pool contribution would be required.

18. The main drawback of this approach is that it would not address comments by stakeholder concerned with the volume of A6.4ERs because it would result in even lower emission reductions per household as compared to the current versions of the two proposed clean cooking methodologies (i.e., to issue even fewer A6.4ERs to activity participants than when requiring a buffer pool contribution), since non-CO_2 represents only about half of baseline emissions in the case of charcoal baselines and a small portion of baseline emissions in the case of fuelwood baselines (see Table 3).

6. Account for non-permanence risk but adjust other requirements for clean cooking activities to enhance crediting levels

19. Under this approach, the clean cooking methodologies would require reversal risk assessment, buffer pool contribution, and cancellation, but simultaneously, different requirements of the Article 6.4 mechanism could be adjusted or exempted for clean cooking activities to address concerns about the implications on the number of A6.4ERs and potential negative impacts on the financing of clean cooking activities. For example, the Baseline Standard requires that emission reductions are “very unlikely to be overestimated”, and for clean cooking activities under MEP014-A04, this results in the creditable emissions reductions being only roughly 45 per centage of the central estimates of emission reductions, due to the high uncertainty in the data inputs required for calculation (particularly, baseline fuel use, activity fuel use (for some cases), emission factors, and fNRB).

Table 1. Outcomes of the Monte Carlo analysis performed for the proposed mechanism methodology “Energy efficiency measures in household cooking” (MEP014-A04)

	Good wood stove (25 *per cent*)	**Excellent wood stove (35 *per cent*)**	**Good charcoal stove (35 *per cent*)**	**Excellent charcoal stove (45 *per cent*)**
Final: Approach A at P10	0.446	0.625	0.230	0.420

	Good wood stove (25 *per cent*)	**Excellent wood stove (35 *per cent*)**	**Good charcoal stove (35 *per cent*)**	**Excellent charcoal stove (45 *per cent*)**
Final: Mean ER (Monte Carlo)	0.950	1.173	0.678	0.909
P10 as per cent of central	46.9	53.3	33.9	46.2

20. As an observation, the estimated emission reductions per household prior to the buffer pool contribution when applying the two draft clean cooking methodologies are generally lower than the emission reductions when applying recent versions of the mechanism methodologies with a similar scope from other carbon crediting programmes and similar assumptions on household cooking energy use and fNRB. Initial estimates suggest that the total emission reductions may be 25 to 70 per cent lower, depending upon the specific scenarios analysed.

21. These activity types could be provided an exemption that permits a different approach to uncertainty as that required by the Baseline Standard. For example, the exemption could require that they be "unlikely to be overestimated" (removing "very"), or allow crediting of the central estimate of emission reductions. A benefit of this approach is that it would increase the emission reductions issued to activity participants without compromising the treatment of reversal risk. A related benefit of this approach is that it would respond to stakeholders' concerns about the reduction in credit volumes leading to difficulties in financing clean cooking activities at the prices they expect in the market.

22. One drawback of this approach may be a perception of lower quality of A6.4ERs allowed this exemption, since each tonnes (t CO_2-eq) would be less secure than those applying the "very unlikely to be overestimated" requirement, which could conversely drive buyers away from these units. Indeed, instances of over-crediting would be statistically more frequent. With the requirement of "very unlikely to be overestimated", which can be interpreted to correspond to a 90 per cent probability of no overestimation based on IPCC categories for likelihood, only about one out of ten A6.4ERs may be subject to over-crediting, whereas with a requirement of „unlikely to be overestimated", which can be interpreted to correspond to a 67 per cent probability of no overestimation based on IPCC categories for likelihood, about one third of A6.4ERs may be subject to over-crediting.

23. To avoid creating two different levels of confidence with regard to the risk of over-crediting, another alternative approach could be moving to a lower requirement for all Article 6.4 activities in terms of uncertainty, i.e. "unlikely to be overestimated" (removing "very"), through a revision to the Baseline Standard that would put all activities on the same footing.

7. Temporary, phased-in approach to buffer pool contributions for clean cooking activities

24. One possible approach would be to consider forms of temporary exemptions to buffer pool contributions as a policy decision. Exemptions reflecting concerns related to policy transitions are provided for in other standard-setting processes that make significant changes compared to past practices. If an exemption is applied, then the reversal risk still could be assessed and quantified using the reversal risk assessment tool, even if no corresponding contributions are made to the buffer pool.

25. The exact configuration and implementation of a temporary exemption would be a policy decision, and such temporary exemptions could consider characteristics such as the duration, nature of the phase-in (e.g., progressive or single step), locations where temporary exemptions would apply, and whether a temporary exemption should be limited to clean cooking activities or apply more broadly to other activity types that reduce the consumption of non-renewable biomass. This approach could be implemented as a full exemption during a transition period or as a deferred structure where liabilities would be quantified and replenished after the transition period.

26. A potential benefit of a temporary, phased approach to buffer pool contributions may be to reduce the immediate economic impact of buffer-pool contributions on clean cooking activity revenues during the early implementation of the mechanism methodologies. This may assist the implementation of Article 6.4 activities in communities with the lowest incomes. If A6.4ER prices increase over time, a temporary exemption also may provide activity participants time to be better able to absorb a subsequent or progressively increasing buffer contribution. Another potential benefit of a phased approach with a deferred liability structure is that it could benefit from future updates to the reversal risk assessment tool, noting that the MEP concluded that additional scientific evidence to address natural reversal risks is expected in the next 2-3 years while substantial uncertainty in projecting human-induced reversal risks would likely persist even if new scientific evidence becomes available.

27. Potential drawbacks include a lack of protection against reversals, though if a temporary exemption were implemented as a deferred liability that was subsequently applied and satisfied through future buffer pool contributions, the drawback itself would be temporary in nature. Either outcome could be perceived as putting this element of the environmental integrity of the Article 6.4 mechanism at risk.

28. Another drawback of the temporary exemption, when implemented as a deferred liability, is that it would create economic liabilities for deferred contributions. Another drawback could be the possibility of establishing a precedent for exemptions to be sought by other activity types. Differentiating the approach geographically could additionally raise questions of consistency and equitable treatment.

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